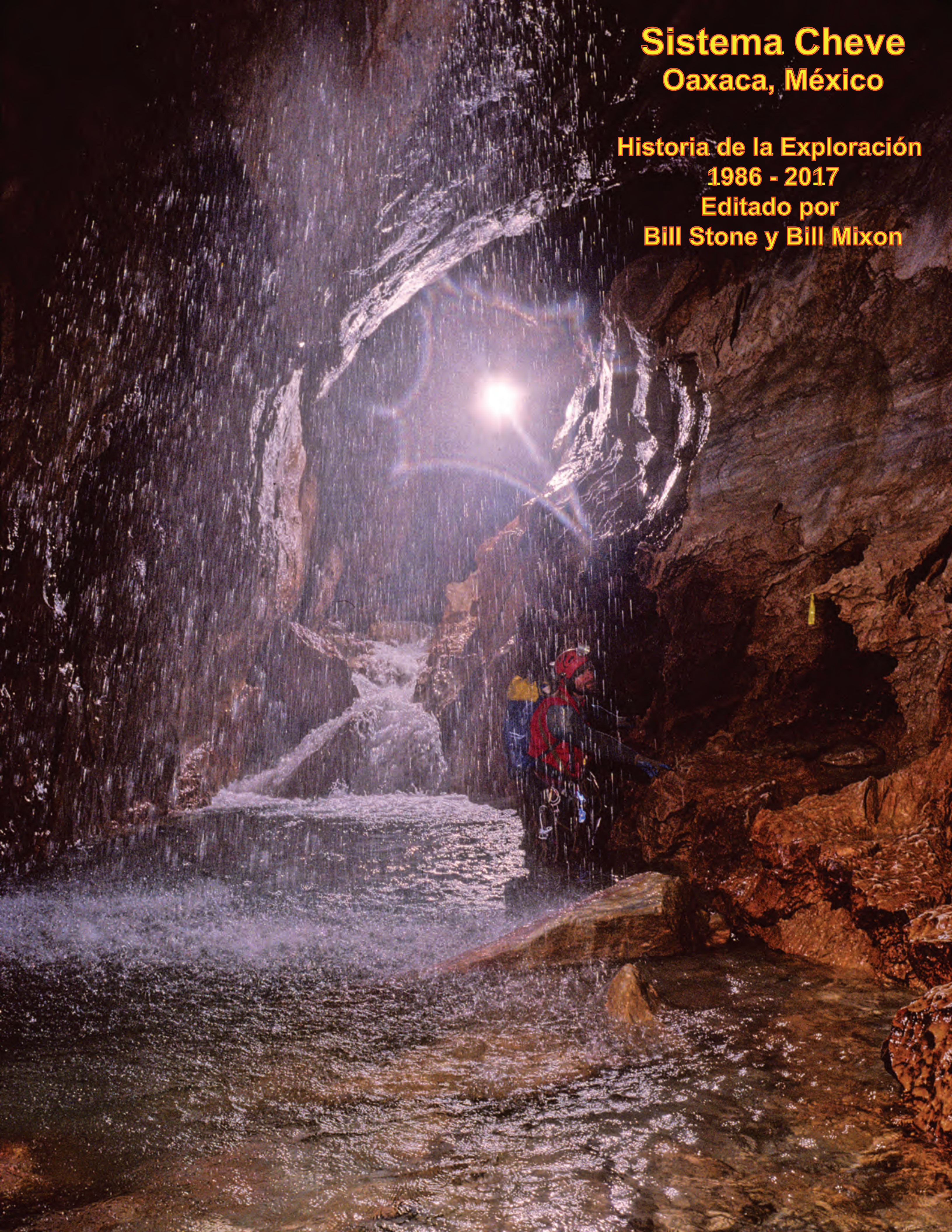


Sistema Cheve
Oaxaca, México

Historia de la Exploración
1986 - 2017
Editado por
Bill Stone y Bill Mixon

Prefacio a la Edición 2017

La última vez que los seres humanos visitaron el fondo de Cueva Cheve – (la cueva más grande de la Sierra Juárez, Distrito de Cuicatlán)- fue en 2003. En ese entonces las dificultades que encontramos allí nos convencieron de que tal vez sería más fácil explorer alguna nueva entrada que nos lleve mas alla de los limites de el sistema de cuevas de cheve.
Una nueva entrada, en teoría, haría más fácil el encontrar una manera de ir más allá del túnel que se había colapsado al final de Cueva Cheve. Así fue que en febrero de 2004 venimos a la sierra, a buscar nuevas entradas en los municipios de Santa Ana Cuauhtémoc y San Francisco Chapulapa, al norte de Cueva Cheve, pero muy cerca del extremo conocido de la cueva. Estábamos buscando allí porque a 1.400 metros bajo nuestros pies se encontraban túneles conocidos en Cueva Cheve.

A principios de marzo de 2004 se descubrió una entrada desconocida que le llamamos "J2" encontrada en una pequeña dolina al fondo de un profundo barranco lleno de selva en el bosque de neblina sobre el pueblo de San Francisco Chapulapa. Fue una de las 64 entradas vistas por primera vez por nuestro equipo ese año. Algunas las habíamos encontrado nosotros por medio de caminatas por la selva, pero la mayoría se nos fueron mostradas por Atanacio Rubio Vargas del pequeño pueblo de El Ocotal. Sólo una de estas entradas - llamada J2 por nuestro equipo[1] - tenía los signos de una cueva que probablemente probaría ser muy profunda. Tenía viento fuerte soplando en la entrada y una corriente de agua que ayudó a mantener el lodo y los escombros a no bloquear el túnel en la temporada de lluvias. Alcanzamos una profundidad de más de 300 metros ese año con corriente de aire circulando mas profundo dentro de la cueva. Fue el comienzo de una odisea de nueve años en la que se realizaron seis expediciones separadas en 2004, 2005, 2006, 2009, 2010 y 2013 fueron dedicadas a lograr una conexión entre J2 y Cueva Cheve.

J2 nunca fue una cueva fácil de explorar. La entrada es una fisura estrecha que mide de 8 a 10 metros de altura por medio metro de ancho. Continúa así por medio kilómetro de distancia recorrida. Entonces hay una sección vertical que desciende directamente a los 400 metros y requiere una gran cantidad de cuerda para armar la cueva y hacerla un paso seguro. Unos 400 metros adicionales por una grieta muy angosta continúan en la parte inferior de estos pozos hasta que se encuentran túneles más grandes. Establecimos nuestro primer campamento subterráneo en J2 - Campamento 1 - a una profundidad de -530 metros al comienzo del gran túnel. Luego, a una profundidad de 630 metros se descubrió un túnel inundado - Sifon 1. Fue muy corto y, sorprendentemente, descubrimos que el agua estaba retenida por rocas sueltas en el lado rio abajo. Tuvimos la suerte de poder mover suficientes piedras del montón para bajar el nivel del agua en el túnel en donde un espacio de 30 centímetros de aire se formó en el techo del túnel. Hacía mucho viento y frío, pero pudimos nadar sin equipo

[1] El equipo en 2004 estaba compuesto por miembros de varios países, incluyendo Polonia. El valle que contiene J2 fue visitado por primera vez por varios miembros polacos de nuestro equipo y la persona que toma notas con respecto a lo que se había encontrado estableció un sistema de etiquetado de las entradas para que podamos discutirlas posteriormente. El nombre polaco para la cueva es "Jaskinia". Así J2 significaba "cueva número 2". Aunque había 37 cuevas "J", sólo J2 continuó a gran profundidad. Las coordenadas para la entrada son: 17 ° 54'12.83 "N 96 ° 45'54.36" W

de buceo. Un kilómetro más allá de este punto establecimos el Campamento 2 a 800 metros de profundidad. La cueva se hizo entonces muy grande, con pasajes de 20 metros de ancho por 15 metros de altura. A una distancia de 7 kilómetros de la entrada descubrimos el Sifon 2, el segundo túnel inundado. Fue sólo en 2006 que un solo buzo (James Brown) fue capaz de explorar y descubrir los túneles llenos de aire en el otro lado. El Sifón 1 era a 220 metros de distancia bajo el agua. El túnel inundado alcanzó una profundidad de 12 metros de profundidad de agua. Más allá de una cámara muy grande descubrimos el Sifón 3. En 2009 descubrimos que había una bifurcación al Sifon 3 pero, después de otros 500 metros de caminata descubrimos el Sifón 4 y éste no podría ser evitado.

Pudimos explorarlo Sifon 4 a una distancia de 300 metros en 2009 - durante una inmersión en solitario realizada por un miembro de nuestro equipo José Morales.

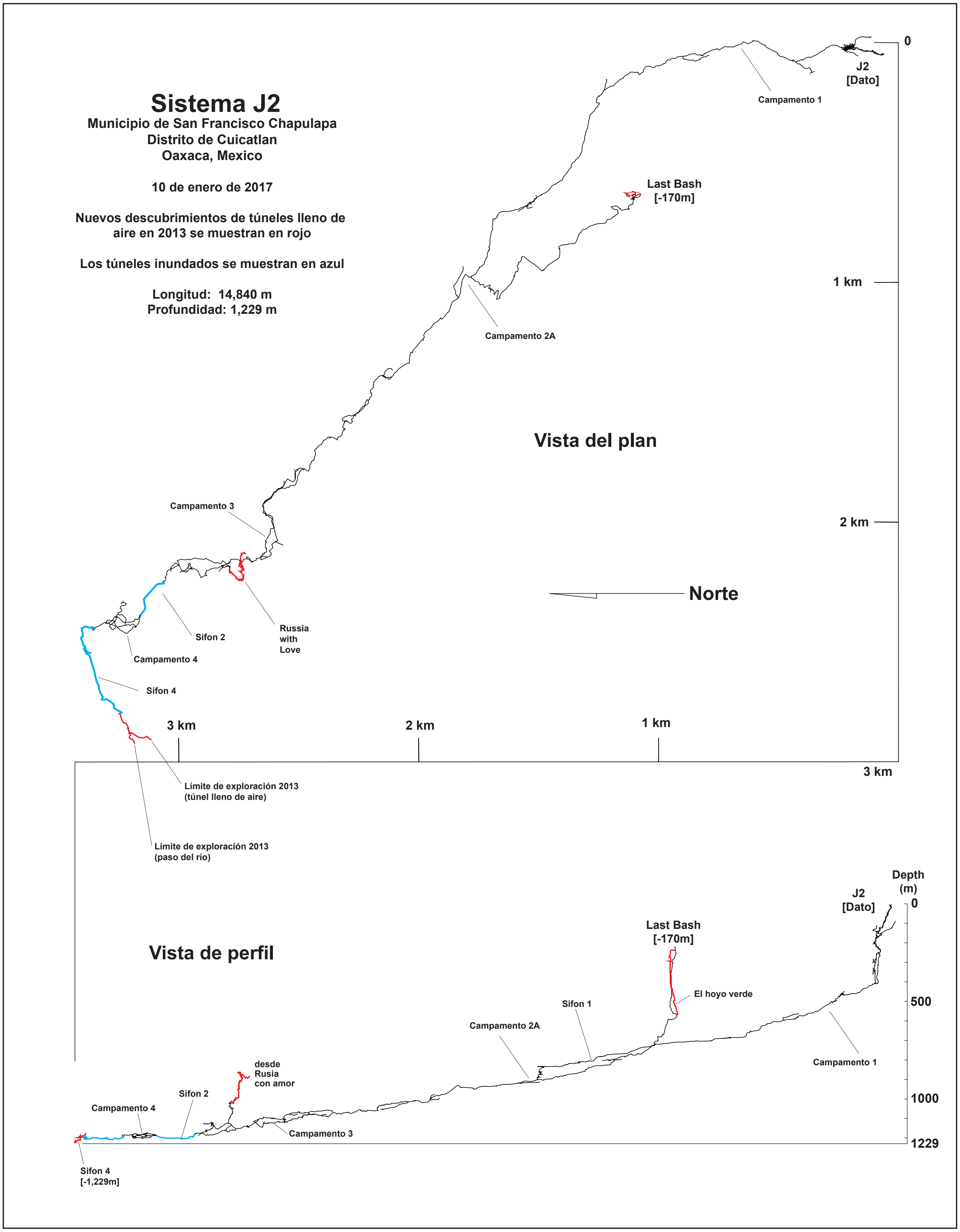
En 2013 el túnel bajo el agua conocido como Sifón 4 (ver el mapa en la página siguiente) en la parte inferior de J2 fue pasado con éxito por los buzos Marcin Gala y Phil Short. El túnel inundado tenía 600 metros de largo y se necesitó casi una hora para nadar a través de él. Llegaron a un túnel que se llenó de aire respirable y se extendió por 350 metros en una dirección que conduce casi directamente hacia Cueva Cheve antes de que el paso se hizo demasiado estrecho para continuar. El río subterráneo - que fluye con un volumen de 50 litros por minuto - desaparece en esta grieta. Pero los seres humanos no pueden continuar por allí. El final de J2 siguen estando a 800 metros de distancia de túneles conocidos en Cueva Cheve.

Así, a pesar de todo este esfuerzo no pudimos conectar J2 a Cueva Cheve. Es totalmente posible que pasamos por alto algo, No muy lejos del Campamento 3 hay una cúpula en el techo del gran cañón que conduce a Sifon 4. En 2009 dos miembros del equipo - Yuri Schwartz y Sergey Tachenko de Rusia - usaron técnicas especiales de escalada para escalar el pozo a una distancia de casi 100 metros sobre el túnel principal. Para sorpresa de todos, un tremendo viento soplaba en este pozo vertical. En 2013 continuamos escalando este pozo vertical hasta llegar a un punto de más de 300 metros verticales por encima del túnel principal de J2. Esto está en un punto todavía 800 metros debajo de la superficie, así que hay un misterio que permanece en J2.

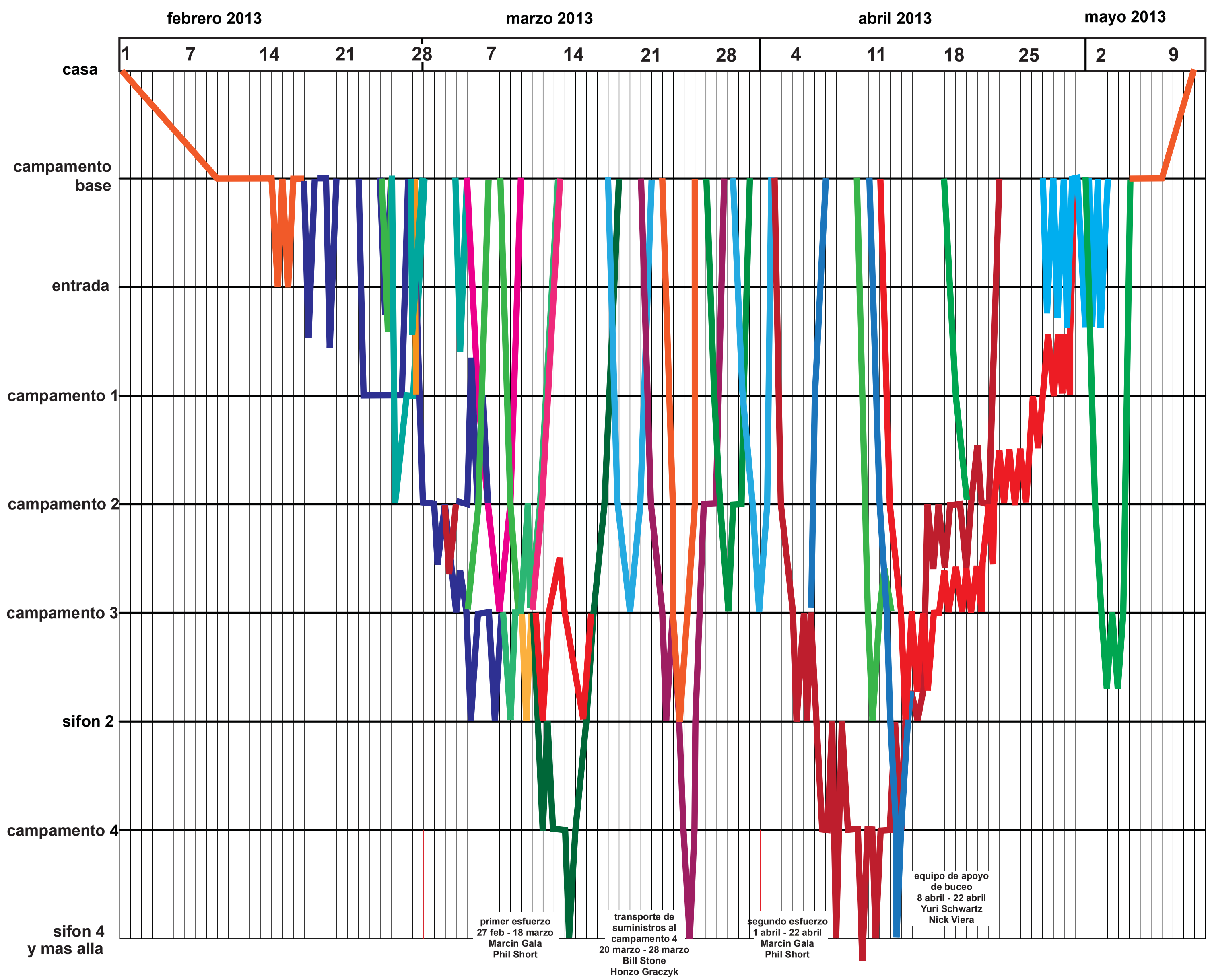
Después de cuatro años de considerar cuál debería ser el siguiente paso, fue el Acuerdo del equipo de que habíamos pasado por alto algo en la parte inferior de Cueva Cheve, en el cañón lleno de aire que existe entre los dos túneles inundados (Sifon 1 y Sifon 2). En las páginas que siguen describimos los objetivos para 2017 y nuestros planes para lo que esperamos será un esfuerzo exitoso para encontrar un camino hacia adelante, y más profundo, en Cueva Cheve.

Quisiera de nuevo expresar mi gratitud a todos los pueblos de la montaña y a las personas y familias que hemos llegado a conocer y consideramos nuestros amigos en los últimos 30 años.

Bill Stone
Austin, Texas
10 enero 2017



Mapas de Plan y Perfil del Sistema J2 a partir de la conclusión de la expedición 2013. J2 es actualmente la cuarta gruta más profunda de México y la cuadragésimo más profunda del mundo. El límite de exploración es de 7.294 metros de distancia de la entrada J2. Para llegar a ese punto se requiere el uso de cuatro campamentos subterráneos y equipo de buceo para pasar dos túneles inundados que totalizan 800 metros de longitud. Sifon 4 tiene 600 metros de largo y requiere una hora para nadar a través de él. En 2010 una cueva conocida como Last Bash (La última oportunidad) fue conectada a J2 para formar el Sistema J2. El uso de la entrada Last Bash reduce el tiempo para llegar al Campamento 2A en aproximadamente 8 horas, lo que lo convierte en un viaje de un solo día en lugar del viaje de 2 días desde la entrada J2.



Este gráfico representa una línea de tiempo gráfica para las actividades en J2 en 2013. Cada línea vertical representa un día durante la expedición, que tuvo lugar durante cuatro meses. En la dirección vertical, procedente de la parte superior de la página, la profundidad se indica mediante ubicaciones clave dentro de la cueva. Las líneas coloreadas representan cada una un equipo separado y su descenso hacia adentro y finalmente salida desde la cueva. Los equipos que iban a Sifon 4 generalmente tenían el tiempo más largo dentro de la cueva. La misión más larga fue de 21 días dentro de la cueva. Esperamos que los equipos que van más allá de Sifon 1 en Cueva Cheve en 2017 estarán en misiones potencialmente más de 30 días a la vez dentro de la cueva.

Expedición Sistema Cheve 2017

Resumen ejecutivo

Introducción:

Sistema Cheve (término general para la colección de cavernas en Cuicatlán, distrito de Oaxaca de la Sierra Juárez en el sur de México) es uno de los grandes sistemas de cuevas del mundo. Aunque las entradas a estas cuevas han sido conocidas durante miles de años por los indigenas Cuicatec, lo que se encuentra en el interior sólo comenzó a ser revelado en 1986, cuando los exploradores de cavernas modernos visitaron la entrada masiva de Cueva Cheve. Año tras año, piezas de este increible rompecabezas subterráneo se ha armado a través de los esfuerzos de más de 16 expediciones, muchas de ellas duran hasta tres meses durante la temporada seca de primavera en el intento por explorar una sola cueva. Sistema Cheve es tan vasto que pasa bajo seis municipios diferentes. Pero es la profundidad lo que hace que Sistema Cheve sea extraordinario: es el sistema hidrológico kárstico más profundo del mundo. Un rastreo del colorante en 1990 demostró que tenía una profundidad de casi 2.600 metros (8.530 pies). El límite actual de exploración humana se alcanzó en 2003 a una profundidad de 1.484 metros (4.869 pies) a una distancia de 10 kilómetros (6.2 millas) de la entrada más cercana.

La entrada más al sur del sistema es Cueva Cheve[1], situada en un bosque de pinos ponderosa a casi 3.000 metros de altitud sobre el nivel del mar. La entrada más Al norte es Cueva de la Mano[2], en la parte inferior del Cañón Santo Domingo, a casi 20 kilómetros de distancia en línea recta. El agua que entra en Cueva Cheve fluye a los manantiales de la Cueva de la Mano. Se cree que el agua que entra en todas las cuevas en una zona de 7 kilómetros de ancho entre estas dos localidades finalmente drena a Cueva de la Mano. El objetivo principal de todas estas exploraciones en esta área es demostrar una coneccion humanamente accesible entre todas estas cuevas. En términos de pura distancia técnica y dificultad subterránea, Cheve no tiene igual. Sólo para alcanzar el límite actual de exploración se necesitarán más de 3 kilómetros de cuerda en más de 120 tiros verticales y hay que establecer tres campamentos subterráneos con 8 a 12 horas de recorrido subterráneo entre cada campamento. Además, las cuevas no corren en líneas rectas subterráneas - siguen las fallas y fisuras dictadas por la geología. Así, aunque la longitud de las partes conocidas de la más grande de estas cavernas - Cueva Cheve - tiene una longitud de 26 kilómetros (ver tabla), la proyección horizontal de la superficie comprende menos del 20% de la distancia terrestre a los manantiales En Cueva de la Mano. Es totalmente posible que una travesía completa pudiera ver a los exploradores en un viaje subterráneo unidireccional que se acerca a 100 kilómetros de longitud, un nivel de lejanía sin igual en la Tierra.

En la actualidad hay cuatro cavernas independientes muy grandes y profundas dentro de la montaña que ya han logrado el reconocimiento mundial sobre la base de sus propias estadísticas:

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[1] 17°51'52.79"N, 96°47'40.28"W

[2] 18°01'35.69"N, 96°49'21.13"W

Nombre	Profundidad (metros)	Longitud (metros)
Cueva Cheve	1,484	26,194
Cueva Charco	1,278	6,710
Sistema (Ozto) J2	1,229	14,840
Cueva de la Mano	180	10,841

La tabla presenta solamente las cuevas mas grandes conocidas. Es importante señalar que nadie ha encontrado un final definitivo a cualquiera de las grandes cuevas que componen Sistema Cheve - los límites de la resistencia humana y la tecnología han sido siempre los factores que han detenido el progreso. Es, de hecho, este persistente fracaso para encontrar el final de estas cuevas que sirve como una llamada a algunos de los exploradores más grandes de cuevas del mundo para venir a probar su suerte y ver si pueden ser los que resuelvan el enigma de una vez por todas . En este sentido, los equipos que hoy exploran Sistema Cheve no son diferentes de los equipos que intentaron ser los primeros en escalar el Monte Everest hace casi 100 años o aquellos que en última instancia fueron los primeros en explorar la Antártida. Es el desafío absoluto - tanto a la resistencia física como a la mente para encontrar una manera de resolver el problema de conectar todas estas piezas para formar la caverna más profunda del mundo - que es el reto. En el caso del Sistema Cheve, este desafío es mucho más difícil que el ascenso de cualquier montaña en la Tierra porque implica tantas disciplinas diferentes -desde explorador, escalador, buzo, cartógrafo e incluso fotógrafos que deben encontrar maneras de iluminar Lugares que están por siempre oscuros. En cierto sentido, Sistema Cheve es la última frontera física y psicológica en la Tierra en 2017. Es un análogo de la lejanía y las dificultades que tendrá que ser superado a medida que la humanidad se expanda eventualmente en el Sistema Solar en el próximo siglo.

<u>Exploraciones recientes</u>:
Ya en 1990 la exploración fue detenida temporalmente en Cueva Cheve debido al descubrimiento de un túnel bajo agua - conocido como Sifón 1 - en el nivel de 1.362 metros de profundidad ya 9 kilómetros de la entrada. Sólo para llegar a ese punto se requerían 3½ días de viaje subterráneo y tres campos subterráneos. El primer intento de encontrar un camino a través del Sifón 1, en 1991, falló cuando el buzo principal siguió una ruta obvia hacia el norte en una estrecha fisura que era demasiado apretada para pasar. Sólo se percibió después que una falla cruzaba ese lugar y que el camino real era hacia atrás, bajo el túnel que los exploradores habían seguido desde la entrada.

En 2003, un equipo de buceo de cuatro personas (con el apoyo de un equipo de 60) regresó, pasó con éxito el Sifón 1 de 140 metros de largo y descubrió una sección de un cañon del rio de un kilómetro de largo más allá de Sifón 1. Esto terminó en un segundo , Túnel bajo agua de 280 metros de largo - Sifón 2 - más allá del cual había una pila de rocas, de un antiguo colapso, que bloqueaba el paso humano pero a través del cual fluía el río. La breve inspección de los dos buzos de punta, concluyó que no había manera de seguir adelante. Sin embargo, hay tres grandes cascadas que entran en la cueva a lo largo del paso de la corriente entre los dos Sifones. Uno de ellos tiene más de 60 metros de altura y se estrella en un lago de 80 metros de largo. No hubo tiempo para investigar estas cascadas en el 2003 como el descubrimiento del camino a través de Sifón 1 y el cañon del río más allá del Sifón, ocurrió tarde en la expedición. La presencia de estas cascadas es significativa. Sistema Cheve es conocido, por medio de la cartografía en 3D, que se ha formado en al menos tres niveles diferentes como el río subterráneo cortado a través de varias capas estratigráficas a lo largo de millones de años. El río activo hoy es el nivel más bajo. Unos 40 a 50 metros verticalmente por encima de eso es un nivel donde existen túneles difíciles pero pasables. Pero Lo más importante, sin embargo, es que a una elevación entre 70 y 100 metros sobre el río existen túneles "fósiles" (antiguos y secos) de proporciones gigantescas. Debido a que Sistema Cheve está altamente controlado por fallas, es decir, tiende a seguir grietas a gran escala en los estratos calcáreos creados cuando la Sierra Juárez fue empujada hacia arriba desde el Golfo de México, estos pasajes de nivel superior tienden a estar justo encima del paso del río . Una cascada, entonces, es un "taladro" geológico que crea una ruta de acceso entre las capas.

<u>Planes para 2017</u>:

Por lo tanto, el objetivo principal en 2017 será establecer el Campamento 4 subterráneo más allá del Sifón 1, escalar estas cascadas, con la esperanza de re-encontrar el gran tunel seco "borehole" de alto nivel ("Borehole" es un termino utilizado por los cueveros para nombrar los pasaje de grandes dimenciones) visto apenas al norte del campamento 3. Si es exitoso, será nuestro objetivo adicional no sólo explorar este túnel superior más profundo en la montaña, sino también conectarlo a una cueva seca (llena de aire) aguas arriba del Sifón 1, evitando así la necesidad de buceo y permitiendo a Todos los miembros del equipo para participar en exploraciones más profundas. Un avance de esta naturaleza podría conducir a la rápida extensión de la cueva principal - Cueva Cheve - a profundidades de más de 2.000 metros, así como ver el posible enlace de otros grandes sistemas de cuevas. Anticipamos que los equipos enviados al Campamento 4 vean permanencias subterráneos de 30 días o más antes de salir con equipos de reemplazo. La duración de la expedición está diseñada para permitir tres empujes independientes desde el campamento 4 por equipos de buceo / escalada de cuatro personas. El resto del equipo de apoyo de 65 personas se llevará a cabo en varios campamentos en toda la cueva para transportar alimentos y material al Sifón 1 en apoyo del esfuerzo de la escalada más allá de Sifón 1.

Somos optimistas con respecto a nuestras posibilidades de éxito. Desde 2003 se han producido avances dramáticos en la tecnología. Las técnicas para escalar domos subterráneas han mejorado hasta el punto donde es posible un ascenso de 60 metros en un solo día. La tecnología de buceo nos ha proporcionado un soporte de vida de ciclo cerrado (rebreathers) con un peso de menos de 15 kilogramos pero que proporciona seis horas de tiempo bajo el agua. Ahora nosotros mezclamos personalmente la comida utilizada como provisiones dentro de la cueva para igualar dietas probadas en los ultramarathones.. Y el equipo y la ropa de campamento se han reducido en tamaño, peso y son más tolerantes a condiciones frías, y mojadas. El equipo tiene una experiencia extraordinaria y representa a los mejores exploradores de cuevas expedicionarios de 11 naciones. Del 10 de febrero al 10 de mayo de 2017 este equipo se enfrentará a uno de los mayores desafíos de exploración que quedan en la Tierra.

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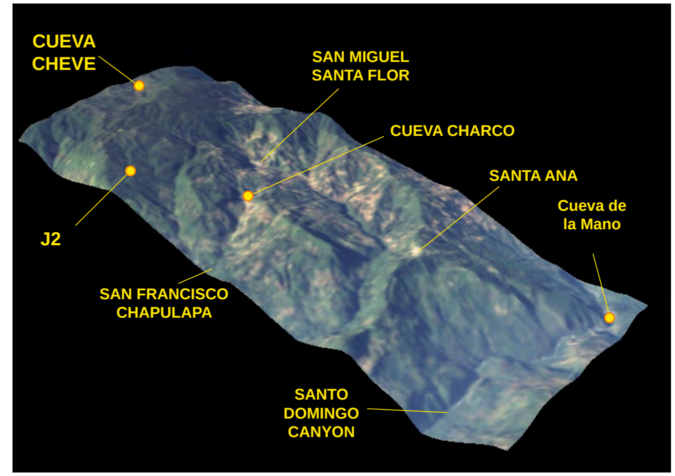


Mapa de la superficie de la región del Sistema Cheve, Oaxaca, México

Antecedentes: En 1987 la Cueva Cheve fue descubierta por exploradores a una gran elevación en la Sierra de Juárez en el noreste del estado de Oaxaca, México. Actualmente tiene 1484 metros de profundidad y es la cueva explorada a mayor profundidad en el hemisferio occidental y la 12ª más profunda del mundo. El límite actual de exploración en Cheve (a 10 kilómetros de la entrada más cercana) representa uno de los lugares más remotos jamás alcanzados dentro de cualquier cueva en la Tierra. La logística de alcanzar este punto es enorme: más de 3 kilómetros de cuerdas son necesarios; tres campamentos subterráneos establecidos; y el equipo de buceo para un equipo de cuatro necesita ser transportado al nivel de -1.362 metros donde comienza una serie de dos túneles bajo agua. La profundidad final conseguida durante una expedición encabezada por los Estados Unidos en 2003 logró ubicar un equipo de buceo de cuatro personas, pasando dos túneles inundados (140 y 280 metros de longitud, respectivamente). Las inmersiones fueron muy exitosas y el equipo exploró rápidamente otros 1,3 kilómetros de nuevo terreno que conduce más profundo a la montaña. El esfuerzo fue finalmente detenido por un antiguo colapso del túnel que bloqueó la ruta hacia adelante.

El reto: Nadie ha regresado a Cueva Cheve y el misterio de lo que queda por descubrir dentro de la Sierra Juárez permanece aún. El equipo de buceo de 2003 hizo otro descubrimiento importante: la existencia de tres grandes cascadas que entran en la cueva a lo largo del paso de la corriente entre los dos túneles submarinos. Uno de ellos tiene más de 60 metros de altura y se estrella en un lago de 80 metros de largo. No hubo tiempo para investigar estas cascadas en el 2003 porque el descubrimiento del camino a través de sifón 1 y mas allá del cañón del río, ocurrieron tarde en la expedición. La presencia de estas cascadas es significativa. Sistema Cheve es conocido, por medio de la cartografía en 3D, que se han formado en al menos tres niveles diferentes y el río subterráneo ha cortado a través de varias capas estratigráficas a lo largo de millones de años. El río activo en la actualidad es el nivel más bajo. Pero a lo largo de la mayor parte de la cueva existen túneles antiguos y secos de proporciones gigantescas de unos 70 a 100 metros sobre el río. Debido a que Sistema Cheve está altamente controlado por fallas geológicas, es decir, tiende a seguir a las grietas en gran escala en los estratos calizos creados cuando la Sierra Juárez fue empujada hacia arriba desde el Golfo de México, estos pasajes superiores tienden a estar directamente sobre el paso del río. Una cascada, entonces, es un "taladro geológico", que crea una ruta de acceso entre capas. Doce miembros del equipo del 2017 están entrenados como buzos y escaladores. Un equipo internacional de 65 personas de 11 países transportará equipo al primer túnel bajo agua durante el primer mes de la expedición. Después tres equipos sucesivos de cuatro personas comenzarán la exploración de lo que está más allá en lo que seguramente será uno de los proyectos de exploración originales más remotos y emocionantes de esta década.

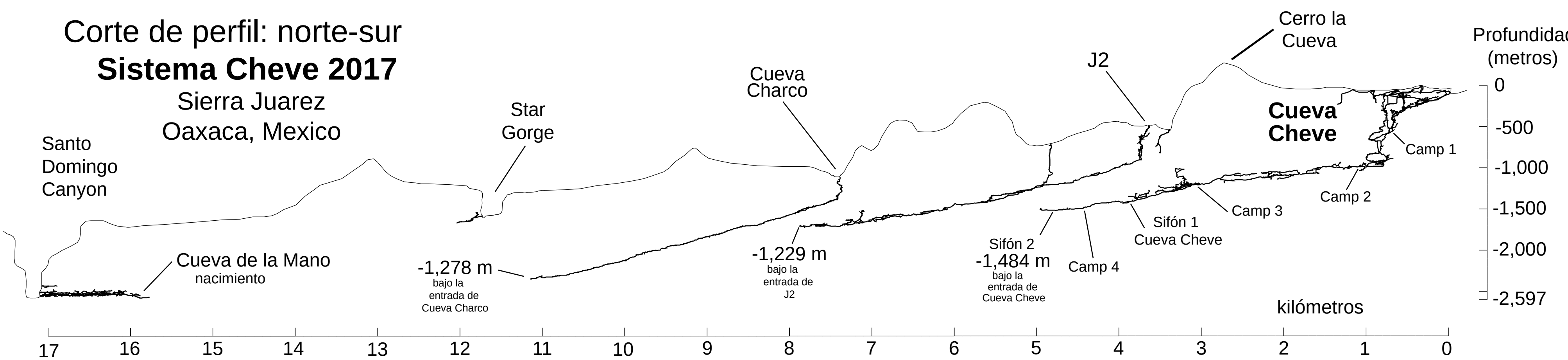
Foto Arriba Izquierda: La entrada enorme de Cueva Cheve, Oaxaca, México

Corte de perfil: norte-sur

Sistema Cheve 2017

Sierra Juarez

Oaxaca, Mexico



Parte superior derecha: La gran escala del Sistema Cheve. El agua se resume a gran elevación. Diecisiete kilómetros después, emerge de nacimientos en las profundidades del Cañón Santo Domingo. El desarrollo vertical hidrológico es de 2597 metros (8520 pies).

Programa:

Agrupamiento en Texas: 10 de febrero de 2017.
Establecimiento del Campamento Base: 18 al 28 de febrero.
Armado hasta el Sifón 4: 1 al 15 de marzo.
Exploración principal: 16 de marzo al 10 de mayo de 2017.

Organización

Cheve 2017 está dirigido por el veterano explorador Dr. Bill Stone y contará con miembros de equipo altamente calificados de los Estados Unidos, Polonia, Suecia, Canadá, Reino Unido, Lituania, México, Rusia, Eslovenia, Rumania y Suiza. La expedición es una empresa oficial del equipo estadounidense Deep Caving Team, Inc. (USDCT).

Sea un patrocinador:
El USDCT es una corporación sin fines de lucro, con metas científicas y educativas. Todas las contribuciones son deducibles de impuestos.

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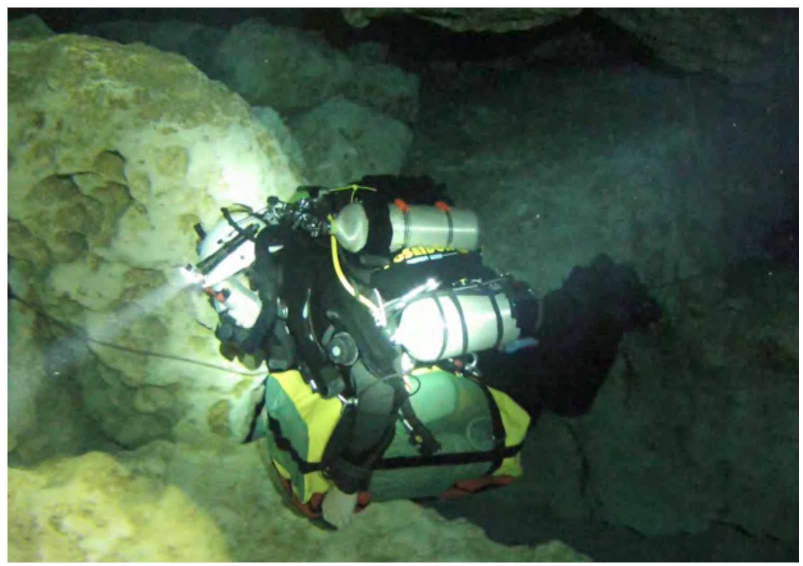
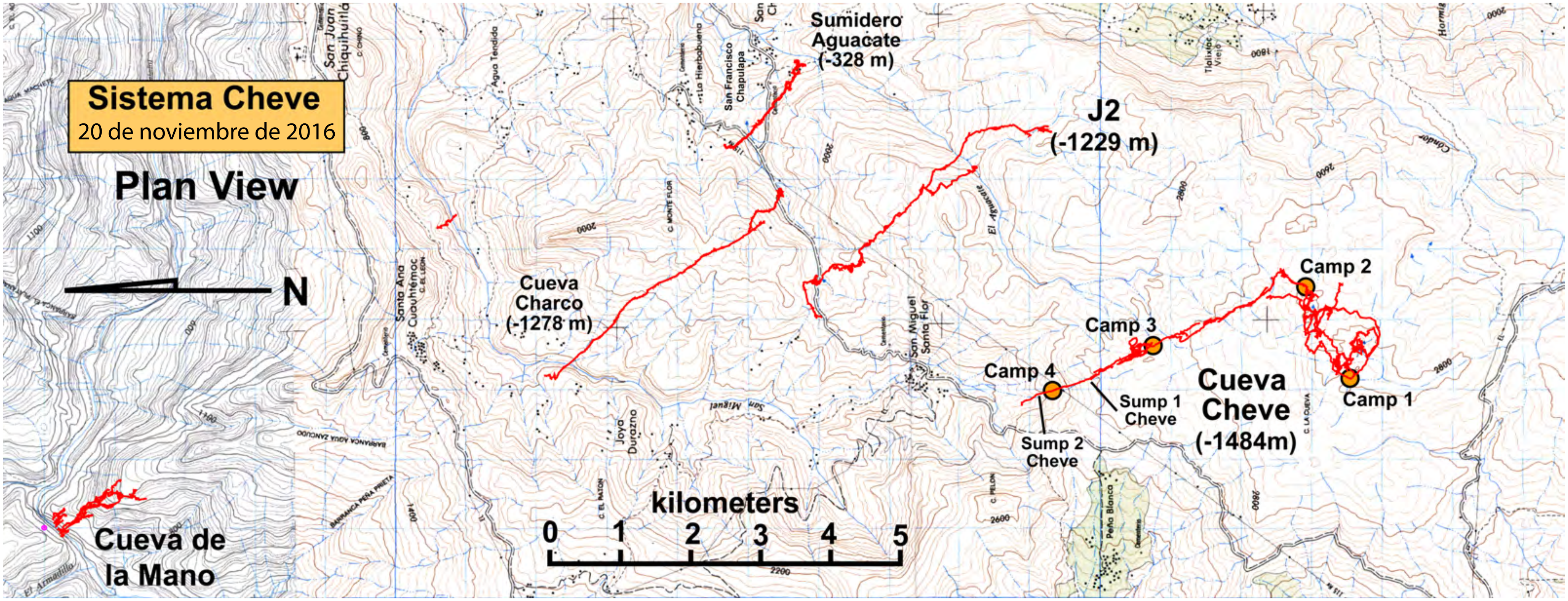
Del Valle, TX 78617
Correo electrónico:
billstone@stoneaerospace.com
Página en la red: www.usdct.org

La Misión: La expedición saldrá de Austin, Texas, USA. la primera semana de febrero del 2017 y estará en el campo por tres meses. El objetivo primario de la expedición en marzo del 2017, será establecer el Campamento 4 subterráneo en los túneles con aire más allá del Sifón 1 en Cueva Cheve y extender la exploración hacia el hipotético corredor del tronco central dentro de la Sierra Juárez por medio de escalada artificial de las tres cascadas Que existen entre los sifones1 y 2. Si estas escaladas son un exito, el esfuerzo en abril y mayo se centrará en extender la exploración del túnel del tronco norte hacia Cueva de la Mano. Una conexión entre Cueva Cheve y Cueva de la Mano produciría una cueva de 2.597 metros de profundidad y representaría el abismo natural más profundo hasta ahora descubierto.

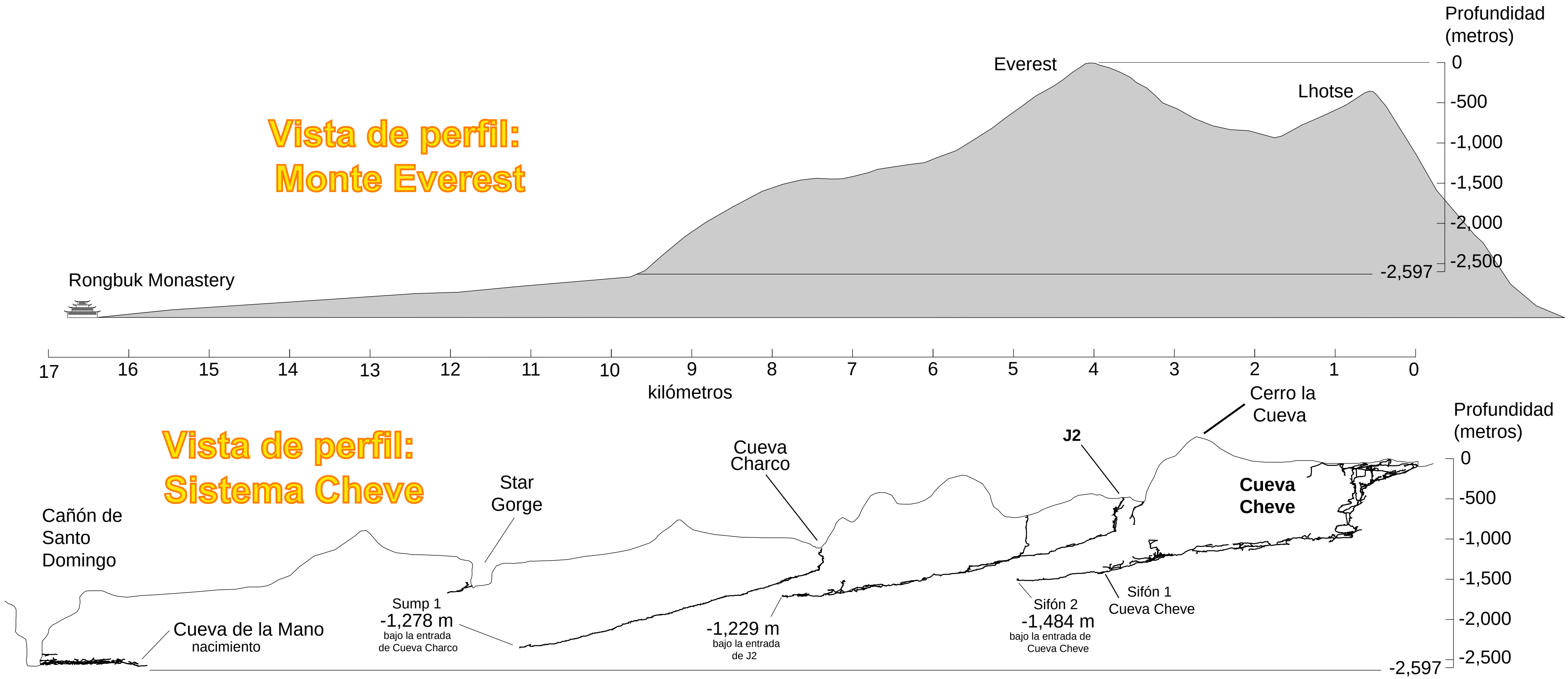


Nueva Tecnología para 2017: En colaboración cercana con los patrocinadores de la expedición Poseidon Diving Systems y trajes secos SANTI han equipado a la expedición con tecnología de vanguardia y trajes ambientales para permitir empujes subterráneos de hasta 30 días a través de Túneles completamente llenos de agua. Nuevos avances en la tecnología de escalada. (Foto a la derecha) permitirá al equipo líder escalar las cascadas previamente inaccesibles a los túneles secos de alto nivel.



2017 Logística: El límite actual de exploración en Cueva Cheve representa un territorio totalmente desconocido. El mapa anterior muestra la topografía de la superficie (vista en planta) junto con los sistemas de cuevas principales conocidos de la Sierra Juárez. Lo que se conoce se obtuvo con dificultad através de exploraciónes y la cartografía de17 expediciones, durante más de 25 años. La distancia real viajada bajo tierra, puede ser tres o más veces la distancia de la superficie en línea recta. Se trata de unos 10 kilómetros de recorrido subterráneo desde la entrada de Cueva Cheve hasta el límite actual de exploración. Esto está más allá de los límites de la resistencia humana. Para hacer frente a esto romperemos el viaje en segmentos que representan de 8 a 12 horas de viaje en un solo sentido con una pesada mochila y estableceremos campamentos subterráneos en esos lugares. En la actualidad hay tres campamentos en Cueva Cheve, siendo los más remotos (Camp 3, primeros en 1990) a nivel de -1,100 metros, a tres días de la entrada. El objetivo primordial en 2017 será establecer el Campo 4 subterráneo más allá de Sifon 1, escalar las cascadas que conducen hacia arriba y, con suerte , volver a re-tomar el pasaje seco en el nivel superior visto al norte del Campamento 3. Si se tiene éxito, Será nuestro objetivo adicional no sólo para explorar este túnel superior más profundo en la montaña, sino también para conectarlo a pasajes secos (lleno de aire) despues del sifón 1, así eludiendo la necesidad de bucear y permitir a todos los miembros del equipo a participar en Exploraciones de mayor profundidad. Un avance de esta naturaleza podría conducir a la rápida extensión de la cueva principal - Cueva Cheve - a profundidades de más de 2.000 metros, así como ver la posible conección de otros grandes sistemas de cuevas. Con la espectación de que los equipos enviados al Campamento 4 se queden 30 dias continuos o más bajo tierra, antes de ser reemplazados por miembros del equipo. La duración de la expedición está diseñada para permitir tres empujes independientes desde el Campamento 4 por equipos de buceo / escalada de 4 personas. El resto del equipo de apoyo de 65 personas estaran en varios campamentos a lo largo de la cueva para transportar alimentos y material al sifón1 en apoyo al esfuerzo de escalada más allá de Sump 1. Somos optimistas con respecto a nuestras posibilidades de éxito. El equipo tiene una experiencia extraordinaria y representa a los mejores exploradores de cuevas expedicionarios de 11 naciones.

Derecha: Bajando las Caídas de Pesadilla, al Nivel -1,320m de Cueva Cheve



Escala Relativa: Las cuevas son oscuras. No se pueden ver desde la superficie. Sus entradas muchas veces no muestran la escala de lo que se encuentra en su interior. No hay una manera de comprender la escala de una cueva desde la superficie. De manera inversa, las montañas tienen el efecto opuesto: mientras más cercano a una montaña, es mayor su imponencia y escala. No hay lugar que brinde un sentimiento mayor de humildad de mejor manera que el Monte Everest. Desde el Monasterio Rongbuk (a la extrema izquierda en el perfil superior, y desde donde se tomó la foto a la izquierda) el Everest es imponente aún a 20 kilómetros de distancia. Al acercarse en la ruta original de Mallory (la arista izquierda en la foto) es claramente aparente el tamaño descomunal de la montaña para cualquier persona que intenta escalarla. El otro mapa en esta página muestra los límites conocidos del Sistema Cheve comparados con un corte transversal del Monte Everest. La extensión horizontal del sistema de cuevas es mucho mayor que la del Everest, que abarcaría desde Lhotse hasta el Monasterio Rongbuk. El equipo de exploración de 2017, de ser exitoso, recorrería una distancia bastante mayor que la distancia del Monasterio Rongbuk a la cumbre del Everest, con un desnivel equiparable necesario para llegar a la cumbre desde el glaciar Rongbuk. Al contrario que los montañistas, la parte más pesada comienza al iniciar el regreso a la superficie: la única salida es hacia arriba.

Sistema Cheve
Oaxaca, México

Historia de la Exploración
1986 - 2013

Editado por
Bill Stone

Esta publicación ha sido montado y editado por el Equipo Estadounidense de Exploración de Cuevas Profundas en colaboración con la Asociación de Estudios de Cuevas Mexicanas. Estas organizaciones se puede llegar a las siguientes direcciones:

United States Deep Caving Team
3511 Caldwell Lane
Del Valle, TX 78617
www.usdct.org

Association for Mexican Cave Studies
PO Box 7672
Austin, Texas 78713
www.amcs-pubs.org

Ambas organizaciones mantienen sitios de Web que contienen más información sobre las cuevas de México en forma electrónica.

Las leyendas de las fotos de portada:

Portada: Robbie Warke recorre bajo una gran cascada en la Cueva Cheve al nivel -1275 metros durante la expedición de 2003 a Cueva Cheve.

Contraportada: Robbie Warke en cuerda, descendiendo La Cascada Pesadilla al nivel -1300 metros en Cueve Cheve, Oaxaca, durante la expedición de 2003 a Cueva Cheve.

Agradecimientos

Durante los últimos 27 años me he dedicado, de forma acumulada, más de dos años de mi vida explorando las cuevas que conforman Sistema Cheve. Muchos de mis compañeros de equipo, algunos de los cuales se describen en este libro, han invertido cantidades similares de su tiempo, todo con el propósito de seguir nuestra curiosidad para ver donde conducen estas cuevas impresionantes. En el camino hemos conocido a muchas personas en la montaña que han demostrado ser buenos amigos con los años y con el que nos hemos comido las comidas y las historias compartidas. Si bien hay demasiados para enumerar aquí por su nombre, a todos nos gustaría dar colectivamente "gracias" por su generosa hospitalidad.

Hay otros que ayudaron de manera más oficial. Estamos en deuda con el ex gobernador de Oaxaca, Diódoro Carrasco Altamirano por su amistad y ayuda con nuestros proyectos a lo largo de dos décadas (por primera vez en Sistema Huautla y luego en Sistema Cheve). Saludamos la positiva labor que llevó a cabo a través de la Fundación Cuicatlán y sus esfuerzos de protección del medio ambiente. Y agradecemos a José Antonio Soriano, por su ayuda como enlace con los funcionarios del gobierno de Oaxaca y como fotógrafo de clase mundial. Asi mismo me gustaría dar las gracias a Sergio Zambrano y Angel Soto Porrua por su larga amistad de más de 30 años y por su ayuda en la organización de expediciones a Oaxaca.

En la ciudad de Oaxaca, nos gustaría dar las gracias a Luis Gabriel Díaz, director de la Unidad Estatal de Protección Civil de Oaxaca, tanto por su apoyo a nuestros proyectos durante los últimos 20 años y por su participación como compañero de equipo en muchas de las expediciones registrados en ellas. También nos gustaría dar las gracias a los funcionarios de Protección Civil de administraciones pasadas entre ellos el Dr. German Cruz Martínez, Luis Javier Valeriano González, Lic. Héctor González Hernández, el Ing.. Abel Trejo González, Lic. L.A. Francisco Martín Vela Gil, y el Ing. Jorge Toledo Luis.

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Por último, damos las gracias a los Presidentes y los Comisariados de Bienes Comunales de los siguientes jurisdicciones políticas en Oaxaca: Distrito de Cuicatlán, Municipio de Concepción Pápalo, Municipio de San Miguel Santa Flor, Municipio de San Francisco Chapulapa, Municipio de Santa María Tlalixtac, Municipio de Santa Ana Cuauhtémoc, Municipio de San Juan Sautla, Municipio de San Juan Chiquihuitlán, Municipio de Cuyamecalco Villa de Zaragoza, y La Hierbabuena y Joya Durazno.

Prefacio

Escrito por:

Bill Stone

Austin, Texas
Enero 2013

El Sistema Cheve (el término general para el conjunto de cavernas en el área de Cuicatlán, Oaxaca) es una de las cuevas exploradas más grandes del mundo. A pesar de que las entradas a las cuevas probablemente han sido conocidas desde hace miles de años por los Cuicatecos, lo que se encuentra en las profundidades de las cuevas sólo ha comenzado a ser revelado a partir de 1986, cuando exploradores de cuevas visitaron por primera vez la entrada masiva de la Cueva Cheve. Año tras año, las piezas de este sorprendente rompecabezas subterráneo se han puesto en posición a través de los esfuerzos de al menos 15 expediciones, muchas de ellas de hasta tres a cuatro meses de duración para explorar una cueva única.

El Sistema Cheve es tan grande que abarca por lo menos un mínimo de seis municipios diferentes, incluyendo los siguientes:

Concepción Pápalo
San Francisco Chapulapa
San Miguel Santa Flor
Santa María Tlalixtac
Santa Ana Cuauhtémoc
Chiquihuitlán de Benito Juárez

La entrada más al sur al sistema es la Cueva Cheve, situada cerca de la cima más alta de la cordillera, ahora conocida como Cerro Cueva Cheve (con una elevación de 3000 metros sobre el nivel del mar). La entrada más al norte es la Cueva de la Mano, en el fondo de la barranca de Santo Domingo, aproximadamente a unos 20 kilómetros de distancia en línea recta. El agua que entra a la Cueva Cheve viaja por debajo de la superficie y sale por los manantiales de la Cueva de la Mano. Del mismo modo, se cree que el agua que entra en todas las cuevas de esta zona (la cual está delimitada hacia el occidente por la zona de Peña Blanca y hacia el oriente por una zona aproximadamente a un kilómetro al este de Santa María Tlalixtac) eventualmente fluye hasta la resurgencia en la Cueva de la Mano.

Hay docenas de entradas en cada uno de los municipios antes mencionados y se cree que todas ellas podrían ser conectarse con este enorme sistema de cuevas. En las siguientes páginas se podrá ver la totalidad del conocimiento que se ha adquirido mediante esfuerzos de exploración durante los últimos veintisiete años.

Se ha hablado de muchas entradas, sin embargo aún no se ha demostrado que en realidad todas ellas se conecten y sean parte de una sola cueva. En la actualidad hay cuatro cavernas independientes muy grandes y profundas dentro de la montaña que ya han sido reconocidas mundialmente en base a sus propias estadísticas:

Nombre	Profundidad (metros)	Longitud (metros)
Sistema Cheve	1484	26,194
Cueva Charco	1278	6710
Sistema (Ozto) J2	1222	11,017
Cueva de la Mano	180	10,841

Estas son sólo las más grande de las cuevas conocidas. Hay cientos de otras, cualquiera de las cuales podría ser otra ruta hacia las profundidades de la montaña.

En las páginas siguientes se va a presentar, en un orden aproximadamente cronológico, toda la información que se ha publicado sobre el Sistema Cheve. Desafortunadamente la mayoría de esta información está en inglés. Donde ha sido posible se han traducido partes de este material a español, y éste será presentado en primer lugar. La colección de artículos en inglés se incluye como Apéndice A al final. Es importante destacar que este apéndice incluye muchos mapas y fotos a color tomadas en el interior de muchas de las cuevas conocidas. Los artículos en inglés han sido compilados por Bill Mixon, editor de la revista de la Asociación de Estudios de Cuevas Mexicanas (www.amcs-pubs.org). Esta organización sigue siendo la mejor fuente de información sobre las cuevas de México.

En 2013 una gran expedición regresará entre febrero y mayo, durante la estación seca, para intentar lograr una conexión entre la cueva conocida como Sistema J2 y la Cheve Cueva. Los objetivos y los métodos que se han programado se describen en el folleto que sigue inmediatamente a este prefacio. Esta es la primera vez desde 2009 que se organiza un esfuerzo de gran magnitud para ampliar la cueva. Han sido necesarios cuatro años de preparación y entrenamiento para esta expedición. La razón de tan largo tiempo de preparación es porque el túnel en el límite actual de exploración en J2 está bajo el agua. Para poder explorar más allá, el grupo de exploración debe ser también capaz de bucear – “espeleobuzos” que se especializan en la exploración de túneles bajo el agua en el interior de las cuevas. Los años de entrenamiento han sido necesarios para hacerlo con seguridad. Y el equipo de buceo es pesado. La logística de la operación prevista se describe en el folleto. Es importante mencionar que en los límites de exploración en todas las grandes cuevas en la montaña interviene ahora el buceo en cuevas (espeleobuceo). Este deporte ha alcanzado la madurez en las últimas tres décadas y tan sólo recientemente buzos que trabajan cerca de Cancún, Quintana Roo lograron conectar el Cenote Dos Ojos y el Cenote Sac Actún para formar una cueva con 303 kilómetros de pasajes, con lo que alcanzó el segundo lugar mundial en longitud. La mayor parte de esa cueva está bajo el agua, y de hecho este es el caso con la mayoría de las cuevas conocidas en la Península de Yucatán. En el Sistema Cheve, en las alturas de las montañas de Oaxaca, los túneles bajo el agua tienden a ser más cortos (con longitudes de algunos cientos de metros) y los túneles sumergidos son una pequeña minoría.

Yo personalmente he estado explorando cuevas en México durante 42 años y siempre me he hecho dos preguntas:

• ¿Por qué alguien querría explorar estas cuevas?

• ¿Qué hay en su interior que pudiera ser de valor?

Permítanme contestar directamente a estas preguntas en el orden indicado.

Es importante señalar que nadie ha encontrado un final definitivo, el “fondo”, a cualquiera de las grandes cuevas que conforman Sistema Cheve - los límites de la resistencia humana y de la tecnología siempre han sido los factores que han detenido el progreso. Es, de hecho, este fracaso persistente para explorar estas cuevas en su totalidad lo que sirve como un llamado a algunos de los exploradores de cuevas más importantes del mundo, que vienen a probar su suerte y ver si pueden ser los que resuelvan el enigma de una vez por todas. En este sentido, los equipos que exploran el Sistema Cheve el día de hoy no son muy distintos de los equipos que trataban de ser los primeros en escalar el Monte Everest hace más de 100 años. La principal atracción es el reto absoluto – requiriendo tanto la resistencia física como la mental para buscar la manera de resolver el problema. En el caso del Sistema Cheve ese reto es mucho más difícil que el ascenso de una montaña en la Tierra porque requiere de varias disciplinas diferentes, como exploración, escalada, espeleobuceo, e incluso fotografía, al tener que encontrar la manera de proveer luz en lugares que se encuentran en perpetua oscuridad. En cierto sentido, el Sistema Cheve, y lugares como este en otros lugares de la Tierra, son la última frontera física y psicológica que queda en la Tierra. Son análogos para la lejanía y las dificultades que habrá que superar al expandirse la humanidad a través del Sistema Solar en el transcurso del próximo siglo.

Pero la verdadera atracción del Sistema Cheve es su profundidad, específicamente la profundidad potencial que pudiera lograrse si todas las cuevas fueran conectadas. La espeleología es un deporte que se inició en Francia en el siglo XIX. Hoy en día se practica en casi todos los países del mundo que tienen piedra caliza, y es un deporte altamente competitivo. Los equipos compiten para ver quién puede explorar las cuevas de más longitud o de mayor profundidad del planeta. Es a la vez un deporte físico - las personas que participan en estas expediciones son el equivalente de atletas olímpicos - y también un reto mental, donde cada expedición es como una jugada más en un complicado juego de ajedrez tridimensional. México es un país famoso por sus cuevas profundas. Al final de este prólogo podrá encontrar una tabla de las cuevas más profundas del mundo, y podrá apreciar que en la actualidad los lugares 11, 12, 28, 36, 37 y 38 de las cuevas más profundas del planeta están en México. El Sistema Cheve ocupa ahora el lugar número 11.

El objetivo del deporte - y del proyecto para explorar el Sistema Cheve - es demostrar que todas las cuevas en esta región están conectadas. De ser así, el

Sistema Cheve se establecería como la cueva más profunda del mundo. Este logro podría llevar una distinción única y positiva a las municipalidades locales, al estado de Oaxaca y a México como país. Para los exploradores el único interés es simplemente el privilegio de formar parte del equipo que gane esta competencia internacional, de igual manera que otros equipos compiten para ganar una meta, por ejemplo en la Copa Mundial de Fútbol.

En cuanto a la pregunta de qué encontramos en las cuevas, la respuesta es simple: roca, agua y lodo. La roca es completamente de piedra caliza (carbonato de calcio), que el agua subterránea disuelve fácilmente para formar cuevas. Al oeste de la región está otro tipo de roca que el agua no disuelve tan fácilmente y por lo tanto las cuevas no se desarrollan en ella. En esta región el agua se transporta sobre la superficie en forma de arroyos, y se hunde bajo tierra al alcanzar la piedra caliza. Ya en el subsuelo el agua sigue grietas en la piedra caliza, y poco a poco las va ensanchando para formar cuevas lo suficientemente grandes como para que puedan ser exploradas. Las entradas a las cuevas a veces se amplían y forman depresiones en el terreno conocidas a veces como "dolinas", o "sumideros" cuando corrientes de agua se internan en ellos. El agua viaja por debajo de la tierra y en ciertos casos reaparece en la superficie en manantiales o resurgencias, como la Cueva de la Mano.

Las fotos que usted verá a lo largo de este libro muestran lo que se encuentra en el interior de las cuevas. Todas estas fotos fueron cuidadosamente iluminadas con luz artificial, a menudo con el fotógrafo colgando de una cuerda a la mitad de un pozo profundo, o bajo el agua con los buzos que están tratando de nadar a través de un túnel sumergido.

La mayoría de las cuevas del mundo se encuentran en piedra caliza. Esta es una roca suave gris que fue depositada poco a poco en capas en el lecho de un mar antiguo. En las montañas de Puebla y Oaxaca se puede encontrar piedra caliza en espesores de hasta 2300 metros. La estratificación de la deposición de caliza es aún visible en los acantilados y las paredes de las cuevas. Las cuevas están formadas por grandes corrientes de agua, como ríos, que viajan por debajo de la tierra, y al irse desplazando por ella van disolviendo un poco de piedra caliza hasta que se satura de minerales. El agua entonces deposita dichos minerales en el interior de las cuevas en la forma de estalactitas, estalagmitas y formaciones similares. Estas formaciones son más cristalinas que la piedra caliza original ya que no incluyen varias impurezas que la piedra tenía en un principio, por lo que son por lo general de un color marrón claro o incluso blanco o transparente. La mayoría de estas formaciones se encuentran en los niveles superiores de las cuevas, fuera del alcance de los flujos violentos de agua.

Ninguno de los materiales encontrados en el interior de estas cuevas tiene un valor comercial. La piedra caliza es valiosa sólo cuando se extrae en grandes cantidades y se procesa como piedra, grava o cal, o para ser usada en la fabricación de cemento. Los espeleólogos nunca han encontrado minerales valiosos en cuevas de la

Sierra Madre Oriental de México. Los materiales preciosos como el oro, las joyas y el petróleo por lo general casi nunca se encuentran en cuevas, y están total y completamente ausentes de las cuevas de los distritos de Cuicatlán y Teotitlán. Las gemas y minerales preciosos se concentran principalmente en zonas con aguas termales volcánicas que se filtran a través del suelo, y no se encuentran en las zonas de arroyos en montañas frías de las zonas del Sistema Cheve, Huautla y Cerro Rabón al norte. El petróleo y el gas se concentran principalmente en las zonas bajas, donde se han acumulado capas profundas de arena y barro, y ciertamente no están presentes en las sierras de Puebla y Oaxaca.

Las declaraciones anteriores son fidedignas y se puede verificar de manera exhaustiva en el siguiente libro sobre geología de cuevas, que pronto estará disponible en español:

Palmer, A.N., 2007, **Cave Geology**: 454 paginas, Reimpreso 2009, 2012.

Este libro está disponible en las siguientes páginas en la red:

www.cavebooks.com
www.speleobooks.com
www.amazon.com

Para aquellos que deseen verificar estos hechos por sí mismos, hay varias organizaciones dentro de México donde puede obtenerse entrenamiento en las técnicas de exploración de cuevas. El entrenamiento es especialmente necesario para la exploración de las cuevas de Oaxaca, ya que son predominantemente de naturaleza vertical, con muchos pozos (tiros verticales) profundos que hay que descender y ascender con equipo técnico especial. En el Apéndice B se proporciona una lista e información de contacto de grupos mexicanos activos en exploración de cavernas y que además proporcionen entrenamiento en técnicas de exploración de cuevas.

Esperamos que a usted le parezca que este libro es educativo y que al mismo tiempo las historias presentadas son interesantes. Usted puede encontrar más información sobre las cuevas de México en la página en la red mencionada anteriormente de la Asociación de Estudios de Cuevas Mexicanos y en la página en la red siguiente: www.usdct.org

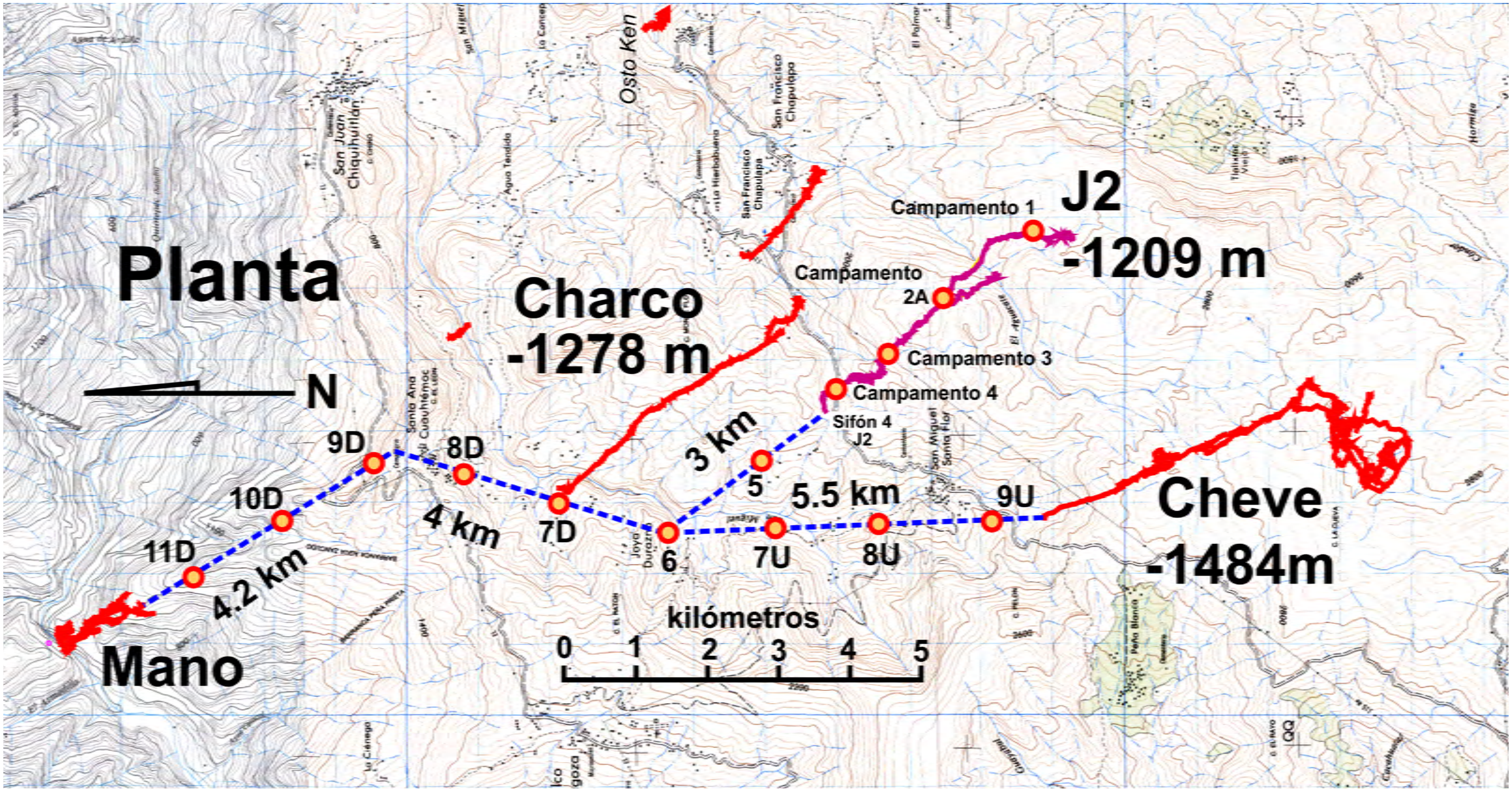
Las preguntas específicas pueden dirigirse a la siguiente dirección de correo electrónico: info@usdct.org

Bill Stone
Austin, Texas
Enero 2013

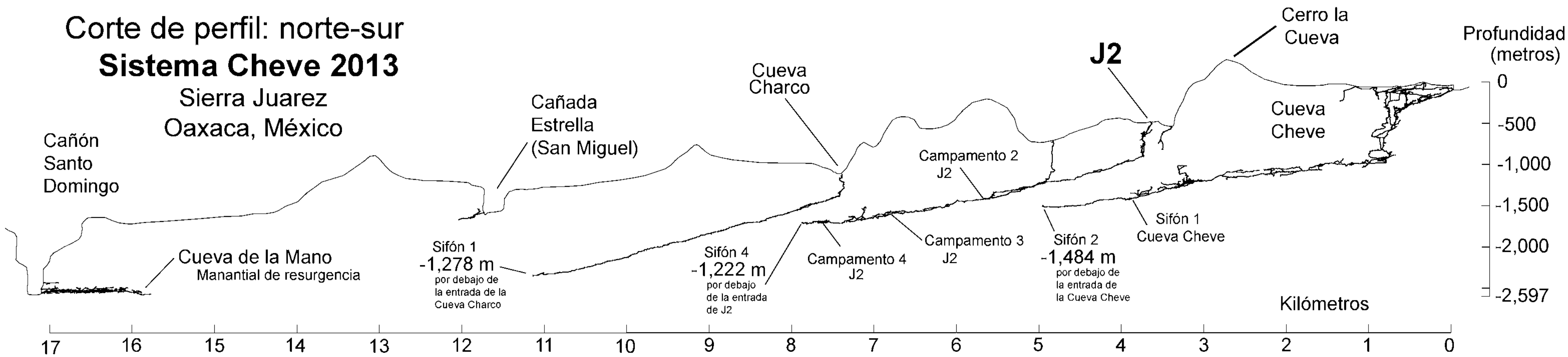
El estado actual de la exploración de Sistema Cheve: enero 2013

Las Cuevas Mas Profundas del Mundo 2013

Numero en el Mundo	Nombre de la Cueva	Pais	Estado	Municipio	Longitud Metros	Profundidad Metros
1	Krubera (Voronja) Cave	Georgia	Abkhazia	West Caucasus	16058	2197
2	Sarma	Georgia	Abkhazia	West Caucasus	6370	1830
3	Illyuzia-Mezhonnogo-Snezhnaya	Georgia	Abkhazia	West Caucasus	24080	1753
4	Lamprechtsofen Vogelschacht Weg Schacht	Austria	Salzburg	Loferer Steinberge	38000	1632
5	Gouffre Mirolda / Lucien Bouclier	France	Haute Savoie	Samoens	13000	1626
6	Reseau Jean Bernard	France	Haute Savoie	Haute-Giffre	20536	1602
7	Torca del Cerro del Cuevon (T.33)-Torca de las Saxifrag	Spain	Asturias	Picos de Europa	7060	1589
8	Shakta Vjacheslav Pantjukhina	Georgia	Abkhazia	West Caucasus	5530	1508
9	Sima de la Cornisa - Torca Magali	Spain	Leon	Picos de Europa	6435	1507
10	Cehi 2	Slovenia	Julian Alps	Rombonski Podi	5291	1502
11	Sistema Cheve (Cuicateco)	Mexico	Oaxaca	Cuicatlan	26194	1484
12	Sistema Huautla	Mexico	Oaxaca	Huautla de Ji.	62099	1475
13	Sistema del Trave	Spain	Asturias	Cabrales	9167	1441
14	Evren Gunay Dudeni (Mehmet Ali Ozel Sinkhole)	Turkey	Icel	Anamur	3118	1429
15	Sustav Lukina jama - Trojama (Manual II)	Croatia	Sj Velebit	Hajdueki kukovi	1078	1421
16	Boj-Bulok	Uzbekistan	Uzbekistan	Gissaro-Alay	14270	1415
17	Gouffre de la Pierre Saint Martin - gouffre des Partages	France / Spain	Pyrenees-Atlantiques	Pierre Saint Martin	80200	1408
18	Sima de las Puertas de Illaminako Ateeneko Leizea (BU.	Spain	Navarra	Larra	14500	1408
19	Kuzgun Cave	Turkey	Eastern Taurus	Aladaglar massif	3187	1400
20	Abisso Paolo Roversi	Italy	Toscana	Alpi Apuane	4000	1350
21	Sistema Aranonera (Sima S1-S2)(Tendenera connected)	Spain	Huesca	Pirineos	44682	1349
22	Siebenhengste-hohgant Hoehlensystem	Switzerland	Bern	Eriz/Beat./Ha.	157000	1340
23	Gouffre Berger - Gouffre de la Fromagere	France	Isere	Vercors	31790	1323
24	Slovacka jama	Croatia	Sj Velebit	Mali kuk	2519	1320
25	Mala Boka - BC4 System	Slovenia	Julian Alps	Bovska Kotlina	8168	1319
26	Hochscharten-Hohlensystem	Austria	Salzburg	Hoher Goll	14100	1318
27	Cosanostraloch-Berger-Platteneck Hoehlesystem	Austria	Salzburg	Tennengebirge	30396	1291
28	Cueva Charco	Mexico	Oaxaca	Cuicatlan	6710	1278
29	Vladimir V. Iljukhina System	Georgia	Abkhazia	West Caucasus	5890	1275
30	Sistema del (Pozu) Xitu (Jitu)(Situ) - Cueva de Culiembro	Spain	Asturias	Picos de Europa	8022	1264
31	Neide - Muruk Cave	Papua New Guinea	New Britain	Galowe Plateau	17000	1258
32	Torca dos los Rebecos	Spain	Asturias	Picos de Europa	2228	1255
33	Pozo del Madejuno	Spain	Leon	Picos de Europa	2853	1252
34	Crnelsko brezno (Abisso Veliko Sbrego)	Slovenia	Julian Alps	Rombonski Podi	11450	1251
35	Renejevo brezno	Slovenia	Julian Alps	Kaninski podi	3500	1250
36	Sotano Akemati	Mexico	Puebla	Ocotempa	4918	1226
37	Kihaje Xontjoa	Mexico	Oaxaca	Cerro Rabon P.	31373	1223
38	Ozto J2	Mexico	Oaxaca	Cuicatlan	11017	1222
39	Schwer-Hoehlensystem (Batmanhole)	Austria	Salzburg	Tennengebirge	6273	1219
40	Abisso Ulivifer (Olivifer)	Italy	Toscana	Alpi Apuane	10000	1215



Vista Planta del Sistema Cheve 2013: Este mapa muestra el estado actual del conocimiento de Sistema Cheve en enero de 2013. Las cuevas más grandes se muestran como líneas rojas. Las líneas de puntos azules son la ruta hipotética de las cuevas más allá de los límites actuales de exploración - el sistema actual, sin duda, será más complejo, pero esto es una idea general de lo que actualmente creemos que será el curso aproximado seguido por los ríos subterráneos más importantes .



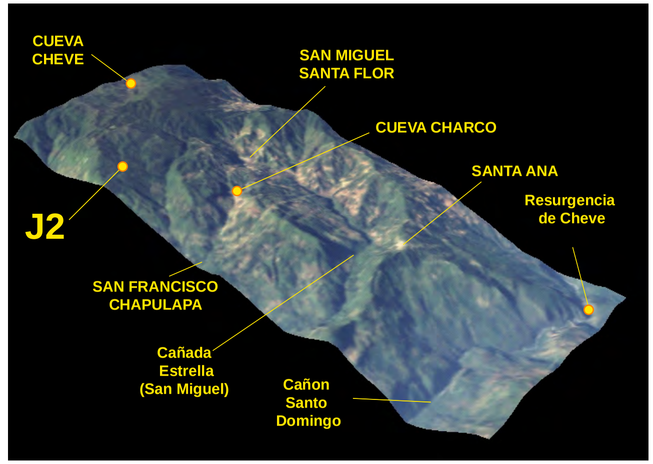
Sistema Cheve 2013 en Vista Corte de Perfil Norte-Sur: La gran escala del Sistema Cheve. El agua se dirige bajo tierra en las alturas. Diecisiete kilómetros después emerge de manantiales en las profundidades del Cañón Santo Domingo. El desarrollo vertical hidrológico es de 2,597 metros. La longitud potencial de todo el sistema, si todas las cuevas están conectados, probablemente será en exceso de 100 kilómetros

La Misión 2013:

El objetivo principal de la expedición en febrero de 2013 será la exploración del Sifón 4 en J2, el establecer del campamento subterráneo 5 en los túneles secos más allá del sifón y extender la exploración hacia el hipotético pasaje central dentro de la Sierra de Juárez. Si la exploración inicial es exitosa entonces en marzo, abril y mayo el enfoque será en la exploración de dicho túnel en dirección sur hacia Cheve y dirección norte hacia la resurgencia de Cueve de la Mano. Una conexión con la Cueva Cheve derivaría en un sistema con más de dos kilómetros de profundidad. La integración del sistema completo significaría una cueva con 2,597 metros de profundidad y representaría la cueva natural de mayor profundidad en el mundo.

Antecedentes: En 1987 la Cueva Cheve fue descubierta por exploradores a una gran elevación en la Sierra de Juárez en el noreste del estado de Oaxaca, México. Actualmente tiene 1484 metros de profundidad y es la cueva explorada a mayor profundidad en el hemisferio occidental y la 11ª cueva más profunda a nivel mundial. El límite de exploración actual en la Cueva Cheve, a 9.3 kilómetros desde la entrada más cercana, representa uno de los puntos más remotos alcanzados en cualquier cueva en el planeta. La logística para alcanzar este punto es enorme: más de dos kilómetros de cuerdas son necesarios y es necesario establecer tres campamentos subterráneos. La profundidad actual fue alcanzada durante una expedición de 3 meses organizada por los Estados Unidos en 2003, que colocó a un equipo de cuatro buzos más allá de dos túneles subacuáticos a una profundidad de -1362 metros. Los buceos fueron altamente exitosos y el equipo exploró rápidamente 1.3 kilómetros adicionales de nuevos terrenos que se internaban más profundamente en la montaña. La exploración fue detenida por un túnel colapsado que bloqueaba la ruta.

El reto: Nadie ha regresado al Sistema Cheve, y el misterio de lo que aún queda por descubrir en la Sierra de Juárez permanece aún. Sin embargo, en 2004 una expedición internacional de reconocimiento organizada por el U.S. Deep Caving Team descubrió una nueva cueva llamada J2, ubicada en el bosque tropical en la zona de Ocotal, 5 kilómetros al noreste de Cheve. Fue inmediatamente aparente que J2 iba a alcanzar una gran profundidad rápidamente y que se dirigía hacia de la Cueva Cheve, con una intersección estimada más allá del túnel colapsado que detuvo la exploración en 2003. Durante el curso de cuatro expediciones en 2004, 2005, 2006 y 2009 la cueva J2 fue explorada hasta una distancia de 11.5 kilómetros desde la entrada más cercana, y hasta una profundidad de -1222 metros.

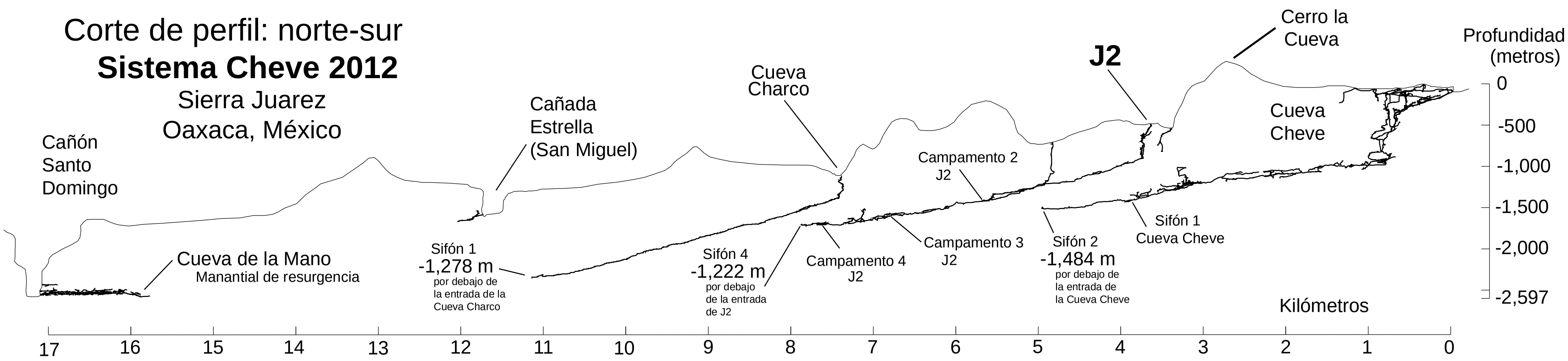


Mapa de la superficie de la región del Sistema Cheve, Oaxaca, México.

Para llegar a ese punto el equipo tuvo que explorar y cruzar cuatro túneles subacuáticos. Tomando como base el Campamento 4, una exploración de punta de 19 días en 2009 exploró hasta 300 metros dentro del Sifón 4, donde el equipo de buceo usó el último tramo de línea guía y se notó que el túnel ascendía. El modelo en 3D de la montaña muestra que el túnel seguirá de manera ascendente, ya no estará sumergido y después descenderá más de 800 metros verticalmente hasta cruzar por debajo de la Cañada Estrella (San Miguel), en ruta hacia la resurgencia en la Cueva de la Mano. Llegar ahí requerirá aumentar los límites de la tecnología actual de exploración. Para lograr esto, un grupo de 11 personas que forman parte de un equipo de 57 exploradores internacionales que trabajarán en la cueva J2 en 20013 están en entrenamiento para usar un equipo de buceo diseñado especialmente para la expedición, que tomará como base el equipo de buceo autónomo por recirculación Poseidón MK6, pero modificado para ampliar su rango de trabajo. El equipo, del tamaño de un portafolios, es suficientemente pequeño como para ser transportado al Sifón 4, donde la exploración de punta comenzará en marzo de 2013. Los buzos de exploración completarán la exploración del Sifón 4 y establecerán el Campamento 5 en los túneles secos más allá del sifón. Equipos de tres personas comenzarán la exploración de los pasajes después del sifón, en lo que seguramente será uno de los proyectos de exploración más remotos y originales de la década.

Foto de la portada: El inicio del Sifón 4 en J2. El límite actual de exploración es 300 metros al interior de este túnel subacuático.

Corte de perfil: norte-sur
Sistema Cheve 2012
Sierra Juarez
Oaxaca, México



Parte superior derecha: La gran escala del Sistema Cheve. El agua se dirige bajo tierra en las alturas. Diecisiete kilómetros después emerge de manantiales en las profundidades del Cañón Santo Domingo. El desarrollo vertical hidrológico es de 2597 metros (8500 pies).

Programa:

Agrupamiento en Texas: 1 de febrero de 2013.
Establecimiento del Campamento Base: 15 al 28 de febrero.
Armado hasta el Sifón 4: 1 al 15 de marzo.
Exploración principal: 16 de marzo al 15 de mayo de 2013.

Organización:

J2 2013 está siendo organizada por el explorador Dr. Bill Stone, quien cuenta con amplia experiencia, e incluye miembros de países como los Estados Unidos, Polonia, Gran Bretaña, Canadá, Irlanda, Holanda, Rusia, Alemania, Suecia, Bélgica y Suiza. La expedición es un proyecto oficial del U.S. Deep Caving Team (USDCT).

Sea un patrocinador:

El USDCT es una corporación sin fines de lucro, con metas científicas y educativas. Todas las contribuciones son deducibles de impuestos.

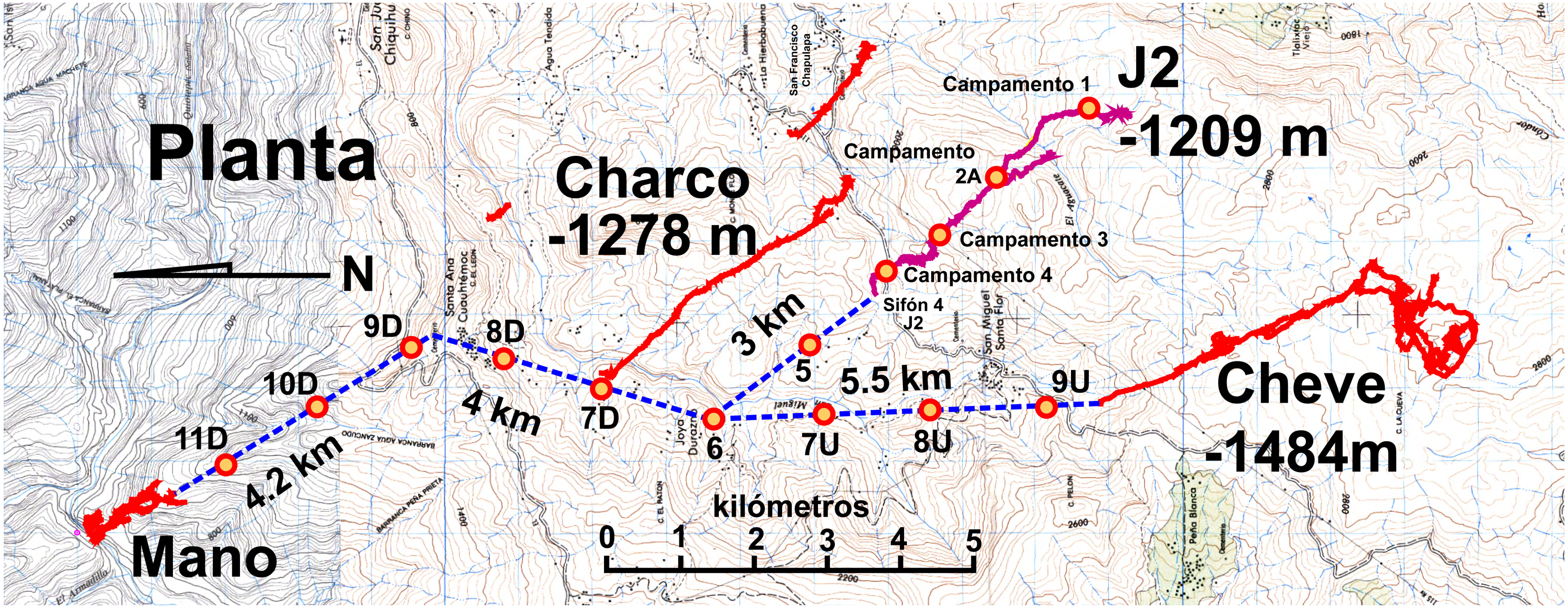
U.S. Deep Caving Team, Inc.
3155 Caldwell Lane
Del Valle, TX 78617
Correo electrónico:
bill.stone@stoneaerospace.com
Página en la red: www.usdct.org

La Misión:

La expedición iniciará en Austin, Texas, EE. UU., donde se realizará el agrupamiento inicial y estará en el campo por tres meses. El objetivo principal de la expedición en marzo de 2013 será la exploración del Sifón 4 en J2, el establecer el Campamento subterráneo 5 en los túneles secos más allá del sifón y extender la exploración hacia el hipotético pasaje central dentro de la Sierra de Juárez. Si la exploración inicial es exitosa entonces en abril y mayo el enfoque será en la exploración de dicho túnel en dirección sur hacia Cheve y dirección norte hacia la resurgencia. Una conexión con la Cueva Cheve derivaría en un sistema con más de dos kilómetros de profundidad. La integración del sistema completo significaría una cueva con 2597 metros de profundidad y representaría la cueva natural de mayor profundidad en el mundo.

Nueva Tecnología para 2013:

En colaboración cercana con los patrocinadores de la expedición Poseidon Diving Systems (Suecia), trajes secos SANTI, Cupron Fabric Systems y Polartec se ha equipado a la expedición con tecnología de punta en equipos de soporte vital y trajes que permitirán la permanencia bajo tierra por 30 días y el cruce de pasajes subacuáticos.

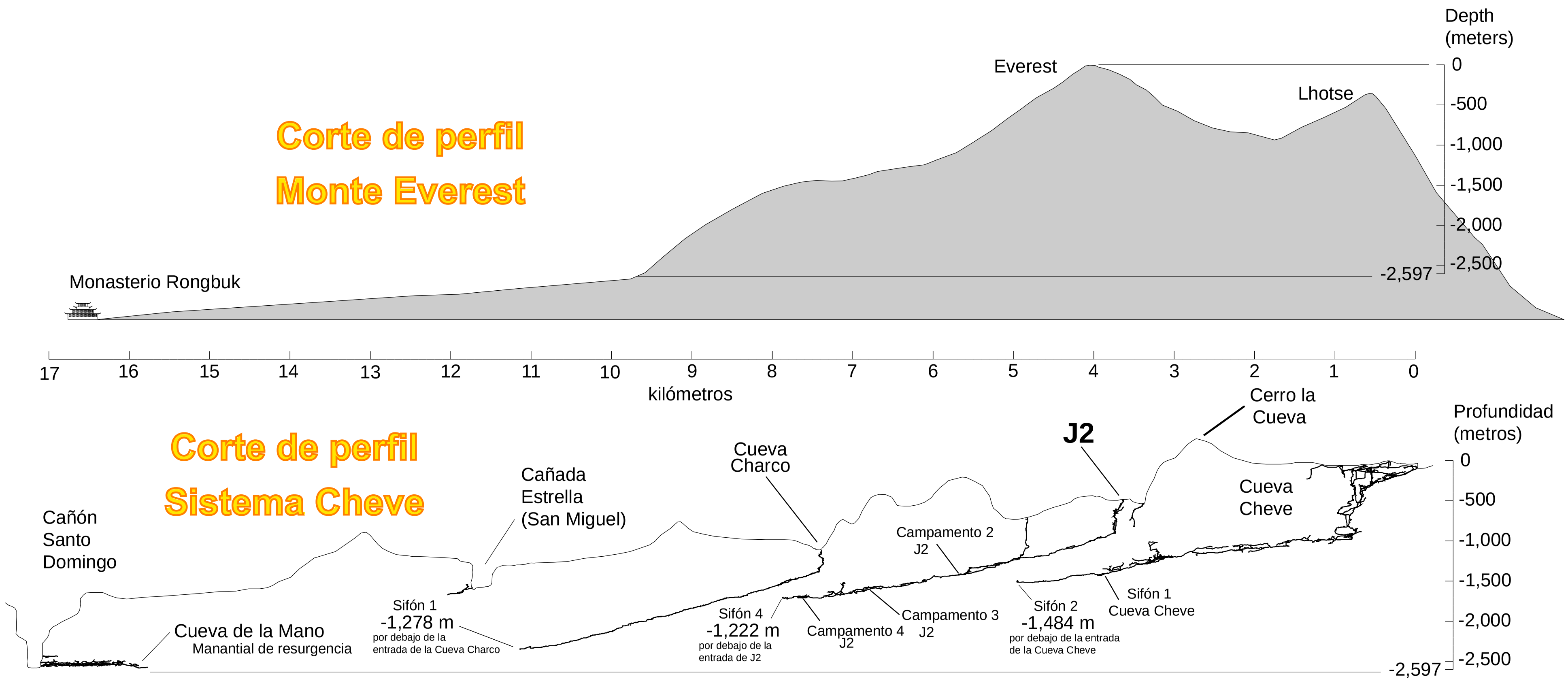


Logística para 2013:

El límite actual de exploración en J2 representa territorios totalmente desconocidos. El mapa en esta página representa la topografía en vista de planta, junto con los sistemas de cuevas conocidos en la Sierra de Juárez. La línea punteada azul representa una hipótesis simplificada de lo que podría haber después de los límites conocidos. Los pasajes actualmente ya explorados han representado un gran esfuerzo a través de más de 25 años y 16 expediciones. La distancia que se tendrá que recorrer bajo tierra podría ser dos a tres veces más que la distancia lineal en la superficie. Son aproximadamente 11 kilómetros de travesía subterránea desde la entrada de J2 hasta el inicio del Sifón 4. Esto es mucho más allá de los límites del cuerpo humano. Para lograr el recorrido se ha partido en segmentos que representan 8 a 12 horas de viaje con una mochila pesada y se han establecido campamentos subterráneos. Hay actualmente cuatro campamentos en J2, con el campamento más remoto (el Campamento 4, establecido en 2009) a una profundidad de -1200 metros y después de más de 220 metros de pasajes subacuáticos. En 2013 se tiene pensado transportar material (equipo de buceo, alimentos, equipo de armado) hasta el Campamento 4 durante las primeras seis semanas del proyecto. A partir del Campamento 4 el equipo de exploración subacuática completará la exploración del Sifón 4 y buscará un lugar para establecer el Campamento 5, más allá de los túneles subacuáticos. El análisis geológico predice que los pasajes tomarán un curso descendente por más de 800 metros después del Sifón 4 hasta el punto donde J2 intersecta el pasaje principal del Sistema Cheve. El mapa muestra con círculos rojos y amarillos los campamentos ya establecidos y los que se podrían necesitar establecer para explorar en su totalidad el Sistema Cheve desde la entrada por J2. Ya que cada campamento representa un día de travesía, una exploración exitosa en el corazón de la Sierra de Juárez significaría permanecer bajo tierra por un mes o más.

De manera simultanea con el esfuerzo aquí detallado, y ya que habrá un gran número de exploradores involucrados, se buscará en la superficie una cueva paralela, actualmente aún desconocida, que podría existir entre J2 y la Cueva Cheve. De ser descubierta, ésta podría proveer una ruta alternativa, libre de sifones, hacia el interior del Sistema Cheve.

A la derecha: Ascendiendo el Cañón Negro, a -700 m en J2.



Escala Relativa:
Las cuevas son oscuras. No se pueden ver desde la superficie. Sus entradas muchas veces no muestran la escala de lo que se encuentra en su interior. No hay una manera de comprender la escala de una cueva desde la superficie. De manera inversa, las montañas tienen el efecto opuesto: mientras más cercano a una montaña es mayor su imponencia y escala. No hay lugar que brinde un sentimiento mayor de humildad de mejor manera que el Monte Everest. Desde el Monasterio Rongbuk (a la extrema izquierda en el perfil superior, y desde donde se tomó la foto a la izquierda) el Everest es imponente aún a 20 kilómetros de distancia. Al acercarse en la ruta original de Mallory (la arista izquierda en la foto) es claramente aparente el tamaño descomunal de la montaña para cualquier persona que intenta escalarla. El otro mapa en esta página muestra los límites conocidos del Sistema Cheve comparados con un corte transversal del Monte Everest. La extensión horizontal del sistema de cuevas es mucho mayor que la del Everest, que abarcaría desde Lhotse hasta el Monasterio Rongbuk. El equipo de exploración de 2013, de ser exitoso, recorrería una distancia bastante mayor que la distancia del Monasterio Rongbuk a la cumbre del Everest, con un desnivel equiparable con el necesario para llegar a la cumbre desde el glaciar Rongbuk. Al contrario que los montañistas, la parte más pesada comienza al iniciar el regreso a la superficie: la única salida es hacia arriba.

Narrativas Históricas de Exploración desde 1986 hasta 1993

Proyecto Cheve 1986-1993

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Un breve comentario sobre el nombre del proyecto:
El nombre de la cueva principal, Cueva Cheve, ha sido usado por la gente de la localidad por mucho tiempo. En 1986, cuando los primeros espeleólogos comenzaron a explorar el área, llamaron al sistema de cuevas Sistema Cuicateco por la cultura local predominante, y llamaron al proyecto de espeleología Proyecto Pápalo por su pueblo más cercano. En los años siguientes, el área del proyecto fue expandiéndose, hasta incluir muchos pueblos y culturas, de forma que los nombres del proyecto y el sistema ya no representaban la totalidad del proyecto. El nombre de la cueva, Cheve, era conocido a través de la región, por lo que en 1992, los nombres fueron cambiados a los de Proyecto Cheve y Sistema Cheve.

INTRODUCCION

El Sistema Cheve se encuentra en dirección norte-sur en la cordillera llamada La Sierra Juárez en el estado de Oaxaca. En estas montañas se localizan algunos de los sistemas de cavernas más profundos de México. La parte alta del Sistema Cheve está en la región norte de la cordillera, nueve kilómetros al este del pueblo de Concepción Pápalo, a aproximadamente 2,800 metros de elevación. El area está cubierta por bosques y pinos. El Sistema Cheve acarrea el agua desde las cumbres cerca de Pápalo hasta que las descarga en el cañón del Río Santo Domingo 19 kilómetros al norte. Durante ocho años el Proyecto Cheve ha estado explorando y haciendo mapas de partes de este Sistema de drenaje subterráneo.

El más alto segmento del Sistema Cheve consiste en Cueva Cheve, la principal caverna del Sistema, y una serie de cavernas más pequeñas (Osto de Puente Natural, Viento Frío, Cuates, Escondida) que se conectan a la caverna principal. La Cueva Cheve contiene 23.5 kilómetros de pasajes explorados que terminan en un masivo pasaje bloqueado por rocas gigantescas al otro lado y tubos submarinos. Al área que rodea estas entradas se le llama el Karst Superior (cada vez que se menciona Karst, es nada más que un término geográfico que se refiere a diferentes tipos de topografía que se ha formado por agua sobre o en caliza).

Las aguas que caen en la más alta de las entradas viajan una distancia de más de 7 kilómetros, 1,362 metros en forma vertical hasta llegar a un pasage submarino. Los siguientes 15 kilómetros de la ruta aquática son desconocidos. Finalmente el agua reaparece en el componente inferior del sistema Cueva del Mano y corre hasta el cañón del río Santo Domingo. Cueva del Mano consiste en una red de pasajes laberinticos que terminan en rocas cubiertas con calcita o pasajes submarinos corriente arriba. Al territorio arriba de la parte desconocida del sistema se le llama El Karst intermedio y Cueva del Mano se localiza en el area de resurgencia.

En 1990, al vertir tinta en la corriente, se confirmó la conexión hidrológica entre la Cueva Cheve y la Resugencia con una extensión vertical de 2,525 metros y una travesía norte-sur de 19 kilómetros. Aunque el agua corre de una entrada a la otra, eso no garantiza un sistema de pasajes por donde quepa un humano. Existe una alta probabilidad de que uno exista. El Proyecto Cheve está avocado a encontrar y documentar una ruta atravesable que vaya de Cueva Cheve a la Resurgencia..

CUEVA CHEVE

Exploración Inicial

Bill Farr y Carol Vesely fueron los primeros exploradores en visitar la Cueva Cheve. En diciembre de 1986, mientras seguían una pista que les dió Peter Sprouse, localizaron un valle de .5 kilómetros por 1.5 kilómetros de largo valle cerca de Concepción Pápalo. Investigaron la entrada sur del valle y encontraron varias cuevas pequeñas antes de encontrar la impresionante (6 metros de alto por 30 metros de alto) entrada a la Cueva Cheve. Justo a la derecha de la entrada principal y un poco más arriba, localizaron otra alta y angosta entrada.

La entrada principal del Sistema Cheve, conocido localmente como Cueva Cheve, está localizado en la base de un acantilado de 60 metros de alto en la parte norte de un llano llamado Llano Cheve. Este llano es un sitio excelente para acampar. Una arroyuelo corre a través del llano y la cámara de entrada. Justo más allá de la línea de entrada, la cueva se abre en una cámara de entrada de 70 metros de ancho por 30 metros de alto por 200 metros largo. Canastas, antorchas, huesos humanos y de animales al igual que otros restos de artículos ceremoniales fueron encontrados demostrando que esta cámara ha sido conocida por al menos 700 años. Piedras gigantescas de diversos tamaños conforman el piso que tiene un declive de 30 grados en promedio.

Corriente abajo de la cámara de entrada hay un cañón largo que conduce al Cuarto de las Canastas, llamado así porque contenía los restos de varios tapetes tejidos. Este es el último punto donde los rayos del sol son visibles. El pasaje continúa al oeste hasta el Cuarto del Elefante Negro. Este cuarto está lleno con grandes rocas oscuras y resbaladizas que dificultan la navegación. Marcas en la pared y el descubrimiento de artefactos indican que este cuarto, a 20 o 30 minutos de la entrada y en total oscuridad, era usado para ceremonias religiosas. La corriente principal corre desde el fondo del Cuarto del Elefante Negro por una serie de repisas húmedas hasta una triple cascada de 12 metros de alto (Triple Wammey Falls). Un pasaje lateral bien decorado llamado La Tierra del Enano conduce a un bello cuarto llamado, por sus formaciones, Taller de Santa Claus.

Continuando por el viento en vez de por el agua, un angosto pasadizo en el Cuarto de las Canastas conduce a Cañón Fresco llamado así por la brisa (usualmente 7 grados centigrados) que sopla a lo largo del fondo del pasaje. La primera repisa cae 7 metros hacia un pequeño y seco cuarto. Una ruta a través de un pasaje bloqueado por rocas grandes conduce a una segunda caída de 6 metros, seguida por una tercera repisa de cerca de 6 metros que cae en un lago poco profundo. El Cañón Fresco continúa hacia otra caída llamada el Doble Vado. Es aquí donde la exploración terminó en el primer viaje.

Farr y Vesely regresaron por pocos días en marzo del 1987 para continuar su exploración de Cueva Cheve y evaluar el potencial del area. Comenzaron un extensivo reconocimiento de superficie que incluía localizar y marcar numerosas entradas a la cueva para exploraciones futuras. En Cueva Cheve continuaron más allá del Doble Vado pasando varias caídas más hasta pronto

The Giant's Staircase
La Escalera del Gigante *by Bill Stone*

reencontrar la corriente principal. La sección corriente arriba se conecta a la base de Triple Wammey Falls. Corriente abajo, la ruta desciende a través de varias cortas y húmedas repisas. Sin embargo, por falta de cuerda no fue posible seguir la corriente.

Un pasaje de la esquina noroeste del Cuarto de Entrada condujo al descubrimiento de la Corriente Sorpresa. La investigación mostró que la Corriente Sorpresa casi se conecta con la corriente de la entrada. La porción corriente abajo termina en un sifón (pasaje submarino) después de algunas repisas. La sección corriente arriba va hacia una caída de agua que abre el camino a varios cientos de metros de pasaje. Una brisa sugiere la existencia de una entrada aunque ésta no se ha podido localizar.

Un alto pasaje de cañón que se ramifica desde la cámara de entrada conduce a la angosta y altísima segunda entrada localizada en la parte superior al este de la entrada principal de Cueva Cheve. El pasaje fue llamado El Pollo Congelado porque se encontraron huesos de pollo y otra evidencia de uso ceremonial por los habitantes locales. Después encontraron dos depresiones en la tierra en el techo del acantilado, 60 metros arriba de la entrada de la Cueva Cheve, que caen directamente en el pasaje del Pollo Congelado.

Cuando Vesely y Farr dejaron la región en esa ocasión, la extensión explorada de la Cueva Cheve era 1.5 kilómetros y la profundidad -200 metros. La cueva tenía tanto buena circulación de aire como de agua y más pasajes por explorar. Además 6 nuevas entradas fueron localizadas y marcadas. Planeaban regresar el siguiente año con más gente.

Regalo de Navidad para las Turbinas

En diciembre de 1987, siete exploradores regresaron al Karst superior para continuar la exploración. El primer equipo continuó explorando el pasaje río abajo hasta llegar a la impresionante Catarata Subterránea. En la Catarata Subterránea, llamada así por el viento y el rocío, hay una desviación seca con una caída de 20 metros que conduce a otras dos caídas más cortas. Aproximadamente 10 metros de pasaje fácil (algo que es raro en la Cueva Cheve) lleva a una de las más largas caídas en Cheve, la Chimenea del Elefante de 45 metros de profundidad. Trepando a algunas rocas grandes, se llega a una serie de pozos precisamente donde el primer equipo de reconocimiento se detuvo a una profundidad de 300 metros.

En el siguiente viaje, Don Coons, Matt Oliphant, Nancy Pistole y Vesely hicieron un muy agradable descubrimiento: encontraron una desviación hacia las repisas húmedas más allá del Doble Vado. Al ascender a través de un agujero, arriba de la fisura que conduce a la Catarata Subterránea, los exploradores se alegraron mucho al encontrarse en una cámara llena de gigantescas piedras, algunas de ellas tan grandes como una casa pequeña. A esta cámara se le llamó Regalo de Navidad porque fue descubierta el día antes de Navidad. Esta cámara, después de tres repisas, se reúne nuevamente con la ruta original abajo de la Catarata Subterránea. Esta nueva ruta hizo posible llegar hasta el punto más lejano de la exploración sin mojarse.

El equipo continuó más allá de la Chimenea del Elefante hasta llegar a la Catarata de la Reunión (15 metros). En la base de esta catarata, la corriente principal es de nuevo encontrada ahora con más caudal que a la entrada. Continuando un alto y angosto cañón bajo una caída de 4 metros, los exploradores pronto llegaron a la Caída del Angel de 30 metros de profundidad. El uso de una ancla redireccional (instrumento que se usa para redirigir la cuerda para que no roce con la roca ni con el agua) que permite un fácil descenso a través de una pared casi vertical a sólo un metro de la fuerte corriente de la cascada. Una fuerte corriente que se junta con la corriente principal en la base de la caída fue después empujada corriente arriba por varias repisas en el contínuo pasaje.

Corriente abajo de la Caída del Angel, una alto pasaje conduce a un Borehole (un túnel enorme) de 20 metros de ancho, llena de piedras gigantescas. Después de 100 metros la corriente se filtra en el suelo, pero el túnel continúa sobre una gran montaña de piedras de 40 metros de altura, La Joroba del Camello (the Camel's Hump). El pasaje, llamada la Escalera del Gigante continúa en declive en un ángulo promedio de 30 grados con piedras de tamaño de casas y carros. Cerca de 200 metros más allá del la Joroba del Camello hay una area arenosa que después sería usada como campamento uno. Otros 200 metros más allá hay un bien decorado pasaje colateral, el cual fue después explorado y que condujo rumbo al suroeste a un pasaje bloqueado por rocas cubiertas de calcita.

Después de un total de 500 metros del túnel, el cielo de la Escalera del Gigante de repente baja hasta casi tocar el suelo. Los exploradores siguieron una fuerte brisa a través de algunas gigantescas piedras y después de otros 100 metros en el túnel, se encontraron al borde de un pozo muy profundo. Descendieron 50 metros por cuerda por la pared cubierta de calcita hasta llegar a un saliente arenoso donde pudieron ver la corriente principal desembocando en la pared del pozo. La corriente fluye bajo el saliente y continúa descendiendo por un largo trecho. Los exploradores estaban ahora a más de 500 metros de profundidad en la cueva pero ya no tenían cuerda.

Peter Sprouse, Susie Lasko, Oliphant y Farr regresaron y aparejaron los 78 metros inferiores del pozo con una cuerda de 90 metros. Después varias anclas fueron instaladas para evitar el poderoso rocío de la cascada. Impresionados por la oscuridad del pozo, los exploradores lo llamaron el Pozo de Saknussemm en honor al famoso explorador de Julio Verne.

En la base del pozo, otra corriente alimenta la corriente principal doblando su tamaño. Una angosta fisura con una fuerte brisa en el fondo de la caída conduce a un pasaje submarino, pero un pasaje alternativo permite reencontrar la corriente, la cual ahora fluye con considerable fuerza. El pasaje comienza a ensancharse y tiene paredes de roca coloridas y esculpidas con una serie de caídas de agua interrumpidas por hermosas y verdes albercas naturales. Esta sección es llamada La Escalera del Salmón. Al final de esta serie de cascadas, la cueva desciende de forma escalonada y la corriente corre a una serie de repisas haciéndose necesario el uso de cuerdas. Es en este punto, llamado las Turbinas donde esta expedición detuvo su exploración.

Waterfall into the East Gorge *by Bill Stone*
La cascada sobre la Garganta del Este

Turbinas a la Garganta del Este

La exploración continuó 3 meses después en marzo del 1988. Esta fue la primera de las grandes expediciones, con 17 participantes, y que duró más de 3 semanas. El primer viaje para la expedición de una nueva cueva aparejó las tres caídas que componen las Turbinas. Aunque las condiciones eran algo más secas que en diciembre, la última repisa de la serie de ellas, apodado el Inyector de Gasolina, estaba tan mojado que era imposible evitar cruzar la fuerza total de la cascada. Hubo varios momentos peligrosos a causa de cuerdas desgastadas. El año siguiente un pasaje alternativo fue encontrado para el alivio de todos.

Más allá del Inyector de Gasolina hay un relativamente trecho horizontal. La corriente principal fluye por un cañón placentero para de repente desaparecer a través de una estrecha fisura. El cañón continúa, y varios cientos de metros más adelante la corriente principal reaparece para casi inmediatamente de nuevo desaparecer en un lodoso pasaje submarino. Hay varias maneras de atravesar esta sección incluyendo una que va por encima de gigantescas piedras cubiertas de lodo resbaladizo. Esta area toda es llamada la Tierra de los Pasajes Submarinos.

Corriente arriba, desde el largo y lodoso pasaje submarino, una pequeña corriente proveniente de un pequeño y ventoso pasaje, El Túnel de Viento, se junta con la corriente principal. Este pasaje ventoso puede ser seguido hasta una caída proveniente de un pasaje impenetrable. Cerca de 10 metros antes de este pasaje impenetrable una ruta fue encontrada arriba de algunas piedras gigantescas que conducía a una grande y complicada cámara de unión. Esta area fue después llamada el Cuarto de la Conexión porque aquí es donde Osto de Puente Natural se junta con Cueva Cheve. La cámara tiene un gran pasaje bloqueado por piedras gigantescas y diferentes grupos se han desorientado tratando de encontrar la manera de traspasar este bloqueo para llegar a la siguiente repisa llamada con poca imaginación La Caída de 23 Metros.

En la base de La Caída de 23 Metros, la corriente principal es de nuevo encontrada con más volumen que la última vez que fue vista en los pasajes submarinos. Un descenso de 15 metros sobre roca negra conduce a la impresionante Garganta del Este, un pasaje casi horizontal (5 metros de ancho por 20 de alto) cuyas paredes de roca son blanco y negras. La corriente está cubierta de guijarros y el agua nunca llega más arriba de la cintura bajo condiciones normales. Sin embargo, evidencia de los restos de una bolsa de dormir indican que el agua sube más de 15 metros en estación de lluvias.

Hacia el final de La Garganta Este, el declive aumenta y la corriente corre hacia un gran pasaje submarino, 956 metros por debajo de la entrada principal. Bill Steele, Bill Stone, Farr, y Oliphant intentaron encontrar un pase alternativo trepando a un nivel superior hacia un Túnel gigantesco (Borehole) de 15 metros de ancho por 15 de alto. Esta ruta conduce de regreso corriente arriba varios cientos de metros hasta terminar en un pozo cerca de la entrada de La Garganta del Este.

Pasaje Noroeste y Piscina del Gimnasio

Ed Halladay y Jim Smith intentaron una ruta diferente. Ellos escalaron una ladera de roca cubierta de calcita en el lado izquierdo de la Garganta Este para encontrar la continuación (corriente abajo) del túnel encontrado en el viaje anterior. Este túnel conduce a través de varias cámaras hasta una serie de caídas que encuentran otro. Al este de este túnel hay una area arenosa y plana que ahora se usa como campamento dos. El pasaje continúa hasta una caída de 15 metros de nuevo en la Garganta Este. Este atajo es ahora la ruta estandard para llegar al campamento dos. Hacia el este, el pasaje se ensancha hasta impresionantes dimensiones y termina en una subida vertical de perno.

El siguiente equipo de reconocimiento logró evitar esta ascensión por medio de un travesaño, llamado El Travesaño del Cielo. Exploraron el Low Rider Parkway o la Barrera Baja, llamado así por el ámplio pasaje y el relativamente bajo cielo. Este túnel de 15 metros de ancho, lleno de rocas gigantescas, es la continuación del pasaje noroeste. A un extremo que desciende de la Barrera Baja se le llamó Hollywood Boulevard por las piedras brillantes por la calcita que caracterizan esta sección de la caverna.

Más allá de la Barrera Baja una caída de 15 metros conduce a una cámara de dimensiones grandes donde una gran piedra está precariamente detenida. A este lugar se le llamó (apropiadamente) El Haceviudas. Esta gran piedra debe ser atravesada para alcanzar la chimenea del Haceviudas (35 metros). Una serie de caídas conduce a la corriente principal, una vez más con su volumen incrementado. Este pasaje es uno de los más bellos en la caverna, con numerosas ascenciones deportivas sobre rocas exquisitamente esculpidas, y hermosas albercas naturales de color verde que contrastan con la piedra negra y anaranjada. Los exploradores llamaron esta sección La Alberca del Gimnasio a causa de las maniobras atléticas requeridas para arrivar a este punto. La exploración continuó a través de dos rocas de regular tamaño semi-obstruidas para finalmente detenerse en una tercera. Para el final de la temporada de exploración de cavernas de 1988, la Cueva Cheve tenía 1,038 metros de profundidad y 9.2 kilómetros de larga.

Salón de los Gigantes Incansables y el Borehole Negro

La siguiente expedición fue en marzo de 1989 y tuvo 23 participantes. Como los viajes de exploración del año anterior habían comenzado a desafiar los límites de la resistencia, se decidió trabajar desde el campamento dos. El primer viaje tuvo mal comienzo cuando Steve Knutson cayó mientras cargaba su mochila a través de la cámara de conexión. Se rompió varias costillas, pero pudo salir de la caverna después de cuatro días, por sí mismo, mientras otros exploradores cargaban su equipo.

Mientras tanto, Peter Quick, Vesely, Farr y Coons encontraron una ruta alternativa a la tercera gran roca obstruida encontrada en la expedición anterior. Una ruta baja sigue la corriente hasta llegar a un pasaje submarino. Una ruta más alta en un cañón obstruído conduce hacia el noroeste antes de encontrar otra gran piedra que obstruye el camino. El equipo de reconocimiento regresó a la Alberca del Gimnasio. Allí ellos encontraron una ruta alternativa, la cual consiste de una serie de escaladas complicadas que conducen al Salón de los Gigantes Incansables. Un túnel enorme de 15 metros de ancho, lleno de gigantescas formaciones agrietadas y derrumbadas. Después de 500 metros encontraron un bloqueo de rocas con una capa de calcita, pero un pozo intermedio ofreció esperanza.

Durante el siguiente viaje, Bob Benedict, Jeb Blakeley, Bill Stone, and Rolf Adams bajaron al pozo donde encontraron otros pozos dificiles. Lograron colarse a través de una fisura para salir al Borehole Negro (10 metros de ancho y 20 de alto) lleno de rocas resbaladizas. Después de cerca de 800 metros fueron detenidos por lo que parecía ser un pasaje lleno de rocas.

Farr regresó a este punto y encontró una estrecha y ventilada ruta de 50 metros que le permitió atravesar este obstáculo emergiendo en el pasaje más grande de toda la caverna (40 metros por 40 metros). Este nuevo descubrimiento fue bautizado como A.S. Borehole inspirado por una inscripción natural de "A.S." en la pared de piedra y en honor de Arne Saknussemm.

Hacia el sureste del A.S. Borehole, hay una ruta ascendiente hacia el Borehole del Suelo de Lodo, uno de los pocos lugares en la caverna donde es posible caminar o correr. El Borehole del Suelo de Lodo se estrecha después de varios cientos de metros hasta llegar a un chico pero bien decorado pasaje de roca con calcita que termina en una estrecha fisura. La fisura fue abierta en una posterior expedición, pero poco después otra fisura aún más estrecha por la cual soplaba un fuerte viento, fue encontrada. Se supone que este viento viene de una continuación del Salón de los Gigantes Incansables.

Al noroeste del Looking Glass o la Lupa, la corriente principal es de nuevo encontrada. El campamento tres se localiza en una area arenosa en la cima de una inclinación de roca, más de 1,000 metros debajo de la entrada principal. Continuando corriente abajo en túnel gigantesco, los exploradores avanzaron varios cientos de metros hasta encontrar una gigantesca y masiva roca con una fuerte corriente de aire que obstruía la ruta. Otro equipo regresó para tratar de empujarla sin éxito. Al final de la temporada de 1989, la Cueva Cheve tenía 16.3 kilómetros de larga y 1,243 metros de profundidad, era el segundo sistema en profundidad en todo México.

Explorando el Pasaje Bloqueado

El siguiente año se hicieron muchos viajes para explorar el area bloqueada. En marzo 1990, hubo dos viajes de 9 días. En el primer viaje Oliphant hizo una ascensión libre de 35 metros (con alguna ayuda), en su intento de encontrar una ruta alternativa al bloqueo. El intento fracasó y no se encontró ningún pasaje nuevo.

Hacia el final de este viaje, Coons encontró una ruta alternativa a un pase submarino localizado corriente abajo del bloqueo terminal. Una estrecha fisura se convierte en un cañón (8 metros de ancho por 20 de alto) pulido y color crema, algo nunca visto en Cheve. La corriente principal pronto se conecta con este pasaje brotando de un hcllo en el lado oeste del cañón con una presión que la disparaba 10 metros horizontales de la pared. Cerca de un kilómetro de pasaje con caídas alternantes, albercas y ascensiones fue explorada. Cerca del final de este pasaje, los exploradores encontraron una turbulenta e intimidante caída llamada Cascada de la Pesadilla. Más allá de la caída de agua la repisa cede y el agua fluye despacio hacia un bello pasaje submarino color azúl cobalto, a 1,362 metros por debajo de la entrada más alta. A esta area se le llamó Sueños Húmedos.

Los participantes del secundo viaje concentraron sus esfuerzos en encontrar una ruta que atravesara el bloqueo terminal. Exploraron una estrecha fisura encontrada por Oliphant en su ascenso de 35 metros. Investigaron e hicieron un mapa de un cañón hacia el norte que condujo a un fin amargo. Buscaron rutas superiores en Sueños Húmedos esperando encontrar un pase alternativo al pasaje submarino y también exploraron sin éxito la fisura angosta al final del Túnel o Borehole del Suelo de Lodo. A pesar del considerable esfuerzo, sólo extensiones menores fueron localizadas sin poderse encontrar una ruta alternativa.

Durante esta expedición Jim Smith vertió 7 kilogramos de tinta fosforescente en la corriente a la entrada de la Cueva Cheve. Dos días después la tinta arrastrada por la corriente alcanzó el campamento tres. Seis días después la tinta fue vista emergiendo del Río Frío de Santa Ana más de 2,500 metros por debajo de la más alta entrada del Sistema Cheve. Esto confirmó al Sistema Cheve como el sistema hidrológico más profundo del que se tenga conocimiento en el mundo.

The Fuel Injector
El Inyector de Gasolina *by Bill Stone*

El Buceo del Pase Submarino de los Sueños Húmedos

Decidiendo que la mejor esperanza residía en bucear el pase submarino al final de los Sueños Húmedos, un ambicioso buzo fue puesto en práctica por la expedición de 1991. Tres tanques de buceo de 14 kilogramos y alta presión, 11 kilogramos de plomo, 600 metros de línea de buceo y todo los accesorios necesarios para un buzo fueron llevados al campamento tres. Con una distancia de 7 kilómetros y un relieve vertical de 1,250 metros desde la entrada principal, éste puede ser uno de los buceos más remotos jamás intentados.

El primero de marzo John Schweyen se sumergió en el pasaje submarino azúl-verde en el fondo del Sistema Cheve. El pasaje desciende bajo el agua a un ángulo promedio de 45 grados hasta una profundidad de cerca de 23 metros para luego nivelarse. Después de varios cientos de metros, el pasaje se bifurca en varios tubos de un metro de altura. Algunos de estos tubos se conectan de nuevo con el pasaje principal mientras que la mayoría de los otros se reducen haciendo imposible continuar. Después de 50 minutos de exploración, una hora de altos para la decompresión fueron necesarios debido a lo largo, lo profundo y lo alto del buceo. Este buceo, junto con las conexiones en la entrada superior, claramente hicieron del Sistema Cheve el más profundo en el hemisferio oeste en 1991 midiendo -1386 metros.

Aunque dos tanques fueron dejados en el campamento tres en previsión de otro intento, éste aún no ha ocurrido. Después del buceo se intentó escalar por arriba de los Sueños Húmedos. Esto condujo a una cámara alta con aire. La ascensión continúa 5 repisas hasta topar con pared.

El Fin de la Expedición

La expedición de 1991 terminó abruptamente con la muerte de Chris Yeager. Peter Haberland y Yeager estaban en camino al campamento dos. Haberland descendió la Caída de 23 Metros y se movió a una esquina para esperar a Yeager. Escuchó el sonido de un ruidoso golpe y se horrorizó al encontrar a Yeager en el fondo de la caída. Trajo a Peter Bosted y a James Brown, quienes estaban en el campamento dos, pero era obvio que Yeager estaba muerto. Diez días después, el cadáver de Yeager fue subido y enterrado en una area arenosa en la cámara de conexión. Esta area fue renombrada la Cámara de Conexión Avalon. Un año después su cuerpo fue traido a la superficie por exploradores de los Estados Unidos, México y Polonia. La causa aparente del accidente fue que el único seguro que conectaba el armazón de Yeager a su harness se abrió al poner Yeager su peso en el armazón.

Subsecuentes Campamentos Profundos

Dos viajes del campamento tres en 1992 y dos más en 1993, cada uno de ellos con 5 a 7 días de duración fueron hechos para encontrar un camino a través del bloqueo al final del A.S. Borehole. Intensos intentos de pasar a través de angostas superficies, ascensiones, excavaciones, y modificación de pasaje fueron usados para seguir al esquivo viento. El bloqueo es bastante extenso y el trabajo se concentró sobre el area desde campamento tres hasta el final de la caverna.

Aunque aproximadamente 1.5 kilómetros de nuevo pasaje fue encontrado y explorado, no se hicieron avances significativos. La mayoría de los nuevos pasajes consistían en conexiones entre puntos ya conocidos o ascensiones a bloqueos impenetrables. Sin embargo, muchos exploradores ganaron experiencia en una de las más bellas y desafiantes cavernas en México. Hasta la fecha, el bloqueo de pasaje sigue siendo la ruta más promisoria en el sistema.

LAS ENTRADAS AL KARST SUPERIOR

Cueva Moscas

Esta cueva se localiza en el fondo de una pequeña depresión en la tierra con muchos arbustos en la ladera cerca de 300 metros al noreste del llano Cheve. Esta entrada desconocida fue encontrada en marzo de 1987 y la cueva fue explorada en marzo de 1988, principalmente por Mark Minton, Gary Mele, Carol Vesely y Peter Bosted. Una vez que se pasa por una angosta entrada, una fuerte corriente de aire es seguida por un pasaje y una unión doble. El pasaje de la derecha zigzaguea por varios cientos de metros antes de caer por dos declives a través de una pequeña constricción.

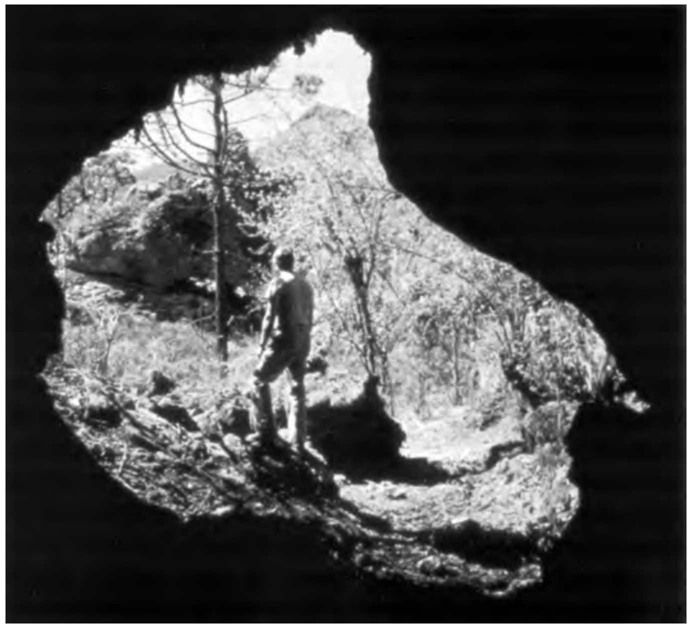
El pasaje de la izquierda conduce a una caída para después correr horizontalmente a través de un tubo de un metro de diametro (otro túnel de viento). Más allá la ruta contiene una serie de 5 húmedas fisuras en repisa y eventualmente se conecta con el Cuarto del Elefante Negro en Cheve. Esta conexión fue la primera en establecer Cheve como un verdadero sistema.

Osto de Puente Natural

El nombre viene de un puente natural localizado en la entrada. Puente fue una de las primeras de las muchas entradas superiores del sistema en ser descubiertas. Un equipo en el viaje en diciembre de 1987 localizó la entrada en el lado este del area del Karst superior.

La entrada rápidamente se abre a una cámara de 8 metros de diametro. Un muy impresionante (100 metros de profundidad) pozo seco, llamado Pozo Mondo, cae precipitadamente de un lado. En la base del Pozo Mondo, hay un pasaje de fisura que va tanto corriente arriba como corriente abajo con un muy pequeño flujo de agua. La ruta corriente abajo sigue generalmente pasajes angostos hasta bajar a una serie de cortas y raras caídas. El equipo de 1987 finalmente se quedó sin cuerda y la exploración se suspendió por ese año.

Cuatro viajes de reconocimiento en marzo de 1988 incrementaron la profundidad a 442 metros y la extensión a más de un kilómetro. Una serie de apretados y raros cañones



The Puente Natural entrance *by Ron Simmons*
La entrada de Puente Natural

conducen a una caída en fisura de 90 metros, de la cual cae una pequeña llovizna la cual no es especialmente placentera. Más allá la cueva se abre a dos caídas de piedra cubierta de calcita de 30 metros de profundidad. La siguiente repisa seca de 13 metros pasa por una angosta caída de agua, y una sección de pasaje horizontal con varias pequeñas pero bien decoradas cámaras aparecen. El único viaje de 1989 encontró que la caverna continúa descendiendo lentamente con pequeñas albercas naturales y bonitas paredes de piedra con calcita.

La gran exploración vino en 1990. Louise Hose, Bill Stone and Rolf Adams continuaron a lo largo de la relativamente horizontal sección. Como el resto de la cueva, la mayoría del nuevo pasaje era angosto y raro con una sección particularmente angosta llamada El Horror de Rolf. A una profundidad de 550 metros pararon en la cima del Mayor Abismo, una impresionantemente profunda y espaciosa chimenea formada en la roca que les recordó a los exploradores el Pozo Saknussemm.

Cerca del final de la expedición, Stone, Adams, y Vesely cargaron más de 250 metros de cuerda en adición de tornillos y otro equipo, lo cual hizo el viaje al Mayor Abismo una experiencia no placentera. Una vez allí, descendieron 10 metros a un saliente, después 60 metros de una pared de bella calcita hasta llegar a un pequeño nicho donde la corriente entra desde un lado.

Después de descensos adicionales de 20 y 30 metros, finalmente arrivaron al fondo del espectacular Mayor Abismo. Desde aquí un pasaje grande fue seguido hasta una ascensión a una repisa de 20 metros, el siguiente pasaje de corriente de 4 metros por 10 estaba perforado por piscinas y una serie de caídas (6, 8 y 13 metros). Más allá, la corriente se hunde en un bloqueo de pasaje pero los exploradores encontraron un pasaje alternativo. Cerca de 100 metros de pasaje, en su mayoría caminable, conduce a una caída de 15 metros y un ascenso de 6 metros. Ya sin cuerda, el equipo estaba jubiloso de encontrarse en la cámara de conexión en Cheve. La ruta de 900 metros de profundidad con 23 caídas en Puente sumaban cerca de 27 metros de profundidad al sistema y 2.5 kilómetros de extensión.

SISTEMA CHEVE

municipio de
CONCEPCION PAPALO

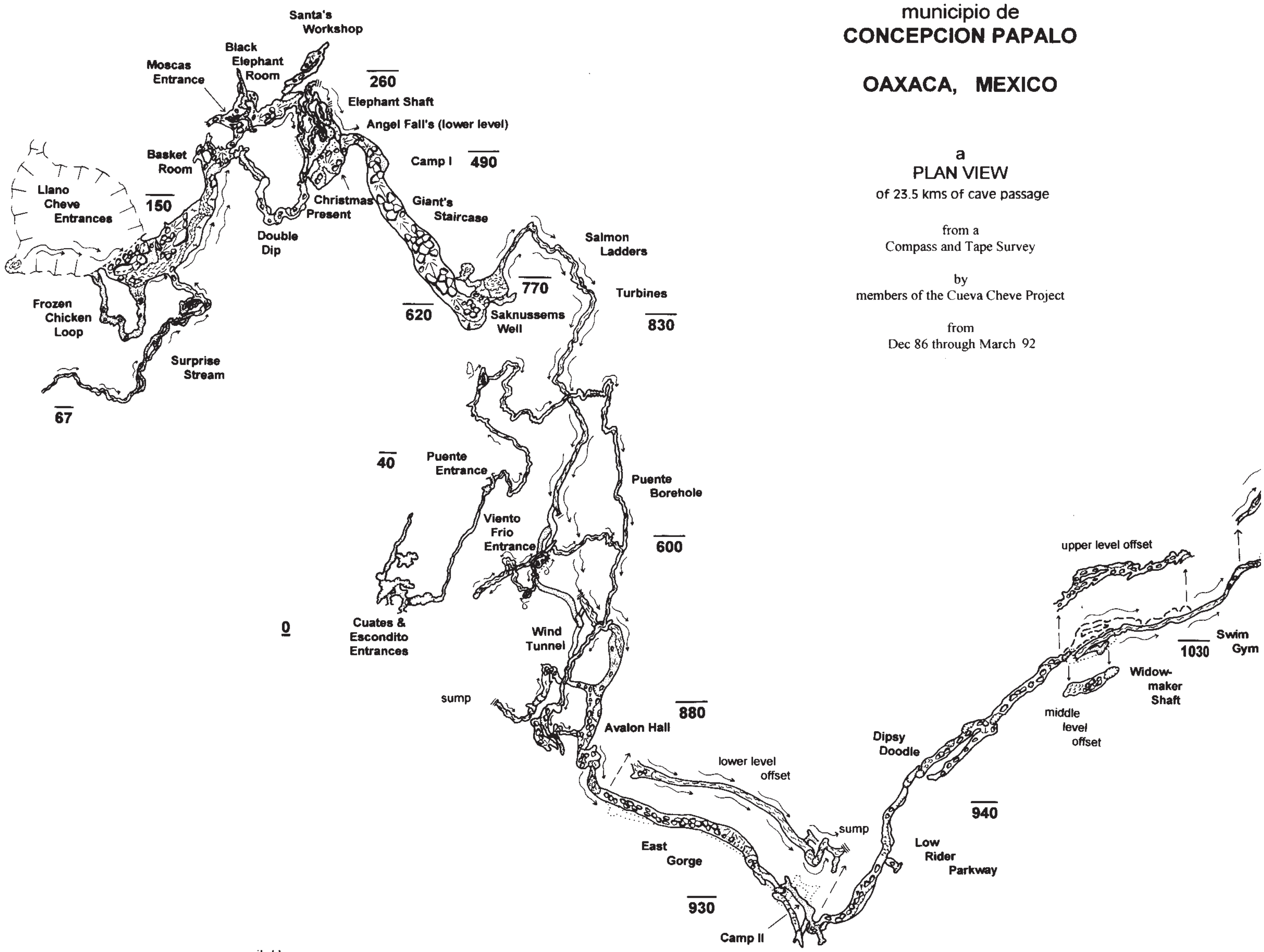
OAXACA, MEXICO

a
PLAN VIEW
of 23.5 kms of cave passage

from a
Compass and Tape Survey

by
members of the Cueva Cheve Project

from
Dec 86 through March 92



compiled by
Don Coons

from working drafts by
Nancy Pistole
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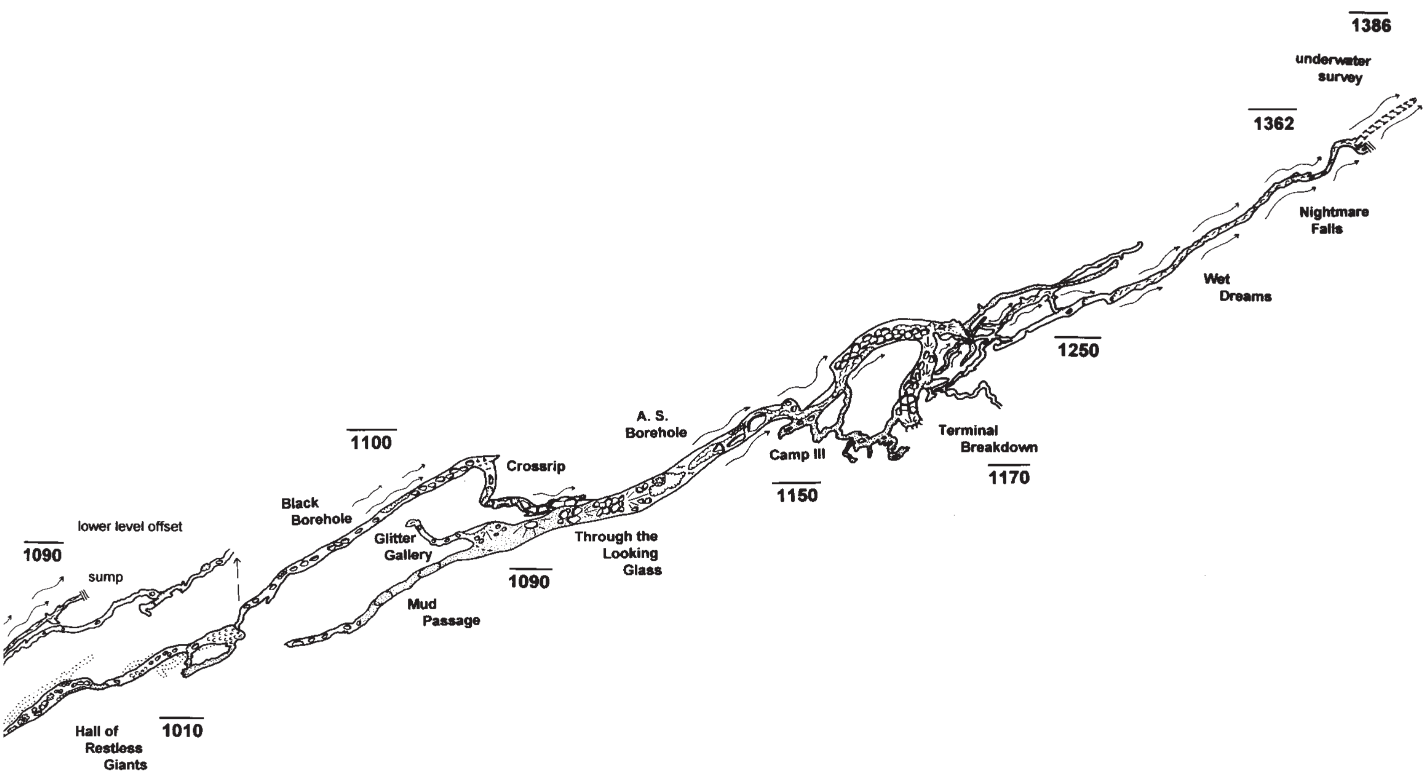
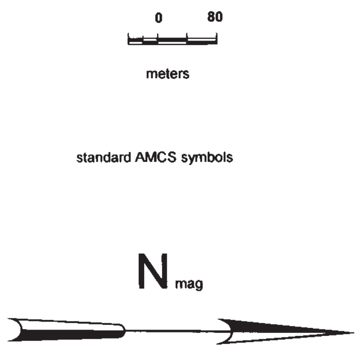
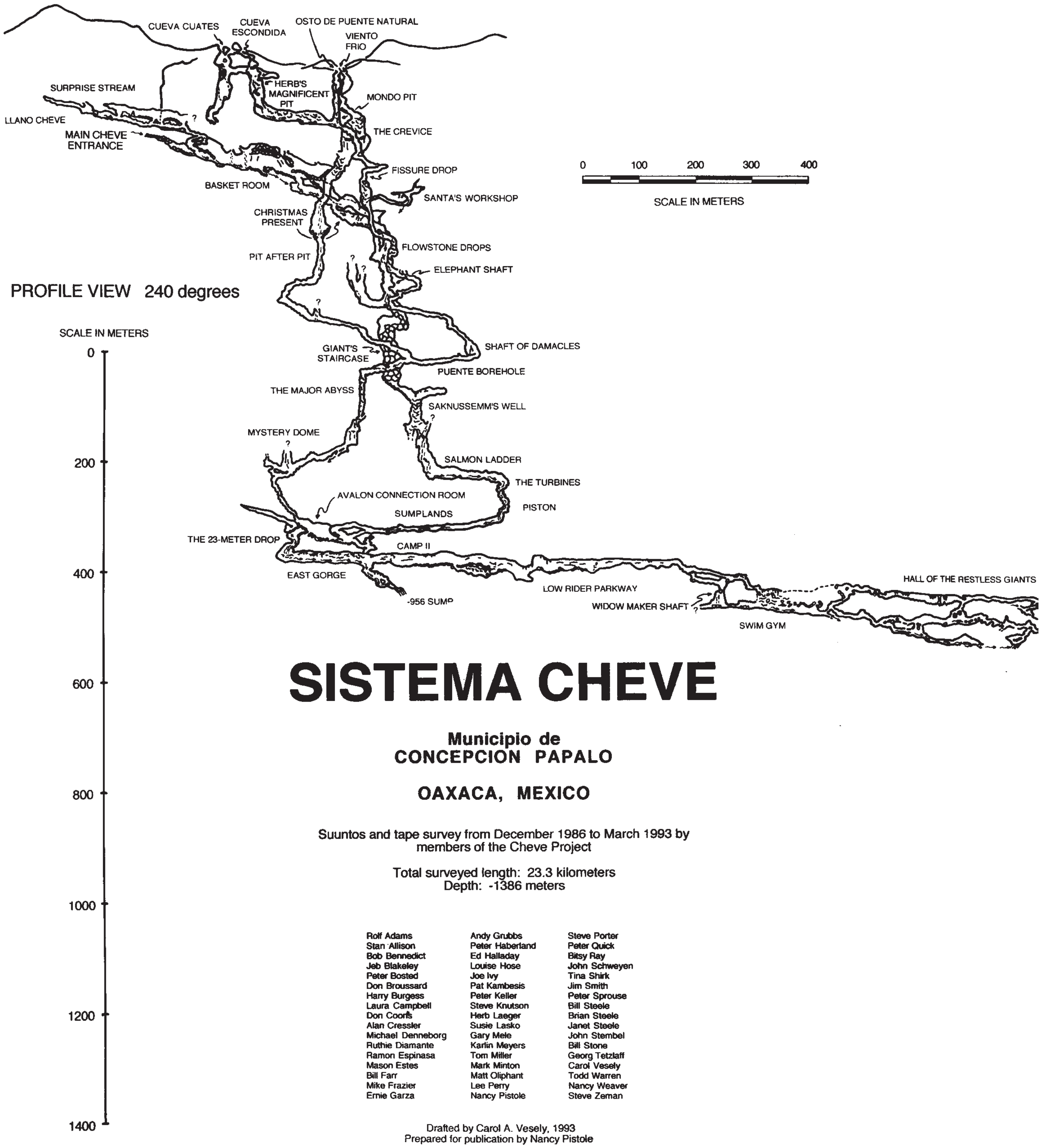




PERSONNEL

survey trips	individual	survey trips	individual
35	Farr	4	Hose
30	Vesely	4	Lasko
19	Coons	4	Zeman
18	Oliphant	3	Campbell
16	Minton	3	Cressler
16	Stone	3	Keller
12	Smith	3	Laeger
10	Adams	3	Mele
10	Pistole	3	Weaver
9	Benedict	2	Allison
9	Holladay	2	Haberland
7	Steele	2	Schweyen
7	Bosted	2	Stembel
6	Warren	1	Quick
5	Blakely	1	Dennenborg
5	Kambesis	1	Garza
5	Meyers	1	Knutson
5	Sprouse	1	Shirk
4	Estes	1	B. Steele
4	Frazier	1	J. Steele
4	Grubbs	1	Tetlaff



SISTEMA CHEVE

Municipio de
CONCEPCION PAPALO

OAXACA, MEXICO

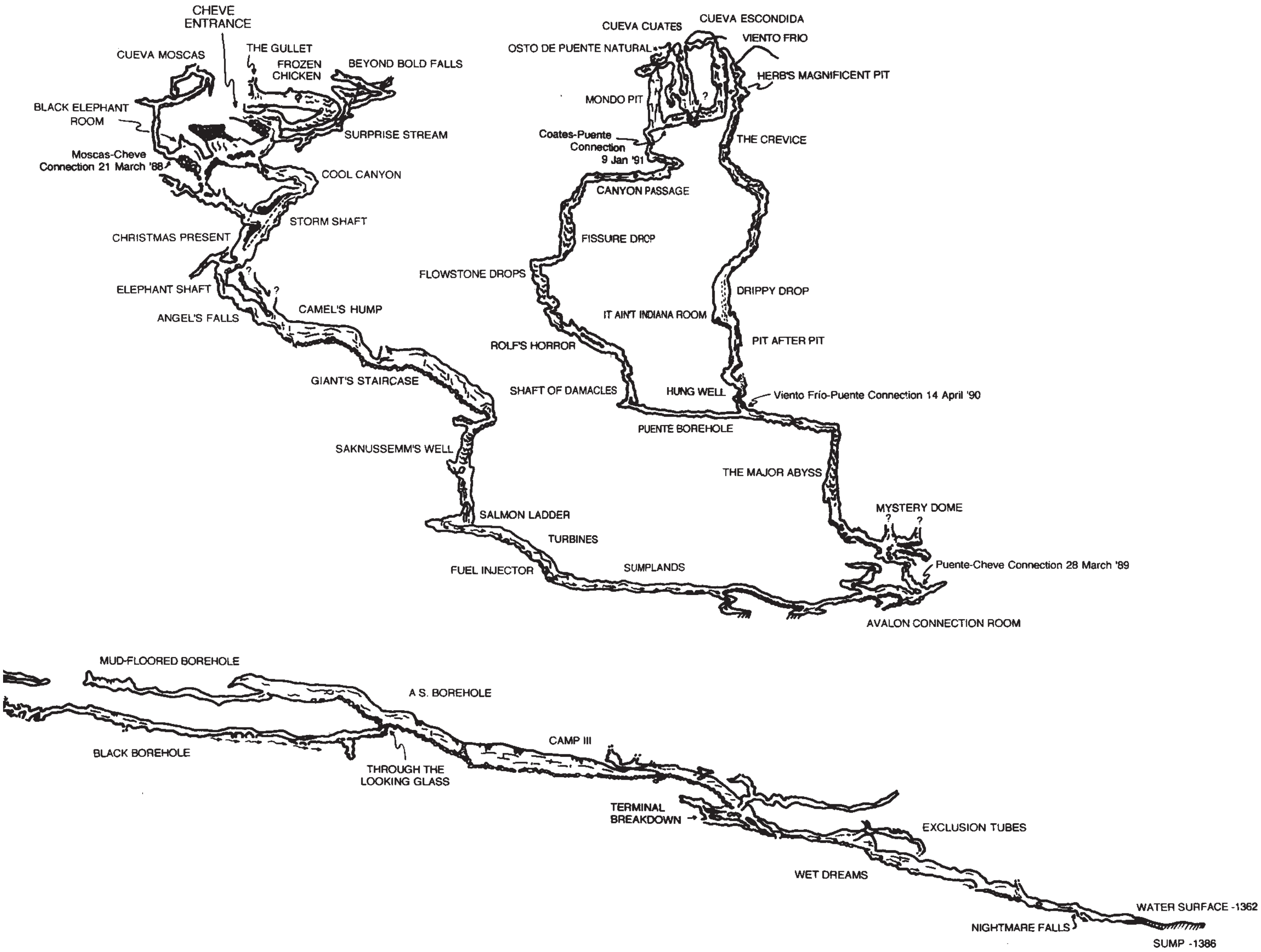
Suuntos and tape survey from December 1986 to March 1993 by members of the Cheve Project

Total surveyed length: 23.3 kilometers
Depth: -1386 meters

Rolf Adams
Stan Allison
Bob Bennedict
Jeb Blakeley
Peter Bosted
Don Broussard
Harry Burgess
Laura Campbell
Don Coons
Alan Cressler
Michael Denneborg
Ruthie Diamante
Ramon Espinasa
Mason Estes
Bill Farr
Mike Frazier
Ernie Garza
Andy Grubbs
Peter Haberland
Ed Halladay
Louise Hose
Joe Ivy
Pat Kambesis
Peter Keller
Steve Knutson
Herb Laeger
Susie Lasko
Gary Mele
Karlin Meyers
Tom Miller
Mark Minton
Matt Oliphant
Lee Perry
Nancy Pistole
Steve Porter
Peter Quick
Bitsy Ray
John Schweyen
Tina Shirk
Jim Smith
Peter Sprouse
Bill Steele
Brian Steele
Janet Steele
John Stembel
Bill Stone
Georg Tetzlaff
Carol Vesely
Todd Warren
Nancy Weaver
Steve Zeman

Drafted by Carol A. Vesely, 1993
Prepared for publication by Nancy Pistole

PROFILE VIEW OF UPPER SECTION 150 degrees



Viento Frío

Esta cueva se localiza bajo un pequeño grupo de rocas en el fondo de una depresión (con forma de cono) cerca de 200 metros al norte de la entrada Puente. Dos pequeñas caídas conducen a una constricción con viento frío, de allí el nombre de la cueva. Más allá, ésta se abre y es mucho más espacioso que Puente. Dos caídas cortas adicionales conducen a una impresionante fisura de repisa de 80 metros. La exploración en 1989 fue suspendida después de dos pequeñas repisas más debido a la falta de cuerda.

La exploración continúa el siguiente año y reveló una serie de pozos relativamente espaciosos en buena roca. Pasando bella roca marmolizada, los exploradores pronto llegaron a una chimenea de 15 metros seguida inmediatamente por una caída de 45 metros. Un largo pasaje semi-obstruido conduce al Pozo Después de Pozo, del cual se llegó al fondo usando dos cuerdas de 40 metros. Cincuenta metros de pasaje de corriente conducen al Tevesaño del Paso del Gato, una ruta expuesta sobre una profunda piscina natural. Repisas de 4, 6 y 12 metros en una galería de fósiles conducen a un bello pasaje de corriente (4 metros de ancho) con numerosas ascensiones y cortas caídas. Dos repisas finales de 7 metros cada uno conectan Viento Frío con Puente en el Borehole del Puente, no lejos del Mayor Abismo. La conexión aumento 2.1 kilómetros al sistema Cheve.

Cueva Cuates y Cueva Escondida

Las entradas gemelas a Cuates se localizan pocos cientos de metros al este y 20 metros más alta que la entrada de Puente. En 1989, el pozo de 22 metros justo a la entrada fue explorado por Minton y Vesely hasta llegar a una cámara con salida obstruida. Después de encontrar un camino a través de la obstrucción, pozos de 28, 35 y 8 metros fueron encontrados, los cuales condujeron a otra area en apariencia totalmente obstruida. El pozo justo dentro de la segunda entrada fue encontrado muy inestable y a pesar de haber limpiado la roca suelta, un guijarro cayó cortando a Mark en el labio. La herida requirió varias puntadas.

La entrada Escondida se localiza cerca de la entrada los Cuates, un poco arriba. Fue descubierta en 1990 y pronto conectada con Cuates. Los primeros exploradores descendieron un agradable pozo de 50 metros, el cual desafortunadamente no resultó ser cueva. Viajes subsecuentes exploraron considerablemente los pasajes superiores.

En el último día de la expedición Herb Laeger descubrió el Pozo Magnífico, una bellamente proporcionada chimenea de 115 metros de profundidad. Al fondo varios cientos de metros de pasaje de fisura conducen a una estrecha constricción con fuerte brisa. Esto fue agrandado al año siguiente conduciendo facilmente a la conexión con Puente al fondo de Pozo Mondo. Esta conexión agregó cerca de 2 kilómetros a la extensión y 25 metros a la profundidad del sistema haciendo Escondida la entrada más conocida.

OTRAS CUEVAS EN EL KARST SUPERIOR

Cuevas de Llano Español

Llano Español se localiza en una gran depresión cerca de 1.5 kilómetros al sureste de Cueva Cheve. Tres cuevas fueron encontradas aquí durante la expedición de 1988. La mayor es Cueva Inclinada cuya difícil entrada se localiza bajo un gran montón de rocas obstruyendo el pasaje en un extremo del este. Después de 10 metros de pasaje a gatas, se encuentra un pasaje mayor que sigue un plano de 30 grados. Después de 100 metros, un pozo de 18 metros se encuentra, el cual lleva a un mayor pasaje. La obstrucción pronto da paso al lodo, lo cual prueba que la cueva se inunda.

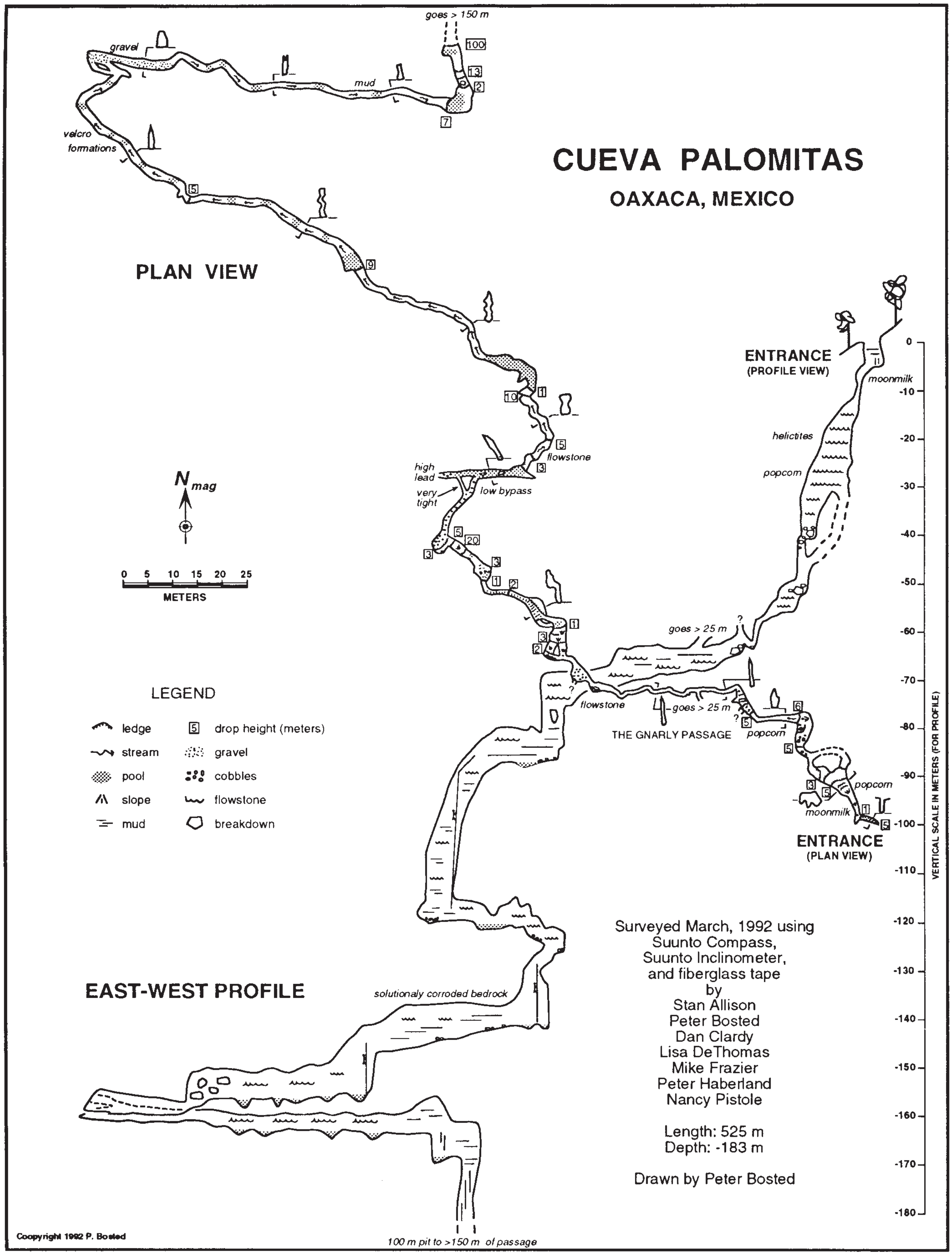
En el fondo, los primeros exploradores encontraron un pasaje submarino arenoso. La fuerte brisa de la entrada desapareció posiblemente yéndose hacia una ruta 40 metros atrás. En un viaje 5 años más tarde, el pasaje submarino arenoso se había abierto mostrando un pasaje a gatas de 15 metros que conducía a otro pasaje submarino sin aire. Hay varios pasajes semi-obstruidos en la cueva, pero al parecer ninguno de ellos lleva la corriente principal de aire.

Cueva Tutilomo se localiza cerca del fin del camino que conduce a Llano Español desde el camino de terracería, en la parte este del valle. Se le llama así por las bellas flores de naranja en la entrada. La cueva está formada a lo largo de una falla. El pasaje puede ser seguido hacia abajo a una caída y luego a una serie de ascensiones hasta una cámara pequeña. Una escarbada conduce a otra cámara donde más excavación es necesaria para poder seguir la buena corriente de aire en este cueva de 140 metros de largo.

Una tercera cueva sin nombre todavía fue investigada en el lado oeste del llano. Era más bien un gigantesco talud que una cueva verdadera pero buena corriente de aire indica potencial.

Cueva de la Selva

Esta Cueva de la Selva se localiza en una densa sección forestal del Bosque Encantado, en el filo norte del Karst Superior. Fue explorada por Alan Cressler, Tina Shirk, y John Stembel en 1990. Una serie de 4 caídas conduce a una chimenea de 47 metros de profundidad. Un pozo final de 12 metros conduce a 200 metros de pasaje horizontal. El cielo de repente baja en este punto y es forzoso gatear por 20 metros siguiendo una fuerte y fresca brisa.


CUEVA PALOMITAS
OAXACA, MEXICO
PLAN VIEW
EAST-WEST PROFILE
goes > 150 m
100
13
2
7
gravel
mud
velcro formations
5
9
10
1
flowstone
3
high lead
very tight
low bypass
20
N mag
0 5 10 15 20 25
METERS
goes > 25 m
?
flowstone
goes > 25 m
THE GNARLY PASSAGE
popcorn
6
moonmilk
ENTRANCE (PROFILE VIEW)
moonmilk
helictites
popcorn
ENTRANCE (PLAN VIEW)
solutionaly corroded bedrock
100 m pit to >150 m of passage
LEGEND
ledge
stream
pool
slope
mud
drop height (meters)
gravel
cobbles
flowstone
breakdown
Surveyed March, 1992 using
Suunto Compass,
Suunto Inclinometer,
and fiberglass tape
by
Stan Allison
Peter Bosted
Dan Clardy
Lisa DeThomas
Mike Frazier
Peter Haberland
Nancy Pistole
Length: 525 m
Depth: -183 m
Drawn by Peter Bosted
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
VERTICAL SCALE IN METERS (FOR PROFILE)
Coopyright 1992 P. Bosted

Los exploradores pararon ante una constricción que requerirá excavación. Si esto se hace probablemente proveerá otros 1,000 metros de profundidad para el sistema.

Cueva Palomitas

Esta cueva de difícil acceso se localiza en el fondo de una de las cientos de fisuras y pozos localizados en la colina arriba de Llano Cheve. Fue encontrada en 1991, pero no fue explorada sino hasta 1992. Los primeros seis metros de descenso conducen a una constricción arriba de una inclinación de piedra cubierta de palomitas de calcita. Una pequeña víbora de cascabel fue encontrada aquí, afortunadamente inactiva, puesto que no fue notada hasta que un explorador se sentó en ella. Algunas pequeñas caídas cortas más conducen al Pasaje Gnarly. Esta sección es muy angosta y cubierta con palomitas, lo cual la hace difícil de atravesar.

Más allá una lodosa caída de 25 metros conduce a un más placentero pasaje de corriente, aunque el lodo nunca es dejado lo suficientemente lejos. Después de varios cientos de metros, varios descensos en cuerda, y un corto pero muy estrecho y ventoso apretujón, la punta de una larga (100 metros de profundidad) chimenea es encontrada. La roca en la cima es del tipo de roca dura cuarzosa, lo cual hace muy difícil poner un tornillo para poder desviar la cuerda de una pequeña caída de agua. Un viento muy frío recorre la cueva. Más allá de la chimenea hay más de 200 metros de agradable pasaje caminable, pero requiere de ser explorado. La cueva tiene buena corriente de aire y agua.

Localizada al norte, justo arriba de Palomitas, está la Cueva de Chris descubierta y explorada por Chris Yeager. Una apertura del tamaño de un cuerpo conduce hacia una cámara semi-obstruida donde una corriente pequeña fluye dentro de una constricción. Si se abriera, esto pudiera muy bien conectar a Palomitas, probablemente pasando por el pasaje Gnarly.

Otras Cuevas

Hay docenas de otras pequeñas cuevas y pozos en el area superior del Karst que han sido localizadas y descritas. Algunas de ellas como el Pozo de la Víbora (52 metros de profundidad) están muy por encima de cualquier entrada conocida al sistema principal, pero hasta ahora todas han terminado en obstáculos mayores. Otras cuevas incluyen Venado Muerto y Cueva Perdida. Mucho trabajo continúa por hacerse para explorar completamente los muchos kilómetros cuadrados de Karst que están por encima de las secciones superiores del Sistema Cheve.

EL KARST INTERMEDIO

El Karst Intermedio comprende casi cerca de 60 kilómetros cuadrados, extendiéndose desde el extremo sur de Plateau de Tierras Altas y continuando 12 kilómetros al norte de la villa de Santa Ana Cuauhtémoc. Los límites este-oeste están definidos por un particular contacto geológico. El drenaje del Karst intermedio está compuesto por ambas corrientes de superficie y otros componentes internos. La mayor corriente de superficie que fluye a lo largo del area eventualmente se hunde en una corriente de grava al sur del Río Santo Domingo. La clave del Karst intermedio y de la integración de los segmentos que conforman el Sistema Cheve es encontrar una ruta que conecte al conducto en lo profundo de la sub-superficie. No hay una manera obvia de saber cuáles cuevas son profundas. Un reconocimiento sistemático de todos los puntos de hundimiento se necesita. Éste es el desafío que el Proyecto confronta.

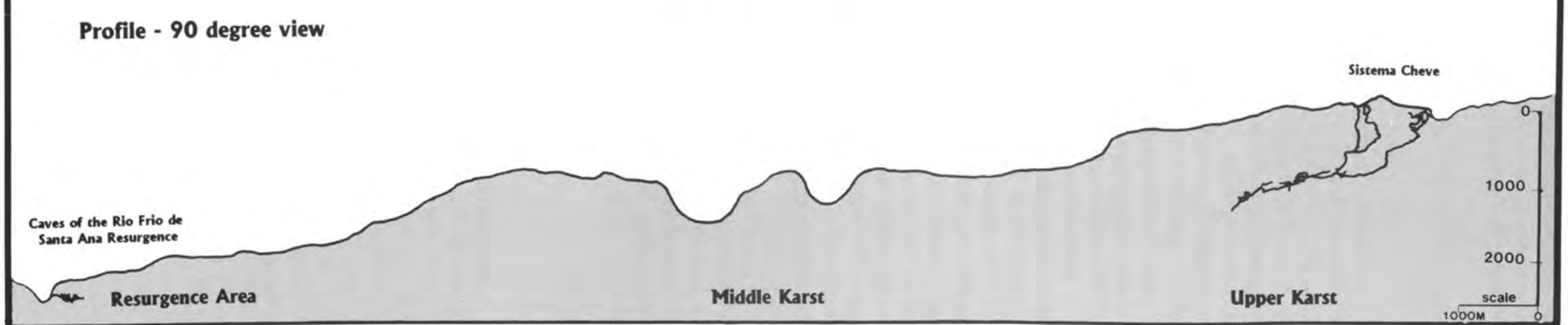
Reconocimiento Inicial

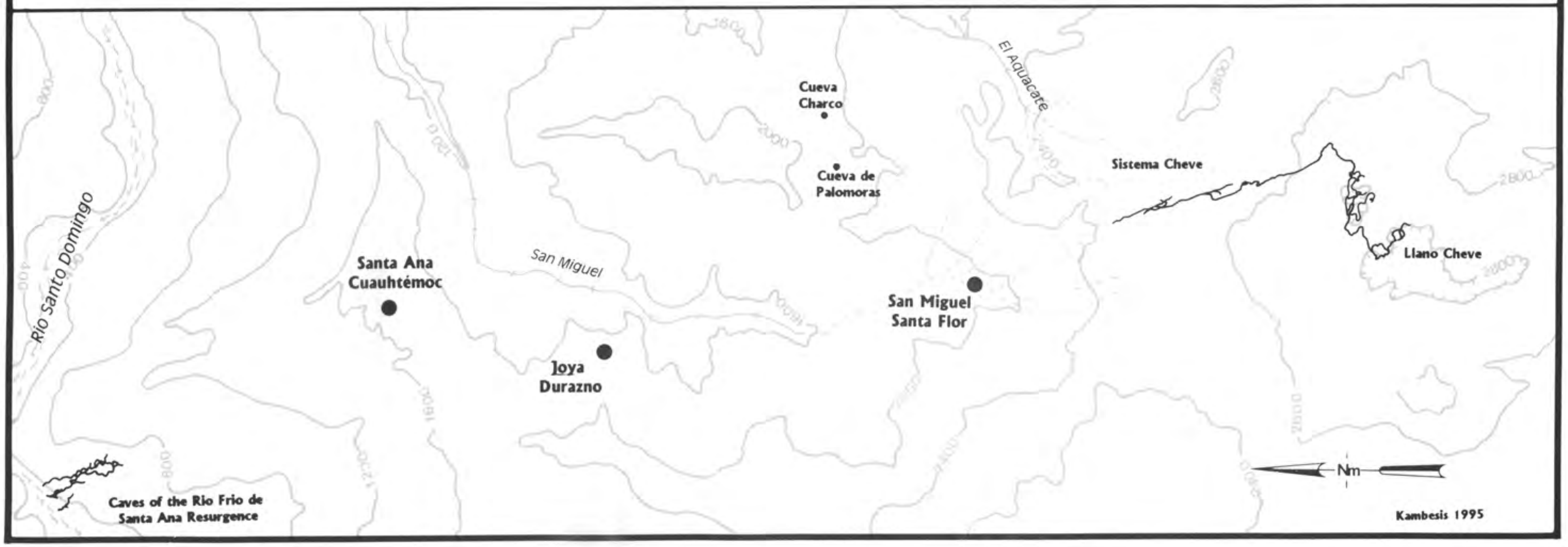
En junio del 1988 Coons, Farr y Vesely lleva-ron a cabo el primer reconocimiento del Karst intermedio. Observaron un número de entradas visibles desde el camino. A Farr y a Vesely les mostraron una entrada en la ladera arriba de Tlalixtac Nueva. Ellos la exploraron pasando 2 repisas para detenerse en una tercera.

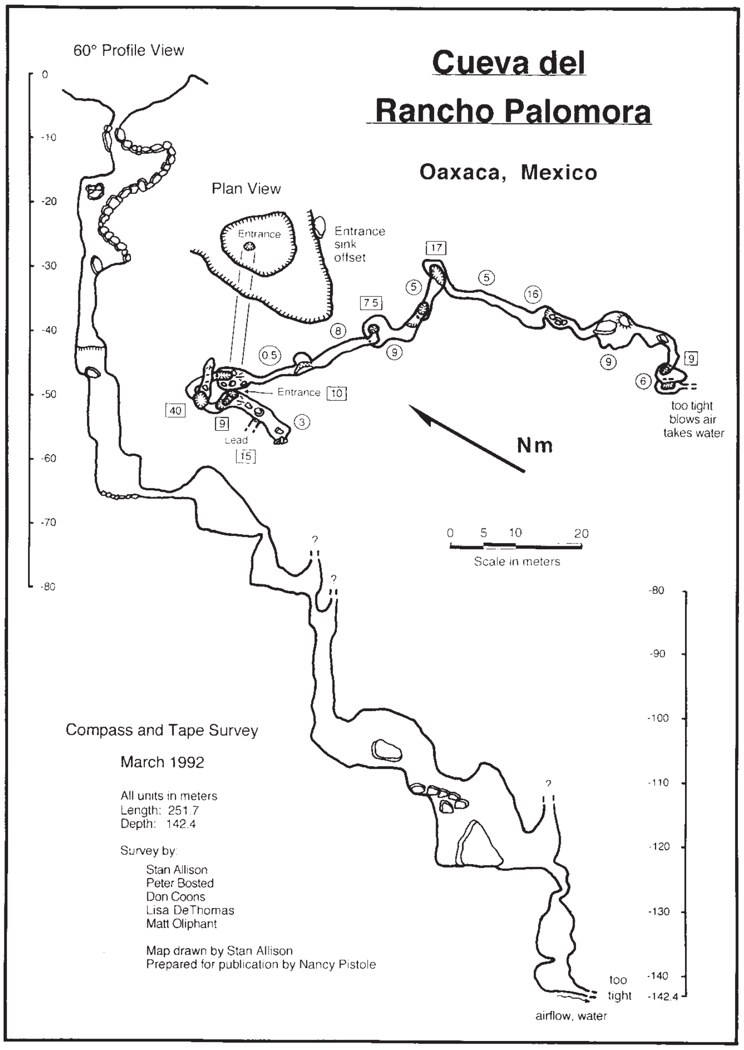
Bill Stone, Pam Smith, Noel Sloan y Mark Milton dieron la pimera caminata en el area durante una visita de 4 días en marzo de 1989. Ellos salieron de Chapulapa y siguieron un número de pistas interesantes, principalmente en el Valle del Aguacate arriba del pueblo. Tres cuevas fueron identificadas pero no exploradas. Además, una entrada fue explorada justo a un lado del camino principal al este de San Miguel Santa Flor. Tenía una repisa corta y agua acumulada.

Farr y Vesely regresaron en marzo de 1990. Exploraron una area alta arriba de San Miguel Santa Flor en la cabecera del Valle de San Miguel. Aunque estaban siguiendo y encontrando cuevas, las entradas eran pequeñas y con un poco de agua. En 1992, Louise Hose, Stan Allison, Tom Miller y Bill Storage visitaron la area de Hierbabuena. En el día que tuvieron que buscar cuevas, fueron llevados a algunas depresiones que no llevaron a cuevas. Sin embargo, la gente del pueblo estaba contenta demostrarle otras cuevas y extendieron una invitación para regresar.

Sistema Cheve/ Caves at the Rio Frio De Santa Ana Resurgence Oaxaca, Mexico



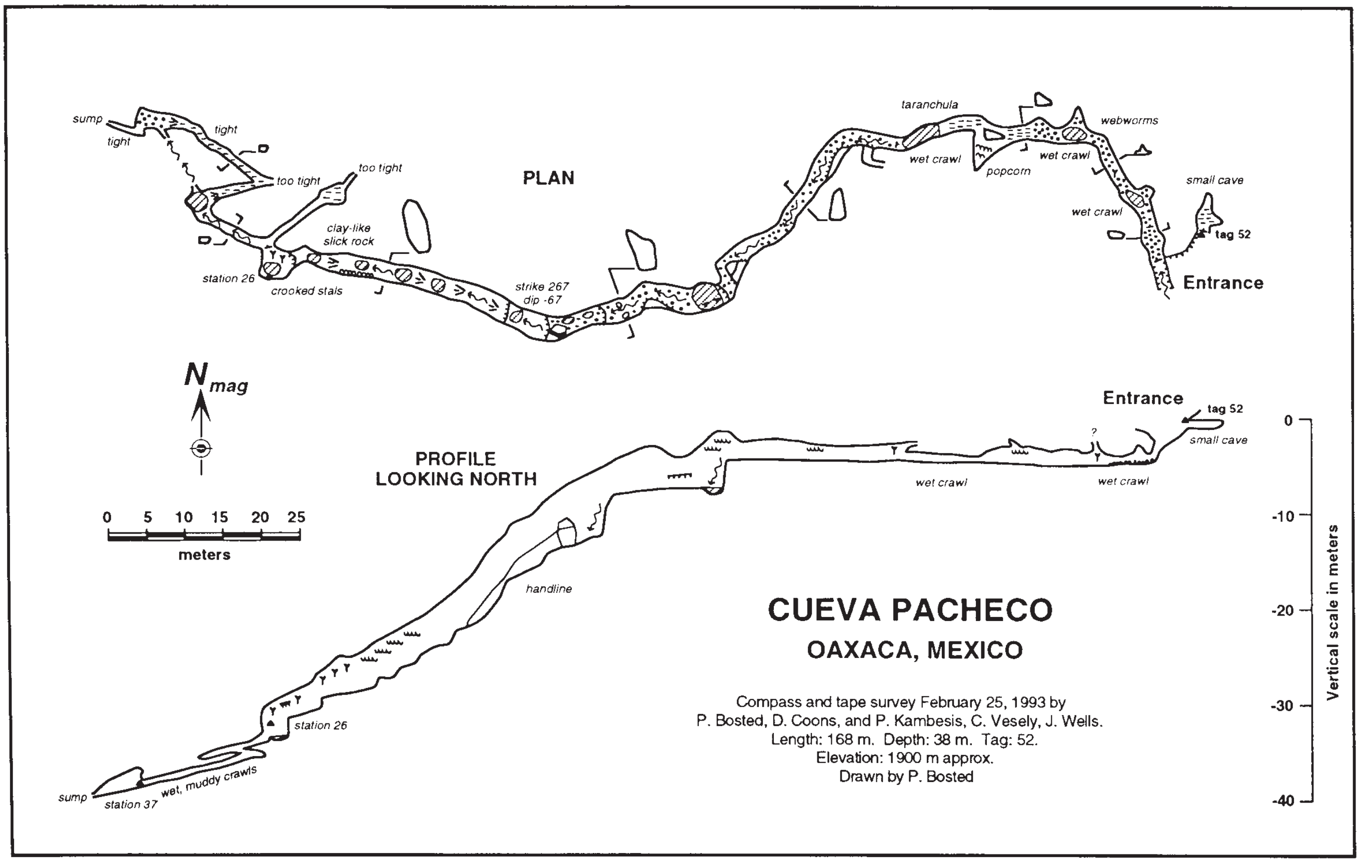




Palomora

En marzo de 1992, Bosted, Coons y Lisa DeThomas regresa-ron a San Miguel Santa Flor. Después de algunos arreglos fueron guiados hacia una loma alta (al este) por un cazador local. Éste los llevó a una pequeña depresión que se encuentra inmediatamente junto al contacto, justo al sur del paso en el camino entre San Miguel Santa Flor y la Hierbabuena. Una ténue brisa mojó los caballos mientras caminaban en la parte alta. El cazador les aseguró que en días fríos una gran corriente emerge de este lugar.

Dos días de excavación revelaron la parte alta de un pequeño domo con buena corriente de aire. Una curva en forma de S conduce a una serie de repisas hasta un angosto cañón. Después de un poco de agua lodosa con buena corriente de aire, hay un pasadizo estrecho y una repisa de 20 metros. Un raro cañón conduce a otras 2 pequeñas repisas de 8 o 9 metros. La exploración terminó aquí en una pared de piedra con calcita con una roca del tamaño de una bota atorada en el pasaje. Cueva de Palomora (llamada así por un rancho) tiene 142 metros de profundidad. Más importante aún, se encuentra directamente en el camino del agua proyectado, del pasaje submarino de Cheve a la resurgencia, y tiene buena corriente de aire.



The Elephant Shaft
La Chimenea del Elefante

by Peter Bosted

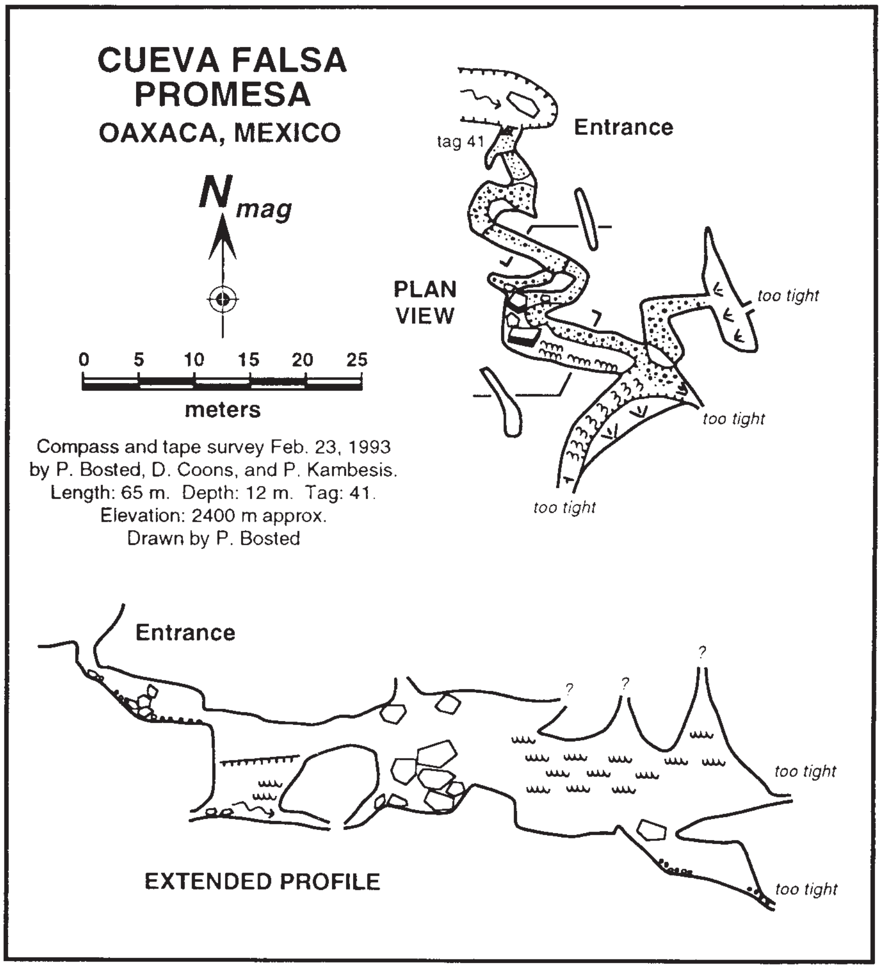
El Viaje del Karst Intermedio en 1993

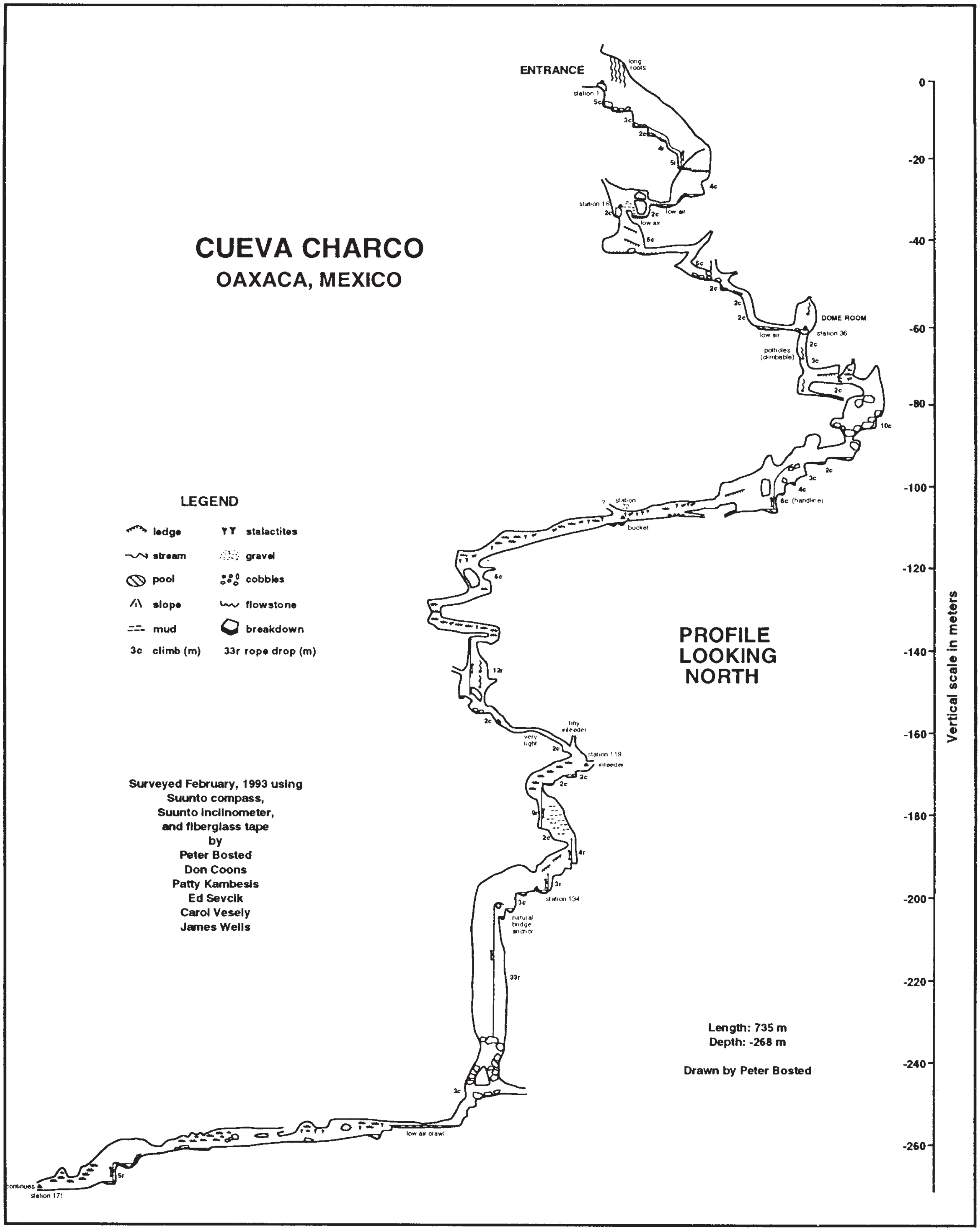
En la primavera de 1993, el Proyecto Cheve mandó un equipo de 6 personas al Karst intermedio. El objetivo era hacer un reconocimiento profundo del area, buscar entradas en los contactos, revisar las muchas depresiones en la piedra y seguir las pistas dejadas en el viaje de 1989. Sin embargo, debido a la falta de permisos para algunas areas, algunas de las cavernas reconocidas no pudieron explorarse más.

Cueva Pacheco

Durante una de las varias expediciones, un ranchero señaló algunas pequeñas cuevas y hollos. Una cueva de interés fue localizada en una gran depresión al este del camino principal y arriba de algunas laderas. Un pequeño chorro salía de un extremo de la depresión y se hundía en el extremo opuesto en una pequeña entrada a la cueva cubierta con guijarros. Esta caverna requiere excavación. Se le llamó Pacheco en honor al dueño del terreno.

La excavación en la entrada se llevó a cabo rápidamente. La cueva consistía de algunos espacios estrechos donde se tenía que gatear. Después, un pasaje donde se podía caminar rápidamente termina en una estructura de forma tubular del





CUEVA CHARCO
OAXACA, MEXICO
ENTRANCE
long roots
station 1
station 16
low air
DOME ROOM
station 36
potholes (climbable)
6c (handline)
bucket
tiny infeeder
very tight
station 119
infeeder
station 134
natural bridge anchor
33r
low air crawl
continues
station 171
LEGEND
ledge
stream
pool
slope
mud
3c climb (m)
stalactites
gravel
cobbles
flowstone
breakdown
33r rope drop (m)
PROFILE LOOKING NORTH
Surveyed February, 1993 using
Suunto compass,
Suunto inclinometer,
and fiberglass tape
by
Peter Bosted
Don Coons
Patty Kambesis
Ed Sevcik
Carol Vesely
James Wells
Length: 735 m
Depth: -268 m
Drawn by Peter Bosted
Vertical scale in meters
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220
-240
-260

tamaño de un cuerpo. Después de 168 metros, la cueva termina en un pasaje submarino. De interés biológico resultan las tarántulas que al parecer se avecindaron en algunos pequeños bancos de lodo.

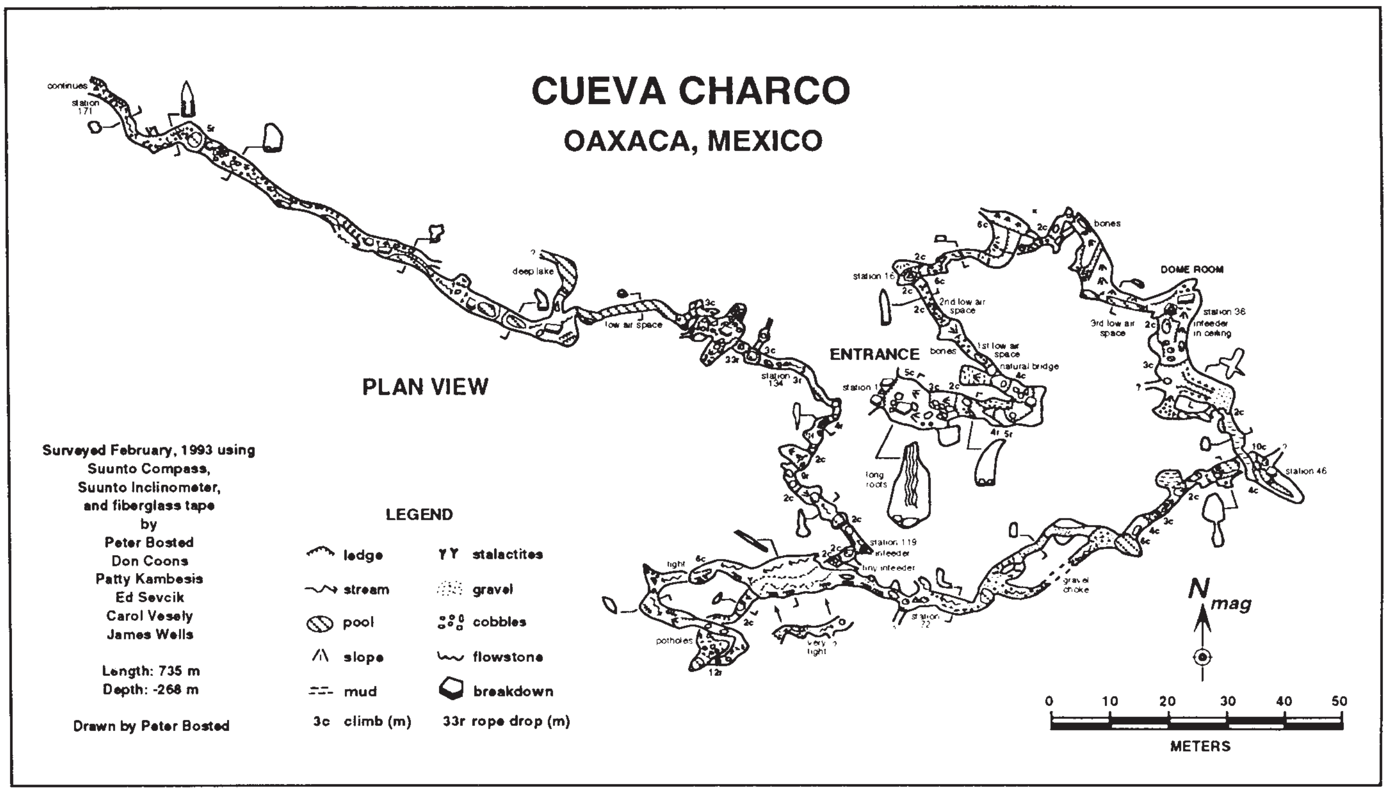
Cueva Charco

Vesely, Bosted y Wells comenzaron una exploración en un cueva encontrada en el viaje de 1989. La entrada está en la más notable depresión en la base de los zig-zags del camino que corta el Rancho Palomora. El que parecía ser un pasaje submarino al final de la cueva resultó un pequeño charco que fue facilmente atravesado. La cueva se llamó Cueva Charco. La cueva tiene una serie de rampas descendientes y pasaje de cañón angosto. Un camino para gatear conduce a una repisa de 12 metros. Ésta es seguida por una rápida sucesión de pozos separados por estrechos pasajes a gatas que conducen a una chimenea de 33 metros.

La buena corriente de aire y el gran pozo eran buenas señales, pero más allá del pozo de 33 metros la cueva degeneró hacia dimensiones más pequeñas. Hay un pozo de 5 metros y después un pasaje a gatas cubierto con agua hasta la mitad que conduce a otro pasaje caminable. Éste tiene buen aire y buena corriente de agua.

A pitch in Cueva Coates
Un pozo en Cueva Coates

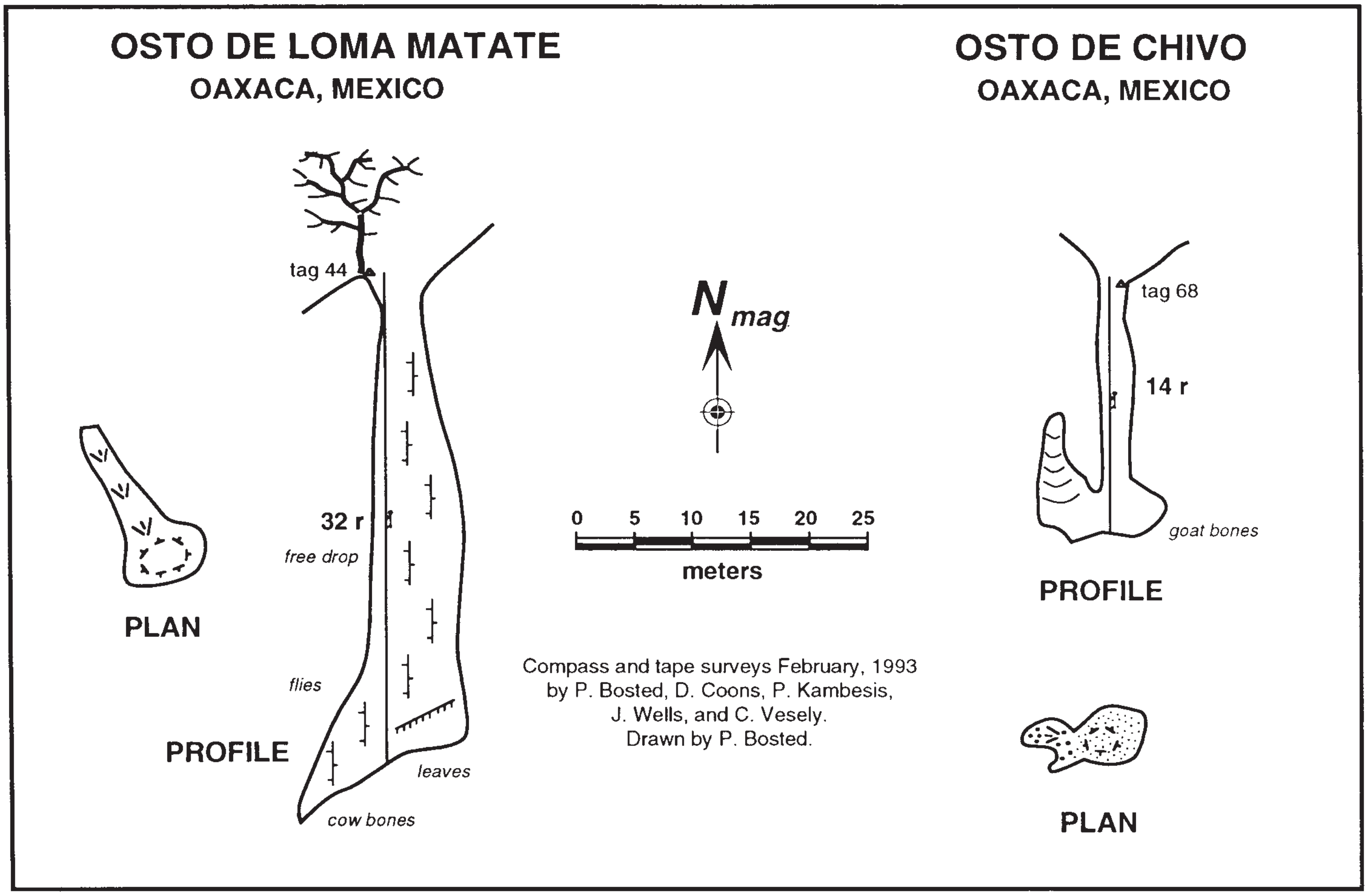
by Carol Vesely



La exploración de la Cueva Charco se detuvo por falta de tiempo. Además del buen prospecto en el fondo, hay un lineamiento muy particular que corta a través de la entrada. Es bastante obvio desde arriba que Charco es un importante drenaje. La cueva desciende en espiral y luego conduce al oeste hacia la proyectada localización del Sistema Cheve.

Caminatas de Reconocimiento

Los días que no se exploraban cuevas eran usados para recorrer la superficie buscando éstas, la mayoría invisibles, por la gruesa vegetación desde la superficie. La mejor manera de encontrar entradas es preguntarle a los habitantes. En el Cañón de Hoya Durazno, 2 pozos de más de 20 metros de profundidad les fueron mostrados a los exploradores. Ninguno de ellos conducía a lado alguno. No tenían aire ni agua. De interés resultó el hecho de que los fondos de ambos pozos se encontraron por debajo del nivel del Río San Miguel . . . un interesante asertijo. Algunas pistas descritas por habitantes locales no pudieron ser seguidas o por falta de tiempo o por falta de permiso. Aún hay mucho terreno por reconocer.

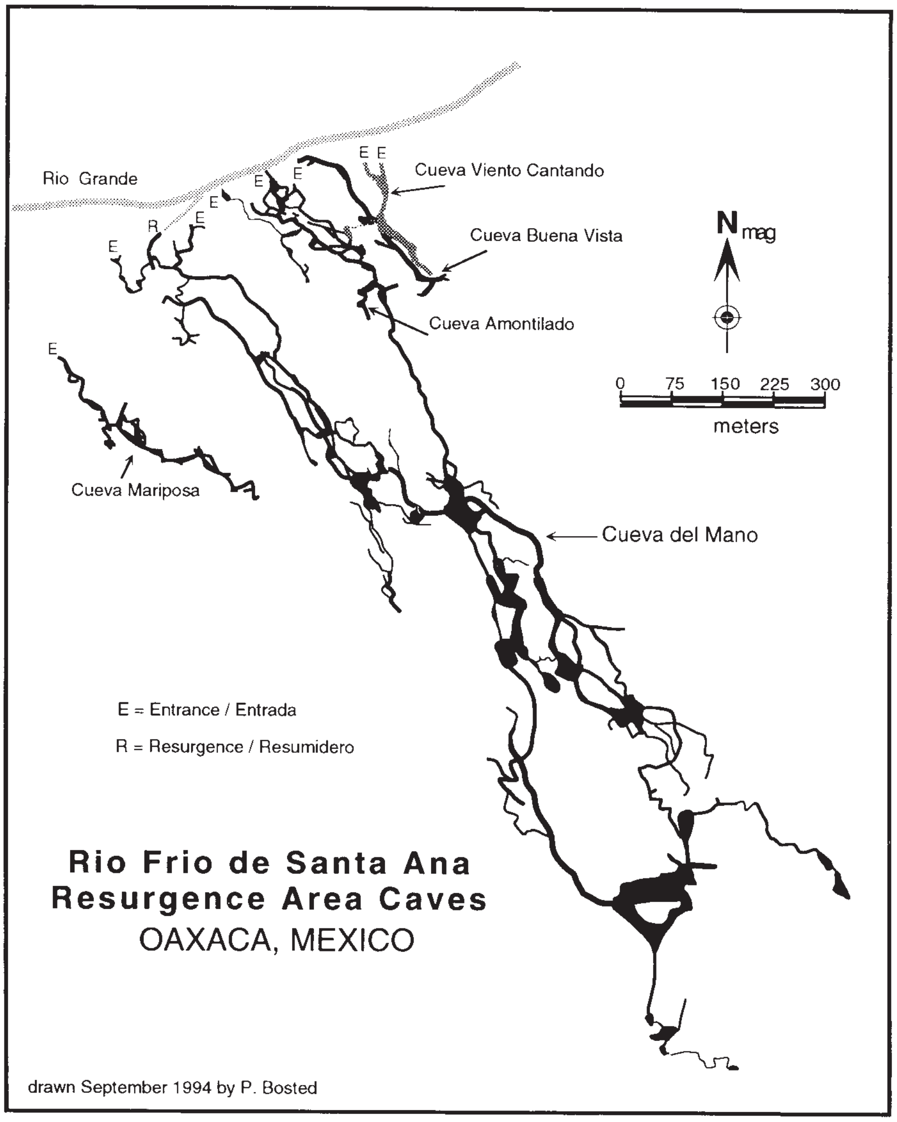


AREA DE RESURGENCIA

La Visita Inicial

El Río Frío de Santa Ana fue visitado por primera vez en 1984 en la expedición Peña Colorada. Bill Stone se sumergió en las frías aguas de lo que él se refirió como la Resugencia del Oeste. Stone descubrió una variedad de pasajes submarinos, siguió uno de éstos y salió a la superficie en una cámara. Aquí él encontró a Peter Quick quien llegó allí a través de una entrada cercana. El equipo de Stone también hizo un reconocimiento de superficie conectando esta resurgencia con el reconocimiento Huautla al otro lado del Río Santo Domingo.

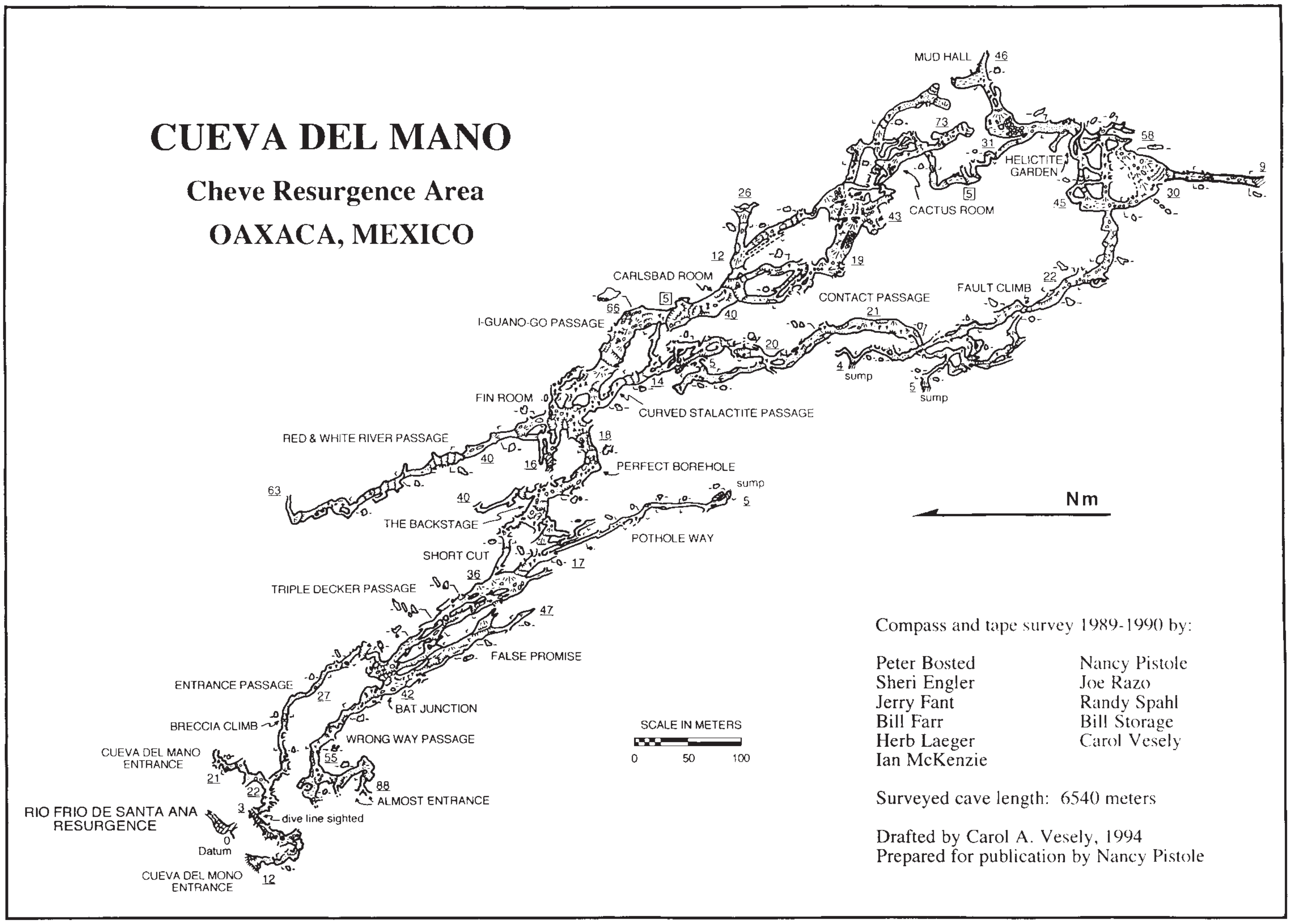
Después de que la Cueva Cheve se descubrió en 1986, se sugirió que la resurgencia oeste podría ser el producto del agua que entra en la Cueva Cheve. En la primavera de 1989, Coons, Minton y Vesely hicieron la larga y empinada ascensión al area para hacer una prueba de tinta. En el proceso localizaron y exploraron parcialmente 3 cuevas. La más promisoria de éstas fue llamada Cueva del Mano por la vieja piedra de moler encontrada en un sendero a gatas justo a la entrada. Al final de la misma expedición, Farr y Vesely exploraron cerca de 350 metros de un bien decorado pasaje caminable en Cueva del Mano dejando muchos prospectos con buena corriente de aire. La cueva se dirigía directamente hacia el sur hacia las montañas rumbo a Cheve. Lo anterior creó espectativas que éste era el fondo del Sistema. Todos resultaron a la vez sorprendidos y desilusionados cuando la primera prueba de tinta resultó negativa.



La Expedición de 1990

Aunque nadie estaba seguro si alguna de estas cuevas estaba relacionada con Cheve, a fines de febrero de 1990, 11 exploradores de los Estados Unidos y Canadá pasaron 11 días explorando las cuevas conocidas en busca de otras entradas. La ascensión al area de resurgencia desciende más de mil metros del camino más próximo. El lecho del río provee una area cómoda para acampar a minutos de las entradas de las cuevas. Las temperaturas en la cueva van de 15 a 18 grados centígrados por la baja elevación.

La cueva más al oeste fue llamada Mariposa por el sonido de mariposas que dieron la bienvenida a los exploradores a la entrada. Justo dentro hay evidencia de murciélagos. La cueva comienza como un laberinto de pasajes arenosos y lodosos con 3 y 4 metros de altura y grosor (promedio). En algunos puntos, el pasaje disminuye hasta hacerse un pasaje a gatas. Sin embargo, una brisa tentadora invitaba a los exploradores a seguir. Después de



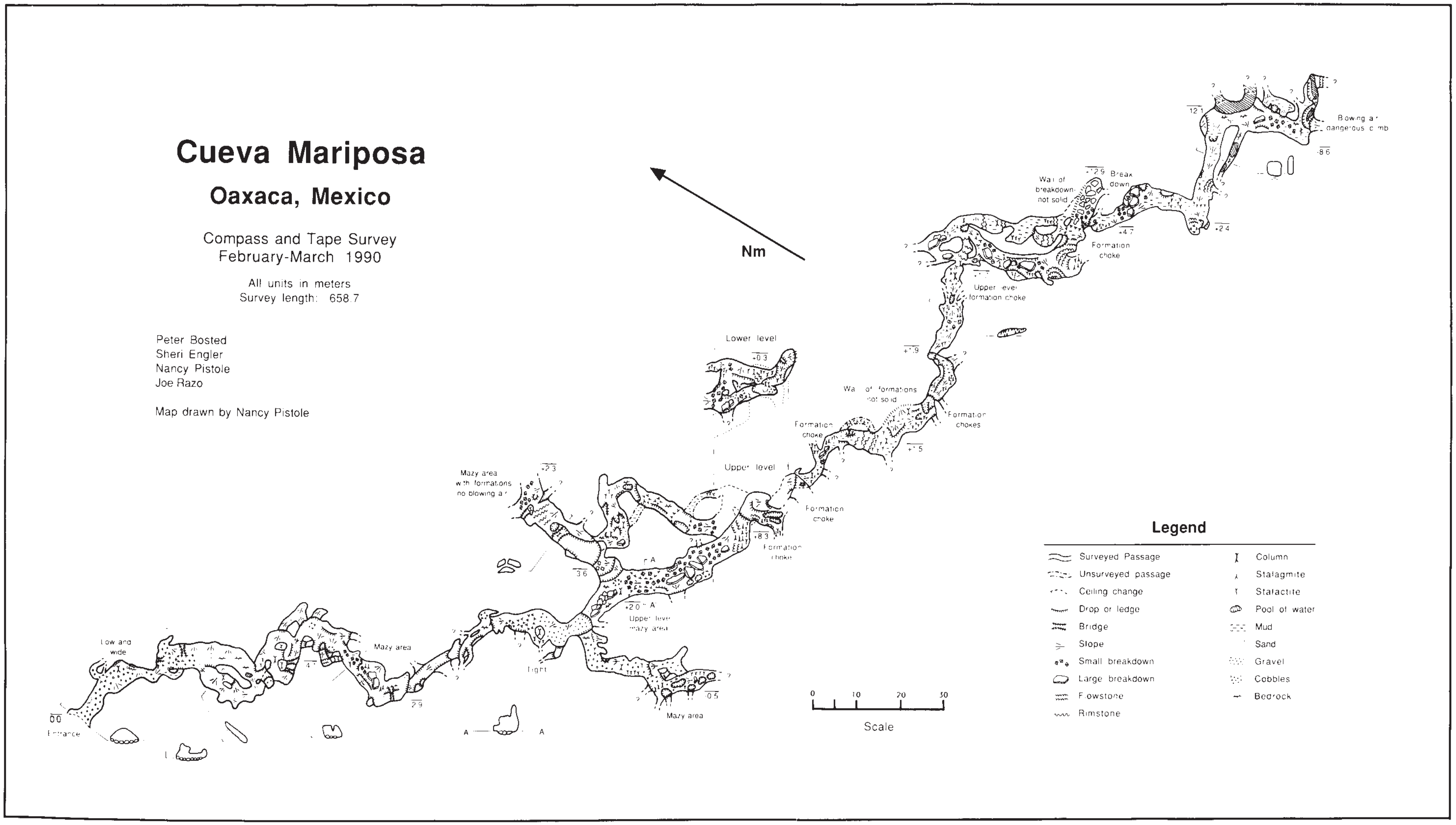
650 metros la cueva termina en un pasaje submarino.

Cueva del Mono, llamada así por la cabeza de un mono esculpida en un columna a la entrada, contiene la ruta que conduce a la piscina donde Stone emergió cuando se sumergió en el río. Este pasaje conecta con Cueva del Mano 100 metros al interior de la entrada. Esta ruta fue explorada en 1993.

Cueva del Mano

Cueva del Mano todavía es considerada como la más promisoria. Retomando la exploración tomada el año anterior los exploradores continuaron abajo a través de un largo y seco pasaje y después cuesta arriba por más de 20 metros hasta encontrar una pequeña entrada a otro pasaje. Era imposible atravesarla.

El siguiente equipo escogió una pista promisoria descrita en las notas originales. Ésta condujo a un largo e inclinado pasaje con hollos en el suelo que conduce a un pasaje inferior para posterior-mente llevar a cámaras en un nivel superior. Los exploradores tomaron el nivel medio hacia el sur hacia el Camino de los Baches. En la unión con prospectos situados más arriba,


Cueva Mariposa
Oaxaca, Mexico
Compass and Tape Survey
February-March 1990
All units in meters
Survey length: 658.7
Peter Bosted
Sheri Engler
Nancy Pistole
Joe Razo
Map drawn by Nancy Pistole
Nm
Entrance
Low and wide
Mazy area
Light
Mazy area
Upper level mazy area
Mazy area with formations no blowing air
Upper level
Lower level
Formation choke
Formation choke
Formation choke
Formation chokes
Wall of formations not solid
Upper level formation choke
Formation choke
Wall of breakdown not solid
Breakdown
Blowing air dangerous climb
Legend
Surveyed Passage
Unsurveyed passage
Ceiling change
Drop or ledge
Bridge
Slope
Small breakdown
Large breakdown
Flowstone
Rimstone
Column
Stalagmite
Stalactite
Pool of water
Mud
Sand
Gravel
Cobbles
Bedrock
0
10
20
30
Scale

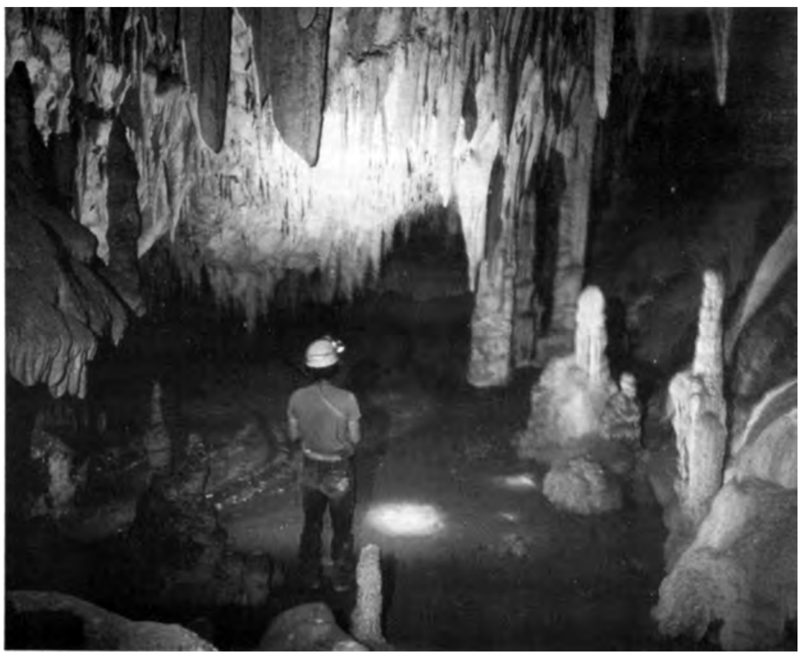
Underground camp *by Bill Stone*
Un campamento dentro de la cueva

el Camino de los Baches desciende y se hace más grande hasta que termina en una repisa arenosa que conduce a un gran pasaje submarino.

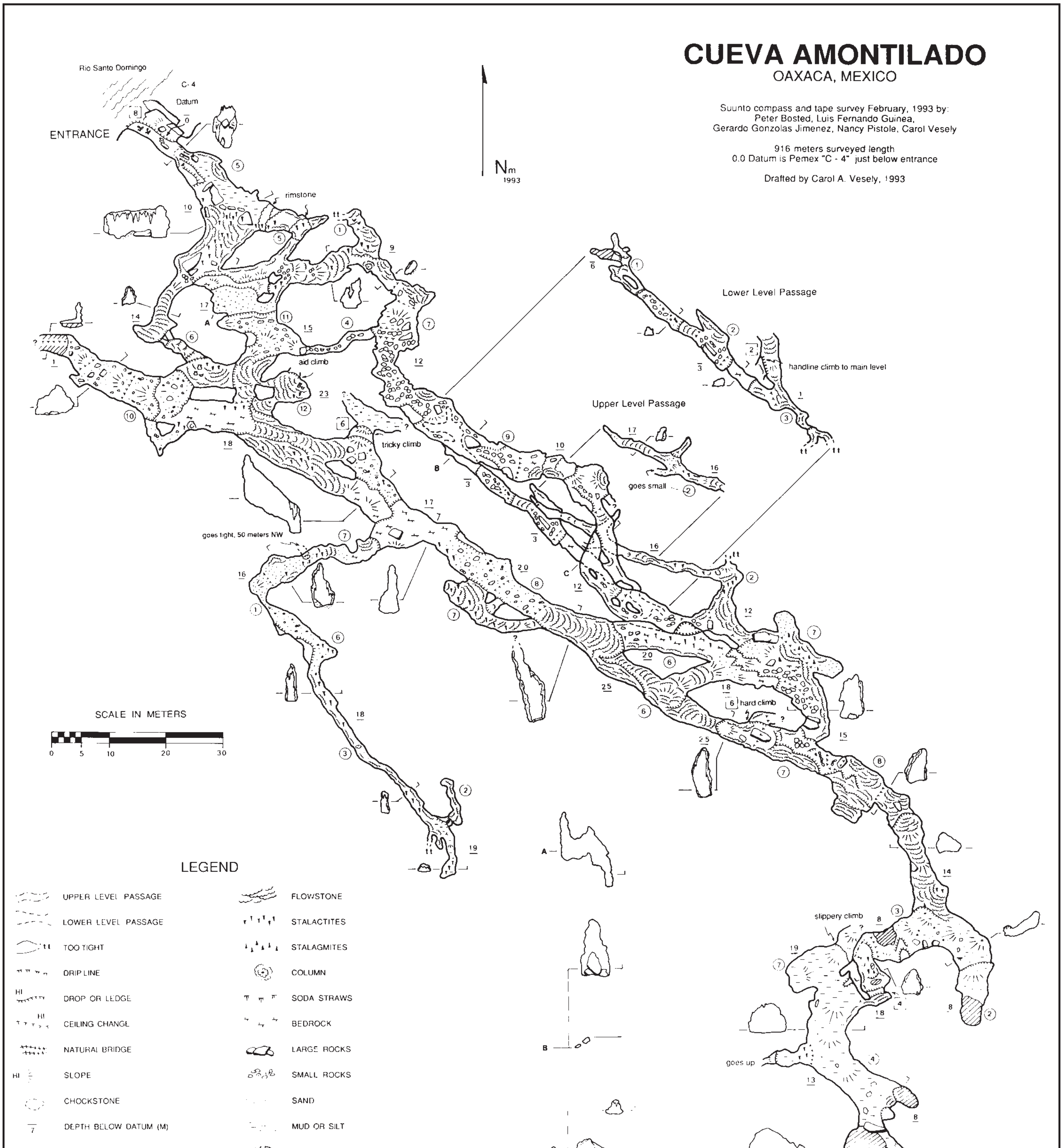
La siguiente exploración regresó a la gran pendiente de piedra con calcita justo antes del Camino de los Baches. En la cima de la bien decorada pendiente, una cámara semi-obstruída fue encontrada la cual conduce a un pozo y a una gran cortina de piedra cubierta de calcita. Después de explorar un largo prospecto menor llamado Borehole Canadiense. Peter Bosted encontró una ranura en la cortina de piedra de un metro de ancha inspirando el nombre Detrás del Escenario. Pronto el equipo estaba explorando rumbo al sureste a través de la formación de 8 metros de diametro llamada el Borehole Perfecto. Después de varias estaciones pudieron observar una gigantesca cámara de unión. Ésta fue llamada la Cámara de la Aleta a causa de una piedra con esta forma que sobresalía de una pared.

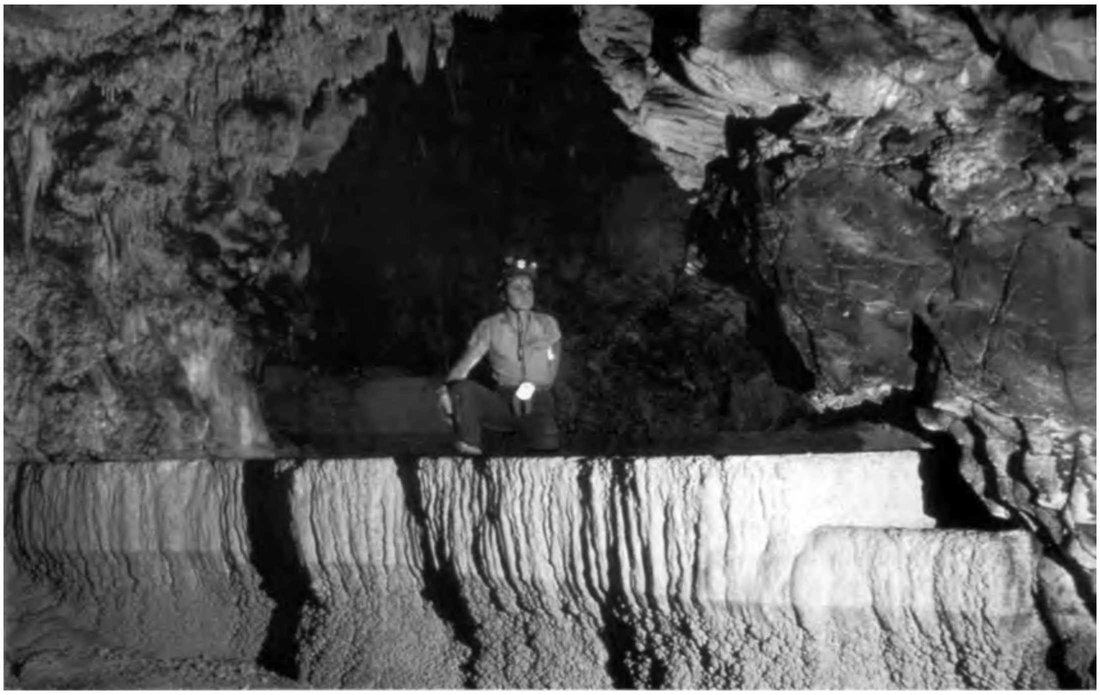
En un pasaje con rumbo al sur hay estalagtitas curveadas de un metro de largos, todas dobladas en dirección de la entrada y el viento prevalesciente. El Pasaje de las Estalagtitas Curveadas continúa bajando a través de un pasaje que es estrecha. Después, en el cielo se encuentra una combinación de piedra rojiza o cafe y piedra mármol gris que continúa hasta el suelo. A esto se le llamó el Pasaje del Contacto. En un punto, el pasaje se sumerge bajo el agua pero hay una fácil ruta alternativa. En la cima de una ascensión de 8 metros a lo largo de una falla, hay algunas pequeñas piscinas. El pasaje se va ensanchando progresivamente hasta que la paredes están separadas 60 metros. Finalmente el pasaje termina abrupta-mente en una piscina. Un pasaje que conduce arriba del vado conduce al Jardín de Helictite, un laberinto de cámaras decorados. Un pequeño agujero por donde pasa una corriente de aire fue encontrado en la cámara superior.

Como el prospecto sur en Mano había supuestamente terminado, los exploradores optaron por una táctica diferente: ir hacia el norte, ir arriba del vado y tratar de intersectar un viejo

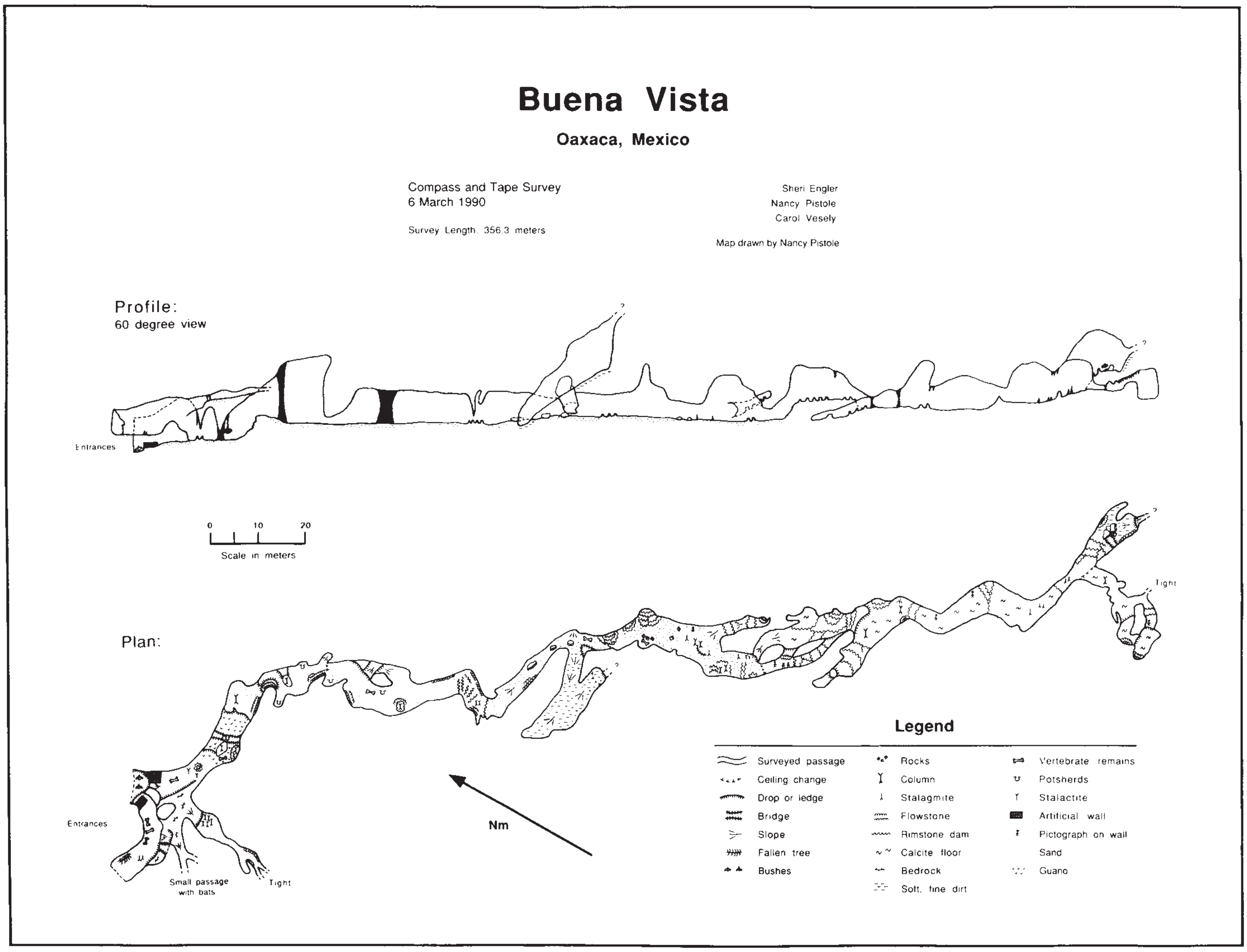


A passage in Cueva del Mano
Un pasaje en Cueva del Mano *by Carol Vesely*


CUEVA AMONTILADO
OAXACA, MEXICO
Suunto compass and tape survey February, 1993 by:
Peter Bosted, Luis Fernando Guinea,
Gerardo Gonzolas Jimenez, Nancy Pistole, Carol Vesely
916 meters surveyed length
0.0 Datum is Pemex "C - 4" just below entrance
Drafted by Carol A. Vesely, 1993
Nm
1993
Rio Santo Domingo
C-4
Datum
ENTRANCE
rimstone
aid climb
tricky climb
goes tight, 50 meters NW
Lower Level Passage
handline climb to main level
Upper Level Passage
goes small
hard climb
slippery climb
goes up
very steep mud slope
possible underwater lead
SCALE IN METERS
0 5 10 20 30
LEGEND
UPPER LEVEL PASSAGE
LOWER LEVEL PASSAGE
TOO TIGHT
DRIP LINE
DROP OR LEDGE
CEILING CHANGE
NATURAL BRIDGE
SLOPE
CHOCKSTONE
DEPTH BELOW DATUM (M)
DEPTH ABOVE DATUM (M)
CEILING HEIGHT (M)
DROP DEPTH (M)
FLOWSTONE
STALACTITES
STALAGMITES
COLUMN
SODA STRAWS
BEDROCK
LARGE ROCKS
SMALL ROCKS
SAND
MUD OR SILT
POOL
PLANTS
POTTERY



Sheri Engler in Buena Vista *by Carol Vesely*



pasaje que pudiera ser un pase alternativo al pasaje submarino. Un prospecto que surge de la Cámara de la Aleta lleva a un impresionante mirador 20 metros arriba del piso. Desde aquí, el pasaje del Río Blanco y Rojo conduce hacia arriba hacia una inclinación cubierta de piedra. Al final, una ascensión de 8 metros conduce a un interesante y pequeño hollo a través de la piedra con una esporádica corriente de aire.

Otro prospecto que sale de la Cámara de la Aleta conduce hacia arriba por un montón de rocas de 20 metros hacia un túnel enorme de 15 metros de diametro que conduce al sur. Hay gigantes-cas presas cubiertas con excremento (guano) de ave y un mirador de piedra que conduce a un gigantesco pasaje que desciende. A esto se le llamó el Pasaje del Guano. El túnel o borehole continuó rumbo al sur a través de la Cámara Carlsbad, el guano rápidamente dando paso a un piso limpio. El area entonces se vuelve bastante laberíntica con diferentes prospectos que fueron dejados sin explorar. Hay un pasaje ventoso que sale del extremo sur del laberinto y que conduce a una caída de 8 metros, la cual intersecta un largo pasaje inclinado. La rama oeste eventualmente conduce a un pasaje submarino hacia el este, pero no tan lejos hacia el sur como el pasaje submarino al final del Pasaje contacto. La rama este conduce a una cámara llena de algunas de las más bellas helictites en la cueva. Al final de la cámara hay un pequeño hollo en la piedra con calcita que conduce aire. La extensión total explorada en Mano es más de 6.5 kilómetros y penetra hacia el sur dentro de la montaña más de un kilómetro en línea recta hacia Cheve.

Caminata de Exploración

Cada día, equipos de exploradores peinaban el difícil terreno en busca de nuevas entradas. Buena Vista fue descubierta cerca de 70 metros arriba del río y unos pocos cientos de metros corriente abajo de la resurgencia. La cueva tiene 2 entradas con increíble vista hacia ambos lados del río. A pesar del difícil acceso, hay viejas paredes de piedra construidas en la entrada y algunos restos vasijas en el suelo. Buena Vista es una cueva en el clásico estilo Hollywood: espaciosa, templada, seca y bien decorada con un suave piso. El único prospecto contiene gran cantidad de guano y murciélagos. Solamente hay una mínima corriente de aire y todos los pasajes parecen estar bloqueados por esa roca cubierta de calcita.

Otra promisoria cueva fue encontrada hacia el final de la expedición. Herb Laeger hizo una ascensión hasta la Cueva Amontilado y varios exploradores recorrieron pocos cientos de metros de ésta hasta llegar a un pasaje submarino. La mayoría de las otras cuevas que fueron encontradas no tenían corriente de aire por lo cual no fueron consideradas muy importantes.

Al final de la expedición, el Río Frío se volvió azúl brillante debido a la tinta fosforescente que Jim Smith había vertido en Cheve. Esto confirmó que la resurgencia estaba hidrológicamente conectada a Cheve, con una diferencia de altitud de más de 2,500 metros entre la entrada Escondida y el punto más bajo alcanzado en la inmersión de Stone en Cueva del Mano.

Repetidos Intentos para Visitar la Resurgencia

Otra expedición fue planeada para Navidades de 1990, pero cuando los exploradores arrivaron el pueblo que controla acceso al area de resurgencia Santa Ana Cuauhtémoc, negó permiso para descender al cañón. Después de una semana y media de inútiles negociaciones, los exploradores no pudieron llegar a la resurgencia.

En marzo de 1991, un pequeño grupo de exploradores fue a Santa Ana para hablar con el presidente y hacerse amigos del pueblo. La gente del pueblo dió la impresión de recibir de buena manera a los exploradores, pero el presidente todavía negó acceso al cañón. En 1992, otros 2 exploradores regresaron a Santa Ana con cartas de recomendación y permisos de alto nivel pero el presidente no se encontró por lo que nadie bajó al cañón.

En junio de 1993, un pequeño grupo se encontraba en el area Pápalo grabando las entradas a las cuevas con 2 unidades de GPS (Sistema de Posición Global). Un nuevo presidente se encontraba en funciones por lo cual la esperanza renació. Con ayuda del gobierno de Oaxaca, a 2 exploradores les fue permitido explorar el cañón por un día. Al mismo tiempo se hicieron arreglos para permitir un grupo más numeroso posteriormente.

En marzo de 1993, a 5 exploradores de E.E.U.U. y 2 miembros de la Cruz Roja mexicana en Oaxaca les fue permitido un viaje de 3 días a la resurgencia. Durante esta breve estadía pudieron hacer mapas de cerca de 900 metros en Cueva Amontilado. Desde la entrada el pasaje conduce a una cámara grande y seca cubierta con formaciones y restos de objetos de barro. Dos prospectos caminables por rumbo al sureste eventualmente se encuentran formando un lazo. En el punto más hacia el sur, la cueva termina en un extenso pasaje submarino. Hay una gran corriente de aire pero sólo es posible continuar buceando o escalando. Lecturas GSP fueron tomadas por tres días para lograr una posición exacta para anudar las entradas a la cueva. El último día de exploración Peter Bosted y Louise Hose regresaron al lejano pasaje submarino en Cueva del Mano y encontraron un estrecho pasaje alterno con corriente de aire y agua corriente por lo que un interesante prospecto quedó allí por explorar.

Este artículo es una compilación de las contribuciones de Peter Bosted (Cueva Cheve y Karst Superior), Pat Kambesis (Karst Intermedio), y Carol Vesely (Area de Resurgencia).

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RESUMEN DE GEOLOGIA E HIDROLOGIA

por James Smith

El estanque de drenaje de Cheve, que sostiene el Sistema Cheve, se encuentra aproximadamente a 280 kilómetros al sur de la Ciudad de México en el extremo norte de la Sierra Juárez, una parte que va en dirección noroeste-sureste de la Sierra Madre Oriental. El plano de la Costa de Golfo de Veracruz se encuentra al este de la Sierra Juárez y el Valle de Tehuacán está al oeste. El Valle de Tehuacán se vacía hacia el este desembocando en el Río Santo Domingo. El río ha formado un cañón muy profundo que corre del este al oeste y separa la Sierra Juárez de otra cordillera llamada la Sierra Mazateca que se encuentra al norte. Varios manantiales grandes que vacían ambas cordilleras, emergen y desembocan en el Río Santo Domingo. El estanque de drenaje de Cheve que mide aproximadamente 6 kilómetros de ancho y 23 de largo, es rodeado de rocas que no contienen caliza. Las aguas desembocan en esta depresión del estanque, en el lugar donde las rocas sin caliza se conectan con las de caliza y corren bajo la tierra en el Sistema Cheve por varios kilómetros antes de emerger en el Río Santo Domingo via el Nacimiento Río Frío de Santa Ana. Este camino subterráneo es determinado por la orientación regional y por una serie de fallas que se orientan en dirección norte-sur.

La Sierra Juárez es la primera cordillera localizada al oeste del Golfo de México y tiene elevaciones que llegan a 3,200 metros. Estas montañas afectan la cantidad de lluvia que recibe cada area. En las inclinaciones inferiores del este, llueve 5 metros al año. La lluvia disminuye al oeste, llueve menos de 2 centímetros al año cerca de Cuicatlán. El Sistema Cheve, que está a 2,700 metros de elevación, recibe aproximadamente un metro de lluvia al año.

Las rocas más antiguas del area se encuentran en el Valle del Río Santo Domingo, al extremo este de las montañas (Moreno 1980). Son rocas Precambrias metamórficas de la edad Greenville. Los 'Redbeds' Triásicos y Jurásicos de la formación de Todos Santos están por encima de las rocas Precámbrias. Sigue en la secuencia hacia arriba los carbonatos Cretáceos de la Plataforma Córdoba (Alvarado 1976) que representan un depósito de arrecife de un mar anciano. Las rocas de la edad Cretácea se dividen en la siguiente serie que va de las más ancianas a las más jóvenes: Tuxpanguillo, Orizaba Unida, Maltrata, y la Nexcolta. Cerca de Cueva Cheve, la Orizaba Unida aparenta ser la formación de roca que predomina, y en la superficie se pueden ver capas de caliza y 'dolostone' de tres metros de grueso. Toda la secuencia Cretácea de rocas tiene por lo menos 1,000 metros de grueso.

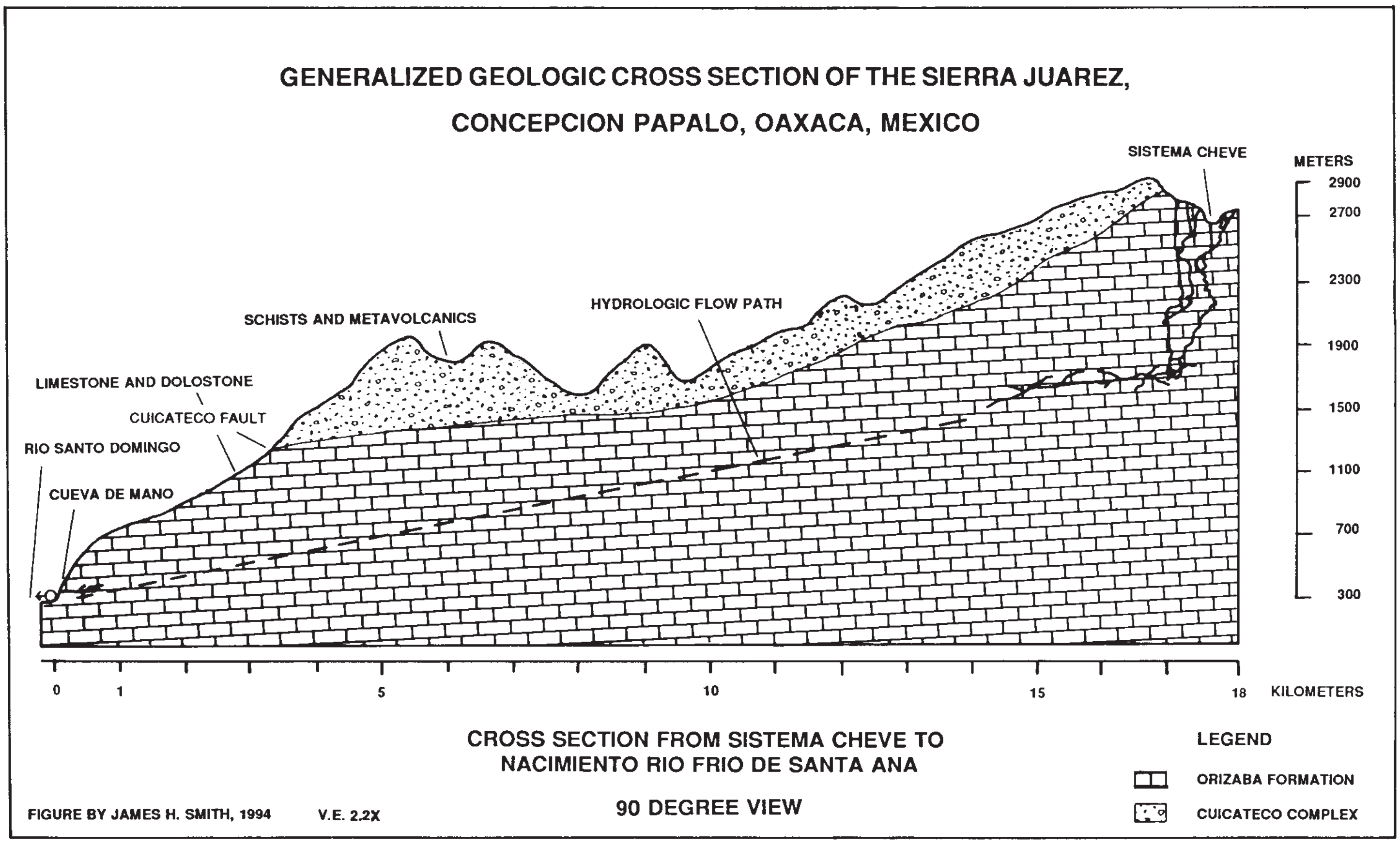
La parte oeste del estanque de drenaje de Cheve consiste de rocas Cretáceas metamórficas. La sección este del estanque consiste de esquistos Cretáceos. En la sección nordeste del estanque, esquistos Paleoceneos y piedras areniscas están por encima de la caliza de la edad Cretácea.

La Sierra Juarez se formó durante un episodio de formación de una montaña que tomó lugar desde fines del Cretáceo hasta principios de los períodos de tiempo del geológico Terciario. Las montañas continuaron su subida desde el geológico Oligoceno hasta el presente. Estos episodios de formación de montaña produjeron muchas fallas y estructuras geológicas dobladas que determinan el lugar y la orientación de las cordilleras, los estanques que vacían las montañas, y las cuevas asociadas con los estanques de drenaje.

El estanque de drenaje de Cheve vacía aproximadamente 80 kilómetros cuadrados de tierra. El origen del drenaje viene tanto de la lluvia que permea la tierra como del agua que fluye de inclinaciones adyacentes de rocas metamórficas. En 1990, un rastreo de tinta se llevó a cabo por el autor, por el cual descubrió el camino de drenaje de las aguas y estableció el rastreo de tinta más profundo del mundo. La tinta tardó 9 días en recorrer su ruta desde la entrada de la Cueva Cheve del Sistema Cheve hasta el Nacimiento Río Frío Santa Ana. La data del rastreo de tinta, junto con la del Sistema Posición Global (Hose 1993), probó que la existencia hidrológica del Sistema Cheve es de 2,525 metros. A partir de 1994, el Sistema Cheve ha sido medido a 23.5 kilómetros de largo y 1,386 metros de profundidad.

Existen muchas similitudes entre la formación y la orientación de los estanques de drenaje y las cuevas del area de Cheve y aquellos del area de Huautla que se encuentra al norte, al otro lado del Río Santo Domingo. Ambas areas contienen muchas entradas a cuevas que requieren la formación de grandes estanques de drenaje. Esto indica que, alguna vez, ambas areas estaban cubiertas por una capa de roca impermeable por el agua (caprock). Al continuar las cordilleras su subida, se formaron grietas en esta capa impermeable, las cuales eventualmente se llevaron las aguas y desembocaron en los sistemas de ríos antiguos que vaciaron esta capa impermeable. Estas aguas invadieron las calizas por debajo y formaron no sólo los estanques de drenaje sino también los sistemas de cuevas que ahora existen.

Cheve Karst *photo by Susie Lasko*



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Una Breve Historia de la Exploración de Cueva Cheve (1986-2002)

por
Bill Stone
Febrero 2003

En diciembre de 1986 la entrada fue descubierta por los espeleologos Carol Vesely y Bill Farr de California después de estudiar mapas topográficos de Oaxaca. Por diciembre de 1987 la cueva había sido explorada rápidamente a una profundidad de casi 700 metros debajo la superficie y la cueva tenía viento muy fuerte, que sugirió que condujera a profundidades mucho más adentro la montaña. En marcha de 1988 un equipo grande llegó en Llano Cheve. Durante este esfuerzo de dos semanas un equipo que consistía en Steve Zeman, Jeb Blakeley, Bill Stone, Jim Smith, Matt Oliphant, Bob Benedict, y Ed Holladay alcanzó una profundidad de -1026m.

Un año más tarde, en 1990, la longitud de la cueva fue extendida por estos mismos exploradores rápidamente a casi siete kilómetros de la entrada a una profundidad de -1100 metros. En 1990 Don Coons, Matt Oliphant, y Bill Stone establecieron el campamento tres al nivel -1050m y extendieron la cueva un kilómetro adicional hacia el norte a una profundidad de -1364m. Allí encontraron un túnel inundado de agua. Un buceo exploratoria fue conducida en el túnel subacuático en 1991 por Juan Schweyen con la ayuda de siete miembros del equipo. El túnel subacuático fue explorado a una profundidad de 22 metros debajo de la superficie del agua a una distancia de 100 metros de la entrada al túnel. Allí el conducto dividió en muchos otros túneles y el buzo no tenía tiempo para investigar todos.

Entre 1992 y 2001 varias expediciones al Sistema Cheve (incluyendo a la zona de nacimientos en la barranca Santo Domingo donde es sabida reaparecer el agua que fluye por la cueva) y a la Cueva Charco cerca de San Miguel Santa Flor, fueron conducidos por Matt Oliphant, Nancy Pistole, y Bill Stone. Sin embargo, ninguno de estos esfuerzos era exitoso alcanzar profundidades mayors. El record actual, establecido durante el buceo de 1991, sigue siendo 1386 metros de profundidad a una distancia de ocho kilómetros de la entrada. Hace 12 años que ha quedado un misterio de qué existe más allá del túnel subacuático. ¿Hay manera de pasar el laberinto subacuático en el fondo de Cueva Cheve? ¿Y nos permite descender a más granes profundidades? Un equipo internacional en 2003, con 54 miembros, establecerá un campo al principio del túnel subacuático. Tendrán con ellos el equipo de buceo avanzado y cuatro especialistas en espeleobuceo. Durante los meses de marcha y abril 2003 pasarán hasta 6 semanas explorando territorio nuevo más allá del túnel subacuático - si hay una ruta. Con suerte, Sistema Cheve se convertirá en la cueva más profunda del mundo en 2003.

Hidrología de Sistema Cheve

Desde que la exploración comenzó en Cueva Cheve en 1986, los espeleologos han mantenido un modelo matematico -- hecho por computadora -- de la cueva en tres dimensiones. Lo qué usted ve aquí en esta página es una proyección de ese modelo de la computadora en vista perfil. Hemos añadido detalles a los conductos de nuestras notas que fueron dibujadas mientras adquirir los datos topográficos por dentro de la cueva. Éstos proporcionan una indicación del tamaño y de la forma de los túneles que se han encontrado en Cueva Cheve.

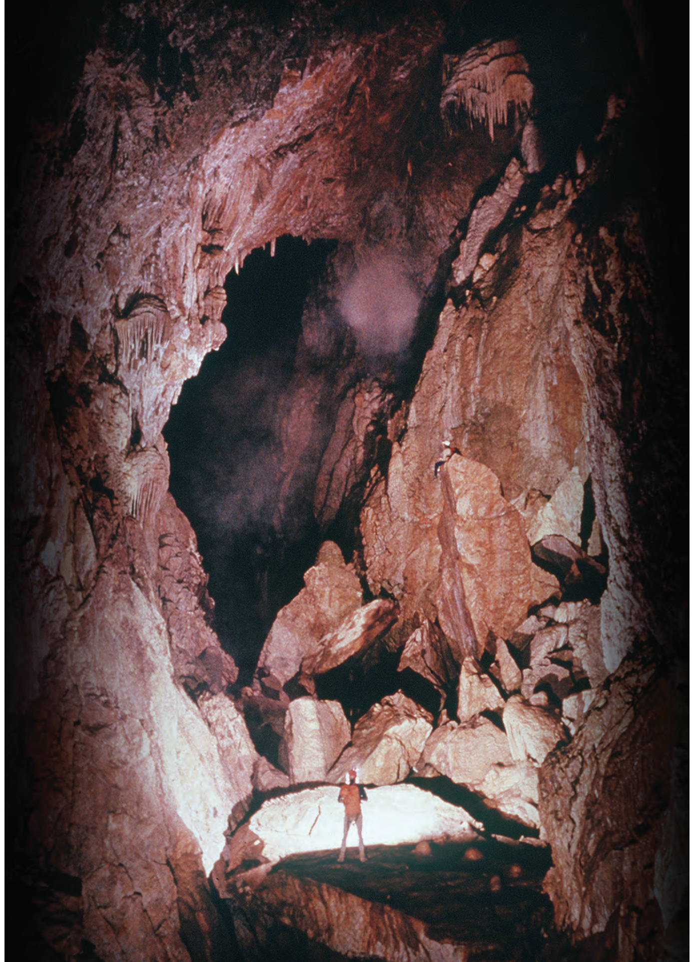
Varias características sobre la cueva son notables. La tierra que rodea la cueva al sur se funda en roca dura - principalmente del origen metamorfica. El agua no puede penetrar esta roca para formar cuevas. Sin embargo, la roca cambia a la piedra caliza exactamente en la localización de la entrada de Cueva Cheve.   Éste no es un accidente. Cueva Cheve se formó en el punto de contacto de la roca metamorfica y la suave piedra caliza. Alli las corrientes que siguen los valles metamorficas hacia el norte de la carretera a Santa María Papalo encontraron esa piedra caliza para la primera vez y alli entra el agua en la tierra.

Por medio de millones de años estas corrientes disolvieron la piedra caliza para formar la gran cueva que existe hoy. Es una cueva muy vertical para los primeros dos kilómetros. En esta distancia corta la cueva desciende casi 900 metros verticalmente, en muchos casos en la forma de tiros verticales espectaculares. Algunos de éstos se demuestran en las fotos colocadas al lado de su localización en el mapa. Más allá de dos kilómetros de la entrada la cueva llega a ser más horizontal. Todavía hay muchas subidas verticales y algunos tiros, pero son mucho más pequeños. Generalmente, hay dos niveles a la cueva a este punto. El túnel más bajo lleva la corriente y está generalmente en la forma de una barranca estrecha con las piscinas en el suelo. El túnel superior, en contraste, es muy grande - a veces midiendo 40 metros de ancho por 25 metros de alto. El suelo de este túnel superior es compuesto de roca quebrada casi el tamaño de una mesa.

Cerca del fondo de la cueva el nivel superior desaparece. Y éste es un misterio que deseamos resolver en 2003. Si existe un nivel superior cerca del conducto inundado puede ser posible alcanzar mayores profundidades sin el uso del aparato de buceo. Sabemos que los túneles existen más allá del túnel inundado en el fondo de Cueva Cheve. Esto fue probada en 1990 en que el tinte coloreado fue utilizado para probar una conexión de Cueva Cheve a los manantiales en Cueva de la Mano debajo de Santa Ana Cuauhtemoc, en el fondo de la barranca Santo Domingo. La corriente dentro de Cueva Cheve llevó el tinte al nacimiento y podíamos probar esto por medio de análisis químico. Así, Sistema Cheve incluye no solamente Cueva Cheve pero también la Cueva de la Mano. Asimismo, por medio de otra prueba de tinte, nosotros han demostrado que Cueva Charco también está conectado a la Cueva de la Mano y por lo tanto es también una parte de Sistema Cheve. Sin embargo, sigue siendo un gran misterio dentro de la montaña entre todas estas cuevas, porque nadie sabe cómo y dónde todas conectan. Ni ha hecho ningun ser humano el viaje subterráneo de Cueva Cheve o de Cueva Charco al nacimiento. Esperamos que la expedición 2003 añadiera más conocimiento.sobre este enigma subterráneo.

La Expedición de 2003 a la Cueva Cheve

Expedición del Sistema Cheve 2003



La exploración del todo por él todo para alcanzar los 2000 metros de Profundidad.

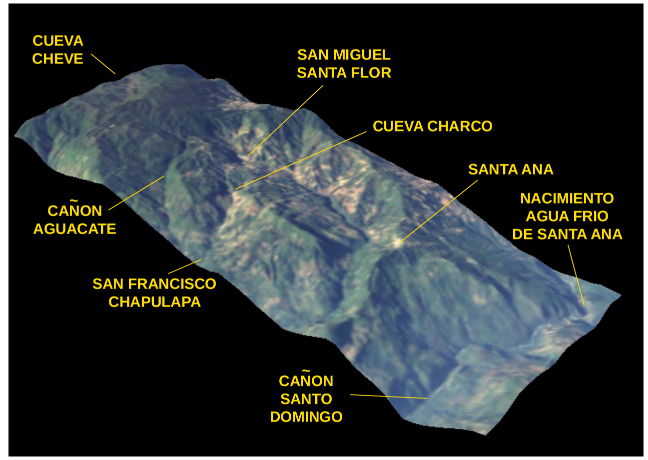
El Reto: En enero de 2001, un equipo Ruso condujo una exploración en la Cueva Krubera de la región de Abkhasia de Georgia a una profundidad de 1,710 metros; de esta manera los rusos se proclamaron el record de la caverna mas profunda en la tierra. El próximo acontecimiento en la exploración espeleologica, será el descubrimiento del primer sistema de cuevas en el mundo que rebase los 2000 metros de profundidad. 2003 puede ser el año en el cual este evento histórico se lleve a cabo.

Cueva Cheve, Cueva Cheve, localizada a una elevación de 3,000 metros en la Sierra Juárez en el parte noreste de Oaxaca, México, actualmente tiene una profundidad de 1,386 metros y es la segunda caverna más profunda conocida del hemisferio occidental. Hasta donde se ha llegado en la Cueva Cheve (a 8 kilómetros de la entrada más cercana) representa una de las distancias más remotas alcanzadas dentro del cualquier cueva en el planeta. El procedimiento para alcanzar este punto, no es sencillo y se requerirá armar más de dos kilómetros de cuerda dentro de la cueva y establecer 3 campamentos a lo largo de esta.

La profundidad de 1,364 metros, fue alcanzada durante una prospección de buceo en el túnel inundado descubierto a los 1,364 metros de profundidad en el año de 1991. La prospección fue poco concluyente dada las limitaciones que presentaba el equipo de buceo en aquella época y por el encuentro de numerosos túneles inundados para ser investigados. Desde entonces la tecnología del equipo de buceo ha mejorado dramáticamente y de igual manera las técnicas de escalada subterránea en cuevas, que abren la posibilidad de seguir cascadas y domos hacia arriba cerca del fondo del sistema de cuevas que antes se habían descartado.

Cueva Charco, situado un kilómetro más bajo en la montaña, se ha explorado a una profundidad de 1,166 metros y continúa, aunque las dimensiones son excesivamente pequeñas: un viaje hasta

Foto de la Portada: El Túnel de Arne Saknussemm a los 1,000 metros de profundidad en la Cueva Cheve

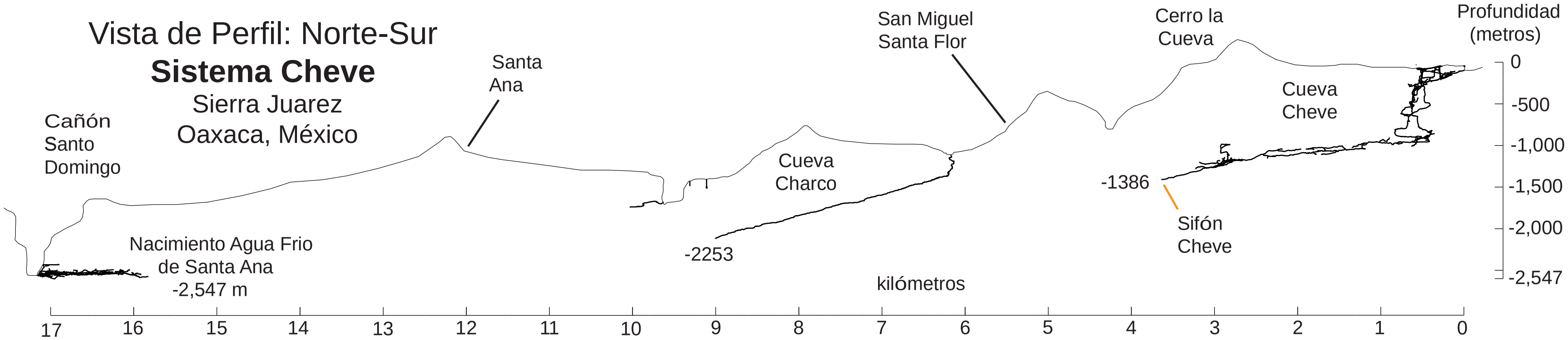


Mapa superficial de la región del Sistema Cheve, Oaxaca, México

donde se ha explorado actualmente, se ha comparado con " un arrastre de 5 kilómetros. " Cueva Charco puede proporcionar un puente adicional al Sifón Cheve y de tal modo a una segunda ruta potencial al desconocido corazón de la Sierra Juárez. Ambas cuevas serán investigadas como parte de la expedición 2003.

Hay un enorme interés espeleológico de por medio. Se ha comprobado que el Sistema Cheve tiene un potencial de profundidad de 2,547 metros, basado en un experimento de rastreo de tinte conducido en 1990. Con esta profundidad, si se consiguiera, se destrozaría el record de la cueva de Krubera por un margen tan amplio que podría para siempre establecer a Cheve como la cueva mas profunda en la tierra. La rapidez con lo que consiguió la conexión con el rastreo de tinte, (ocho días) garantiza la presencia de pasillos mas allá del sifón de Cheve. La Expedición 2003 será la primera en regresar a la parte más lejana alcanzada hace seis años. Usando equipo avanzado de buceo en circuito cerrado, tecnología de escalada artificial, y equipo ligero de vivaque, el equipo de exploración pasará hasta un mes debajo de los 1,000 metros de profundidad, atravesando por territorio nunca antes visto por humanos.

Vista de Perfil: Norte-Sur
Sistema Cheve
Sierra Juarez
Oaxaca, México



La Misión: La expedición se agrupara en Austin, Texas la ultima semana de febrero del 2003 y estará en el área del Sistema Cheve a explorar por dos meses y medio. El primer objetivo será una exploración a fondo de Cueva Charco y paralelamente se hará una investigación de las características hidrológicas inusuales de la región cercana a Charco. Si cualquiera de estos esfuerzos condujeran a un pasaje hacia el hipotético corazón de la Sierra Madre, entonces el principal esfuerzo se enfocara a explorar el pasaje al sur hacia Cheve y al norte hacia los nacimientos de agua. Si los esfuerzos iniciales fracasan, entonces el equipo establecerá el campamento numero 4 en el sifón de Cheve para una serie de exploraciones subacuaticas usando equipo de buceo de circuito cerrado (abajo, derecha); los equipos de escaladores trabajaran en paralelo (debajo, izquierda) para sobrepasar el sifón de Cheve por un pasaje superior y seco.

Arriba y derecho: El extenso modelo del Sistema Cheve. El agua se resume a los 3000m de elevación y a 17 kilómetros emerge de un nacimiento, a 2,547m mas abajo, en las profundidades del cañón Santo Domingo

Programa:
Punto de partida en Texas: 22 de Feb., 2003
Cueva Charco: 1-23 de marzo, 2003
Cueva Cheve: 9 de marzo - 4 de mayo, 2003

Organización
La expedición Sistema Cheve 2003, está siendo conducida por los exploradores veteranos Guillermo Piedra, Matías Oliphant, y Nancy Pistolas e incluirá miembros altamente capacitados del equipo de E.U., Gran Bretaña, México, Polonia, Francia y Suiza. La expedición esta oficialmente a cargo del Equipo estadounidense de exploración de cuevas profundas. (USDCT por sus siglas en Ingles)

Cualquier patrocinador
El USDCT es una Organización 501(c3) no lucrativa científica y educativa. Todas las contribuciones son deducibles de impuestos.

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Informe al Gobierno de México
La Expedición de 2003 al Sistema Cheve

Por
Dr. Bill Stone, Yvonne Droms, Nancy Pistole y J.A. Soriano
8 de diciembre, 2003

Un equipo conducido por Bill Stone descendió en Cueva Cheve, Oaxaca, México, por 10 semanas en la primavera de 2003 en un esfuerzo de ampliar la exploración en el fondo del sistema más allá del túnel subacuático donde el progreso de la exploración ha parado desde 1990. Una prueba realizada en 1990 usando tintes especiales en el agua había demostrado previamente un acoplamiento a una resurgencia (nacimiento) llamada Cueva de La Mano, localizado 2.547 m por debajo de la entrada más alta de la Cueva Cheve y 17 kilómetros horizontalmente al norte. Si un equipo de la exploración puede hacer el mismo viaje en el Sistema Cheve se convertirá en la cueva más profunda del mundo por un margen substancial - posiblemente por siempre. Había motivación significativa en volver al túnel subacuático puesto que las exploraciones en la década pasada no habían podido descubrir una ruta adelante en otras partes de la cueva.

El plan de la exploración en 2003 tenía dos componentes: un equipo de buzos utilizaría "rebreathers" (equipo de buceo de tipo circuito cerrado) para explorar el sifón (conducto inundado) al nivel -1362 m (- 1228 m debajo de la entrada de Cheve, y 8 kilómetros de la entrada) para buscar un conducto seco más allá de la parte hasta ahora conocida. Simultáneamente un equipo de escaladores procuraría establecer rutas en la parte del sifón, ascendiendo a las partes más altas de los túneles en la barranca final que conduce al sifón. El primer contingente de un equipo de 45 espeleólogos de ocho diversos países montó en el Campamento Base en Llano Cheve el 9 de Marzo del 2003, listo para comenzar un nuevo intento en la cueva después de su ultima expedición en hace seis años.

Casi simultáneamente, elementos del equipo, conducido por Nancy Pistole y Matt Oliphant conformado por 12 espeleólogos, continuó la exploración de Cueva Charco para alcanzar la parte final o la conexión con el sistema principal.
Cueva Charco está situado aproximadamente 8 kilómetros al norte de Cueva Cheve en las afueras del poblado de San Miguel Santa Flor y 1000 metros por debajo de la mayor elevación. Se ha visto correctamente como una puerta potencial al centro del Sistema Cheve. Sin embargo, debido a su naturaleza y características increíblemente estrechas, su exploración se ha convertido en una lucha legendaria en la comunidad de la exploración de las cuevas. En las secciones que abajo divulgaremos por separado sobre todos estos dos esfuerzos comunes en 2003.

Exploraciones en Cueva Cheve 2003

En los primeros 16 días se armaron las rutas de descenso instalando casi tres kilómetros de cuerda en 92 tiros verticales, y transportando muchas cargas del equipo hacia las partes mas profundas. Este equipo incluyó bolsas para dormir, colchones, estufas, carburo del calcio para nuestras lámparas, cuerda, pernos para roca, taladros, baterías, y los equipos y aparatos de buceo. Tres campamentos subterráneos fueron establecidos. Campamento 1, un sitio del vivaque para emergencia a un nivel -385 m; Campamento 2, un campamento espacioso y cómodo pero con muchas corrientes de viento a un nivel -787 m; y el Campamento 3, una serie de terrazas construidas en una cuesta de piedras en un lado del pasaje masivo "Socavón Saknussemms", en el nivel -1010 m. Ahora estando establecidos los campamentos se realiza la transportación de material y equipos de escalada y buceo al campamento 3 y posteriormente al sifón, preparando esta etapa para el primer buceo el 26 de marzo del 2003.

Rick Stanton y Jason Mallinson, dos de los más experimentados buzos espeleológicos del mundo, hicieron el primer esfuerzo. Como referencia histórica, el Sifón Cheve se buceo por primera ves 1991 por John Schweyen a una distancia de 100 metros de penetración y a una profundidad de 24 metros. Sin embargo, este buceo era poco concluyente porque Schweyen divulgó que todos los túneles que él investigó eran demasiado pequeños para continuar.

En la preparación para el esfuerzo de 2003 estudiamos los datos a partir de la expedición 1991 y concluimos que una fractura en la piedra caliza había desviado el agua en un diferente curso. La tendencia principal de Cueva Cheve es 330 grados, es decir, al noroeste. Sin embargo, en ciertas secciones de la cueva las fracturas hacen la cueva desvíe al este por distancias cortas regresando al rumbo original. Concluimos que esto es lo qué debe ocurrir en el Sifón Cheve y por lo tanto tomamos una decisión para explorar inmediatamente en dirección este para buscar un nuevo paso en lugar de seguir la vieja línea guía que fue establecida en 1991. Esta hipótesis demostró ser correcta. Stanton y Mallinson navegaron con éxito una trayectoria a través del sifón y emergieron en un pasaje lleno de aire después de un buceo de 15 minutos. El túnel subacuático que había parado la exploración por 13 años, era solamente 140 metros de largo y 12 metros de profundo. El cual más allá (véase el mapa de Sistema Cheve 2003) era una barranco estrecho y escarpado que descendía llevando un río de agua blanca. En este reconocimiento inicial de los dos buzos no tenían ninguna cuerda para armar y asegurar los tiros verticales. Así, el descenso implicó innumerables escaladas difíciles a través de peligrosas cascadas. Además, la exploración más allá del túnel subacuático fue complicada por el problema que tuvimos que hacerla en nuestros trajes secos de buceo. Esto había sido una de las decisiones difíciles de la expedición. Ya que no sabíamos de qué largo sería el túnel subacuático. Por lo tanto, era una decisión entre los cuatro buzos (Stanton, Mallinson, Richie Hudson, y Bill Stone) para utilizar trajes secos mejor que los trajes mojados tradicionales, más flexibles, usados por la mayoría de los buzos. Estos trajes secos trabajaron bien en el túnel subacuático. Pero eran significativamente más calientes en los pasos secos. Afortunadamente, había muchos lagos profundos más allá y éstos servían para ayudar a reducir la acumulación del calor.

En este primer reconocimiento más allá del Sifón Cheve Stanton y Mallinson descubrieron 800 metros del túnel adicional antes de que encontraran otro sifón... ahora llamado "Sifón 2". En ese punto habían aumentado 940 m en longitud y 103 m de profundidad. Pero el equipo que teníamos para bucear a través del primer sifón ("Sifón 1" ahora) no era suficiente para continuar otro buceo por el sifón 2. El equipo de buceo volvió a la superficie después de nueve días en los campamentos subterráneos. Las discusiones entonces fueron comenzar a organizar un intento para bucear el segundo túnel subacuático con más equipo y exploradores adicionales para ayudar a transportar los aparatos de buceo más allá de Sifón 1.

Mientras tanto, un equipo de escaladores buscó los pasos altos en el techo del kilómetro final que conducía al Sifón 1. El 26 de marzo Tomek Fiedorowicz condujo una escalada de diez metros en un túnel nuevo que terminó después solamente de algunos metros. Otra escalada conducida por Marcin Gala ascendió en una chimenea estrecha, que igualmente terminaba. Marcin Gala, Tomek Fiedorowicz, y Pawel Skoworodko entonces encontraron más adelante un túnel horizontal, pero después de que 200 metros se dividió en cuatro direcciones, cada uno conduce de nuevo al conducto ya conocido o llega a ser demasiado estrecho para seguir. El 29 de marzo el equipo de escaladores volvió a la superficie por algunos días para descansar.

El 4 de abril, el equipo de buceo, ahora ampliado por Richie Hudson y Bill Stone llegó al Campamento 3, listo explorar el segundo sifón. El equipo de buceo fue llevado más allá del Sifón 1, y las cuerdas fueron amarradas en las cascadas para hacerlas más seguras mientras se descendía llevando los equipos de buceo. El 6 y 7 de abril el equipo pasó 20 horas más allá del Sifón 1, explorando y dibujando un mapa del nuevo territorio. Después de ayudar con el transporte de los aparatos de buceo al Sifón 2, Hudson y Stone empezaron topografía la cueva y dibujar el mapa entre Sifón 2 y Sifón 1 en un esfuerzo continuo de 14 horas. Mallinson y Stanton bucearon el segundo sifón. Siguieron adentro una grieta inclinada por 280 m, alcanzando una profundidad máxima de 12 m, y alcanzaron un compartimento lleno de aire con una pared de cantos rodados apenas a continuación. Aunque podrían oír el agua a través del derrumbe no encontraron ningún paso hacia adelante a pesar de que casi destrozan sus trajes secos en sus esfuerzos de entrar a través de las aberturas minúsculas en el derrumbe. Este punto ahora sigue siendo el punto más alejado alcanzado en Cueva Cheve.

El 4 de abril el equipo de escaladores descendió a Campamento 3 para otro esfuerzo más y puntear una ruta en el Sifón 1 por medio de escalar a conductos en el techo de la barranca antes del sifón. Esta vez, después de una subida difícil encima de una cascada, encontraron una grieta que había sido observada por Mike Frazier y que había explorado parcialmente en 1997. Cerca de 40 m sobre el nivel de la corriente activa, el equipo de escaladores de 2003 interceptó un nuevo paso. Algunas partes hacia arriba, hacia abajo y al norte los trajeron de nuevo al paso conocido después de 200 m, a un punto cerca del Sifón 1. Sin embargo, había más continuaciones del nivel alto al norte. El túnel que alcanzo más al norte - nombrado "Playa Mazunte" – alcanzo un punto casi media la distancia al otro lado del Sifón 1, y encontrando otro derrumbe. El 9 de abril, el equipo de escaladores, junto con muchos otros miembros del equipo, vuelve a la superficie, ayudando con el transporte de los aparatos de buceo usados (tanques vacíos etc.).

El 14 de abril, un equipo pequeño integrado por Robbie Warke, John Kerr, Marcus Preissner, Bart Hogan, y Bill Stone comenzaron un empuje final de diez días. Ellos investigaron varias escalas y empezaron desarmar las rutas dentro de la cueva. En un esfuerzo final puntearon una ruta en el Sifón 1, Stone, Kerr, y Preissner escalaron 35 metros por encima de una bóveda cerca del túnel "Playa Mazunte," pero ésta terminó en una grieta llenada con piedras casi 70 m sobre el nivel del río. El esfuerzo de desamarrar la cueva siguió por casi una semana. Varios sitios de vivaque fueron establecidos entre el Campamento 2 y el Campamento 3, durante el esfuerzo de desarmado se investigaron algunos túneles laterales. El más prometedor de éstos - una bóveda con una cascada entrando al principio del Socavón Negro - fue escalado por 50 m a donde conecto con una extensión raramente visitada del Pasillo de Gigantes Intranquilos.

En resumen equipo pasó 33 días trabajando desde los campamentos 2 y 3. La cueva fue extendida a una distancia de 9,3 kilómetros de la entrada más cercana, en el derrumbe que bloquea el túnel más allá del Sifón 2. Más de 700 metros de túneles en el nivel sobre la barranca final antes de Sifón 1. Además, un equipo pequeño de espeleólogos exploró Cueva Palomitas, una cueva con una entrada arriba de la entrada de Cueva Cheve, con una profundidad de 500 metros donde se esta muy cerca de hacer una conexión con el paso en Cheve. Si Cueva Palomitas puede ser conectado con Cheve será la entrada más alta de todo el sistema.

Por los principios de mayo 2003, Llano Cheve era de nuevo tranquilo y solitario abandonado por los equipos de exploración. Los 1,9 kilómetros adicionales en el fondo de Cueva Cheve aumentaron su longitud a 26.194 metros y su profundidad a -1484 metros, haciendo de la Cueva Cheve la más profunda del hemisferio occidental y de México, y actualmente el novena cueva más profunda del mundo. Los 9,3 kilómetros alcanzados de la entrada más cercana, al derrumbe más allá de Sifón 2 representa actualmente el punto más alejado dentro de la tierra alcanzada por los seres humanos.

Exploraciones en Cueva Charco 2003

Cueva Charco está situada entre la entrada principal de Cueva Cheve, y la resurgencia (el Nacimiento Agua Fría de Santa Ana, o también llamado "Cueva de la Mano). Geológicamente, Cueva Charco está en una posición ideal para conectar en el Sistema Cheve, y la cueva tiene un flujo fuerte de aire y recoge buena cantidad de agua. En 1989, un grupo pequeño de espeleólogos investigó la entrada. Durante los 14 años próximos, varios grupos de exploradores de muchos países exploraron más y más profundo dentro de Cueva Charco. En 2003, un grupo final de exploradores alcanzó un sifón en el fondo de la cueva. Una prueba de tinte confirmó que Cueva Charco se conecta hidrológicamente con el Sistema Cheve, pero sin el equipo especializado de buceo, y con la dificultad de que las características de ser una cueva sumamente estrecha son tan especiales, la exploración adicional es imposible. Cueva Charco tiene ahora -1278 metros de profundidad y 6,71 kilómetros de longitud. Es a la fecha la tercera cueva mas profunda de la República Mexicana (la numero 2 es El Sistema Huautla, con -1475 m de profundidad a solo 30 kilómetros al norte).

La entrada a Cueva Charco es grande y pintoresca. Sin embargo, después de una serie de tiros cortos, rápidamente llega a un arrastre muy apretado en un área que es muy propensa a inundarse. Para los 1000 metros siguientes, la cueva tiene una serie de rampas descendentes, grietas apretadas, túneles con techos muy bajos, y varios tiros cortos. Varios pequeños afluentes agregan volumen a la corriente. Algunos de los túneles bajos se llenan casi totalmente de agua. Al principio la cueva tuerce en espiral abajo de sí misma, después se conduce aproximadamente al noroeste con pocos meandros. La dirección principal es la misma que se encuentra en Cueva Cheve, 330 grados.

Una afluente grande de agua que entra en un lugar único de la cueva el cual es más grande -- aumenta significativamente el flujo en la corriente. Mientras que en la mayoría de las cuevas, tienen la tendencia a ser más grandes a mayores profundidades, los pasajes en Charco siguen siendo estrechos. Se describe mucho mejor como una máquina para hacer tiras de queso, con pasos apretados y estrechos aun debajo del nivel -1000 metros. Momentos antes del sifón el paso de la corriente intercepta un socavón … un conducto muy largo. La sección por río arriba es bloqueada por travertino, y la sección en dirección río abajo conduce al sifón y parte final de la cueva conocida hasta ahora. El sifón no fue investigado, aunque es ciertamente bastante grande para a entrar. La logística para transportar los aparatos de buceo a este punto increíblemente alejado, es muy difícil y casi inimaginable.

Al principio, los exploradores podían entrar en Cueva Charco en viajes que se podían acabar en un día. Pero pronto un viaje de " un día " duró más de 24 horas solo para conseguir al extremo final de la cueva (en aquella época). Un campamento fue establecido en una distancia de 2,5 kilómetros de la entrada en el año 2000 a una profundidad de -600 metros. Durante las expediciones de 2000 y 2001 los exploradores trabajarían típicamente del Campamento 1 por períodos de hasta una semana subterráneamente. No era un lugar agradable. El campamento 1 fue situado cerca del techo de una grieta estrecha donde fueron utilizadas varias repisas pequeñas para dormir y cocinar. Si usted rodara en uno de sus sueños había la posibilidad de caer en un tiro de 12 metros abajo a la corriente de agua. En 2003 el Campamento 2 fue establecido en nivel -1000 metros para el esfuerzo final. Puesto que no hay puntos planos para instalar un campamento más cercano al extremo final de la cueva, los exploradores en 2003 durmieron en hamacas suspendidas de las paredes usando los pernos de la roca. El final actual de Cueva Charco sigue siendo uno de los lugares más alejados, y más hostiles conocidos en este planeta.

Reconocimiento

La expedición de 2003 al Sistema Cheve aumento significativamente los límites de la exploración en uno de los sistemas de cuevas más grandes del mundo. Un total de 55 miembros del equipo de 8 países trabajaron miles de horas para armar las rutas de la cueva, transportar aparatos de buceo y escalada, y desarmar la cueva, fue un trabajo muy grande. El éxito de la expedición es el resultado de un trabajo conjunto con la generosidad de nuestros patrocinadores y la ayuda de numerosos oficiales estatales, regionales, locales así como de El Gobierno de Oaxaca. Todos ellos ayudaron a nuestros esfuerzos. A todas esta gente y organizaciones que hicieron posible esta expedición, le ofrecemos nuestro más sincero agradecimiento, gracias.

Cheve 2004 Objetivos De la Misión

Como resumen rápido, el trabajo en 2003 en el área de Cheve dio lugar a nuevas profundidades para Cueva Charco (-1276m) y Cueva Cheve (-1484m). Cueva Charco termina actualmente en un sifón aproximadamente seis kilómetros de la entrada. Dos sifones fueron pasados con éxito en el fondo de Cueva Cheve (140m y 300m de longitud, respectivamente) antes de que una obstrucción fuera descubierta a 9.3 kilómetros de la entrada. Estos aumentos están marcados en rojo en el mapa topográfico del área que acompaña a este informe. Los nuevos datos agregan recorridos importantes así cómo la exploración total en el sistema. Después de una nueva planeación durante el verano de 2003 sentimos que 2004 debe ser un año de reconocimiento, durante el cual dedicaremos aproximadamente ocho semanas a la exploración para las nuevas entradas en el sistema principal que puenteará los extremos entre las dos cuevas más profundas.

Hay cuatro áreas propuestas para el trabajo en 2004 que refieren este asunto. Estas son:

1) Una investigación detallada del Sumidero Barranca Estrella -- marcado como el círculo rojo y amarillo en el mapa topográfico, al noreste del final de Cueva Charco. Casi 3/4 del flujo del agua en el Sistema Cheve entra en la cueva y se filtra en esta área. Esto fue descubierto en 2001 y fue visitado brevemente otra vez en la primavera de 2003 antes del esfuerzo primario en Cueva Cheve. El

sumidero esta lleno de restos de miles de años y de cantos rodados acumulados ahí por la corriente. Sin embargo, progresos prometedores para abrir una entrada ahí fueron hechos durante nuestra estancia de 4 días en los principios de marzo 2003. Nosotros creemos que con un esfuerzo mas dedicado para quitar los restos que tapan este pasaje, esto nos conducirá probablemente al túnel que lleva actualmente el agua del río del San Miguel en su parte subterránea.
Tiempo estimado en el sitio: 2-3 semanas conducidas simultáneamente con el trabajo en Cueva Barranca Estrella. Punto de estacionamiento: Santa Ana Cuauhtemoc. Campamento base será situado en el valle cerca del sumidero del río.

2) Exploración adicional de la Cueva Barranca Estrella. Esta cueva está situada 500 metros río abajo del sumidero del río en un arroyo seco. La cueva fue descubierta en 2001 con la ayuda de cazadores locales de la aldea de Santa Ana Cuauhtemoc. Fue explorada a una distancia de 500 metros en aquella época. Está situada en el lado del norte del arroyo seco del Río San Miguel. El extremo de la cueva es bloqueado actualmente por los restos de una inundación que consiste en arena seca y piedras pequeñas. Esperamos que quitando estos restos descubriremos la continuación de la vieja trayectoria subterránea del Río San Miguel y de tal modo encontremos una ruta nueva que nos conduzca a Sistema Cheve. Tiempo estimado en el sitio: 2-3 semanas, conducidas simultáneamente con el trabajo en el Sumidero Barranca Estrella. Punto de estacionamiento: Santa Ana Cuauhtemoc; Campamento base en el valle cerca del sumidero del río.

3) Regresando a Sumidero Aguacate. Este es un sumidero importante situado al pie de la barranca Aguacate a 500m al sudoeste de la aldea de San Francisco Chapulapa y aproximadamente 1 kilómetro sudeste de Cueva Charco. Diferente de Cueva Charco, el Sumidero Aguacate contiene túneles mucho más grandes puesto que drena la Barranca Aguacate entera (véase el mapa de localización del área). En esta cueva se conoce actualmente un kilómetro de longitud y -170 metros de profundidad con tres tiros cortos, de menos de 30 metros. Las dimensiones medias del paso tienen 8 a 10 metros de ancho y de 8 a 15 metros de altura. La cueva termina en un sifón muy prometedor el cual espera ser buceado. El buceo puede conducir a los túneles llenos de aire que proporcionarían un puente rápido a Cueva Charco y nos conducirían río abajo hacia la confluencia subterránea presumida del río entre Charco, Cheve, y Barranca Estrella. Puesto que la cueva se ha visitado solamente una vez (en marzo de 1994) y con los avances significativos en tecnología habría mas posibilidades de encontrar un paso, probablemente con mas oportunidades para puentear el sifón por medio de escaladas a túneles en el techo del conducto principal antes del sifón. Tiempo estimado en el sitio: 1-2 semanas. Punto de estacionamiento: Aldea de Chapulapa o Campamento base para Cueva Charco.

4) Una búsqueda general de la zona del contacto entre la roca de la piedra caliza y la roca metamórfica de sobre posición entre Cueva Charco y Cueva Cheve en la zona marcada por las líneas naranja en el mapa topográfico. La montaña se ha estudiado extensivamente cerca de Cueva Cheve y Cueva Charco, pero hay un área alejada en el centro, que nadie ha alcanzado debido a la carencia del agua. Planearemos emplear burros del rancho Charco para traer el agua hasta un campamento base establecido en el centro de esta área y permitirnos investigar detalladamente cuáles cuevas se encuentran ahí. Si localizamos una cueva significativa hay la posibilidad que conducirá a un sistema con una profundidad de mas que -900 m antes de conectar con Sistema Cheve …o posiblemente yendo más allá de él, como un sistema independiente hasta alcanzar el tronco principal más allá del conocido y que termine en el Sistema Cheve. Tiempo estimado en el sitio: 4-5 semanas. Punto de estacionamiento: Aldea de Chapulapa o Campamento base Charco; Lugar del campamento base en el campo: determinado por los limites de acceso de los burros.

Las fechas tentativas propuestas para el proyecto son las siguientes:

15 enero – 15 febrero	Llegar a la zona y visitar varias nuevas aldeas para estudiar los limites de la hidrología del Sistema Cheve
15-29 febrero, 2003	Sumidero y Cueva Barranca Estrella (región de Santa Ana Cuauhtemoc / de Chiquihuitlán)
22 – 29 febrero, 2003	Sumidero Aguacate (región de Chapulapa)
29 febrero - 15 de abril	Reconocimiento en la zona al sur de Cueva Charco y al norte de Cueva Cheve

Los líderes de la expedición 2004 serán el Dr. Bill Stone, Matt Oliphant, Nancy Pistole, José Antonio Soriano, y el Dr. Mark Minton. Para la información adicional entre en contacto por favor con: Dr. Bill Stone, Equipo Estadounidense de Exploración de Cuevas Profundas (USDCT), 18912 Glendower Road, Gaithersburg, MD 20879-1833, EE.UU. email: billstone@compuserve.com
Tel: 001- (301) 975-6075.

SISTEMA CHEVE 2003

MUNICIPIO DE CONCEPCION PAPALO OAXACA, MEXICO

LONGITUD: 24,300 metros
PROFUNDIDAD: -1,386 metros

Topografia Diciembre 1986 - Marzo 1997 por los miembros del Proyecto Cheve:

Rolf Adams	Mike Frazier	Herb Laeger	John Schweyen
Stan Allison	Ernie Garza	Susie Lasko	Tina Shirk
Bob Benedict	Andy Grubbs	Jason Mallinson	Jim Smith
Carl Bern	Peter Haberland	Lance Mattson	Peter Sprouse
Jeb Blakeley	Ed Halladay	Paul Medhurst	Rick Stanton
Peter Bosted	Louise Hose	Gary Mele	Bill Steele
Don Broussard	Bart Hogan	Karlin Meyers	Brian Steele
Harry Burgess	Richie Hudson	Tom Miller	Janet Steele
Laura Campbell	Andi Hunter	Mark Minton	John "Rocco" Stembel
Don Coons	Joe Ivy	Matt Oliphant	Bill Stone
Alan Cressler	Becky Jones	Lee Perry	Georg Tetzlaff
Ken Davis	Pat Kambesis	Nancy Pistole	Taco Vanleperen
Michael Denneborg	Peter Keller	Steve Porter	Carol Vesely
Ruthie Diamante	John Kerr	Marcus Preissner	Robbie Warke
Ramon Espinasa	Michael King	Peter Quick	Todd Warren
Mason Estes	Steve Knutson	Bitsy Ray	Nancy Weaver
Bill Farr	Matt Kramar	Susan Sanders	Steve Zeman

Mapa 1993 Dibujado por Carol A. Vesely

Mapa 1997, incluyendo Sala Precursor, por Nancy Pistole

Mapa 2003, incluyendo traducción bi-lingual, geologia hydrologia, historia, fotos y anotaciones nuevas, por Dr. Bill Stone (Guillermo Piedra)

Una breve historia de la exploración de Cueva Cheve

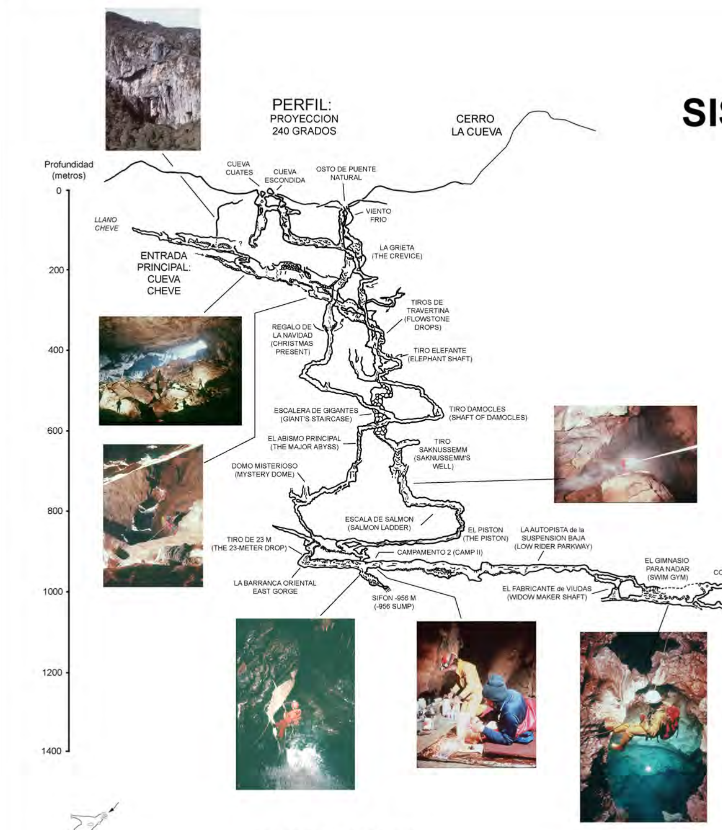
En diciembre de 1986 la entrada fue descubierta por los espeleologos Carol Vesely y Bill Farr de California después de estudiar mapas topográficos de Oaxaca. Por diciembre de 1987 la cueva habia sido explorada rápidamente a una profundidad de casi 700 metros debajo la superficie y la cueva tenía viento de aire muy fuerte, que sugirió que condujera a profundidades mucho más adentro la montaña. En marcha de 1988 un equipo grande llegó en Llano Cheve. Durante este esfuerzo de dos semanas un equipo que consistia en Steve Zeman, Jeb Blakeley, Bill Stone, Jim Smith, Matt Oliphant, Bob Benedict, y Ed Holladay alcanzó una profundidad de -1026m. Un año más tarde, en 1990, la longitud de la cueva fue extendida por estos mismos exploradores rápidamente a casi siete kilómetros de la entrada a una profundidad de -1100 metros. En 1990 Don Coons, Matt Oliphant, y Bill Stone establecieron el campamento tres al nivel -1050m y extendieron la cueva un kilómetro adicional hacia el norte a una profundidad de -1364m. Allí encontraron un túnel inundado de agua. Un buceo exploratoria fue conducida en el túnel inundado en 1991 por John Schweyen con la ayuda de siete miembros del equipo. El túnel subacuático fue explorado a una profundidad de 22 metros debajo de la superficie del agua a una distancia de 100 metros de la entrada al túnel. Allí el conducto dividió en muchos otros túneles y el buzo no tenía tiempo para investigar todos. Entre 1992 y 2001 varias expediciones al Sistema Cheve (incluyendo a la zona de nacimientos en la barranca Santo Domingo donde es sabida reaparecer el agua que fluye por la cueva) y a la Cueva Charco cerca de San Miguel Santa Flor, fueron conducidos por Matt Oliphant, Nancy Pistole, Bill Stone, Bev Shade y otros. Sin embargo, ninguno de estos esfuerzos era exitoso alcanzar profundidades mayores. El record actual, establecido durante el buceo de 1991, sigue siendo 1386 metros de profundidad a una distancia de ocho kilómetros de la entrada. Hace 12 años que ha quedado un misterio de qué existe más allá del túnel inundado. ¿Hay manera de pasar el laberinto subacuático en el fondo de Cueva Cheve? ¿Y nos permite descender a más grandes profundidades? Un equipo internacional en 2003, con 54 miembros, establecerá campamento 4 al principio del túnel inundado. Tendrán con ellos el equipo de buceo avanzado y cuatro especialistas en espeleobuceo (la exploracion de conductos inundados adentro cuevas). Durante los meses de marcha y abril 2003 pasarán hasta 6 semanas adentro la cueva explorando territorio nuevo más allá del túnel subacuático - si hay una ruta. Con suerte, Sistema Cheve se convertirá en la cueva más profunda del mundo en 2003.

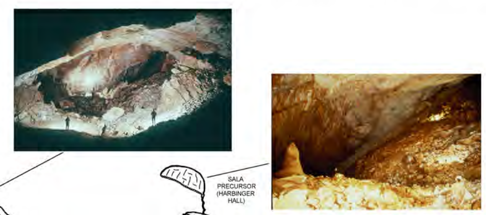
Posdata:

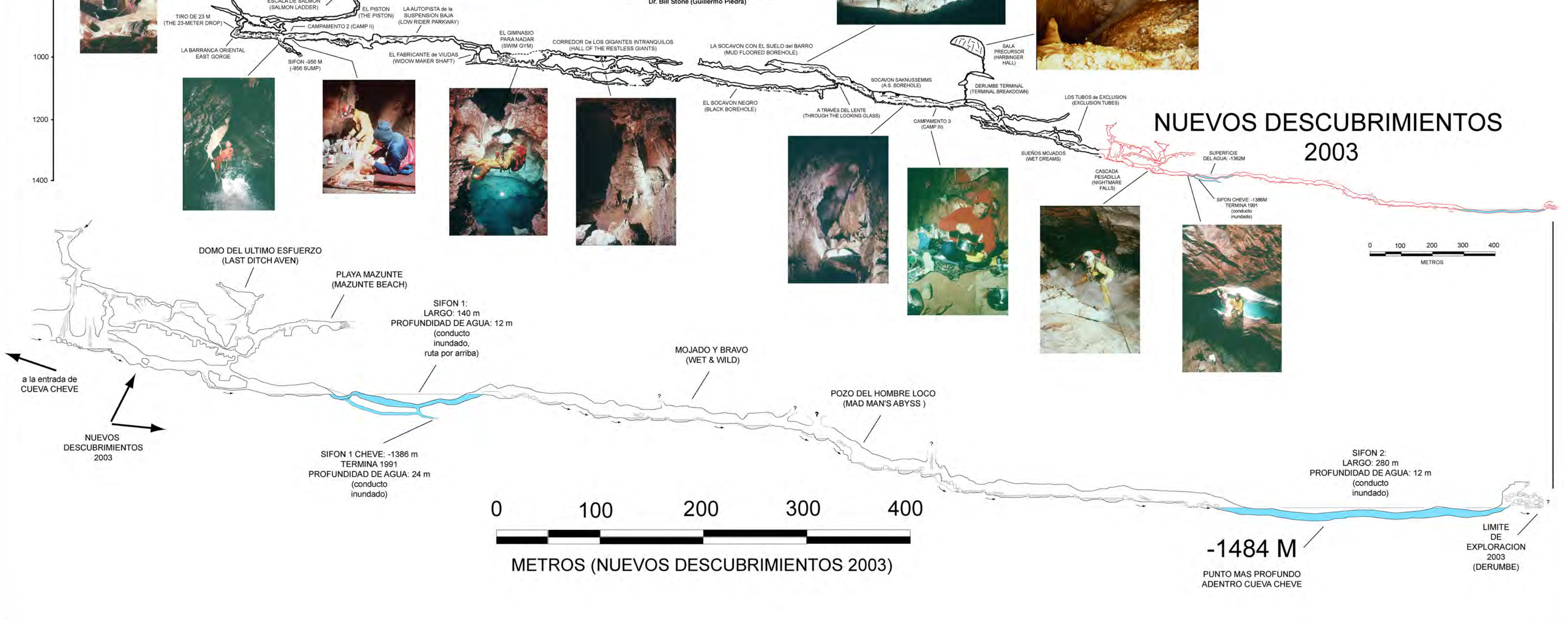
La expedición de 2003 al Sistema Cheve tuvo éxito en descubrir una ruta a través del túnel subacuático a -1362m. El buceo tenía 140 m de largo y alcanzó una profundidad máxima de 12 m subacuático antes de alcanzar una barranca que fue llenada de aire. El equipo exploró 800 m del túnel en esta barranca nueva antes de llegar a un otro túnel subacuático: Sifón 2. Entonces, un equipo de cuatro buzos transportaron el aparato de buceo al Sifon 2 y el 6 y 7 de abril 2003 dos buzos podían alcanzar un túnel lleno de aire después de 280 m de salto. El túnel más allá de Sifon 2 continúa menos de 100 m antes de que un derrumbamiento gigante llene el paso. El punto más profundo de la cueva está situado en el piso del túnel subacuático en el sifon 2.

Hidrología de Sistema Cheve

Desde que la exploración comenzó en Cueva Cheve en 1986, los speleologists han mantenido un modelo de computadora de la cueva en tres dimensiones. Lo qué usted ve aquí en esta página es una proyección de ese modelo de la computadora - en la vista perfil. Hemos agregado los detalles de los conductos de nuestras notas que fueron dibujadas mientras que adquirían los datos topográficos por dentro de la cueva. Éstos proporcionan una indicación del tamaño y de la forma de los túneles que se han encontrado en Cueva Cheve. Varias características de la cueva son notables. La tierra que rodea la cueva al sur se funda en roca dura - principalmente del origen volcánico. El agua no puede penetrar esta roca y formar cuevas. Sin embargo, la roca cambia a la piedra caliza exactamente en la localización de la entrada de Cheve. Éste no es ningún accidente. Cueva Cheve fue formado porque las corrientes que siguen al norte y descienden los valles de la carretera a Santa Maria Papalo encontraron esa piedra caliza suave y primero entraron en la tierra en el sitio actual de Cueve Cheve. Hace millones de años estas corrientes disolvieron la piedra caliza para formar la gran cueva que existe hoy. Es una cueva muy vertical para los primeros dos kilómetros de conducto. En esta distancia corta la cueva desciende casi 900 metros verticalmente, en muchos lugares en la forma de tiros verticales espectaculares. Algunos de éstos se demuestran en las fotos colocadas al lado de su localización en el mapa. Más allá de dos kilómetros de la entrada la cueva llega a ser más horizontal. Todavía hay muchas subidas verticales y algunos hoyos, pero son mucho más pequeños. Generalmente, hay dos niveles a la cueva a este punto. El túnel más bajo lleva la corriente y está generalmente en la forma de una barranca estrecha con piscinas en el piso. El túnel superior, en contraste, es muy grande - a veces midiendo 40 metros de ancho por 25 metros de alto. El piso de este túnel superior se abarca de roca quebrada mas o menos el tamaño de una mesa. Cerca del fondo de la cueva el nivel superior desaparece. Y éste es un misterio que deseamos resolver en 2003. Si existe un nivel superior el conducto inundado puede ser posible alcanzar mayores profundidades sin el uso del aparato de buceo. Sabemos que túneles existen más allá del túnel inundado en el fondo de Cueva Cheve. Esto fue probada en 1990 cuando tinte coloreado fue utilizado para probar una conexión de Cueva Cheve al nacimiento en Cueva de la Mano debajo de Santa Ana Cuauhtemoc en el fondo de la barranca de Santo Domingo. La corriente dentro de Cueva Cheve llevó el tinte al nacimiento y podíamos probar esto por medio de análisis químico. Así, Sistema Cheve incluye no solamente Cueva Cheve pero también la Cueva de la Mano. Asimismo, a través de otra prueba de tinte en 2001, nosotros han demostrado que Cueva Charco también está conectado a la Cueva de la Mano y por lo tanto es también una parte de Sistema Cheve. Sin embargo, sigue siendo un gran misterio dentro de la montaña entre todas estas cuevas, porque nadie sabe cómo y dónde él todo esta conectado. Ni ha hecho cualquier ser humano el viaje subterráneo de Cueva Cheve o de Cueva Charco al nacimiento por la ruta interior. Esperamos que la expedición 2003 agregue más conocimiento a esta criba subterránea.





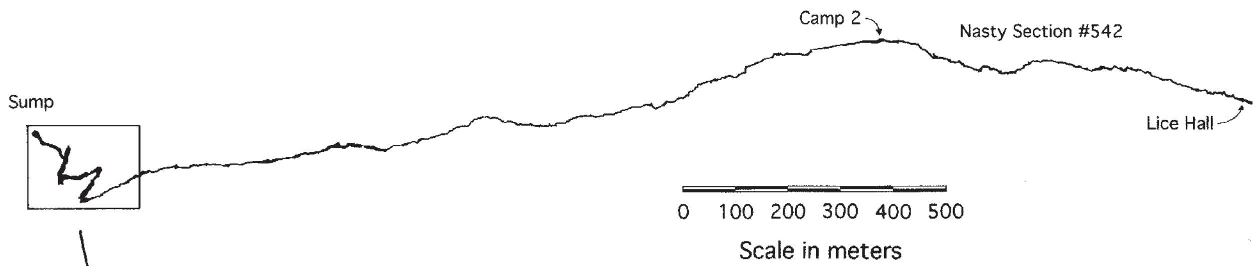


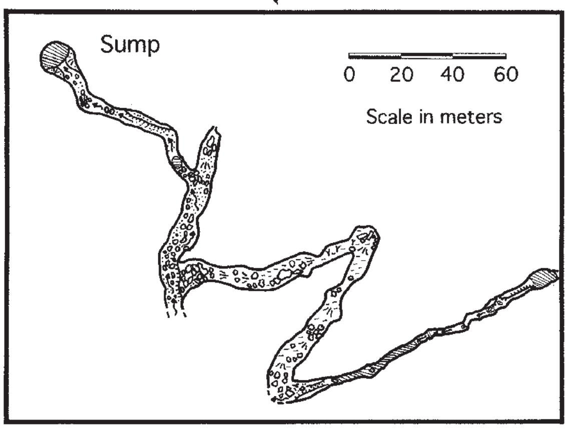
CUEVA CHARCO

SAN MIGUEL SANTA FLOR, OAXACA, MEXICO

Total surveyed length: 6.71 kilometers

Total depth: -1,278 meters





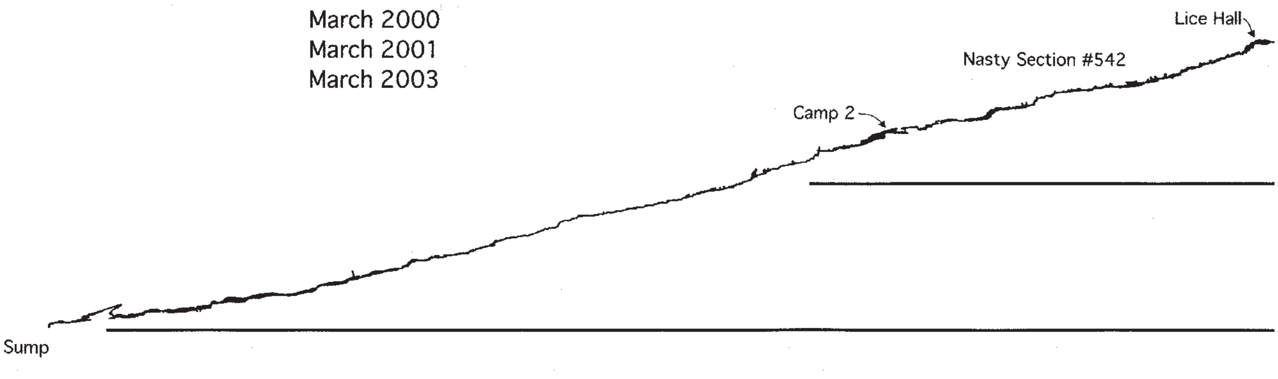
Surveyed by:

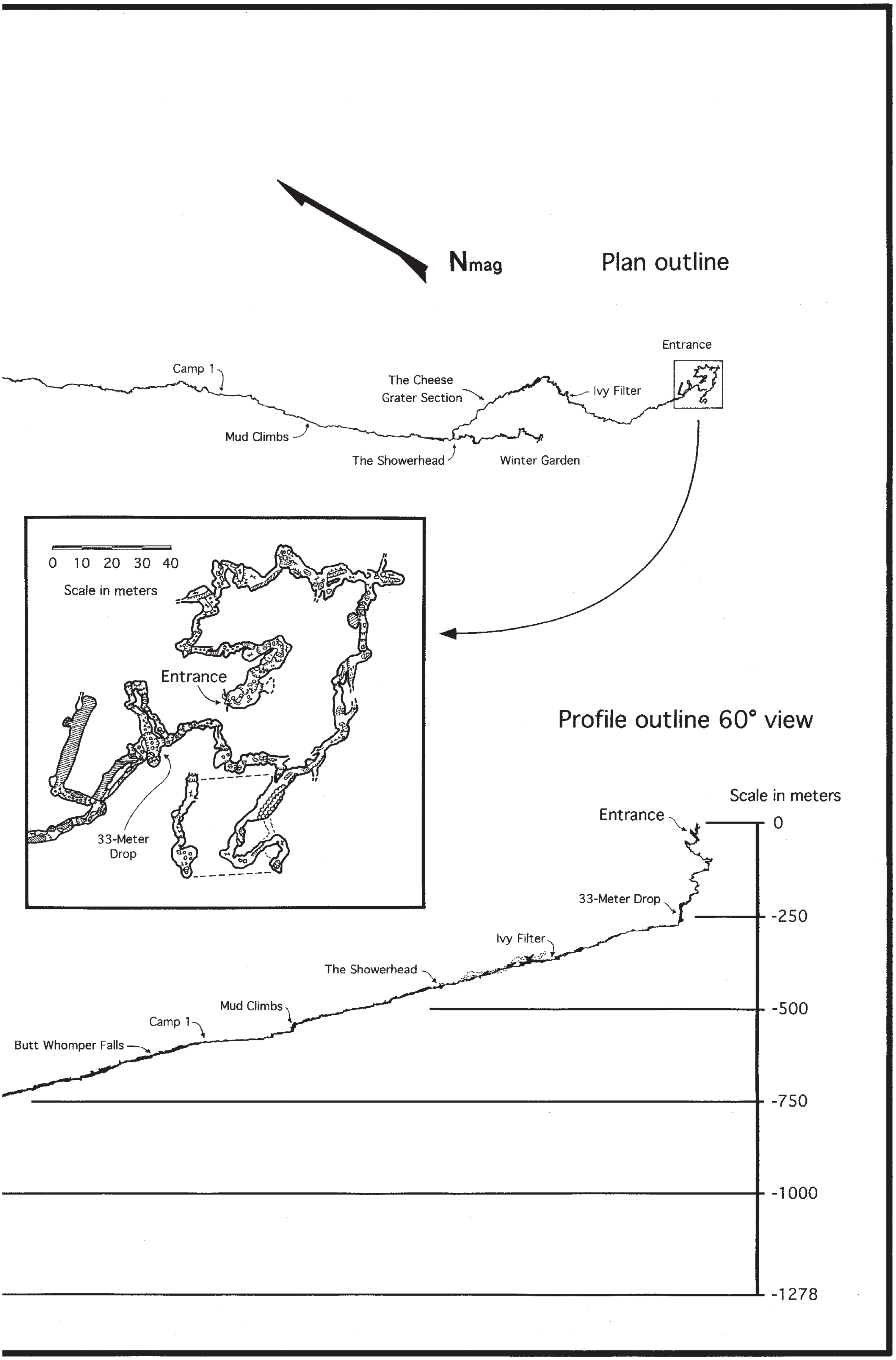
Peter Bosted	Catherine Perret
Harry Burgess	Nancy Pistole
Andy Capel	Bob Riley
Don Coons	Matteo Rivadossi
Luís "Wicho" Diaz	Giacomo Rossetti
Tony Dwyer	Charley Savvas
Jerry Fant	Tony Seddon
Mike Ficco	Ed Sevcik
Mark Folsom	Tommy Shifflett
Mike Frazier	Jason Siemion
Mariano Fuentes	José Antonio Soriano
Chris Gibson	Bill Stone
Peter Haberland	Luca Tanfoglio
Pete Hartley	Taco vanIeperen
Patty Kambesis	Gustavo Vela
Paul Medhurst	Carol Vesely
Nathan Noble	Yvo Weidmann
Matt Oliphant	James Wells

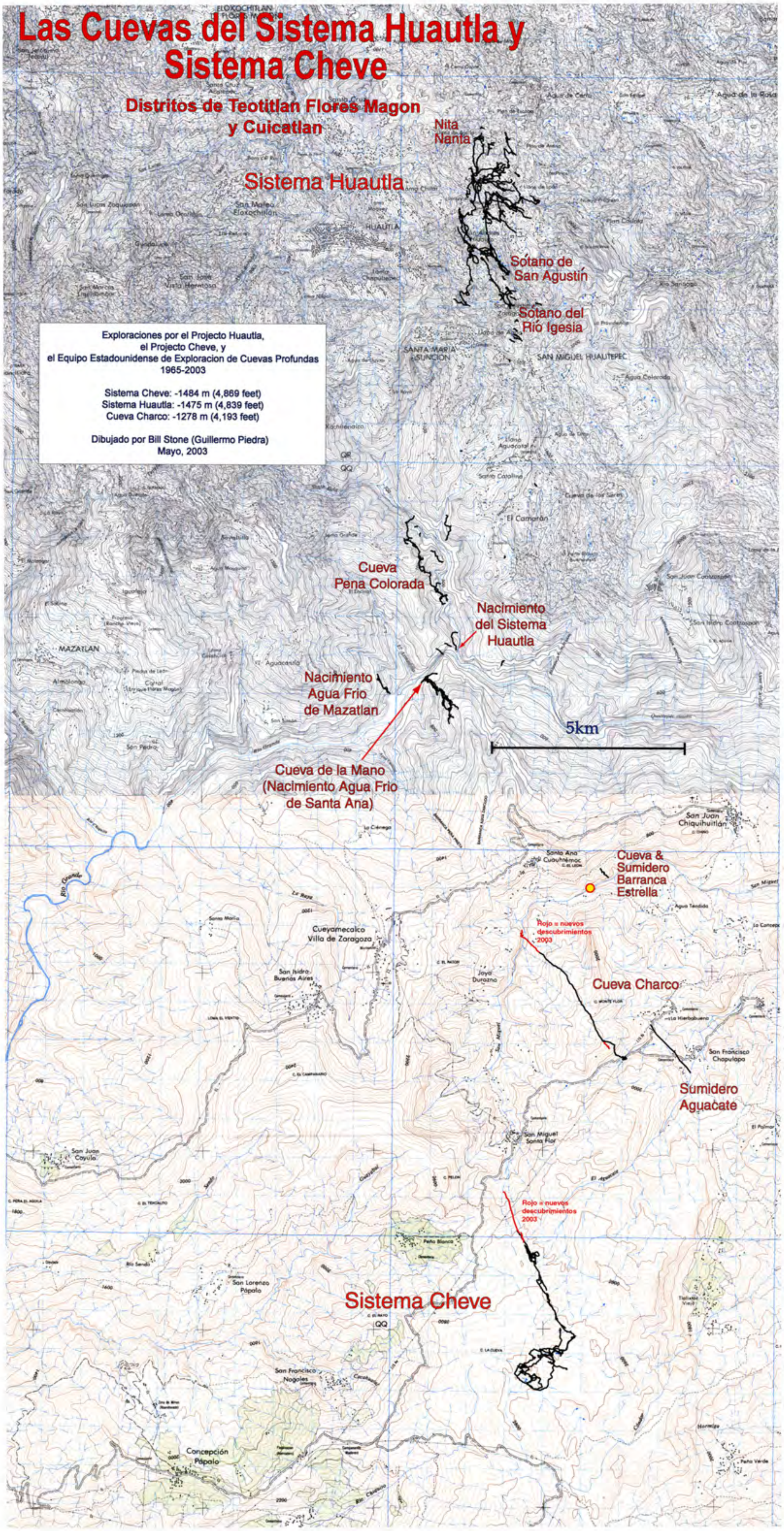
Cartography by Nancy Pistole and Charley Savvas

Suunto and tape surveys:

February 1993
March 1994
March 1999
March 2000
March 2001
March 2003




Nmag
Plan outline
Entrance
Camp 1
The Cheese Grater Section
Ivy Filter
Mud Climbs
The Showerhead
Winter Garden
0 10 20 30 40
Scale in meters
Entrance
33-Meter Drop
Profile outline 60° view
Scale in meters
Entrance
0
33-Meter Drop
-250
Ivy Filter
The Showerhead
-500
Mud Climbs
Camp 1
Butt Whomper Falls
-750
-1000
-1278


Las Cuevas del Sistema Huautla y Sistema Cheve
Distritos de Teotitlan Flores Magon y Cuicatlan
Nita Nanta
Sistema Huautla
Sotano de San Agustin
Sotano del Rio Igesia
Exploraciones por el Projecto Huautla, el Projecto Cheve, y el Equipo Estadounidense de Exploracion de Cuevas Profundas 1965-2003
Sistema Cheve: -1484 m (4,869 feet)
Sistema Huautla: -1475 m (4,839 feet)
Cueva Charco: -1278 m (4,193 feet)
Dibujado por Bill Stone (Guillermo Piedra)
Mayo, 2003
Cueva Pena Colorada
Nacimiento del Sistema Huautla
Nacimiento Agua Frio de Mazatlan
5km
Cueva de la Mano (Nacimiento Agua Frio de Santa Ana)
Cueva & Sumidero Barranca Estrella
Rojo = nuevos descubrimientos 2003
Cueva Charco
Sumidero Aguacate
Rojo = nuevos descubrimientos 2003
Sistema Cheve
HUAUTLA
MAZATLAN
San Juan Chiquihuitlán
Cuyamecalco Villa de Zaragoza
San Isidro Buenos Aires
San Francisco Chapulapa
San Miguel Santa Flor
San Juan Coyula
San Lorenzo Pápalo
San Francisco Nogales
Concepción Pápalo

La Expedición de
2004
para localizar entradas
alternativas a Sistema Cheve

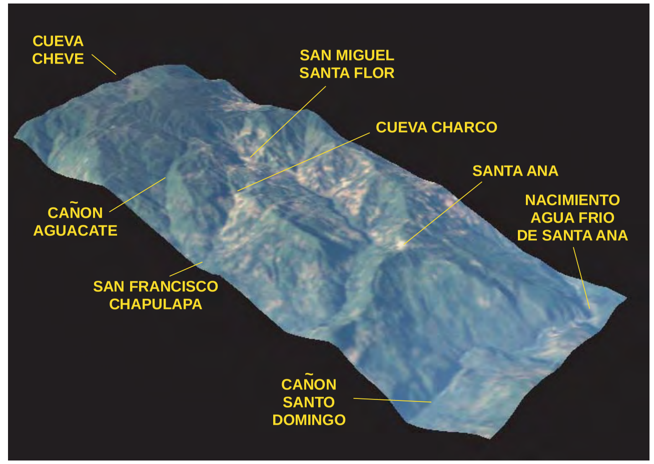
El Reto: En enero de 2001, un equipo Ruso condujo una exploración en la Cueva Krubera de la región de Abkhasia de Georgia a una profundidad de 1,710 metros; de esta manera los rusos se proclamaron el record de la caverna mas profunda en la tierra. El próximo acontecimiento en la exploración espeleologica, será el descubrimiento del primer sistema de cuevas en el mundo que rebase los 2000 metros de profundidad. 2003 puede ser el año en el cual este evento histórico se lleve a cabo.

Cueva Cheve, localizada a una elevación de 3,000 metros en la Sierra Juárez en el parte noreste de Oaxaca, México, actualmente tiene una profundidad de 1,484 metros y es la caverna más profunda conocida del hemisferio occidental y el 9no más profundo del mundo. Hasta donde se ha llegado en la Cueva Cheve (a 9.3 kilómetros de la entrada más cercana) representa la distancia más remota alcanzada dentro del cualquier cueva en el planeta. El procedimiento para alcanzar este punto no es sencillo y se requerirá armar más de dos kilómetros de cuerda dentro de la cueva y establecer 3 campamentos a lo largo de esta.

La profundidad de 1.484 metros fue alcanzada durante una expedición grande en 2003 que tuvieron éxito en la colocación de un equipo de 4 buzos más allá de dos túneles inundados en el nivel -1.362 metros. Los buceos eran altamente acertadas y el equipo exploró rápidamente 1,3 kilómetros de túneles adicionales que condujo más profundo adentro la montaña. Allí un derrumbamiento del techo bloqueó el paso del río y forzó un retratamiento después de 2-1/2 meses dentro de la montaña.

La Barranca Estrella - profunda e espectacular - es localizado un kilómetro más bajo en la montaña que la entrada de Cueva Cheve. Es el sitio de varias características superficiales hidrológicas inusuales que pueden desempeñar un papel dominante en la exploración final de Sistema Cheve. Uno de éstos es un fregadero sumidero del río - el Sumidero Barranca Estrella -- ese traga la corriente superficial más grande en la montaña, del río San Miguel. Pero entrar en esta "puerta trasera" y alcanzar el sistema primario de cuevas más allá del fondo de Cueva Cheve significa quitar centenares de toneladas de cantos rodados lavados adentro durante millares de años. Otras cuevas próximas pueden proporcionar puente ocultado al sumidero del río. Lo qué existe más allá es territorio totalmente desconocido -- nunca antes visto por seres humanos.

Foto de la Portada: El tiro primero de 100 metros del Osto de Cerro Voludo, situado cerca de los acantilados que pasan por alto la Barranca Estrella.

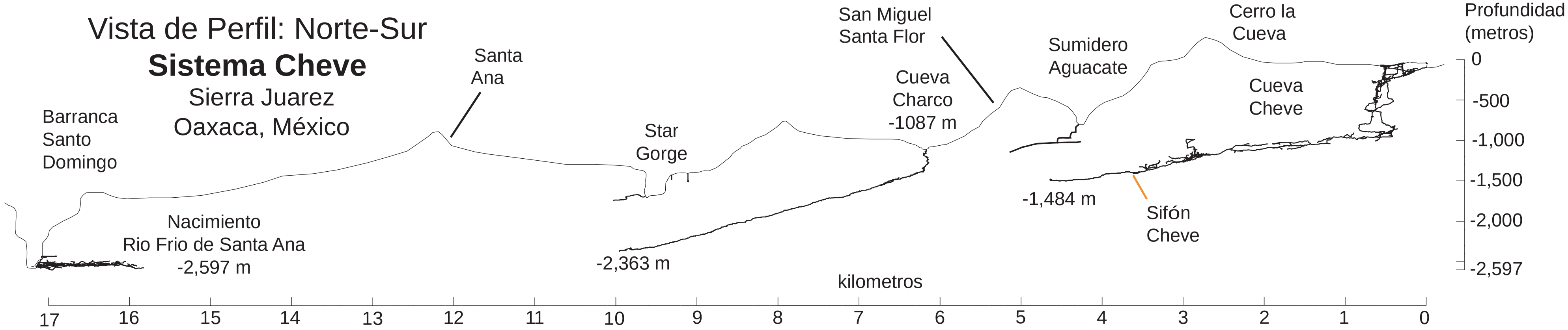


Mapa superficial de la región del Sistema Cheve, Oaxaca, México

Hay un enorme interés espeleológico de por medio. Se ha comprobado que el Sistema Cheve tiene un potencial de profundidad de 2,547 metros, basado en un experimento de rastreo de tinte conducido en 1990. Con esta profundidad, si se consiguiera, se destrozaría el record de la cueva de Krubera por un margen tan amplio que podría para siempre establecer a Cheve como la cueva mas profunda en la tierra.

El equipo 2004 utilizará el equipo avanzado de buceo, tecnología de escalada artificial, y soluciones de la ingeniería para abordar la Barranca Estrella con la esperanza de capturar la " medalla de oro " de la exploración - la cueva mas profunda del mundo.

Vista de Perfil: Norte-Sur
Sistema Cheve
Sierra Juarez
Oaxaca, México



Arriba y derecho: El extenso modelo del Sistema Cheve. El agua se resume a los 3000m de elevación y a 17 kilómetros emerge de un nacimiento, a 2,547m mas abajo, en las profundidades del cañón Santo Domingo

La Misión: La expedición se agrupara en Austin, Texas la primera semana de febrero de 2004 y estará en el área del Sistema Cheve a explorar por dos meses. El primer objetivo será una exploración de características hidrogeológicas inusuales en la Barranca Estrella incluyendo un sumidero importante del río San Miguel y una cueva seca donde el río previamente entró la tierra en épocas antiguas. Si cualquiera de estos esfuerzos condujeran a un pasaje hacia el hipotético corazón de la Sierra Madre, entonces el principal esfuerzo se enfocara a explorar el pasaje al sur hacia Cheve y al norte hacia los nacimientos de agua. Si los esfuerzos iniciales fracasan, entonces el equipo investigará el Sumidero Aguacate y entonces, como esfuerza final, conduciremos misiones de reconocimiento para localizar nuevas entradas entre el Sumidero Aguacate y Cueva Cheve.

Programa:

Punto de partida en Texas: 10 de feb., 2004
Barranca Estrella: 14-29 de febrero, 2004
Sumidero Aguacate: 1-7 de marzo, 2004
Reconocimiento: 8 marzo - 2 abril, 2004

Organización

La expedición Sistema Cheve 2003, está siendo conducida por el explorador veterano Dr. Guillermo Piedra (Bill Stone) e incluirá miembros altamente capacitados del equipo de E.U., Gran Bretaña, México, Polonia, Francia y Suiza. La expedición esta oficialmente a cargo del equipo estadounidense de exploración de cuevas profundas. (USDCT por sus siglas en Ingles)

Cualquier patrocinador

El USDCT es una Organización 501(c3) no lucrativa científica y educativa. Todas las contribuciones son deducibles de impuestos.

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Resumen de Exploración de Cuevas Oaxaqueñas

por
Dr. Bill Stone

Marzo 2005

Lo que sigue es un breve resumen de las áreas dentro del estado de Oaxaca que han visto actividad significativa de exploración de cuevas en los últimos 40 años. Aunque las cuevas pueden generarse dondequiera que haya piedra caliza, la mayoría de los esfuerzos descritos abajo se han emprendido en la cordillera montañosa del noreste del estado. La cordillera visible al este de la Ciudad de Oaxaca se extiende hacia el norte hasta Puebla y contiene muchas de las grandes cuevas más profundas del mundo: Cheve, Huautla, Charco, Kijahe Xontjoa (Cerro Rabón), Sonconga (Chilchotla) entre otras. De hecho, dentro en esta cordillera se encuentran todas las ocho cuevas de -1.000 m de profundidad fuera de Europa y Rusia.

Sistema Cheve (Distrito de Cuicatlán): Esta área, también conocida como "Sierra de Juárez," primero fue investigada por espeleólogos Bill Farr y Carol Veseley de los Estados Unidos en 1986. Como las visitas originales a Huautla de Jiménez (véase abajo) su descubrimiento estuvo basado en un estudio de los mapas topográficos que indicaron la presencia de dolinas (estos son "valles cerrados" en los cuales la precipitación drena internamente en la montaña) de alta elevación conjuntamente con la presencia de nacimientos de agua a baja elevación. La entrada a **Cueva Cheve** está en una elevación de 2.705 metros sobre el nivel del mar. El agua que entra en la cueva en última instancia sale de la montaña más de 2.500 metros de elevación por debajo de ésta, y casi 20 kilómetros al norte en un nacimiento conocido como el Nacimiento Río Frio de Santa Ana. Entre estos dos lugares hay una franja de piedra caliza que contiene muchas otras cuevas importantes, notablemente Cueva de la Mano, Cueva Charco, y el Sumidero de Aguacate.

La cueva principal de Cueva Cheve ha sido explorada hasta una profundidad de -1.484 metros con más de 26 kilómetros de túneles conocidos actualmente. Es la 8va cueva más profunda del mundo. Un viaje al límite de exploración dentro de Cueva Cheve (a 9,3 kilómetros de travesía en distancia desde la entrada) está entre los más difíciles del mundo. La existencia de una serie de túneles subacuáticos (inundados), comenzando en el nivel -1.362 m, complica la logística perceptiblemente. Fue solamente hasta 2003 que una expedición finalmente tuvo éxito en ir más allá de este obstáculo. El Sifón 1 en Cheve tiene 140 metros de largo y requiere 20 minutos de buceo para pasarlo. Más allá de esto hay una barranca que desciende rápidamente a lo largo de su longitud de un kilómetro, donde se encuentra el Sifón 2. Éste fue buceado por una distancia de 280 m a donde emergió en un túnel lleno de aire. A poca distancia el conducto se encuentra bloqueado por piedras de derrumbe. Un paso a través de estas piedras sigue esperando ser descubierto y es uno de los retos espeleológicos más grandes del mundo.

En el año 1989 la **Cueva Charco** fue descubierta al este de la comunidad de San Miguel Santa Flor. Durante los siguientes 14 años fue explorada laboriosamente hasta una profundidad de -1.278 m donde un sifón (pasaje inundado) fue encontrado a una distancia de 6 kilómetros de la entrada en marzo de 2003. Charco tiene la notoria distinción de ser una de entre las cuevas profundas del mundo la que cuenta con pasajes mas estrechos (las dimensiones promedio del túnel tienen aproximadamente 1 metro de ancho y 1 metro de alto).

La **Cueva de la Mano** es una cueva seca situada directamente arriba del Nacimiento Río Frió de Santa Ana. Combinada con otra cueva cercana, ambas (una totalmente subacuática, la otra llena de aire y hogar de aproximadamente 5.000 murciélagos) abarcan 11 kilómetros de túneles que se dirigen al sur hacia Cueva Cheve.

El **Sumidero Aguacate**, situado cerca de la aldea de San Francisco Chapulapa, fue explorado recientemente por una longitud de 3 kilómetros en abril de 2004 y también será probablemente una parte del enorme "Sistema Cheve" cuando finalmente se integre encontrando una conexión entre las cavernas arriba mencionadas. En este tiempo, el Sumidero Aguacate tiene una longitud de 3.224 metros y una profundidad de 215 metros. El límite actual de la exploración es casi 300 metros directamente debajo de la aldea de La Hierbabuena. Una serie de túneles estrechos y lleno de arena y sedimento fueron descubiertos allí en 2004. No fue possible pasar este obstaculo en 2004 porque de limites de tiempo. Se cree que por quitando la arena y el sedimento que llenan este paso que una continuación será descubierta. En última instancia, el Sumidero Aguacate probablemente conecta con Sistema Cheve en el área de la Barranca Estrella, debajo de Santa Ana Cuauhtemoc. Pero puede tomar décadas del esfuerzo de probar este hecho.

Los límites de Sistema Cheve se extienden del poblado de Concepción Papalo en el oeste a Tlalixtac Viejo al este, y desde Santa María Papalo en el sur, al fondo de la barranca del río Santo Domingo al norte con la resurgencia. La extensión final del Sistema Cheve podría exceder fácilmente los 100 kilómetros de longitud. Las exploraciones en Sistema Cheve han sido dirigidas por Bill Stone, Matt Oliphant, y Nancy Pistole, aunque numerosas expediciones de Europa han visitado Cueva Cheve simplemente para visitar la cueva.

<u>Sistema Huautla (Distrito de Teotitlán del Camino):</u> Esta área, también conocida como "la Sierra Mazateca," primero fue investigada por espeleólogos en 1964. Principalmente estos esfuerzos iniciales fueron dirigido por Bill Russel de Austin, Texas. Es importante reconocer que incluso entonces, hace 40 años, la motivación de esos grupos era igual que lo es para muchos hoy: el descubrimiento y la exploración de la cueva más profunda del mundo. Durante el espacio de una tarde este grupo descubrió las entradas al **Sótano de San Agustín**, **Sótano del Río Iglesia**, Cueva San Agustín, y Cueva de Agua Carlota. Tomaría varias décadas explorar totalmente éstas, y otras cuevas que abarcan actualmente el "Sistema Huautla". Este sistema de cuevas ahora alcanza una profundidad de -1.475 m y 56 kilómetros en longitud. Es la 9na cueva más profunda del mundo, aunque en varios años fue la tercera (1980) y segunda (1987) en el mundo. La extensión última del sistema podría exceder fácilmente 150 kilómetros en longitud y 1.900 m de profundidad.

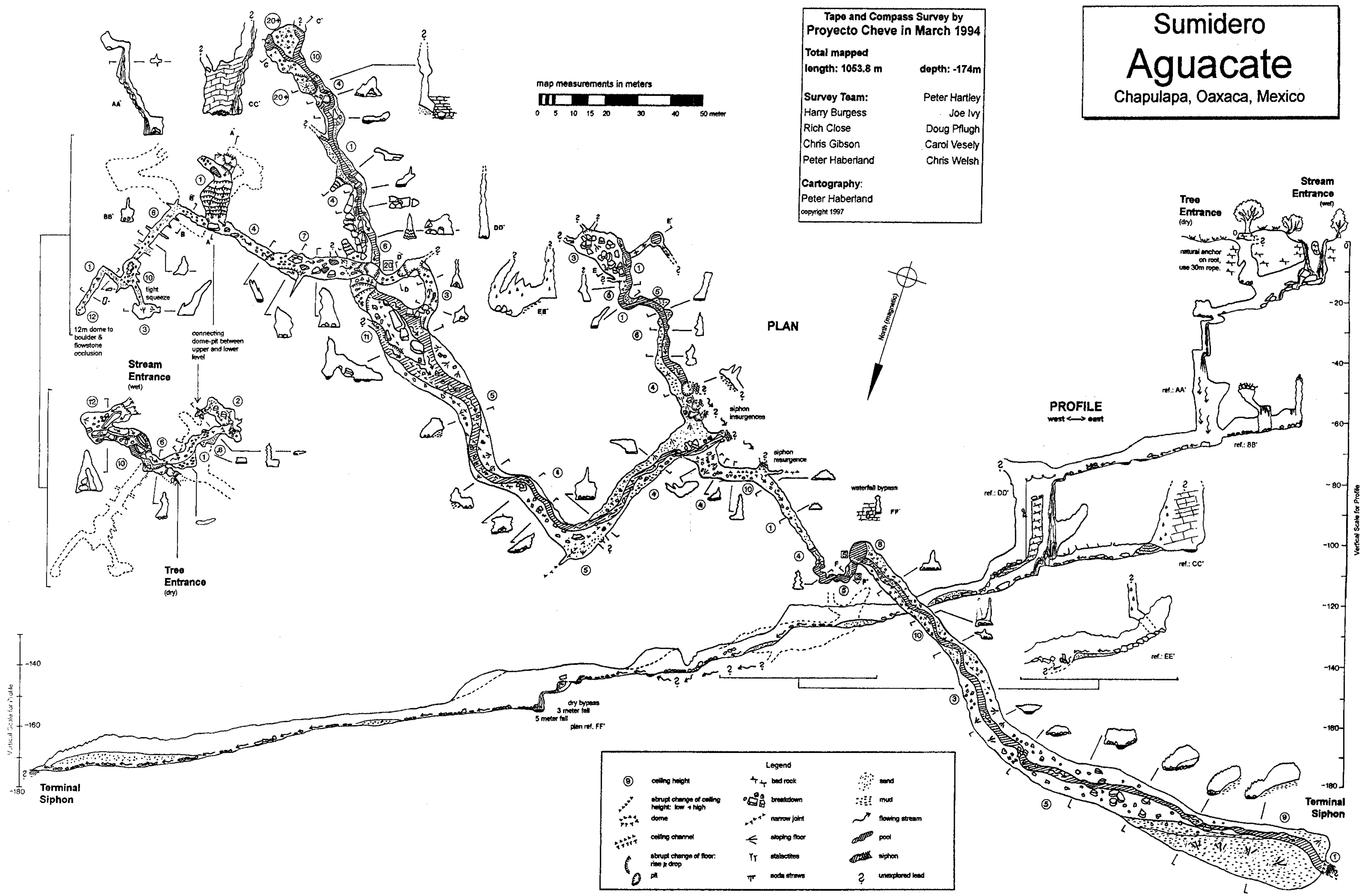
Los límites actuales de la exploración son extraordinarios y remotos. Algunos ejemplos: la entrada principal del Sótano de San Agustín ha sido explorada, en 1994, usando técnicas avanzadas de espeleobuceo, hasta el Sifón 9, a una distancia de 6.500 kilómetros de la entrada y más allá de 600 metros de túneles inundados que empiezan al nivel -1.328 m. Un viaje allí requiere una expedición de mas de 4 meses con un equipo de 40 espeleólogos. Por lo menos seis de esos individuos tendrían que ser expertos en la habilidad de espeleobuceo con aparatos de circuito cerrado (recicladores). Comenzando con un equipo de 44 exploradores en enero de 1994, solamente dos -- El Dr. Barbara Ende y el Dr. Bill Stone -- podían alcanzar el Sifon 9 durante los 4-1/2 meses de la expedición. El agua que entra en todas las cuevas del Sistema Huautla sale de la montaña en el **Nacimiento del Sistema Huautla** en el fondo de la barranca Santo Domingo (Quiotepec). El nacimiento ha sido buceado (en 2001) por una distancia de 1.100 m, a una profundidad de 65 m, otra vez usando tecnología de espeleobuceo con recicladores, y continúa. Requeriría una expedición de 3 meses con seis buzos usando recicladores y seis personas de ayuda que usaran aparato tradicional de espeleobuceo para hacer progreso más adelante hacia el Sistema Huautla.

De manera semejante, un nacimiento antiguo debajo del pueblo de San Miguel Huautepec, conocida como la **Cueva de la Peña Colorada**, fue explorada (en 1984) por 9,5 kilómetros en la dirección del Sistema Huautla. Más del 25% de esta longitud está en túneles subacuáticos. Un asalto a los límites de exploración en la Peña Colorada requeriría a una expedición de 3 meses con 6-8 espeleobuzos quienes serían expertos con recicladores y un equipo de ayuda de 10 a 15, todos ellos entrenados en la técnicas tradicionales de espeleobuceo usando “tanques laterales” de modo circuito abierto. Los límites del Sistema Huautla se extienden de la aldea de Cinco de Mayo, al norte de Huautla, al fondo de la barranca del río Santo Domingo y del borde oriental de Huautla de Jiménez hasta el pueblo de San Miguel Huautepec, y abarca un área geográfica de aproximadamente 10 x 15 kilómetros. Las exploraciones en esta área desde 1976 han sido coordinadas en gran parte por Bill Stone, Jim Smith, Bill Steele, y Mark Minton. En 2002 Bill Stone escribió un libro sobre la expedición de 1994 que alcanzó el límite actual de la exploración en Sifon 9 en el Sotano de San Agustin. El libro esta llamado “Más allá del Profundo” (Beyond the Deep, en inglés).

Chilchotla (Distrito de Teotitlán del Camino): Esta área fue investigada originalmente por espeleólogos Australianos (dirigidos por Alan Warild) a partir de 1981 hasta mediados de los noventas. Una gran cantidad de cuevas profundas fueron descubiertas rápidamente en esta región incluyendo **Sonconga** (- 1.014m), Guixani Ndia Kijao (- 956 m) y seis más con profundidades mayores a los -700 m. Esta área está situada apenas 10 kilómetros al norte de Huautla de Jiménez y forma el frente de la Barranca del Río Petalapa al norte. Los límites de esta área se extienden del Río Petalapa en el norte a la aldea de Cinco de Mayo al sur y de la comunidad de San Jerónimo al oeste a un punto aproximadamente 5 kilómetros al este de Chilchotla. Estas cuevas tienen la característica de ser casi verticales en su naturaleza: una serie de pozos profundos con dislocaciones horizontales pequeñas entre cada tiro vertical. Un espeleobuceo fue requerido para pasar el sifón en el fondo de Sonconga. Fue este esfuerzo de buceo el que produjo la primera cueva de más de un kilómetro profundidad en el área de Chilchotla.

Cerro Rabón (Distrito de Teotitlán del Camino): Esta área se considera el límite este de la meseta de Huautla. Se levanta precipitadamente de la planicie costera y está limitada por la Presa Miguel Alemán al este, y por la ciudad de San Miguel Huautepec al oeste. Se levanta por encima de la barranca del río Santo Domingo al sur, sobre la comunidad de Jalapa de Díaz y se extiende al norte al valle de Tenango. Las caminatas de reconocimiento por espeleólogos comenzaron a esta área poco despuées del descubrimiento del Sótano de San Agustín cerca de Huautla en los últimos años de los sesentas. Sin embargo, no se descubrió nada significativo allí hasta mediados de los años 80, por una colaboración de espeleólogos de Suiza y de los Estados Unidos. El terreno es extraordinariamente difícil. Recibe en exceso de 10 metros de precipitación cada año. La selva, que continene con frecuencia árboles de caoba en las ubicaciones más remotas, es densa. Debajo de la selva hay centenares de hoyos. Un número pequeño de estos hoyos son muy profundos y conducen a sistemas de cuevas extensos. El más grande de éstos es **Kijahe Xontjoa**, que alcanza una profundidad de -1.223 m y una longitud de 12 kilómetros. El agua que se colecta en Kijahe Xontjoa se presume que sale de la montaña por medio de nacimientos sumergidos en la Presa Miguel Alemán, aunque esto nunca ha sido confirmado. Siguiendo al oeste está el gran nacimiento del Río Uruapan, apenas al este de la ciudad de San Bartolome Ayautla. Este ha sido explorado por buzos (en 1986 y 1995), a una distancia de 600 metros hacia el interior de la montaña donde una cascada alta fue encontrada en el final del pasaje inundado. La exploración del área de Cerro Rabón ha sido conducida por varios equipos bajo la dirección de Karlin Meyers, Ernesto Garza, Mike Frazier, y otros espeleólogos.

El resumen precedente describe la mayoría de los descubrimientos significativos de cuevas en Oaxaca durante los últimos 40 años. De ninguna manera representa un listado completo de todas las cuevas conocidas en el estado. Además, debe ser resaltado que estas áreas representan un segmento geográfico relativamente pequeño del estado de Oaxaca y que aún dentro de estas áreas el conocimiento de las extensiones de las cuevas conocidas es muy poco completo. Así queda un potencial enorme para exploración adicional por gente de México y del extranjero.


Sumidero
Aguacate
Chapulapa, Oaxaca, Mexico
Tape and Compass Survey by
Proyecto Cheve in March 1994
Total mapped length: 1053.8 m
depth: -174m
Survey Team:
Harry Burgess
Rich Close
Chris Gibson
Peter Haberland
Peter Hartley
Joe Ivy
Doug Pflugh
Carol Vesely
Chris Welsh
Cartography:
Peter Haberland
copyright 1997
map measurements in meters
0 5 10 15 20 30 40 50 meter
PLAN
North (magnetic)
PROFILE
west ⟷ east
Stream Entrance (wet)
Tree Entrance (dry)
natural anchor on root, use 30m rope.
12m dome to boulder & flowstone occlusion
connecting dome-pit between upper and lower level
tight squeeze
siphon insurgences
siphon resurgence
waterfall bypass
dry bypass
3 meter fall
5 meter fall
plan ref. FF'
ref.: AA'
ref.: BB'
ref.: CC'
ref.: DD'
ref.: EE'
Terminal Siphon
Vertical Scale for Profile
Legend
ceiling height
abrupt change of ceiling height: low → high
dome
ceiling channel
abrupt change of floor: rise ≥ drop
pit
bed rock
breakdown
narrow joint
sloping floor
stalactites
soda straws
sand
mud
flowing stream
pool
siphon
unexplored lead

La Expedición de 2005 al Ozto J2

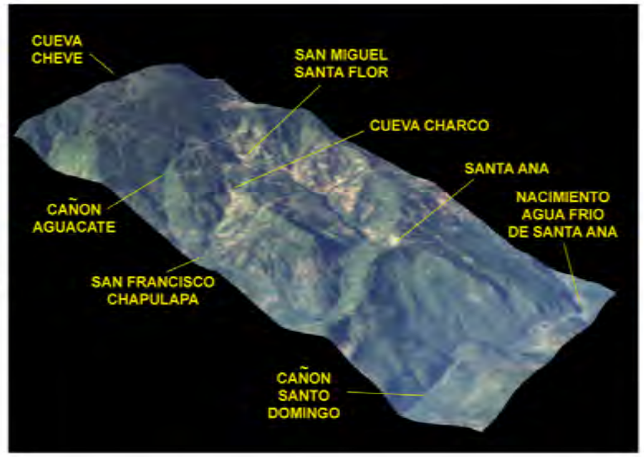
El Reto: En octubre de 2004, un equipo ucraniano condujo una exploración en la Cueva Krubera de la región de Abkhasia de Georgia a una profundidad de 2,080 metros; de esta manera los ucranianos se proclamaron el record de la caverna mas profunda en la tierra. El próximo acontecimiento en la exploración espeleologica, será el descubrimiento del primer sistema de cuevas en el mundo que rebase los 2500 metros de profundidad. 2005 puede ser el año en el cual este evento histórico se lleve a cabo.

Cueva Cheve, localizada a una elevación de 3.000 metros en la Sierra Juárez en el parte noreste de Oaxaca, México, actualmente tiene una profundidad de 1.484 metros y es la caverna más profunda conocida del hemisferio occidental y el 9no más profundo del mundo. Hasta donde se ha llegado en La Cueva Cheve (9.3 kilómetros de la entrada más cercana) representa la distancia más remota alcanzada dentro del cualquier cueva en el planeta. El procedimiento para alcanzar este punto no es sencillo y se requerirá armar más de dos kilómetros de cuerda dentro de la cueva y establecer 3 campamentos a lo largo de esta.

La profundidad de 1.484 metros fue alcanzada durante una expedición grande en 2003 que tuvieron éxito en la colocación de un equipo de 4 buzos más allá de dos túneles inundados en el nivel -1.362 metros. Los buceos eran altamente acertados y el equipo exploró rápidamente 1,3 kilómetros de túneles adicionales que condujo más profundo adentro la montaña. Allí un derrumbe del techo bloqueó el paso del río y forzó un regreso después de 2-1/2 meses dentro de la montaña.

Osto J2 - profunda y estrecha - localizada a 300 metros más bajo en la montaña que la entrada de Cueva Cheve. Está situado en el corazon del bosque de niebla de El Ocotal arriba de San Francisco Chapulapa. Es en una posición que pueda permitir un equipo de exploración penetrar la montaña y alcancar el río subterráneo de Cueva Cheve más allá de los túneles subacuáticos que pararon la exploración en 2003. **Osto J2** será un desafío de clase mundial. Sus grietas extraordinariamente estrechas hacen el recorrido lento y difícil. Pero el viento subterráneo, y la dirección de los túneles de la cueva, sugiere que una conexión con Cheve no sea sólo posible, pero probable. La tarea de alcanzar esa conexión incluirá un esfuerzo significativo que requerirá el paso de varias semanas bajo la superficie en oscuridad total. Lo qué existe más allá es territorio totalmente desconocido -- nunca antes visto por seres humanos.

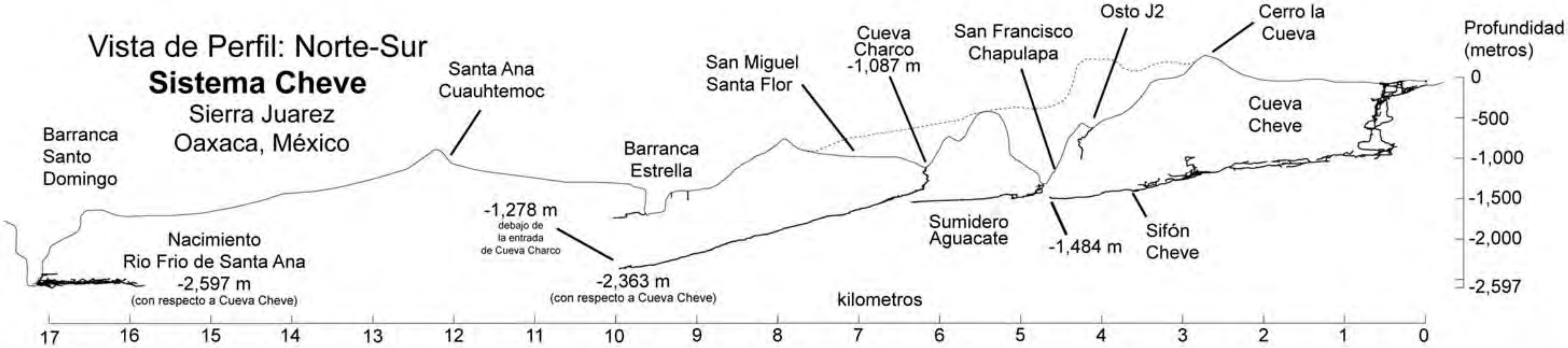
Foto de la Portada: El segundo tiro muy mojado de 50 metros del Sumidero Aguacate, situado 400 metros bajo la entrada de Osto J2



Mapa superficial de la región del Sistema Cheve, Oaxaca, México

Hay un enorme interés espeleológico de por medio. Se ha comprobado que el Sistema Cheve tiene un potencial de profundidad de 2.547 metros, basado en un experimento de rastreo de tintes conducido en 1990. Con esta profundidad, si se consiguiera, se superaría el record de la cueva de Krubera por un margen tan amplio que podría ser por siempre y establecer a Cheve como la cueva mas profunda en la tierra.

El equipo 2005 utilizará aparato avanzado de buceo y tecnología de escalada artificial para abordar el **Osto J2** con la esperanza de capturar " El primer lugar " de la exploración subterránea - la cueva mas profunda del mundo.



Arriba y derecho: El extenso modelo del Sistema Cheve. El agua se resume a los 3000m de elevación y a 17 kilómetros emerge de un nacimiento, a 2,547m mas abajo, en las profundidades del cañón Santo Domingo

La Misión: La expedición se agrupara en Austin, Texas la tercera semana de marzo de 2005 y estará en el área del Sistema Cheve para explorar por dos meses. El primer objetivo será una exploración de **Osto J2**, una cueva apenas descubierta en 2004. Está situada en la alta altitud y un viento fuerte y frío sopla en la entrada. Se sabe actualmente que **J2** alcanza una profundidad de - 348 metros, pero el túnel continúa. Los modelos de la computadora del Sistema Cheve (por ejemplo, el perfil arriba) sugieren que J2 conecte con la cueva principal en una profundidad que excede probablemente 1900 metros. Si J2 condujera a un pasaje hacia el hipotético corazón de la Sierra Madre, entonces el principal esfuerzo se enfocara a explorar el pasaje al sur hacia Cueva Cheve y al norte hacia los nacimientos de agua.

Programa:
Organización en Texas: 16 de marzo, 2005
Sistema J2: 20 de marzo - 15 de mayo, 2005

Organización

La expedición Sistema Cheve 2005 "Expedición J2", está siendo conducida por el explorador veterano Dr. Guillermo Piedra (Bill Stone) y José Antonio Soriano e incluirá miembros altamente capacitados del equipo de México, E.U., Gran Bretaña, Polonia, Australia, Suiza, España, e Irlanda. La expedición esta oficialmente a cargo del equipo estadounidense de exploración de cuevas profundas (USDCT por sus siglas en Ingles).

Reconocimientos
Deseamos expresar nuestra gratitud especial a la Fundación Cuicatlan, la Asociación Mexicana de Alpinismo, y Protección Civil Oaxaca para hacer posible esta expedición.

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Un breve informe sobre la expedición J2 2005

por Bill Stone
10 de diciembre de 2005

Introducción:

La cueva “J2” está situada a una elevación de 2300 m y aproximadamente a 5 kilómetros de distancia del poblado EL Ocotal en el municipio de San Francisco Chapulapa, distrito de Cuicatlán, Oaxaca. Fue descubierta a principios de marzo de 2004 durante la expedición Sistema Cheve 2004. La expedición del 2004 fue organizada por el Dr. Bill Stone con el objetivo de conducir la exploración de tres áreas al norte y al este del Sistema Cheve con la meta explícita de descubrir una nueva entrada al sistema, esto para proporcionar una vía alterna a los obstáculos que habían bloqueado la continuación de la exploración en la cueva en el 2003 a una profundidad de -1484 m. El área de El Ocotal era el último de los tres objetivos de 2004. El 2 y 3 de marzo de 2004 un pequeño grupo que consistía en Andi Hunter (Estados Unidos), Tjerk Dalhuisen (Países Bajos), Maarten Poot (Países Bajos) y Bill Stone realizó el primer reconocimiento sobre EL Ocotal con el fin de localizar entradas de cuevas y pozos (los cuales, en este zona, se llaman “ostos” en cuicateco). Descubrieron las entradas a 25 cuevas nuevas, localizaron el sitio que ahora es el campamento base para J2 y exploraron a través del bosque de montaña hasta llegar a 500 m de la entrada a J2. El 10 de marzo un grupo más grande comenzó una búsqueda metódica de cuevas, operando desde el Campamento Base J2. Enrique “Zape” Ogando Lastra (España) fue el primero en descubrir la dolina que conducía a la entrada de la cueva J2. El primero en entrar a la cueva fue Marcin Gala (Polonia), quien descendió hasta una profundidad de -25 m sin la necesidad de cuerdas. Posteriormente, cuatro exploraciones en el 2004 ampliaron la profundidad de la cueva a -346 m, nivel al que se agotó la cuerda para seguir explorando. La cueva continuaba, con un viento muy fuerte.

Dentro del marco histórico, el primer equipo de reconocimiento mencionado arriba (Stone y demás) etiquetó sus entradas con el prefijo “P” para “pozo” -- como en “P25” para la 25ta cavidad. Cada equipo de reconocimiento en el 2004 seleccionó su propio prefijo para identificar las entradas que descubrieran. Los espeleólogos polacos utilizaron el prefijo “J”, una abreviatura para “jaskinie” que significa “la cueva” en polaco. Así “J2” fue la segunda entrada descubierta por el equipo predominantemente polaco/español que exploraba el pequeño valle al sudoeste del campamento base J2.

La expedición J2 2005:

La expedición 2005 fue organizada y conducida por Bill Stone y José Antonio Soriano e incluyó un equipo de 40 miembros provenientes de nueve países, entre el 17 de marzo y 15 de mayo de 2005.

El primer equipo partió de Texas el 17 de marzo. Llevó una semana el establecer el Campamento Base J2 y el armar la cueva hasta el límite de la exploración anterior, a -346 m (alrededor de 590 m de distancia desde la entrada). Los eventos procedieron rápidamente durante los tres días siguientes. Mike Frazier y Bill Stone establecieron un vivaque [campamento ligero] a una profundidad de -553 m, en lo que ahora es el sitio del Campamento 1, y armaron hasta una profundidad de -665 m, momento en que agotaron su cuerda. El siguiente equipo que tomó la exploración fue integrado por Alan Warild, Greg Tunnock, Pavo Skoworodko, John Kerr y José Antonio Soriano y alcanzó una profundidad de -752 m, donde descubrieron un sifón [pasaje indundado] en la base de una sala grande (en promedio 50 m de diámetro y 35 m de altura) directamente debajo de la Barranca Aguacate y a una profundidad de 500m debajo del piso de ella. Éste había sido el posible obstáculo que mayor preocupación causaba, ya que era la única barrera geológica significativa que podría bloquear el desarrollo de una conexión entre la entrada J2 y la Cueva Cheve. El problema principal ahora era que, por primera vez en la historia de estas expediciones no se contaba con equipo de espeleobuceo. En vez de ello, las camionetas habían sido cargadas con 3 kilómetros de cuerda, debido al viento extraordinariamente fuerte en la entrada que prometía pasajes extensos.

Durante las dos semanas siguientes se examinó el pasaje que conducía al Sifon 1, buscando arduamente en los niveles superiores del cañón, intentando ubicar un paso alterno al tunel inundado, sin éxito alguno. Tres días y varias llamadas por teléfono satelital a Estados Unidos llevaron a una decisión sobre las siguientes acciones. Al principio de estas discusiones casi la mitad del equipo estaba a favor de simplemente reanudar la búsqueda de nuevas entradas en el bosque de montaña del Ocotal, con la esperanza de que quizás una cueva nueva pudiera evitar el túnel subacuático. La búsqueda de nuevas entradas de hecho continuó durante las dos semanas mientras los intentos de localizar rutas alternas en J2 sucedían; algunas cuevas con profundidades de 100 a 150 m fueron descubiertas pero ninguna continuaba internándose más en la montaña. Finalmente, el 14 de abril cuatro voluntarios comenzaron un viaje de 4 días a Texas, reuniéndose en la frontera con un equipo de compañeros espeleólogos de Austin, Texas, que llevaron equipo de espeleobuceo y un compresor de aire.

Regresaron al Campamento Base J2 el 17 de abril y un nuevo grupo transportó el equipo al Campamento 2, establecido en un gran salón a -752 m. Bill Stone hizo el primer buceo en el Sifón 1 y descubrió rápidamente que después de 12 m (a una profundidad de solamente 4 m) el pasaje se estrechaba a 0.5 m de ancho. La superficie del agua era visible más allá de la grieta, apenas a 2 m de distancia -- pero no cabía a través de la grieta con el montaje tradicional de espeleobuceo de "tanques laterales" utilizado. Regresando al inicio del Sifón 1, el grupo discutió la situación y decidió hacer algunas modificaciones al equipo: quitar los tanques laterales del arnés y atarlos con correas como tanques independientes con flotación neutra (dos tanques y dos reguladores) que el espeleobuzo flotaría delante de él con una mano y así podría deslizarse lateralmente a través de la grieta. Alan Warild utilizó esta técnica para llegar a una grieta con aire en el otro lado del Sifón 1. Su breve exploración confirmó que la cueva continuaba y tenía una corriente de aire, que debía filtrarse por una grieta arriba del Sifón 1, pero era casi imposible de detectar debido a las cascadas cercanas que azotaban el viento y el rocío en todas las direcciones. Alan Warild también observó que el Sifón 1 aparecía ser ocasionado por un derrumbe de 6 metros altura en el lado río abajo del pasaje.

Durante la semana siguiente un equipo conducido por John Kerr y Marcin Gala logró algo absolutamente sin precedentes. Movieron manualmente cerca de 10 toneladas de bloques de piedra desde el derrumbe y abrieron un drenaje para el sifón, suficiente como para bajar el nivel del agua 2.5 metros y abrir así un espacio con aire y evitar de tal manera la necesidad del equipo de espeleobuceo. El viento aumentó drásticamente – al disponer de una mayor área de conducción – hasta tener la velocidad de una tormenta, creando olas con espuma en el lago del sifon. El superar este pequeño obstáculo costó 3 semanas, pero para el 25 de abril se tenía un equipo fuerte en el Campamento 2 que contaba con un kilómetro de cuerda. La cueva fue extendida un kilómetro adicional a través de un cañón alto de piedra negra y pulida por la corriente, con el río rugiendo entre pozas separadas por tiros de 5 a 20 m, semejante al Cañón Inferior del famoso Sótano de San Agustín en Huautla. El 30 de abril los refuerzos y un cambio de equipo dejaron el grupo siguiente en el Campamento 2: Pavo Skoworodko, Artur Nowak y Kasia Kedracka de Polonia; John Kerr, Matt Covington, Jon Lillestolen y Bill

Stone de los Estados Unidos; y Franco Attolini de México.

Durante los 5 días siguientes realizaron tres exploraciones de 15, 20, y 24 horas a partir del Campamento 2. Casi inmediatamente el 1 de mayo fue descubierta una galería grande de alto nivel a -870 m que continuó por 1.5 kilómetros como un pasaje de 20 m de ancho y 8 m de alto. El 3 de mayo fue alcanzada una profundidad de -1067 m en un punto a 5 kilómetros de la entrada, pero un área con un derrumbe obligó a detener la exploración. El 5 de mayo se reanudó, y un primer equipo formado por Attolini, Covington, Kedracka, y Stone estableció una mapa de la cueva hasta el límite de exploración. El segundo equipo (Pavo Skoworodko y John Kerr) logró encontrar una ruta compleja a través del derrumbe. De hecho tan compleja era la ruta que al intentar Skoworodko regresar no lo logró hacer. Los dos equipos consiguieron estar en un un punto tan cercano que podían saludarse de mano a través de él, pero el paso era imposible. Se evaluaron diversas opciones, como enviar una bolsa de dormir y alimento a través de la grieta, sin embargo John Kerr salvó el día con una barra de titanio que parece siempre llevar consigo. Él logró liberar algunos bloques del techo (y quitarse a tiempo de su paso) y el derrumbe creó una grieta estabilizada de una manera precaria. Skoworodko animó al resto del grupo a cruzar este paso riesgoso para continuar la exploración, lo cual fue realizado [pero mi opinión profesional como ingeniero estructural es que estaba sostenida por un capricho y rogué que se sostuviera por este viaje, lo que afortunadamente sucedió. Claramente un objetivo significativo para la expedición J2 2006 es encontrar una ruta alternativa que evite esta zona de colapso]. A 20 horas del Campamento 2 Attolini, Covington, Kerr y Stone alcanzaron el punto más profundo para el 2005: una profundidad de -1101 m a una distancia de 6 kilómetros de la entrada. Los cuatro estaban parados en un túnel de 8 m de ancho y 20 m de alto mirando hacia abajo a una grieta gigante con un río que tronaba debajo – un tiro de por lo menos de 25 m. Con las luces de alta potencia se podía ver el túnel debajo, continuando como un cañón de 8 m de ancho y más de 25 m de alto, en dirección noroeste, hacia la Cueva Cheve.

El viento soplando en ese túnel es el más fuerte que haya encontrado en 37 años de espeleología de expedición y ésto fue a un nivel de -1100 m. Tommy Shifflett es uno de los pocos veteranos restantes de Huautla aún realizando expediciones, quien lo ha visto todo y no se impresiona fácilmente, y mencionó en el campamento base que "esa cosa llega hasta la resurgencia." Eso llevaría a la cueva a una profundidad de -2000 m. El lograr la conexión con la Cueva Cheve, por otra parte, representa uno de los retos más grandes en la exploración en la historia de la humanidad. Esencialmente es porque la expedición de dos meses en J2 culminó en un punto a 6 kilómetros de la entrada, llevando a los recursos al máximo. Un tercer campamento subterraneo tendrá que ser establecido en el límite actual de exploración. Además de esto se requerirá duplicar o triplicar la distancia de penetración para llegar a la posible conexión con la Cueva Cheve, más allá del Cañón San Miguel. Esta conexión, sin embargo, únicamente representa una "puerta trasera" que se ha estado buscando para evitar los sifones en Cheve. Si se incluye la resistencia humana en ese mapa, como mínimo se tendrán cinco o seis campamentos subterraneos para alcanzar la conexión.

Es entonces aquí donde el impacto completo de la crisis logística inminente comienza a ser aparente. Desde ese punto son siete kilómetros en línea recta al punto más cercano de la Cueva Cheve y nueve kilómetros a los manantiales de la resurgencia (Río Frío de Santa Ana Cuauhtémoc). Las cuevas nunca viajan en línea recta, como mínimo será el doble de la distancia o 14 kilómetros a la Cueva Cheve y otros 18 kilómetros río abajo a la resurgencia. Calculando la resistencia humana (y la dificultad de J2, particularmente en las frías y estrechas secciones superiores de la cueva) se requerirá un campamento cada tres kilómetros. Así, esto implica que existirán los campamentos 9, 10 u 11 para el momento en que se alcancen cualquiera de esas zonas de la conexiones. No hay otras maneras conocidas para llegar a esas áreas. Es claro, a partir de la fuerza del viento, que J2 se internará en la montaña y que es la clave que se ha estado buscando durante más de una década. Se está planeando el retorno en el 2006 (del 1 de abril hasta el 15 de mayo) para continuar la exploración con el equipo actualmente disponible y sin cambios significativos en la tecnología. Usando técnicas tradicionales se podrán alcanzar -1400 m o quizá -1500 m, quedando aún la zona del entronque del Cañón San Miguel 5 a 6 kilómetros de distancia al final de la expedición 2006.

Se está comenzando actualmente a considerar cómo realizar un proceso más metódico para una expedición de 3 a 4 meses en el 2007. Esto requerirá un cambio en el paradigma de la exploración subterránea. Por ejemplo, un cierto tipo de comunicación electrónica entre todos los campamentos subterráneos y el campamento base en la superficie va a ser esencial. Un mensaje equivocado desde el Campamento 8 solicitando apoyo logístico transmitido por mensajeros humanos hasta la superficie, tomando en cuenta el retraso en la comunicación, podría ocasionar el fallo completo de la misión. Algo semejante sucedió en el campamento 2 este año, apenas a doce horas de distancia de la superficie y con solamente una retransmisión del mensaje (en el campamento 1). De igual manera se tendrá que rediseñar totalmente el sistema de iluminación portado en el casco, ya que incluso las baterías de litio comienzan a ser demasiado pesadas debido a las cantidades usadas. También los taladros utilizados para el armado de la cueva requieren baterías pesadas. Y la ropa en el campamento requiere constantemente ser secada. Y como punto final, de nueva cuenta cada uno de los integrantes del equipo perdió peso, a pesar de consumir lo que se consideró como cantidades masivas de alimento. Se estima que como promedio un miembro del equipo quemaba 8000 calorías por día durante la fase final de la expedición 2005.

Hubo por lo menos tres incidentes donde el grupo en el campamento 2 estuvo a doce horas de tener que volver a la superficie por la carencia de alimento antes de que llegara un grupo de reabastecimiento. Se están considerando varias opciones en cuanto a comunicación (inalámbrica, por cables o por vía asincrónica magnética). Se trabajará con la idea de un pequeño generador hidroeléctrico para recargar las baterías de los taladros y lámparas. Y la situación de los alimentos es aún el mayor reto. La estimación actual es que una exploración a partir del campamento 8 o 9 involucraría 40 días bajo la tierra, lo cual también impondría retos psicológicos. Algunas personas en la expedición de este año tuvieron problemas para estar bajo tierra por más de una semana. Sin embargo, algunos en la exploración final partiendo del campamento 2 se sentían cómodos incluso con la idea de olvidarse de la superficie. Esta será una adaptación esencial. Pero posibles problemas médicos (principalmente infecciones en los pies y dedos) son también fuente de preocupación. De cualquier manera, J2 está al borde de algo extraordinario: un cambio completo en los métodos de exploración subterranea. Y una revisión completa del concepto de lejanía dentro del planeta. Las expediciónes del 2006 y 2007 a J2 brindarán una probada de esta nueva frontera.

Bill Stone
Gaithersburg, Maryland, EE.UU.
Diciembre de 2005.

Apéndice A: Miembros de la Expedición J2 2005

Jefes: Bill Stone y Jose Antonio Soriano

Alan Warild [Australia]
Greg Tunnock [Australia]
Mark Wilson [Australia]
Tony Dwyer [Irlanda]
Gustavo Vela Turcott [México]
José Antonio Soriano Sanchez [México]
Luis Gabriel "Wicho" Diaz [México]
Franco Attolini [México]
Tjerk Dalhuisen [Paises Bajos]
Artur Nowak [Polonia]
Katarzyna Anna Biernacka [Polonia]
Katarzyna Kedracka [Polonia]
Marcin Gala [Polonia]
Marlena Ostrowska [Polonia]
Pawel Skoworodko [Polonia]
Tomasz Fiedorowicz [Polonia]
Enrique "Zape" Ogando Lastra [España]
Ignacio "Nacho" de Rafael Ramos [España]
Marta Candel Ureña [España]
Yvonne Droms [Suiza]
Peter Hartley [Reino Unido]
Robbie Warke [Reino Unido]
Andi Hunter [EE.UU.]
Anne Mariah Tapp [EE.UU.]
Bart Hogan [EE.UU.]
Bill Stone [EE.UU.]
John Kerr [EE.UU.]
Jon Lillestolen [EE.UU.]
Lewis Carroll [EE.UU.]
Mark Minton [EE.UU.]
Mark Stover [EE.UU.]
Matt Covington [EE.UU.]
Michael Frazier [EE.UU.]
Paula Warke-Grgich [EE.UU.]
Thomas Shifflett [EE.UU.]
Todd Warren [EE.UU.]

Apéndice B: Miembros de la Expedición J2 2006

Jefes: Mark Minton, John Kerr, y Jose Antonio Soriano

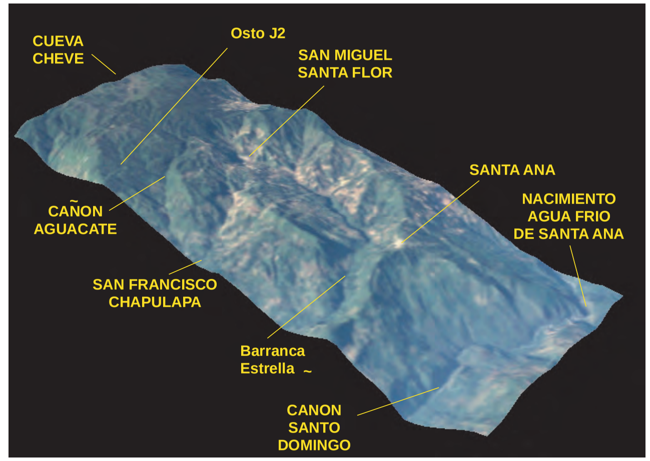
Alan Warild [Australia]
Greg Tunnock [Australia]
Mark Wilson [Australia]
Tony Dwyer [Irlanda]
Gustavo Vela Turcott [México]
José Antonio Soriano Sanchez [México]
Luis Gabriel "Wicho" Diaz [México]
Franco Attolini [México]
Tjerk Dalhuisen [Paises Bajos]
Artur Nowak [Polonia]
Katarzyna Kedracka [Polonia]
Pawel Skoworodko [Polonia]
Enrique "Zape" Ogando Lastra [España]
Ignacio "Nacho" de Rafael Ramos [España]
Marta Candel Ureña [España]
Yvonne Droms [Suiza]
Andi Hunter [EE.UU.]
Bart Hogan [EE.UU.]
Bill Stone [EE.UU.]
John Kerr [EE.UU.]
Jon Lillestolen [EE.UU.]
Mark Minton [EE.UU.]
Mark Stover [EE.UU.]
Matt Covington [EE.UU.]
Michael Frazier [EE.UU.]
Thomas Shifflett [EE.UU.]
Pauline Berendse [Paises Bajos]
James Brown [EE.UU.]
Andi Hunter [EE.UU.]
Jan Matthesius [Paises Bajos]
Kasia Okuszko [Polonia]
Fernando Pinto [Portugal]
Samuel Ribeiro [Portugal]
Philip Rykwalder [EE.UU.]
Bev Shade [EE.UU.]
Victoria Siegel [EE.UU.]
Sergio Zambrano [México]
Angel Soto [México]

La Expedición de 2006 al Ozto J2

El desafío: en octubre del 2004, un grupo liderado por ucranianos exploró la cueva Krubera (Voronya) en la región de Abjazia en Georgia a una profundidad de -2060 metros, con lo cual reclamaron para ella el título de la cueva más profunda explorada en la Tierra y la primera en romper la marca de los 2000 metros de profundidad. Un año después un grupo ruso aumentó la profundidad a -2140 metros. El próximo gran hito en la exploración terrestre será el descubrimiento de la primera cueva de 2500 metros de profundidad. Nuestras expediciones en el 2006 y 2007 podrían materializar este logro histórico.

La cueva Cheve, con entradas a 2650 y 2800 metros de altitud en la Sierra de Juárez, región noreste de Oaxaca, México, actualmente presenta una profundidad de -1484 metros, es la cueva más profunda en el hemisferio occidental y la novena a nivel mundial. El límite de exploración actual en Cheve, a más de 9 kilómetros de la entrada más cercana, es una de las distancias más remotas jamás alcanzadas dentro de cualquier cueva en la Tierra. Los desafíos logísticos para alcanzar este punto son enormes: más de dos kilómetros de cuerda tienen que ser colocados y tres campamentos subterráneos tienen que ser establecidos. La profundidad final actual fue alcanzada durante una expedición de gran escala liderada por espeleólogos de los Estados Unidos en 2003, que exitosamente lograron que un grupo de cuatro buzos cruzara dos pasajes inundados a una profundidad de -1362 metros. Los buceos tuvieron un excelente resultado y el equipo rápidamente exploró 1.3 kilómetros adicionales de nuevos pasajes que se internaban a mayor profundidad en la montaña. Al llegar a la profundidad actual, un colapso en el techo bloqueaba el camino, forzando la retirada después de dos y medio meses de esfuerzos continuados.

Foto de la Portada: Explorando en Osto J2, al nivel -700 metros bajo la entrada.



Mapa superficial de la región del Sistema Cheve, Oaxaca, México

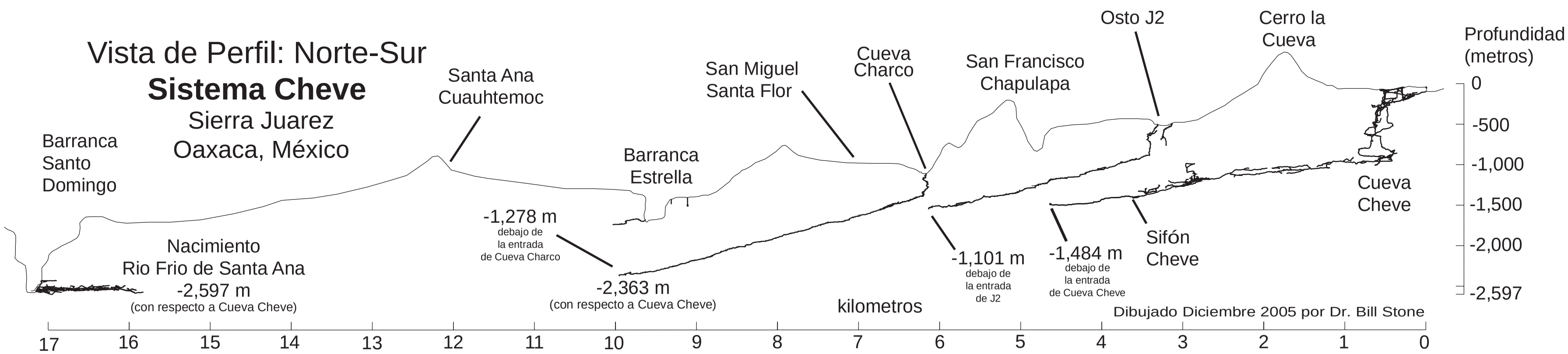
Después de que vigorosos intentos de lograr ingresar a la zona intermedia de la cueva por vía de la Barranca Estrella no fueron exitosos en el 2004, la exploración superficial de una mesa no revisada previamente sobre el Ocotal llevó al descubrimiento de una nueva gran cueva, Osto J2. Inicialmente explorada a -346 metros y aumentada a -1100 metros en el 2005 hasta que el grupo utilizó toda la cuerda disponible, J2 está perfectamente posicionada para convertirse en el eslabón faltante para alcanzar la vasta sección media del sistema hidrológico Cheve, no explorada aún y desconocida. El gran desplazamiento de aire y agua y la dirección de los túneles de J2 indican no únicamente la posibilidad, sino la alta probabilidad de esto.

Hay mucho en juego. El Sistema Cheve tiene un potencial de profundidad probado - basado en experimentos de rastreo de pigmentos realizados en 1990 - de 2547 metros, el mayor conocido en el mundo y una profundidad que, de lograrse, rompería la marca actual de la cueva Krubera (Voronya) por un margen tal que se podría establecer a Cheve por siempre como la cueva de mayor profundidad en la Tierra.

Vista de Perfil: Norte-Sur

Sistema Cheve

Sierra Juarez
Oaxaca, México



La Misión: la expedición partirá de Austin, Texas, en la primer semana de abril del 2006 y permanecerá en el campo por seis semanas. Los objetivos primarios serán el reestablecimiento de las cuerdas de progresión y mejoras en la ruta a través de J2 y el establecer un nuevo campamento subterráneo (Campamento 3) en el punto de mayor profundidad alcanzado en -1100 metros. A partir de ahí la exploración continuará hacia la unión de J2 con el conducto principal de Cheve. Desde este punto se tendrá la opción de dividir al grupo de tal manera que una exploración corriente arriba llevará a la zona ya explorada de Cheve y la exploración corriente abajo llevará a la resurgencia, en la cual se han explorado ya más de diez kilómetros de pasajes que se internan en la montaña. Los campamentos subterráneos estarán conectados entre ellos y con la superficie por medio de teléfonos de campaña de dos hilos, que permitirán la coordinación de personal y necesidades de equipo. Serán probadas también nuevas tecnologías para recargar las baterías de las lámparas y taladros, que utilizan microgeneradores hidroeléctricos. Serán establecidos campamentos subterráneos adicionales de acuerdo a las necesidades, ya que se anticipa que las distancias involucradas finalmente requerirán semanas de trabajo en la oscuridad total de la cueva.

Arriba, a la derecha: La vasta escala del Sistema Cheve. El agua entra en el sistema a 2654 m de altitud. Dieciocho kilómetros después emerge en manantiales que se encuentran 2363 m más abajo en las profundidades del Cañón de Santo Domingo. Incluyendo las entradas a mayor altura y las profundidades alcanzadas buceando en los manantiales, el potencial total es de 2547 m, el mayor en el mundo.

Fechas

Reunión en Texas y viaje a México: abril 1 - 3, 2006. Establecimiento del campamento base en Oaxaca, México: abril 4 - 6, 2006. Exploración de J2: abril 7 - mayo 9, 2006. Levantar el campamento y regreso a los EUA: mayo 10 - 14, 2006.

Organización:

Cheve 06 es liderado por los experimentados exploradores Dr. Mark Minton, John Kerr, y Jose Antonio Soriano e incluirá a miembros altamente capacitados de Australia, Gran Bretaña, México, los Países Bajos, Polonia, España y los Estados Unidos. La expedición es una actividad oficial del Equipo de Exploración de Cuevas Profundas de los Estados Unidos (USDCT, por sus siglas en inglés) y un proyecto oficialmente reconocido por la Asociación Nacional de Espeleología de los Estados Unidos (NSS, por sus siglas en inglés).

Reconocimientos

Deseamos expresar nuestra gratitud especial a la Fundación Cuicatlan, la Asociación Mexicana de Alpinismo, y Protección Civil Oaxaca para hacer posible esta expedición.

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Fotos por Marcin Gala y Kasia Biernacka




Fotos: (empezando a la izquierda) bajando un tiro al nivel -733m en J2; buceando el Sifon 1 en J2; subiendo la cuerda hacia Campamento 1 (-563m) en J2; y durmiendo en una hamaca en Campamento 2.

Un breve informe sobre todas las expediciónes a la cueva profunda

J2

Municipio de San Francisco Chapulapa
Distrito de Cuicatlan
Oaxaca, Mexico

por Bill Stone, Mark Minton, Fofo Gonzales
8 de marzo de 2009

Introducción:

La cueva “J2” está situada a una elevación de 2300 m y aproximadamente a 5 kilómetros de distancia del poblado EL Ocotal en el municipio de San Francisco Chapulapa, distrito de Cuicatlán, Oaxaca. Fue descubierta a principios de marzo de 2004 durante la expedición Sistema Cheve 2004. La expedición del 2004 fue organizada por el Dr. Bill Stone con el objetivo de conducir la exploración de tres áreas al norte y al este del Sistema Cheve con la meta explícita de descubrir una nueva entrada al sistema, esto para proporcionar una vía alterna a los obstáculos que habían bloqueado la continuación de la exploración en la cueva en el 2003 a una profundidad de -1484 m. El área de El Ocotal era el último de los tres objetivos de 2004. El 2 y 3 de marzo de 2004 un pequeño grupo que consistía en Andi Hunter (Estados Unidos), Tjerk Dalhuisen (Países Bajos), Maarten Poot (Países Bajos) y Bill Stone realizó el primer reconocimiento sobre EL Ocotal con el fin de localizar entradas de cuevas y pozos (los cuales, en este zona, se llaman “ostos” en cuicateco). Descubrieron las entradas a 25 cuevas nuevas, localizaron el sitio que ahora es el campamento base para J2 y exploraron a través del bosque de montaña hasta llegar a 500 m de la entrada a J2. El 10 de marzo un grupo más grande comenzó una búsqueda metódica de cuevas, operando desde el Campamento Base J2. Enrique “Zape” Ogando Lastra (España) fue el primero en descubrir la dolina que conducía a la entrada de la cueva J2. El primero en entrar a la cueva fue Marcin Gala (Polonia), quien descendió hasta una profundidad de -25 m sin la necesidad de cuerdas. Posteriormente, cuatro exploraciones en el 2004 ampliaron la profundidad de la cueva a -346 m, nivel al que se agotó la cuerda para seguir explorando. La cueva continuaba, con un viento muy fuerte.

Dentro del marco histórico, el primer equipo de reconocimiento mencionado arriba (Stone y demás) etiquetó sus entradas con el prefijo “P” para “pozo” -- como en “P25” para la 25ta cavidad. Cada equipo de reconocimiento en el 2004 seleccionó su propio prefijo para identificar las entradas que descubrieran. Los espeleólogos polacos utilizaron el prefijo “J”, una abreviatura para “jaskinie” que significa “la cueva” en polaco. Así “J2” fue la segunda entrada descubierta por el equipo predominantemente polaco/español que exploraba el pequeño valle al sudoeste del campamento base J2.

La expedición J2 2005:

La expedición 2005 fue organizada y conducida por Bill Stone y José Antonio Soriano e incluyó un equipo de 40 miembros provenientes de nueve países, entre el 17 de marzo y 15 de mayo de 2005.

El primer equipo partió de Texas el 17 de marzo. Llevó una semana el establecer el Campamento Base J2 y el anclaje de la cueva hasta el límite de la exploración anterior, a -346 m (alrededor de 590 m de distancia desde la entrada). Los eventos procedieron rápidamente durante los tres días siguientes. Mike Frazier y Bill Stone establecieron un campamento ligero a una profundidad de -553 m, en lo que ahora es el sitio del Campamento 1, y anclaron a hasta una profundidad de -665 m, momento en que agotaron su cuerda. El siguiente equipo que tomó la exploración fue integrado por Alan Warild, Greg Tunnock, Pavo Skoworodko, John Kerr y José Antonio Soriano y alcanzó una profundidad de -752 m, donde descubrieron un sifón [pasaje indundado] en la base de una sala grande (en promedio 50 m de diámetro y 35 m de altura) directamente debajo de la Barranca Aguacate y a una profundidad de 500m debajo del piso de ella. Éste había sido el posible obstáculo que mayor preocupación causaba, ya que era la única barrera geológica significativa que podría bloquear el desarrollo de una conexión entre la entrada J2 y la Cueva Cheve. El problema principal ahora era que, por primera vez en la historia de estas expediciones no se contaba con equipo de espeleobuceo. En vez de ello, las camionetas habían sido cargadas con 3 kilómetros de cuerda, debido al viento extraordinariamente fuerte en la entrada que prometía pasajes extensos.

Durante las dos semanas siguientes se examinó el pasaje que conducía al Sifon 1, buscando arduamente en los niveles superiores del cañón, intentando ubicar un paso alterno al tunel inundado, sin éxito alguno. Tres días y varias llamadas por teléfono a Estados Unidos llevaron a una decisión sobre las siguientes acciones. Al principio de estas discusiones casi la mitad del equipo estaba a favor de simplemente reanudar la búsqueda de nuevas entradas en el bosque de montaña del Ocotal, con la esperanza de que quizás una cueva nueva pudiera evitar el túnel subacuático. La búsqueda de nuevas entradas de hecho continuó durante las dos semanas mientras los intentos de localizar rutas alternas en J2 sucedían; algunas cuevas con profundidades de 100 a 150 m fueron descubiertas pero ninguna continuaba internándose más en la montaña. Finalmente, el 14 de abril cuatro voluntarios comenzaron un viaje de 4 días a Texas, reuniéndose en la frontera con un equipo de compañeros espeleólogos de Austin, Texas, que llevaron equipo de espeleobuceo y un compresor de aire.

Regresaron al Campamento Base J2 el 17 de abril y un nuevo grupo transportó el equipo al Campamento 2, establecido en un gran salón a -752 m. Bill Stone hizo el primer buceo en el Sifón 1 y descubrió rápidamente que después de 12 m (a una profundidad de solamente 4 m) el pasaje se estrechaba a 0.5 m de ancho. La superficie del agua era visible más allá de la grieta, apenas a 2 m de distancia -- pero no cabía a través de la grieta con el montaje tradicional de espeleobuceo de “tanques laterales” utilizado. Regresando al inicio del Sifón 1, el grupo discutió la situación y decidió hacer algunas modificaciones al equipo: quitar los tanques laterales del arnés y atarlos con correas como tanques independientes con flotación neutra (dos tanques y dos reguladores) que el espeleobuzo flotaría delante de él con una mano y así podría deslizarse lateralmente a través de la grieta. Alan Warild utilizó esta técnica para llegar a una grieta con aire en el otro lado del Sifón 1. Su breve exploración confirmó que la cueva continuaba y tenía una corriente de aire, que debía filtrarse por una grieta arriba del Sifón 1, pero era casi imposible de detectar debido a las cascadas cercanas que azotaban el viento y el rocío en todas las direcciones. Alan Warild también observó que el Sifón 1 aparecía ser ocasionado por un derrumbe de 6 metros altura en el lado río abajo del pasaje.

Durante la semana siguiente un equipo conducido por John Kerr y Marcin Gala logró algo absolutamente sin precedentes. Movieron manualmente cerca de 10 toneladas de bloques de piedra desde el derrumbe y abrieron un drenaje para el sifón, suficiente como para bajar el nivel del agua 2.5 metros y abrir así un espacio con aire y evitar de tal manera la necesidad del equipo de espeleobuceo. El viento aumentó drásticamente – al disponer de una mayor área de conducción – hasta tener la velocidad de una tormenta, creando olas con espuma en el lago del sifon. El superar este pequeño obstáculo costó 3 semanas, pero para el 25 de abril se tenía un equipo fuerte en el Campamento 2 que contaba con un kilómetro de cuerda. La cueva fue extendida un kilómetro adicional a través de un cañón alto de piedra negra y pulida por la corriente, con el río rugiendo entre pozas separadas por tiros de 5 a 20 m, semejante al Cañón Inferior del famoso Sótano de San Agustín en Huautla. El 30 de abril los refuerzos y un cambio de equipo dejaron el grupo siguiente en el Campamento 2: Pavo Skoworodko, Artur Nowak y Kasia Kedracka de Polonia; John Kerr, Matt Covington, Jon Lillestolen y Bill Stone de los Estados Unidos; y Franco Attolini de México.

Durante los 5 días siguientes realizaron tres exploraciones de 15, 20, y 24 horas a partir del Campamento 2. Casi inmediatamente el 1 de mayo fue descubierta una galería grande de alto nivel a -870 m que continuó por 1.5 kilómetros como un pasaje de 20 m de ancho y 8 m de alto. El 3 de mayo fue alcanzada una profundidad de -1067 m en un punto a 5 kilómetros de la entrada, pero un área con un derrumbe obligó a detener la exploración. El 5 de mayo se reanudó, y un primer equipo formado por Attolini, Covington, Kedracka, y Stone estableció una mapa de la cueva hasta el límite de exploración. El segundo equipo (Pavo Skoworodko y John Kerr) logró encontrar una ruta compleja a través del derrumbe. De hecho tan compleja era la ruta que al intentar Skoworodko regresar no lo logró hacer. Los dos equipos consiguieron estar en un un punto tan cercano que podían saludarse de mano a través de él, pero el paso era imposible. Se evaluaron diversas opciones, como enviar una bolsa de dormir y alimento a través de la grieta, sin embargo John Kerr salvó el día. Él logró liberar algunos bloques del techo (y quitarse a tiempo de su paso) y el derrumbe creó una grieta estabilizada de una manera precaria. Skoworodko animó al resto del grupo a cruzar este paso riesgoso para continuar la exploración, lo cual fue realizado [pero mi opinión profesional como ingeniero estructural es que estaba sostenida por un capricho y rogué que se sostuviera por este viaje, lo que afortunadamente sucedió. Claramente un objetivo significativo para la expedición J2 2006 es encontrar una ruta alternativa que evite esta zona de colapso]. A 20 horas del Campamento 2 Attolini, Covington, Kerr y Stone alcanzaron el punto más profundo para el 2005: una profundidad de -1101 m a una distancia de 6 kilómetros de la entrada. Los cuatro estaban parados en un túnel de 8 m de ancho y 20 m de alto mirando hacia abajo a una grieta gigante con un río que tronaba debajo – un tiro de por lo menos de 25 m. Con las luces de alta potencia se podía ver el túnel debajo, continuando como un cañón de 8 m de ancho y más de 25 m de alto, en dirección noroeste, hacia la Cueva Cheve.

El viento soplando en ese túnel es el más fuerte que haya encontrado en 37 años de espeleología de expedición y ésto fue a un nivel de -1100 m. Tommy Shifflett es uno de los pocos veteranos restantes de Huautla aún realizando expediciones, quien lo ha visto todo y no se impresiona fácilmente, y mencionó en el campamento base que “esa cosa llega hasta la resurgencia.” Eso llevaría a la cueva a una profundidad de -2000 m. El lograr la conexión con la Cueva Cheve, por otra parte, representa uno de los retos más grandes en la exploración en la historia de la humanidad. Esencialmente es porque la expedición de dos meses en J2 culminó en un punto a 6 kilómetros de la entrada, llevando a los recursos al máximo. Un tercer campamento subterraneo tendrá que ser establecido en el límite actual de exploración. Además de esto se requerirá duplicar o triplicar la distancia de penetración para llegar a la posible conexión con la Cueva Cheve, más allá del Cañón San Miguel. Esta conexión, sin embargo, únicamente representa una “puerta trasera” que se ha estado buscando para evitar los sifones en Cheve. Si se incluye la resistencia humana en ese esfuerzo, como mínimo se tendrán cinco o seis campamentos subterraneos para alcanzar la conexión.

Es entonces aquí donde el impacto completo de la crisis logística inminente comienza a ser aparente. Desde ese punto son siete kilómetros en línea recta al punto más cercano de la Cueva Cheve y nueve kilómetros a los manantiales de la resurgencia (Río Frío de Santa Ana Cuauhtémoc). Las cuevas nunca viajan en línea recta, como mínimo será el doble de la distancia o 14 kilómetros a la Cueva Cheve y otros 18 kilómetros río abajo a la resurgencia. Calculando la resistencia humana (y la dificultad de J2, particularmente en las frías y estrechas secciones superiores de la cueva) se requerirá un campamento cada tres kilómetros. Así, esto implica que existirán los campamentos 9, 10 u 11 para el momento en que se alcancen cualquiera de esas zonas de la conexiones. No hay otras maneras conocidas para llegar a esas áreas. Es claro, a partir de la fuerza del viento, que J2 se internará en la montaña y que es la clave que se ha estado buscando durante más de una década. Se está planeando el retorno en el 2006 (del 1 de abril hasta el 15 de mayo) para continuar la exploración con el equipo actualmente disponible y sin cambios significativos en la tecnología. Usando técnicas tradicionales se podrán alcanzar -1400 m o quizá -1500 m, quedando aún la zona del entronque del Cañón San Miguel 5 a 6 kilómetros de distancia al final de la expedición 2006.

Se está comenzando actualmente a considerar cómo realizar un proceso más metódico para una expedición de 3 a 4 meses en el 2007. Esto requerirá un cambio en el paradigma de la exploración subterránea. Por ejemplo, un cierto tipo de comunicación electrónica entre todos los campamentos subterráneos y el campamento base en la superficie va a ser esencial. Un mensaje equivocado desde el Campamento 8 solicitando apoyo logístico transmitido por mensajeros humanos hasta la superficie, tomando en cuenta el retraso en la comunicación, podría ocasionar el fallo completo de la misión. Algo semejante sucedió en el campamento 2 este año, apenas a doce horas de distancia de la superficie y con solamente una retransmisión del mensaje (en el campamento 1). De igual manera se tendrá que rediseñar totalmente el sistema de iluminación portado en el casco, ya que incluso las baterías de litio comienzan a ser demasiado pesadas debido a las cantidades usadas. También los taladros utilizados para el anclaje de la cueva requieren baterías pesadas. Y la ropa en el campamento requiere constantemente ser secada. Y como punto final, de nueva cuenta cada uno de los integrantes del equipo perdió peso, a pesar de consumir lo que se consideró como cantidades masivas de alimento. Se estima que como promedio un miembro del equipo quemaba 8000 calorías por día durante la fase final de la expedición 2005.

Hubo por lo menos tres incidentes donde el grupo en el campamento 2 estuvo a doce horas de tener que volver a la superficie por la carencia de alimento antes de que llegara un grupo de reabastecimiento. Se están considerando varias opciones en cuanto a comunicación (inalámbrica, por cables o por vía asincrónica magnética). Se trabajará con la idea de un pequeño generador hidroeléctrico para recargar las baterías de los taladros y lámparas. Y la situación de los alimentos es aún el mayor reto. La estimación actual es que una exploración a partir del campamento 8 o 9 involucraría 40 días bajo la tierra, lo cual también impondría retos psicológicos. Algunas personas en la expedición de este año tuvieron problemas para estar bajo tierra por más de una semana. Sin embargo, algunos en la exploración final partiendo del campamento 2 se sentían cómodos incluso con la idea de olvidarse de la superficie. Esta será una adaptación esencial. Pero posibles problemas médicos (principalmente infecciones en los pies y dedos) son también fuente de preocupación. De cualquier manera, J2 está al borde de algo extraordinario: un cambio completo en los métodos de exploración subterranea. Y una revisión completa del concepto de lejanía dentro del planeta. Las expediciónes del 2006 y 2007 a J2 brindarán una probada de esta nueva frontera.

La expedición J2 2006:

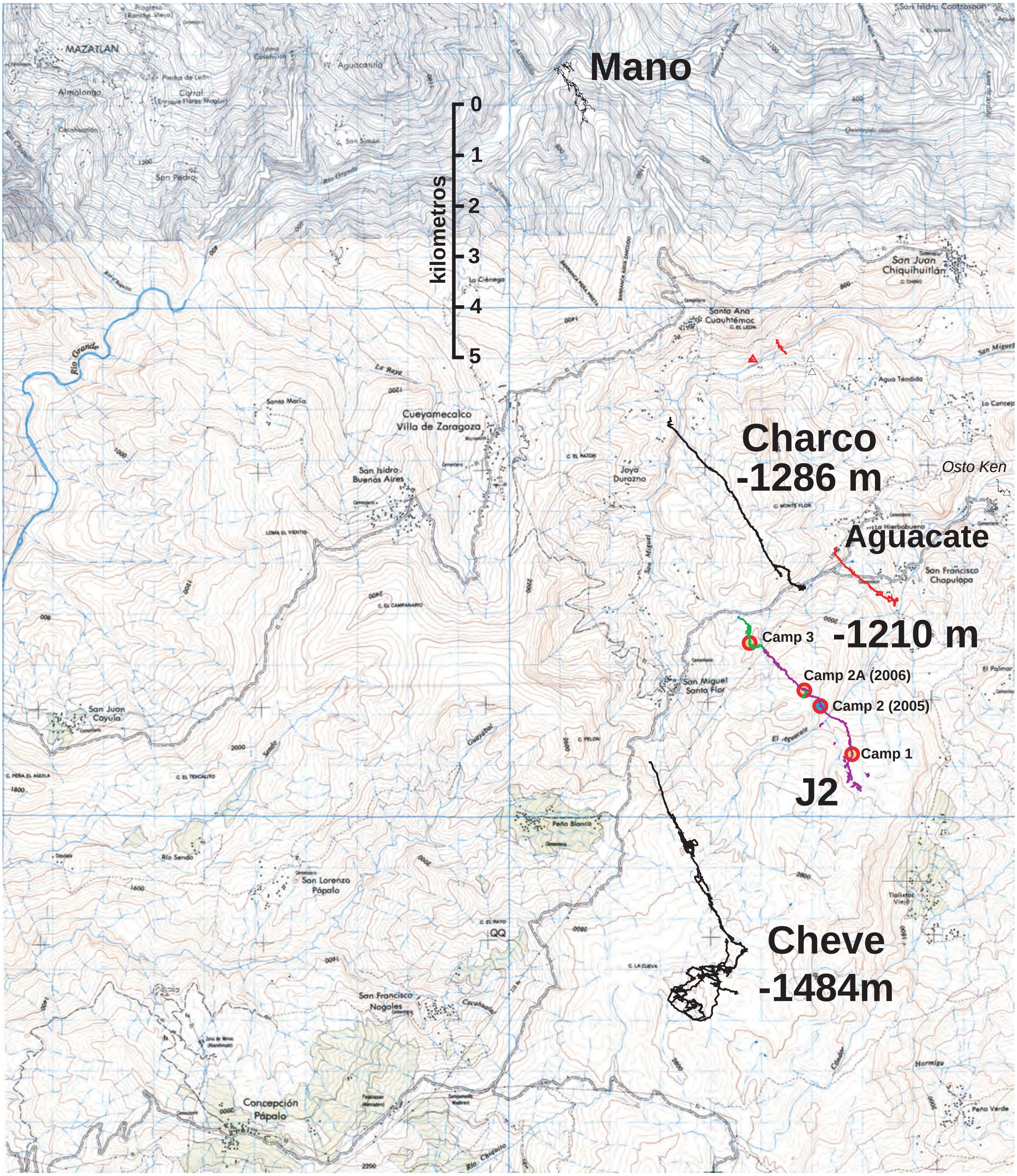
La expedición J2 2006 se llevó a cabo durante las seis semanas comprendidas entre el 3 de abril y el 12 de mayo. Participaron casi cuarenta espeleólogos de nueve países, contando en todo momento con alrededor de veinticinco personas. En cuanto se terminó la instalación de las cuerdas de progresión en la cueva al inicio de la expedición, el Campamento 2 fue reubicado en una zona más agradable después de un pasaje que anteriormente estaba inundado y se estableció un nuevo campamento, el Campamento 3, a 1100 metros de profundidad, un poco más allá de lo que anteriormente era el límite de la exploración. La continuación de la exploración reveló un pasaje bloqueado por un colapso masivo que fue eventualmente superado. Más allá de él continuaba un pasaje de gran tamaño que llevó a un pasaje inundado ("sifón") a una profundidad de 1198 metros. El gran flujo de aire presente en las zonas superiores de la cueva se perdió en algún punto entre los grandes pasajes entre los campamentos 2 y 3. Una muy buena parte del tiempo fue dedicada a buscar un camino que evitara el sifón, sin lograr tener éxito. Finalmente, James Brown buceó el sifón, que resultó tener 150 metros de longitud y únicamente 7 metros de profundidad. Más allá encontró una bóveda de colapso con otro sifón, que no fue buceado debido a la falta de personal de apoyo con la capacitación adecuada.

Se exploraron varios pasajes laterales, algunos de los cuales eventualmente conectaron de nuevo con la zona ya conocida de la cueva. Uno de estos fue una serie independiente de tiros verticales de 160 metros de profundidad. La fuente de agua potable del campamento 2A fue explorada río arriba remontando cascadas unos 100 metros hacia el oeste, hasta la base de otra cascada. Hay una fuerte corriente de aire que baja por esa serie de pasajes. Se encontraron varias cuevas en las cercanías de J2, pero hasta ahora ninguna se ha logrado conectar con la zona ya explorada en la cueva. Éstas tienen el potencial de aumentar significativamente la profundidad de la cueva o de lograr evitar zonas en J2 cuyo recorrido no es muy agradable. Otra cueva, ubicada casi sobre el límite actual de exploración en J2, fue explorada y podría ser otra entrada y quizá una alternativa que evitaría los sifones, si es que conecta. La cueva J2 tiene una profundidad de 1209 metros y lleva el numero 38 en la lista de las cuevas mas profundas del mundo.

Apéndice A: Miembros de la
Expedición J2 2009

Jefes: Bill Stone, Jose Morales, Mark Minton, Marcin Gala, Jose Antonio Soriano

Tony Dwyer [Irlanda]
José Antonio Soriano Sanchez [México]
Luis Gabriel "Wicho" Diaz [México]
Tjerk Dalhuisen [Paises Bajos]
Katarzyna Kedracka [Polonia]
Yvonne Droms [Suiza]
Bill Stone [EE.UU.]
Jon Lillestolen [EE.UU.]
Mark Minton [EE.UU.]
Mark Stover [EE.UU.]
Matt Covington [EE.UU.]
Michael Frazier [EE.UU.]
James Brown [EE.UU.]
Kasia Okuszko [Polonia]
Victoria Siegel [EE.UU.]
Magda Aksman [Polonia]
Kasia Biernacka [Polonia]
Petr Caslavsky [Czech]
Anthony Castro [EE.UU.]
Michael Denneborg [Alemania]
Marcin Derlatka [Polonia]
Marcin Gala [Polonia]
Fofo Gonzalez [Mexico]
Nikki Green [EE.UU.]
Bart Hogan [EE.UU.]
Heather Levy [EE.UU.]
Jose Morales [EE.UU.]
Nina Mueller [Danada]
David Ochel [Alemania]
Paulina Olinkiewicz [Polonia]
Yuri Schwartz [Rusia]
Sergey Tkachenko [Rusia]



Sistema Cheve en mayo de 2006: Los nuevos descubrimientos realizados en 2006 en J2 se muestra por la línea verde. Extensiones importantes de Sumidero Aguacate (hecha en 2004) se muestran en rojo. El progreso muy limitado en J2 (línea verde) era debido al descubrimiento de Sifon 2, en el nivel de -1.209 metros. Una inmersión de reconocimiento fue hecha en 2006, que condujo al descubrimiento de Sifon 3, el tercer túnel bajo el agua en J2.

La Expedición de 2009 al Ozto J2

Expedición J2 2009

Hacia Nuevos Territorios, Empujando el Límite

Antecedentes: En 1987 la Cueva Cheve fue descubierta al explorar a una elevación de 3000 metros en las alturas de la Sierra Juárez en el noreste de Oaxaca, México. Actualmente se ha explorado hasta 1484 metros de profundidad y es la cueva más profunda en el hemisferio occidental y la número 11 en profundidad a nivel mundial. El límite de la exploración actual en Cheve (a 9.3 kilómetros de la entrada más cercana) representa uno de los sitios más remotos alcanzados dentro de una cueva en el planeta. La logística para llegar a este punto es impresionante: se requieren más de dos kilómetros de cuerda y tres campamentos subterraneos. La profundidad actual se alcanzó en 2003, durante una expedición de tres meses lidereada por exploradores de los EE. UU. que exitosamente apoyó a un equipo de cuatro buzos para la exploración más allá de dos túneles inundados a una profundidad en la cueva de 1362 metros. Los buceos fueron tremendamente exitosos y el equipo rápidamente exploró 1.3 kilómetros adicionales de nuevos pasajes. La exploración terminó al llegar a un antiguo colapso en en pasaje que impidió la progresión.

El Reto: Nadie ha regresado a la Cueva Cheve y el misterio de lo que todavía está por ser descubierto en las profundidades de la Sierra Juárez continúa. Sin embargo, en 2004 una expedición internacional de reconocimiento lidereada por el U.S. Deep Caving Team descubrió una cueva nueva llamada **J2**, ubicada en las alturas del bosque húmedo de montaña del Ocotal, a tan solo 5 kilómetros al noreste de Cheve. Fue inmediatamente aparente que J2 sería una cueva profunda y además la evolución era en dirección a Cheve, con una intersección proyectada más allá de los pasajes inundados que detuvieron la

Mapa del Terreno de la Zona del Sistema Cheve, Oaxaca, México

exploración en 2003. Durante tres expediciones en 2004, 2005 y 2006, J2 fue explorada hasta 10 kilómetros de la entrada más cercana, a una profundidad de -1209 metros. Para llegar a ese punto el grupo pasó dos túneles sumergidos, el Sifón 1 a -633 metros y el Sifón 2 a -1201 metros. El Sifón 2, de 150 m de longitud, llevó a una bóveda con aire y un tercer sifón. El Sifón 3 aún no ha sido explorado, pero la geología de la zona sugiere que será corto y que después de él hay galerías no inundadas extendiéndose hacia el noroeste, hipotéticamente intersectando el pasaje principal de Cheve.

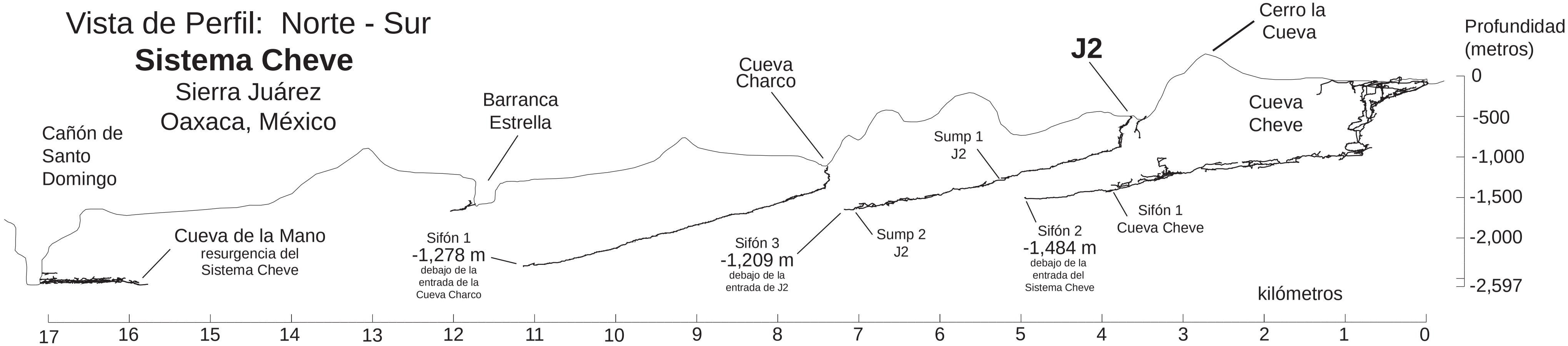
Se requerirán los últimos adelantos tecnológicos y un esfuerzo humando extraordinario. 20 miembros del equipo internacional de la expedición J2 2009 están entrenando con el equipo de buceo de recirculación MK6 diseñado por Poseidon Diving Systems. Este sistema es facilmente transportable al Sifón 2, donde la exploración principal iniciará en marzo de 2009. Buzos de exploración se internarán en el Sifón 3 y tenderán una linea de seguridad. Entonces, equipos de 6 a 8 personas iniciarán la exploración de los pasajes más allá del sifón, en lo que será seguramente uno de los proyectos de exploración original más remotos y excitantes de esta década.

Foto de Portada: El pozo de 60 m de entrada a Osto Atanasio, uno de los muchos posibles tributarios de J2.

Vista de Perfil: Norte - Sur

Sistema Cheve

Sierra Juárez
Oaxaca, México



Arriba: La gran escala del Sistema Cheve. El agua se interna en él a 3000 m de elevación. Después de 17 kilómetros, sale de manantiales 2547 metros más abajo, en las profundidades del Cañón de Santo Domingo.

La Misión: La expedición saldrá de Austin, Texas, la última semana de febrero de 2009 y estará en el campo por tres meses. El objetivo principal de la expedición en marzo de 2009 será explorar el Sifón 3 en J2, establecer el Campamento Subterraneo 4 en los pasajes no inundados posteriores al sifón y continuar la exploración hacia el hipotético conducto principal dentro de la Sierra Juárez. Si la exploración es exitosa, en abril y mayo el enfoque principal será en extender la exploración del conducto principal hacia el sur en dirección a Cheve y hacia el norte hacia los manantiales que sirven de resurgencia a Cheve. Una conexión con el Sistema Cheve resultará en un sistema con más de 2 kilómetros de profundidad. La integración de todo el sistema brindaría una cueva de 2597 metros de profundidad y sería el abismo subterraneo natural más profundo hasta ahora descubierto

Itinerario

Staging in Texas: February 25, 2009
Establish J2 Basecamp: March 1-7
Rigging to Sump 2: March 8-15
Main Push: March 16 - May 30, 2009

Organización

J2 2009 es organizada por el veterano explorador Dr. Bill Stone, e inclurá miembros altamente capacitados de los Estados Unidos, México, Polonia, Gran Bretaña, Canada, Irlanda, Paises Bajos, Rusia, Alemania y Suiza. La expedición es una actividad oficial del U.S. Deep Caving Team, Inc. (USDCT).

Sea un Patrocinador

El USDCT es una asociación científica y educativa sin fines de lucro 501(c3). Todas las aportaciones son deducibles de impuestos.

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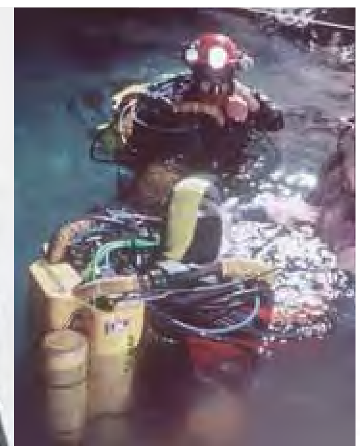
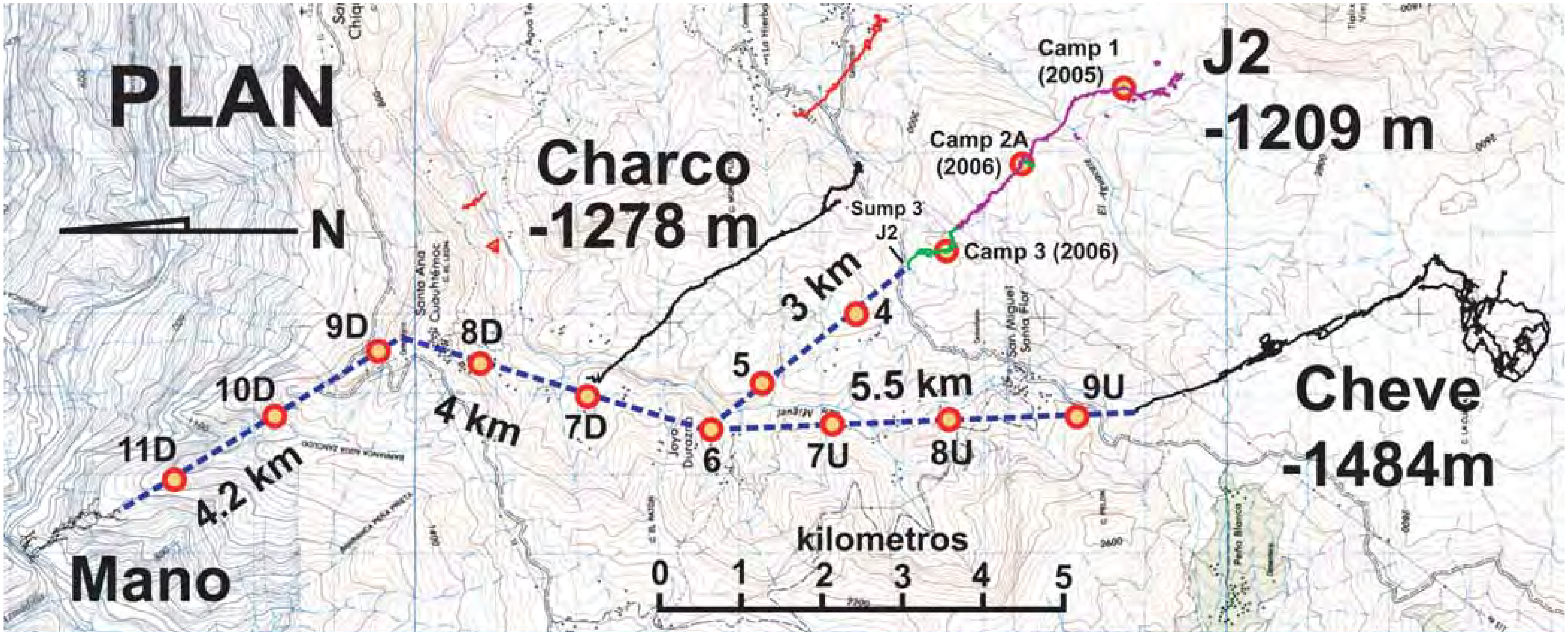


Nueva Tecnología para 2009:

En colaboración con el patrocinador de la expedición Poseidon Diving Systems de Suecia, la expedición está desarrollando una versión personalizada del equipo de buceo por recirculación MK6. El MK6 permitirá a los buzos principales y de apoyo trabajar bajo el agua por más de 3 horas a 60 m de profundidad.



Logística: El límite de la exploración actual en J2 representa un territorio completamente desconocido. El mapa aquí incluído muestra la topografía de la superficie (en vista de planta) junto con los principales sistemas de cuevas de la Sierra Juárez. Las lineas punteadas azules representan una visión hipotética simplificada de lo que podría ser descubierto más allá de estos límites. Lo que está ya explorado fue alcanzado a través de una difícil exploración y mapeo durante 14 expediciones a lo largo de 21 años. La distancia recorrida por debajo de la tierra puede ser de dos a tres veces la distancia en linea recta sobre la superficie. Es necesario recorrer aproximadamente 10 kilómetros bajo la tierra desde la entrada de J2 para llegar al inicio del Sifón 3. Esto es más allá de los límites de la resistencia humana. Para poder llegar ahí el viaje será segmentado en porciones de 8 a 12 horas de viaje (cargando una mochila pesada) y se establecerán campamentos subterraneos en esos puntos. Hay actualmente tres campamentos subterraneos en J2, con el más profundo (Campamento 3) a una profundidad de 1100 m y a medio día de viaje del Sifón 2. Inmediatamente se establecerá un pequeño campamento entre los sifones 2 y 3 mientras la exploración del Sifón 3 es llevada a cabo. Después se establecerá formalmente el Campamento 4 en una zona seca más allá del Sifón 3 y se continuará la exploración río abajo a partir de él. El mapa indica con círculos rojos y amarillos los campamentos actuales y proyectados que se requerirán para explorar todo el Sistema Cheve desde la entrada de J2. Como referencia histórica, hasta la fecha nadie ha establecido más de tres campamentos subterraneos necesarios para la progresión en una cueva. Estimamos que se requerirán hasta 11 para llegar a la resurgencia y 9 para llegar a Cheve río arriba. Ya que cada campamento representa un día de viaje bajo la tierra, una exploración exitosa en el corazón de la Sierra Juárez implicará estancias bajo la tierra de un mes o más.

Derecha: Descenso en las "Cataratas de Pesadilla" ("Nightmare Falls"), cerca del fondo de la Cueva Cheve

La exploración de Cueva de la Mano y la Cueva Cheve 1986 – 2003 y el comienzo de la exploración en J2 2004-2006

En las páginas siguientes se presenta una historia cronológica de la exploración de Cueva de la Mano y Cueva Cheve en las fotos. Estos le muestran lo que sucedió a partir de la superficie y proceder más en las cuevas hasta que las imágenes finales muestran los límites de exploración alcanzado en 2001 (adentro Cueva de la Mano) y 2003 (en Cueva Cheve), respectivamente. Concluimos con una colección de imágenes sacadas en el área J2 entre 2004 y 2006. Las ultimas fotos muestran el descubrimiento de Sifon 2, el segundo túnel submarino encontrado en J2.

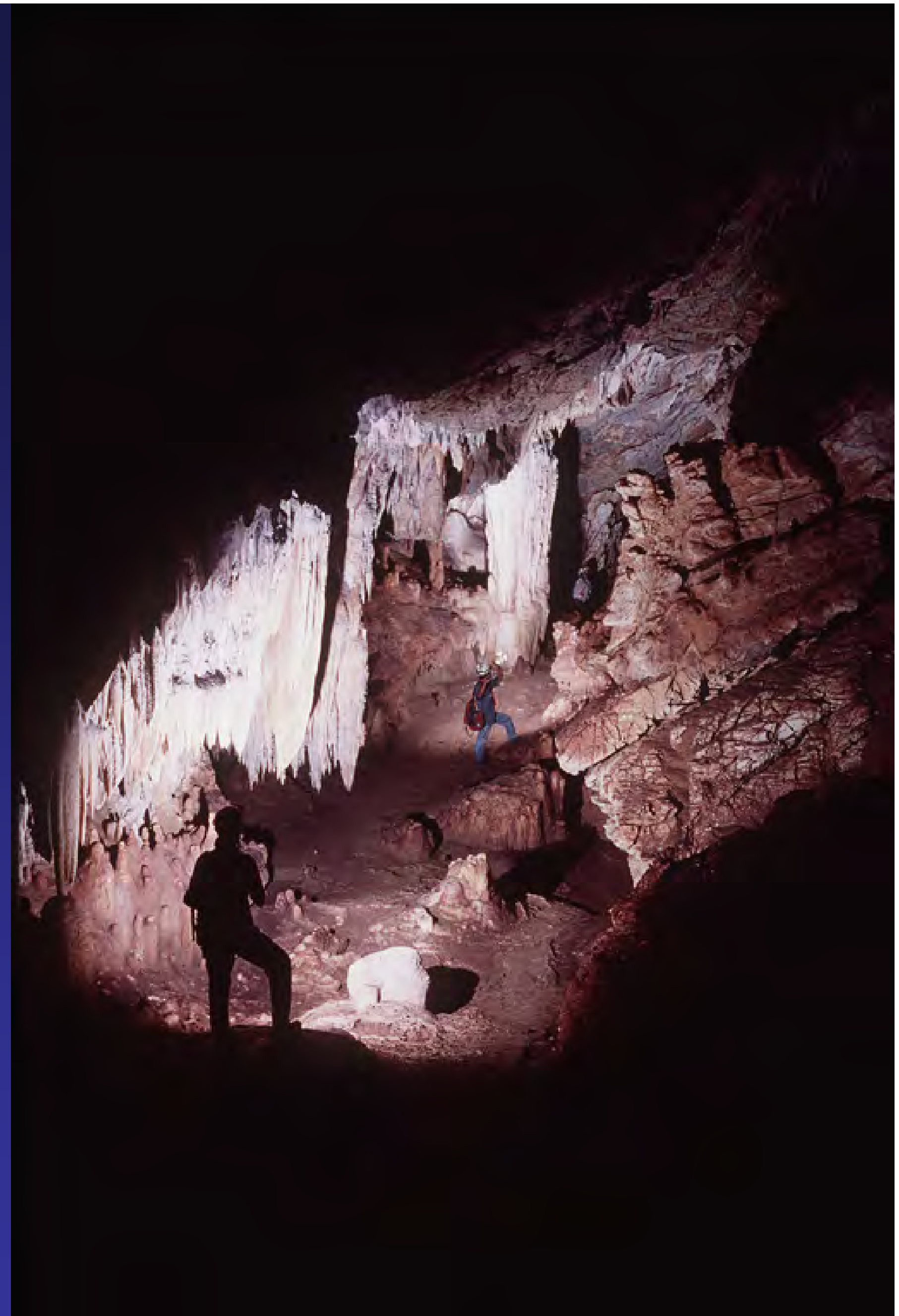
La Exploracion del Sistema Cheve y J2

Escrito por Bill Stone
Equipo Estadounidense de
Exploracion de Cuevas Profundas

Sistema Cheve Area
Oaxaca, Mexico

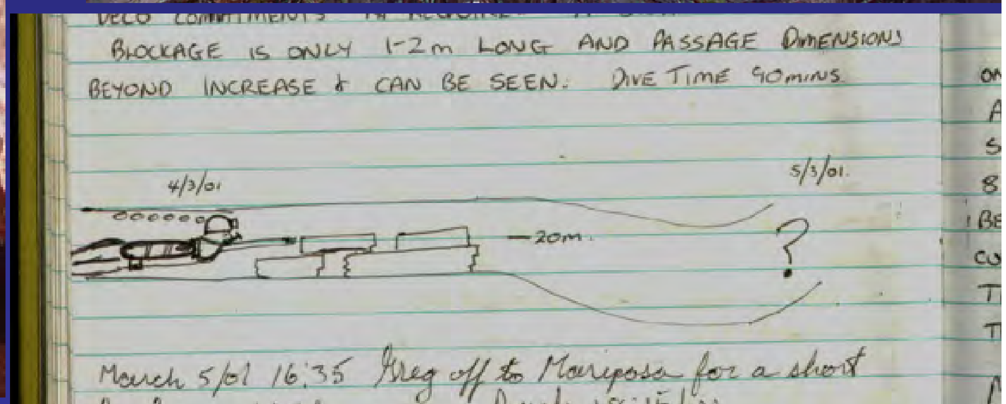
La Barranca Santo Domingo

Cueva de la Mano

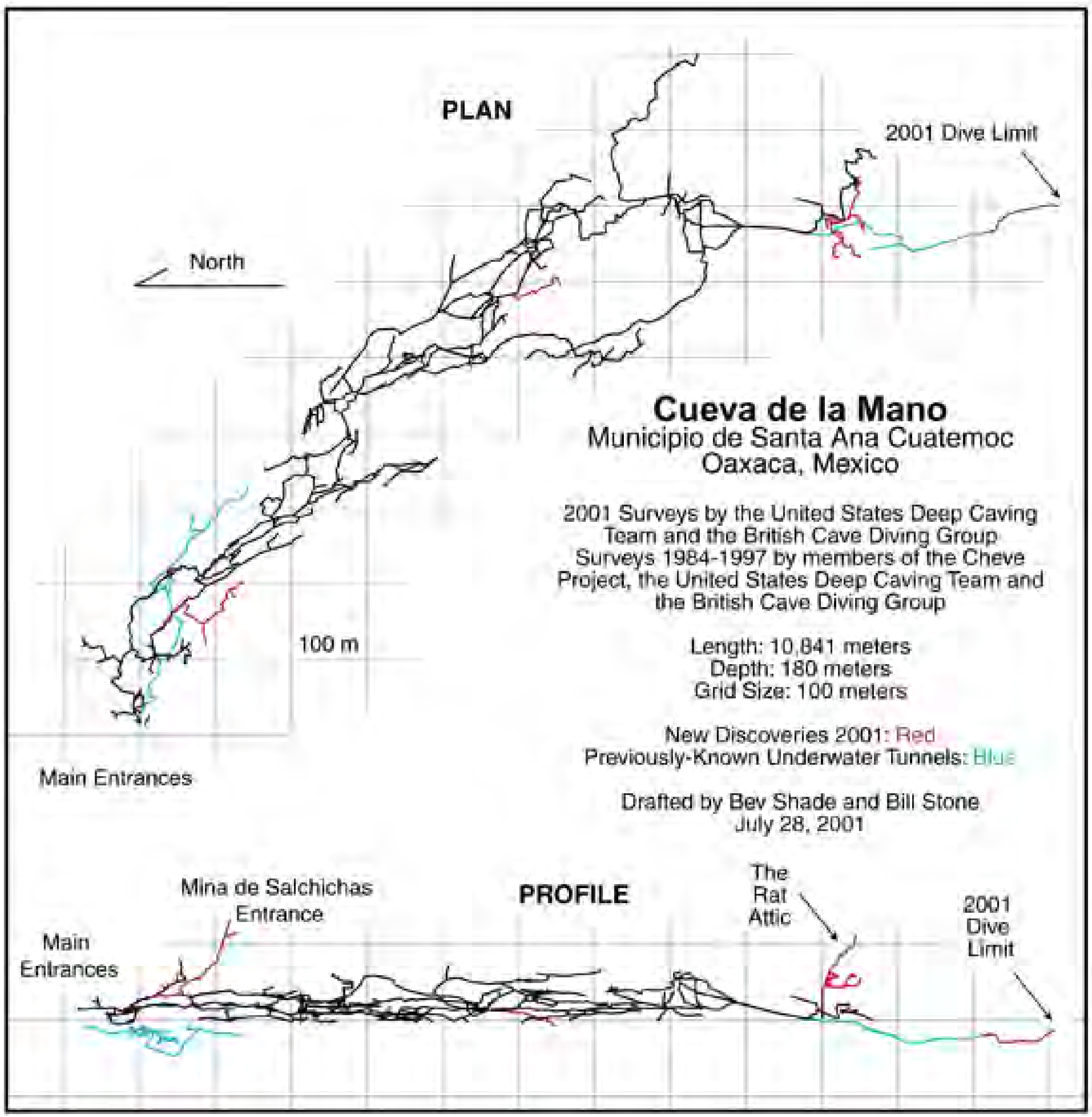
Cueva de la Mano


Cueva de la Mano



El Sifon Sur, Cueva de la Mano. Los esfuerzos de buceo en 2001 alcanzaron un derrumbe bajo el agua a una distancia de 470 m

Pero, arriba del sifon, se encuentra un domo. Escalamos 100 m… encontrando otro derrumbe.



Límites de exploración en Cueva de la Mano

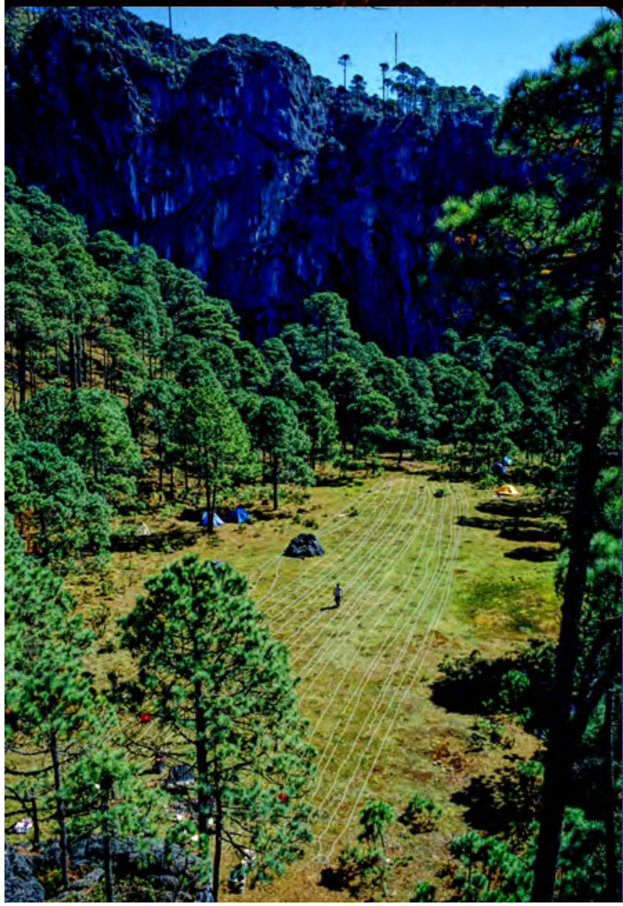
Longitud: 10.8 km
Profundidad: 180m

Partes en color azul son inundados

Partes en color rojo fueron descubiertas en 2001

CHEVE 2003

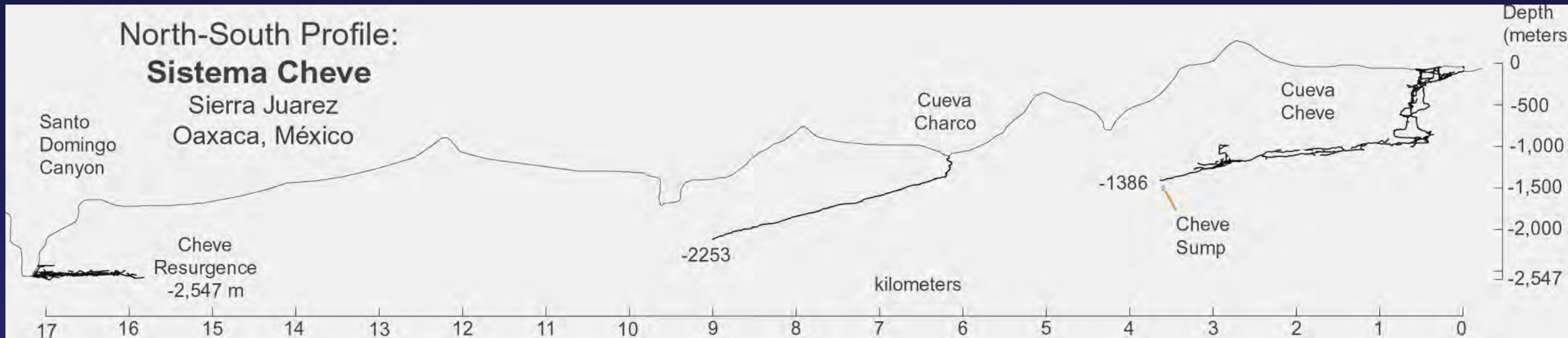
El esfuerzo de buceo en el Sifon Cheve



La Sierra Juarez, vista desde Cuicatlán

Llegada al Llano Cheve:
Campamento Base para la
Exploracion de Cueva Cheve

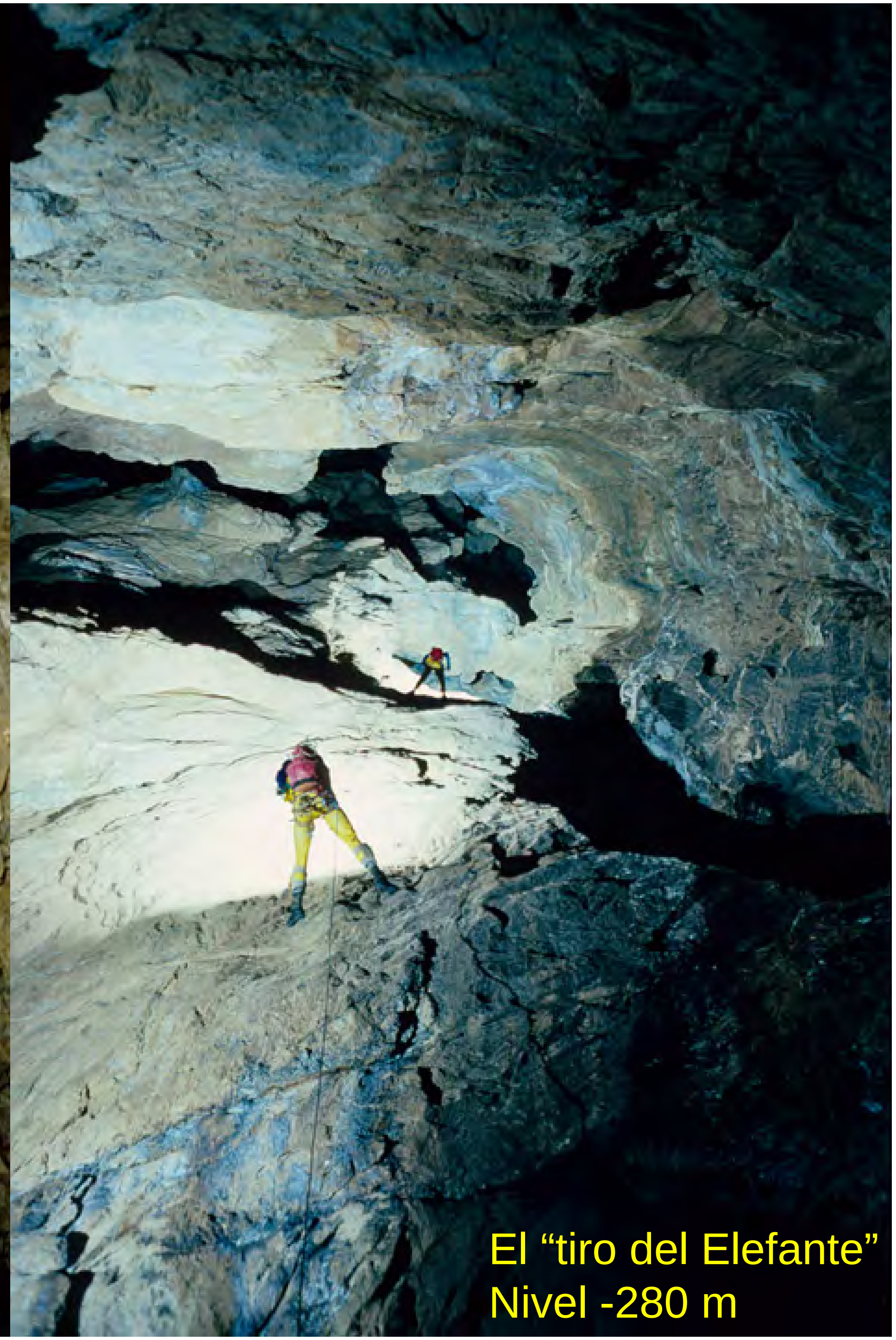
Los tres componentes principales de Sistema Cheve en 1997:
Cueva Cheve, Cueva Charco, y el Nacimiento Rio Frio de Santa Ana.



Primer “tiro” vertical en Cueva Cheve.

Para alcanzar al fondo en 1997, se requirio mas de 3,000 metros de cuerda para armar mas de 92 tiros y travesías .

Nivel: - 50 m



El “tiro del Elefante”
Nivel -280 m

Cascada de Los Angeles

Nivel -320 m

Primer tiro de 50 m en
El “Pozo Saknussemms”

Nivel -500 m

El segundo tiro de 100 m en el “Pozo Saknussemms”
Nivel -580 m

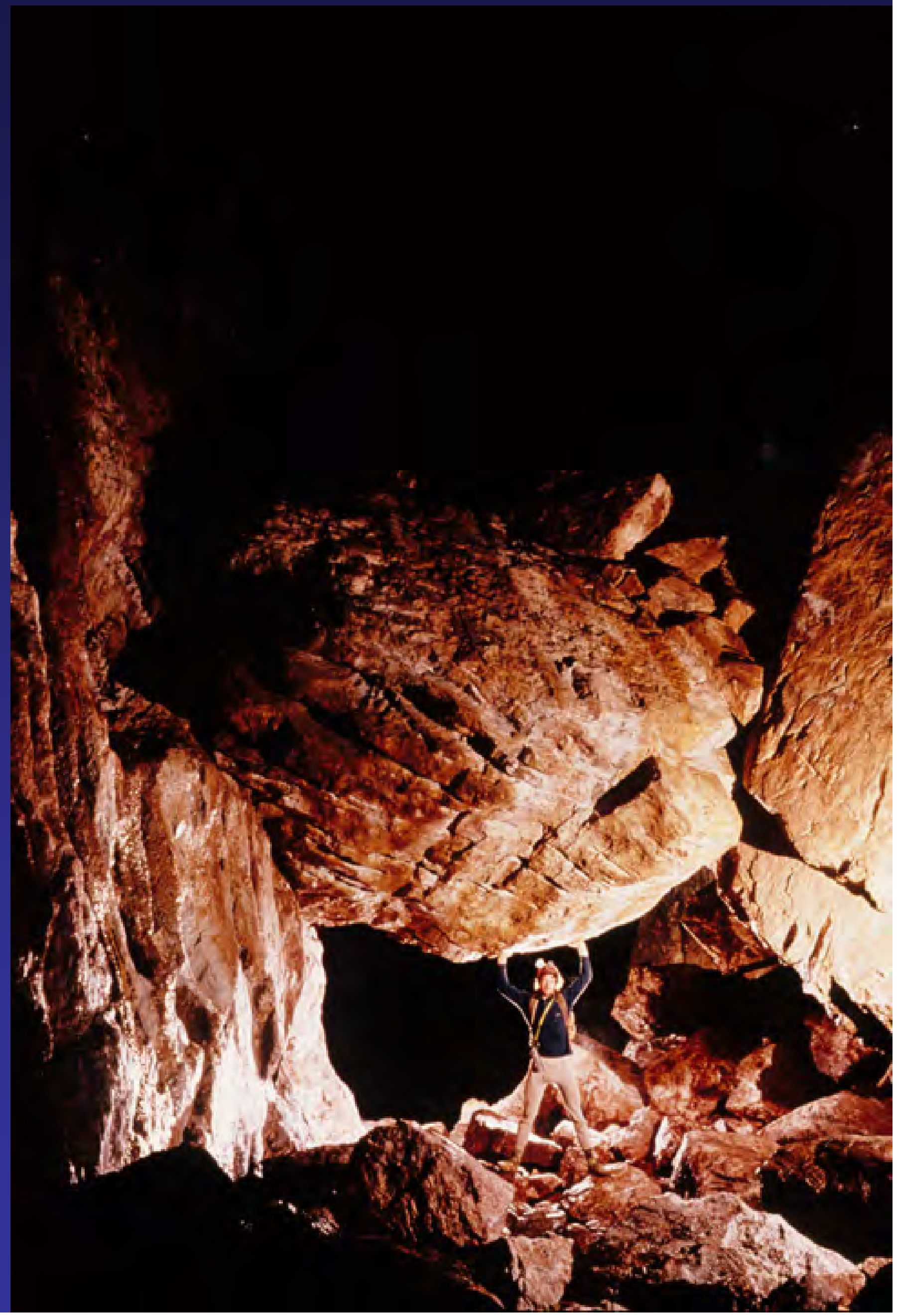
La Escalera del Salmón : Nivel -650 m

Transportando los aparatos de buceo a través de las turbinas.

Campamento 2 y un descanso informal en el Conducto Negro.

El Pasillo de Gigantes Agitados: Nivel -900 m

El Conducto de Arne Saknussemm: Nivel -1000 m



Campamento 3 Cueva Cheve: Nivel -1025 m

Cascada de la Pesadilla: Nivel -1300 m

Transportando aparatos de buceo en la barranca abajo del Campamento 3, abril 2003

Cascada de La Pesadilla: Nivel -1300 m

El paso de la grieta momentos antes del Sifon 1

Sifon 1 Cheve: -1362 m

Derecha: preparando para el esfuerzo del 6 y 7 abril, 2003

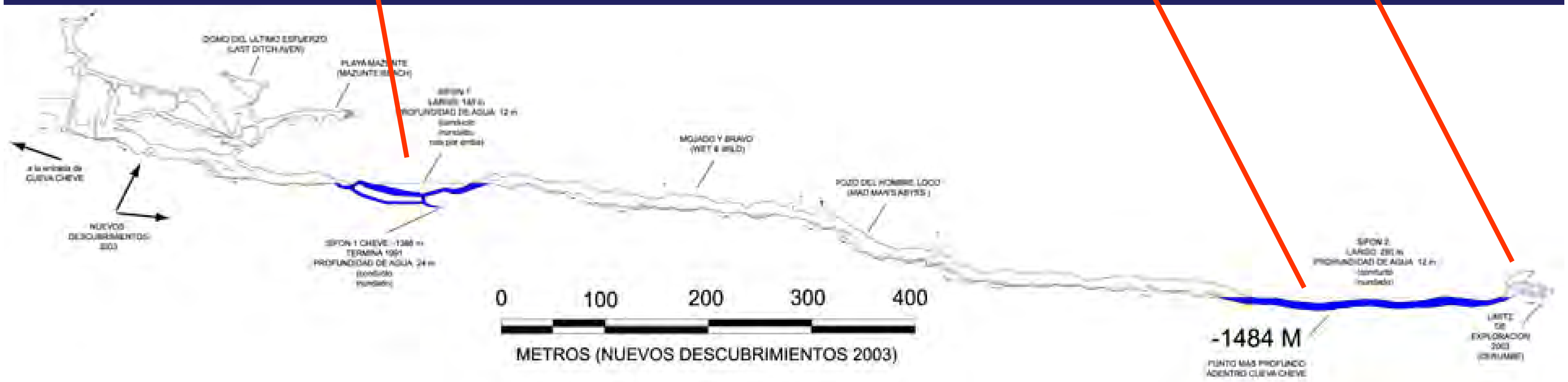
El espeleobuceo con recicladores se ha convertido en el procedimiento estándar para los túneles subacuáticos en cuevas muy profundas.

En Cheve un total de ocho buceos fueron hechos en 2003 a través del Sifon 1 y 2.
La logística de hacer esto sin recicladores habría sido imposible.

Sifon 1:
Profundidad: -22 m
Longitud: 140 m

Sifon 2:
Profundidad: -12 m
Longitud: 280 m

Derrumbe



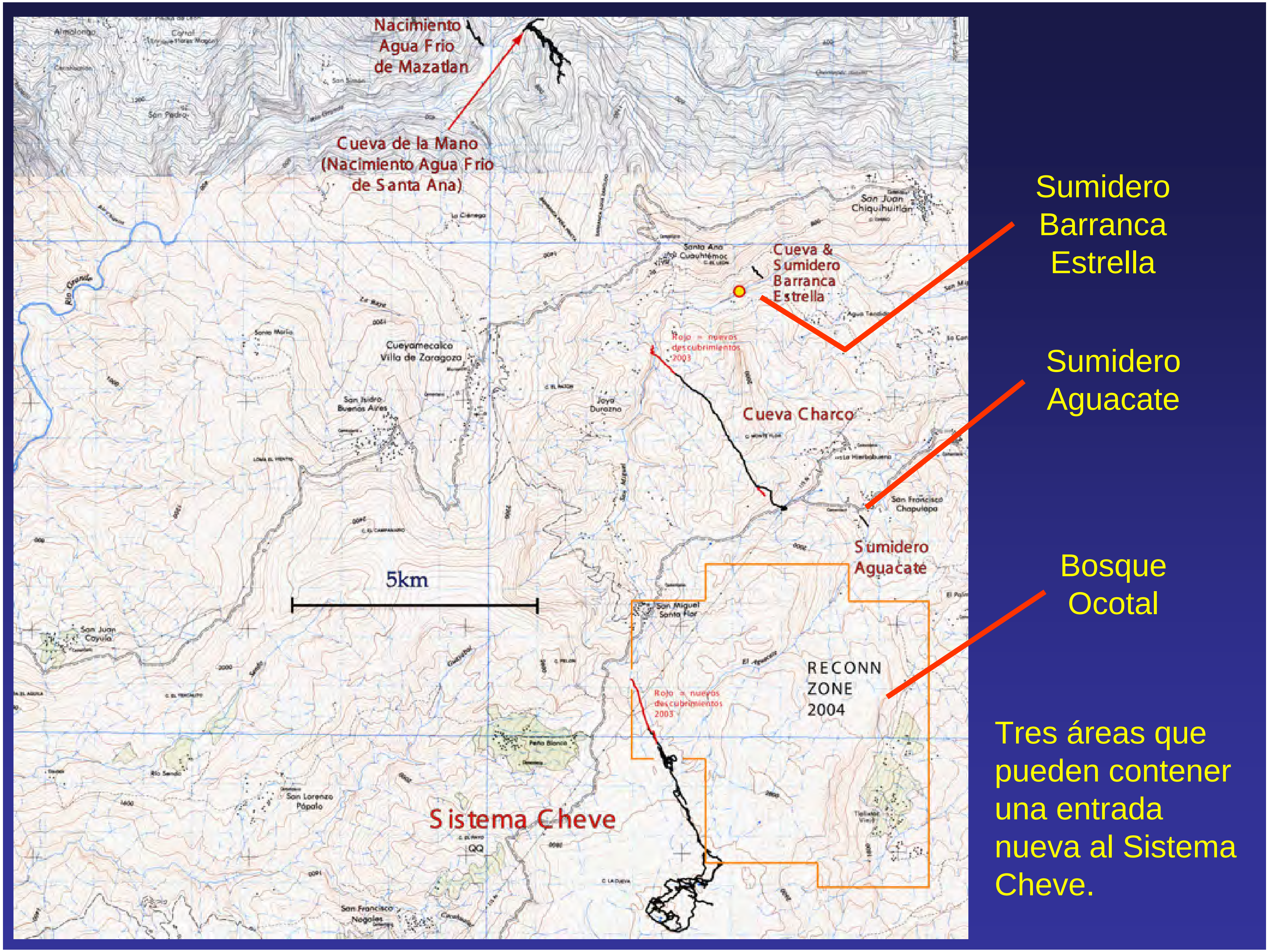
Resultados de la expedición 2003:

420 m de conductos inundados fueron atravesados con éxito
2 kilómetros de nuevos descubrimientos en todo.

Pero, el límite de la exploración es bloqueado por un derrumbe

CHEVE 2004

La búsqueda de
la puerta trasera
de
Cueva
Cheve



Nacimiento Agua Frio de Mazatlan
Cueva de la Mano (Nacimiento Agua Frio de Santa Ana)
Cueva & Sumidero Barranca Estrella
Rojo = nuevos descubrimientos 2003
Cueva Charco
Sumidero Aguacate
RECONN ZONE 2004
5km
Sistema Cheve
Sumidero Barranca Estrella
Sumidero Aguacate
Bosque Ocotal
Tres áreas que pueden contener una entrada nueva al Sistema Cheve.

La área alta de piedra caliza arriba de el EL Ocotal.   Este bosque de niebla es una de las áreas más alejadas y más dificiles de la zona Cheve.

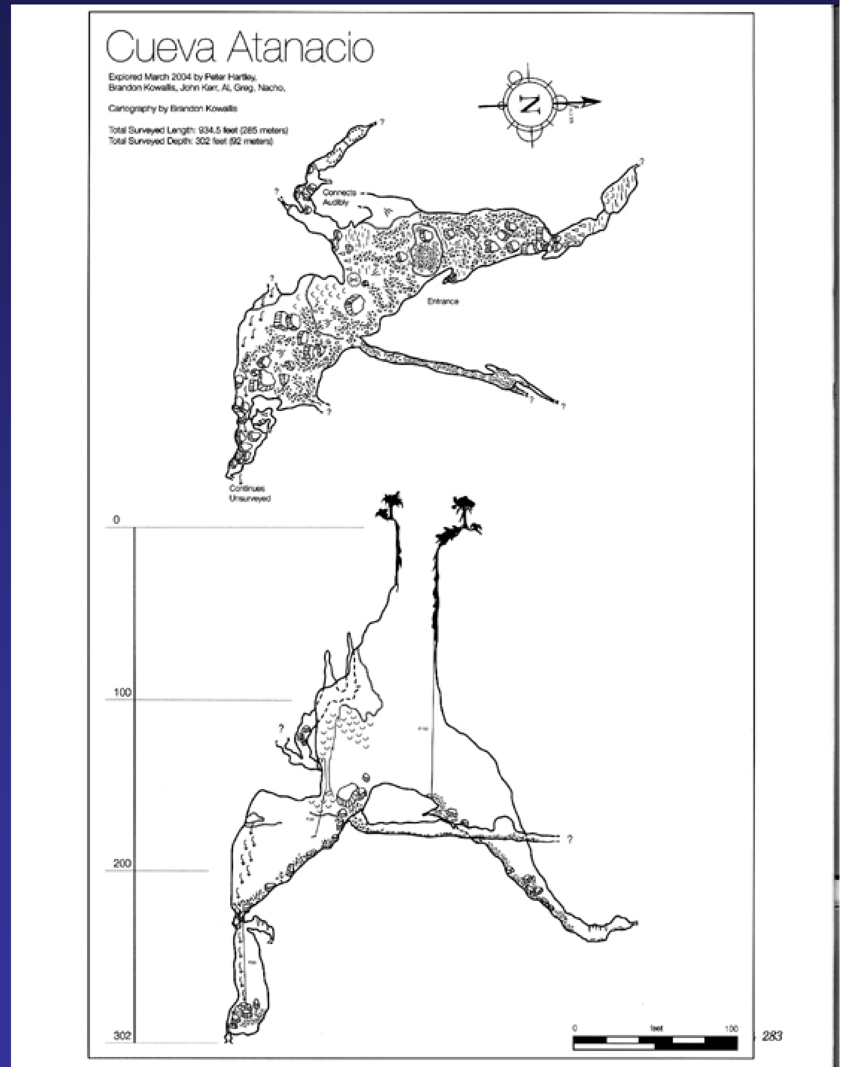
Vegetación típica en el bosque de niebla de El Ocotal.


bosque de niebla de El Ocotal.

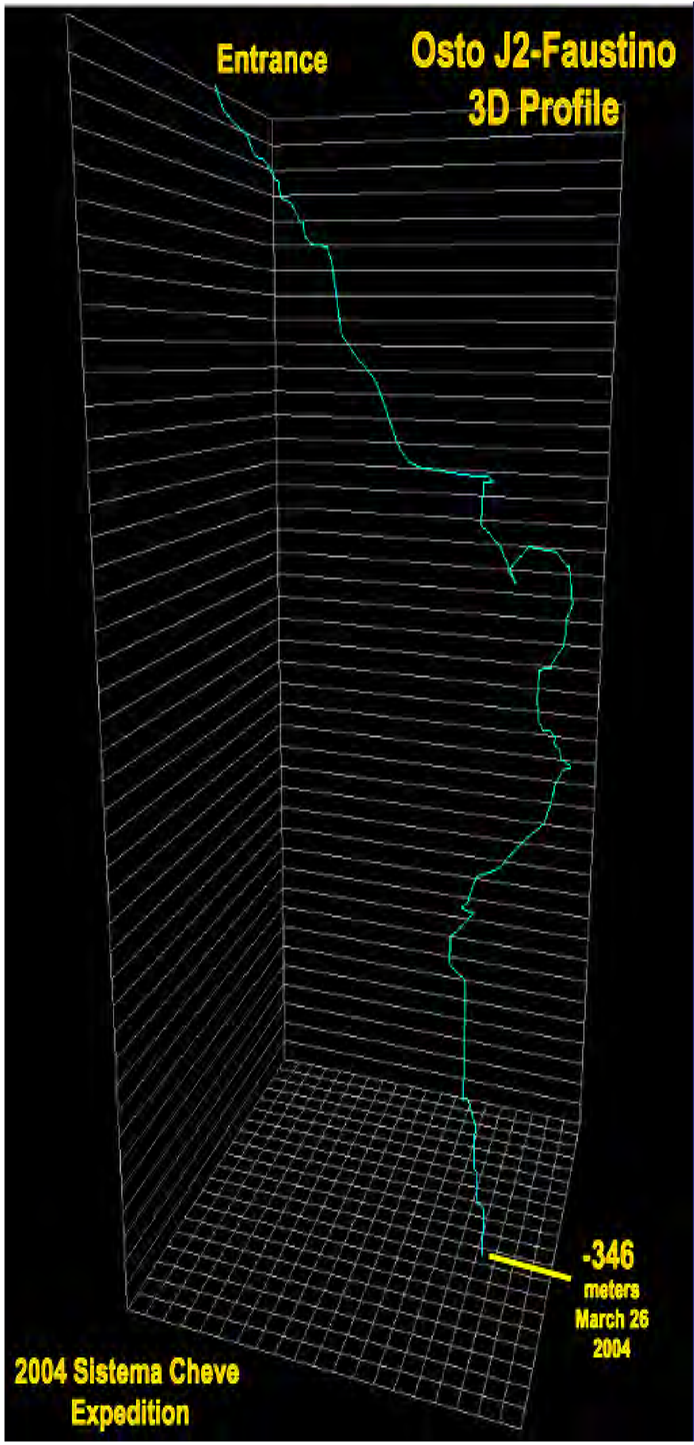
El pozo “P25” : Cueva de Atanacio

El Pozo "P25" :

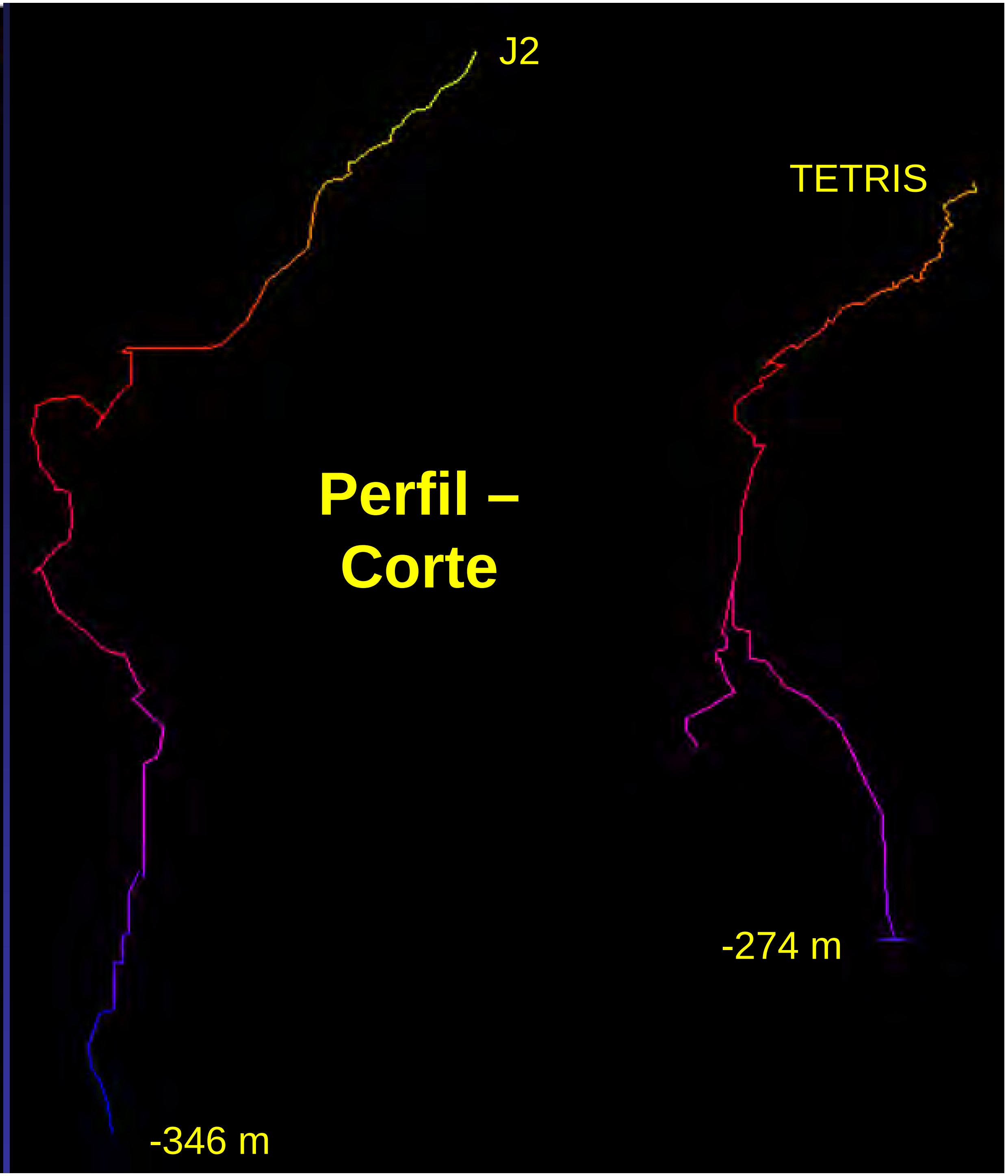
Cueva Atanacio




"J2"
Osto Faustino



Entrance
Osto J2-Faustino
3D Profile
-346
meters
March 26
2004
2004 Sistema Cheve
Expedition



J2
TETRIS
Perfil –
Corte
-274 m
-346 m

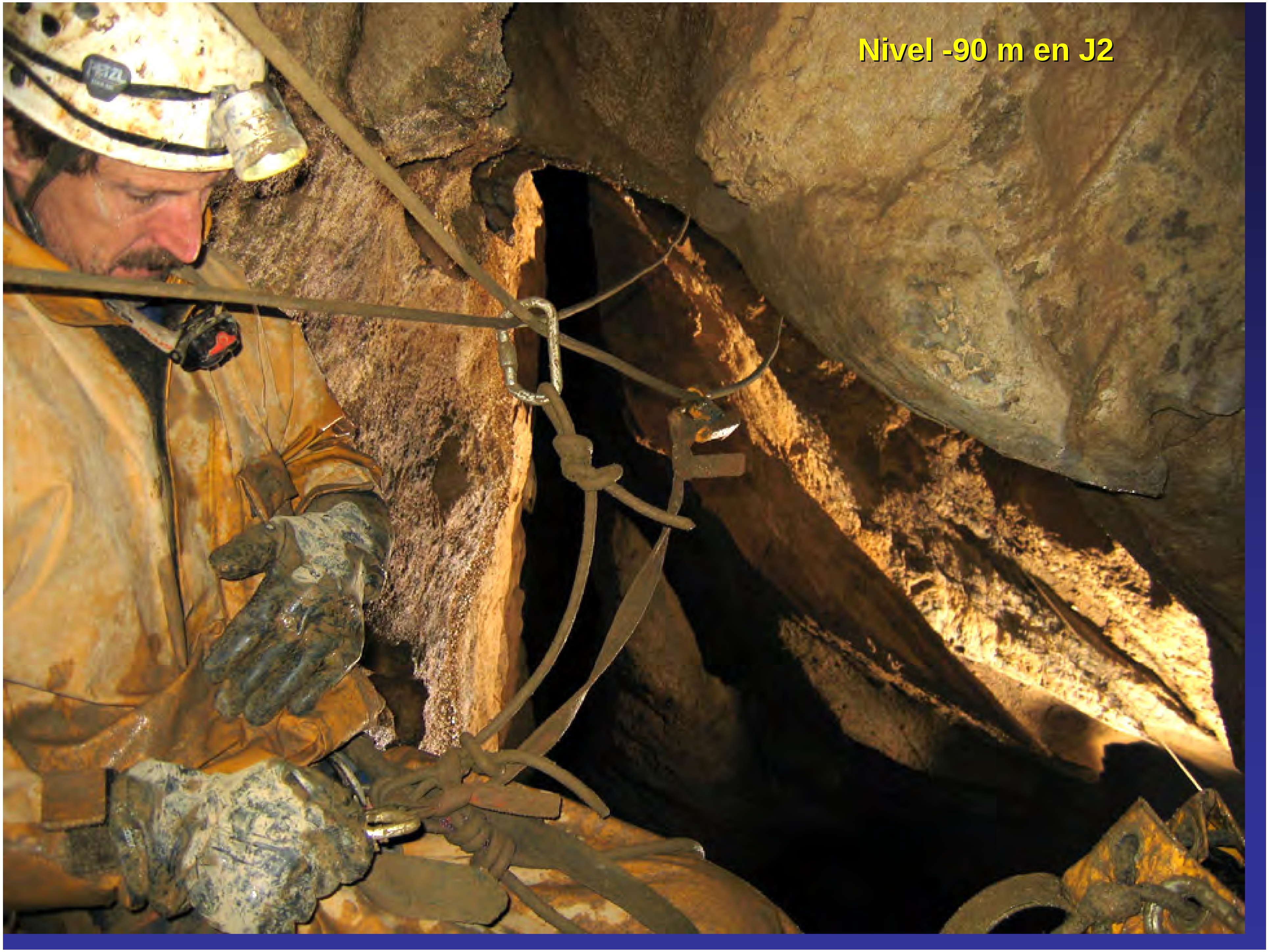
J2

2005

Campamento base para J2 en el bosque de niebla de El Ocotal.

Nivel -60m en J2


Nivel -110 m en J2


Nivel -90 m en J2


Nivel - 480 m en J2


J2
Camp 1
-553m


J2 Campamento 1

Nivel - 580 m en J2


Nivel - 560 m en J2


Nivel - 600 m en J2

J2
Camp 2
-633m


J2
Camp 2
-633m


J2
Camp 2
-633m


J2
Camp 2
-633m


J2
Camp 2
-633m

Comiendo
El
Desayuno
En
J2
Camp. 2
-633m

J2
Camp 2
-633m

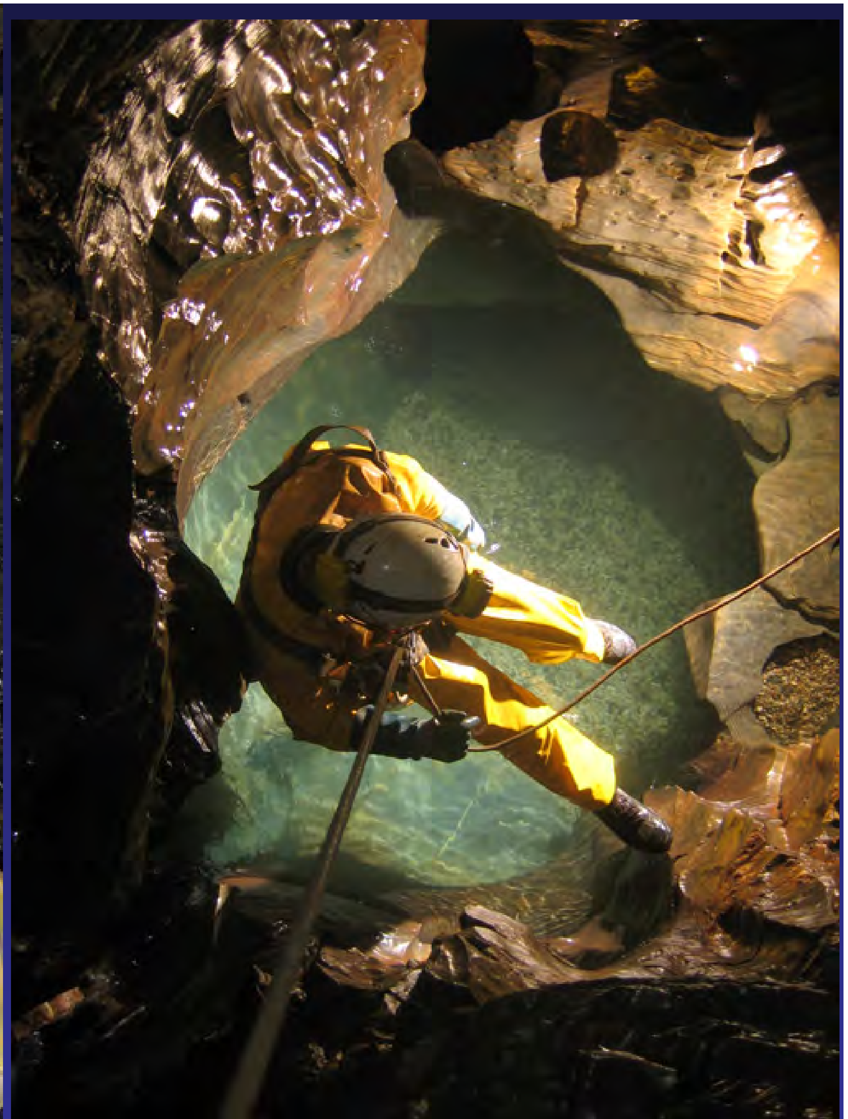
Sifon 1
-663m

Sifon 1
-663m


Sifon 1
-663m


Telefono de
seguridad
Para
comunicar
Atras de
Sifon 1
-663m


Otro lado de
Sifon 1
-663m



Nivel
-550m
J2

Nivel
-750m
J2


Nivel
-800m
J2

En
campamento
Base:
determinando
La profundidad
al fin de 2005:

-1101 m

J2
2006

Nivel
-350m
J2

Nivel
-780m
J2


J2
Campamento 2A
-800 m


J2: Campamento 2A   -800 m

J2: Campamento 2A -800 m

J2:
Campamento 2A
-800 m
Recargando
Pilas para
luces

Nivel
-890m
J2

Nivel
-840m
J2


Nivel
-1000m
J2

Nivel -780m J2


Nivel
-1000m
J2

Nivel
-1000m
J2


Niv
-108
J


J2
Camp. 3
-1100 m


J2
Camp. 3
-1100 m


J2
Camp. 3
-1100 m


J2
Camp. 3
-1100 m

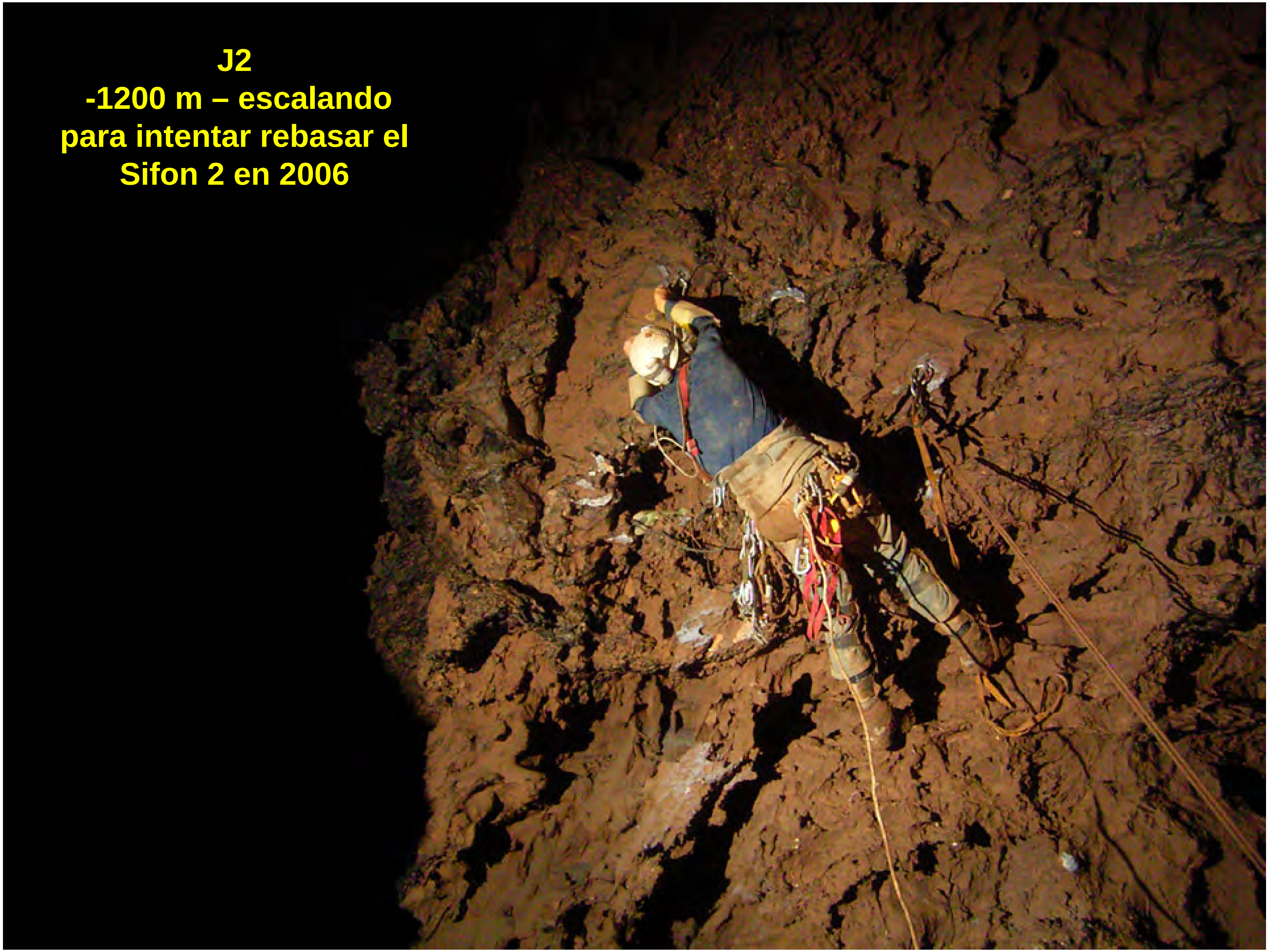
J2
Camp. 3
-1100 m

J2
Nivel
-1150 m

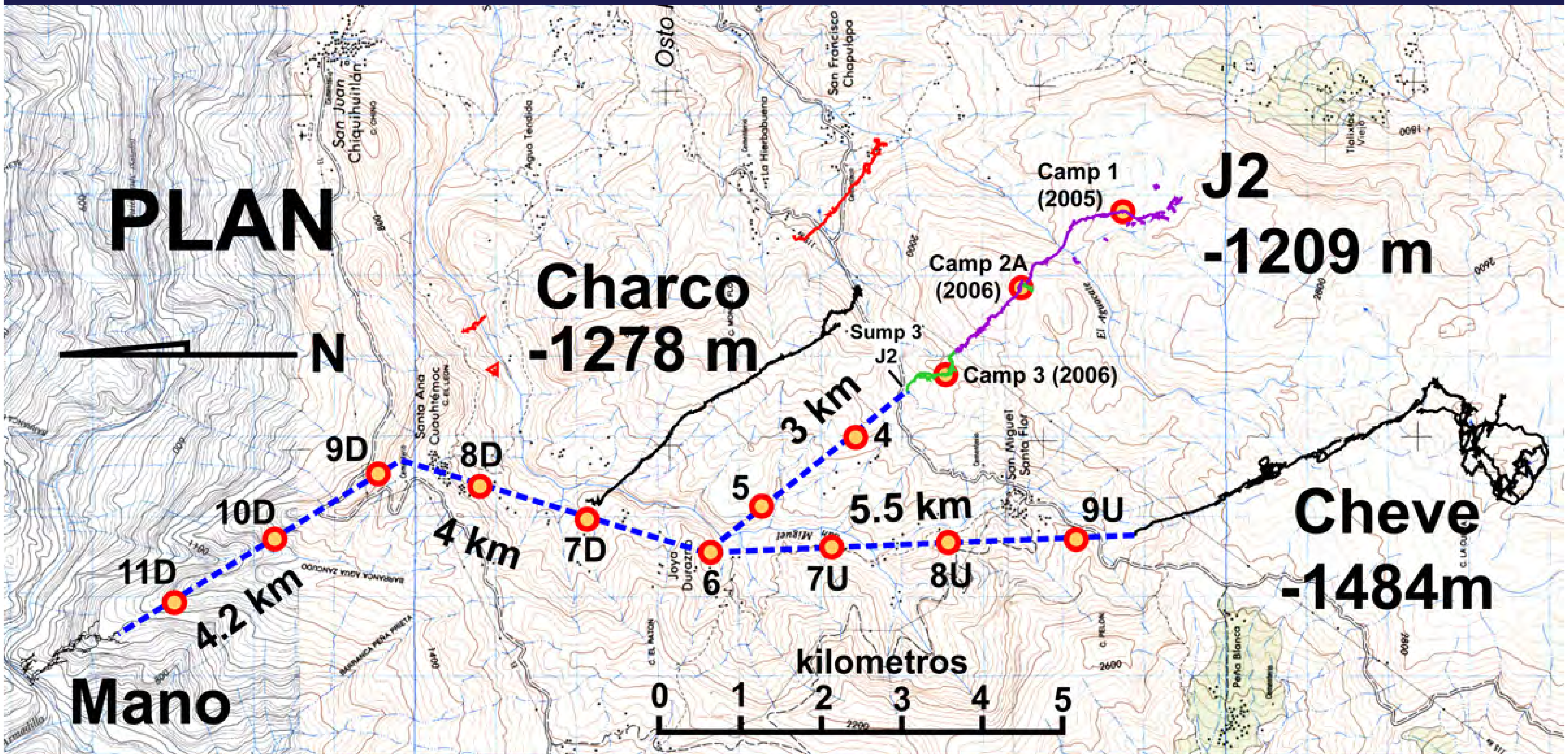
J2
Camp. 3
-1201 m

Sifon 2

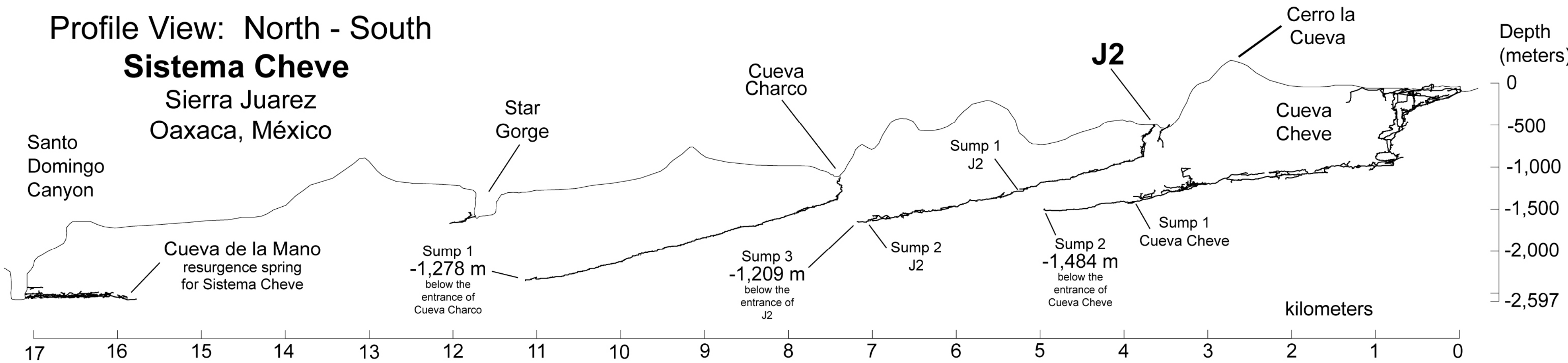
J2
-1180 m – escalando para intentar rebasar el Sifon 2 en 2006


J2
-1200 m – escalando
para intentar rebasar el
Sifon 2 en 2006

Expedicion 2009 J2: Vista del Sistema Cheve en Plano



Expedicion 2009 J2 : Vista en Perfil de Sistema Cheve



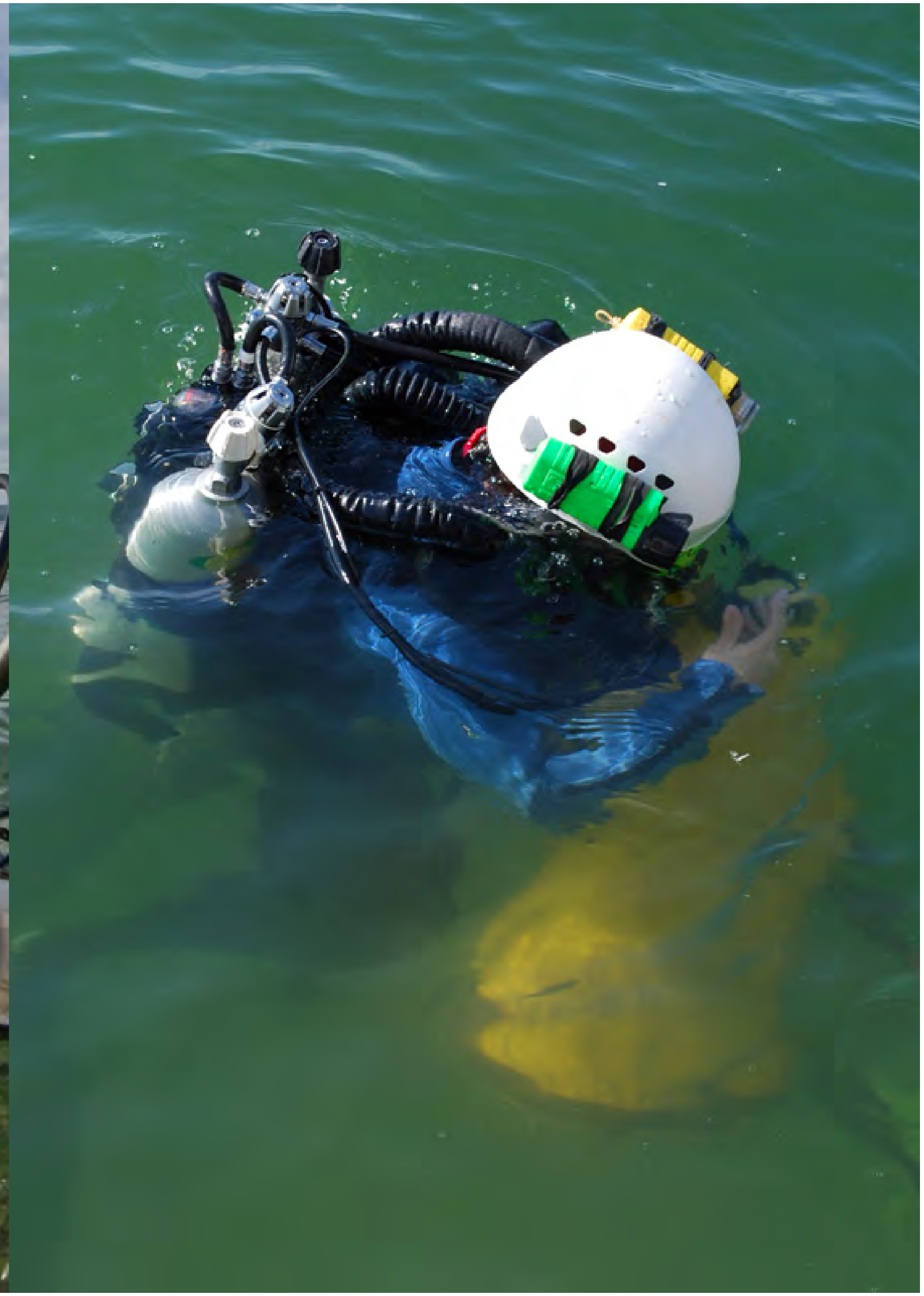
2009 J2: Equipo de Espeleobuceo

Mk6 reciclador

2009 J2: Equipo de Espeleobuceo

2009 J2: Equipo de Espeleobuceo

2009 J2: Equipo de Espeleobuceo

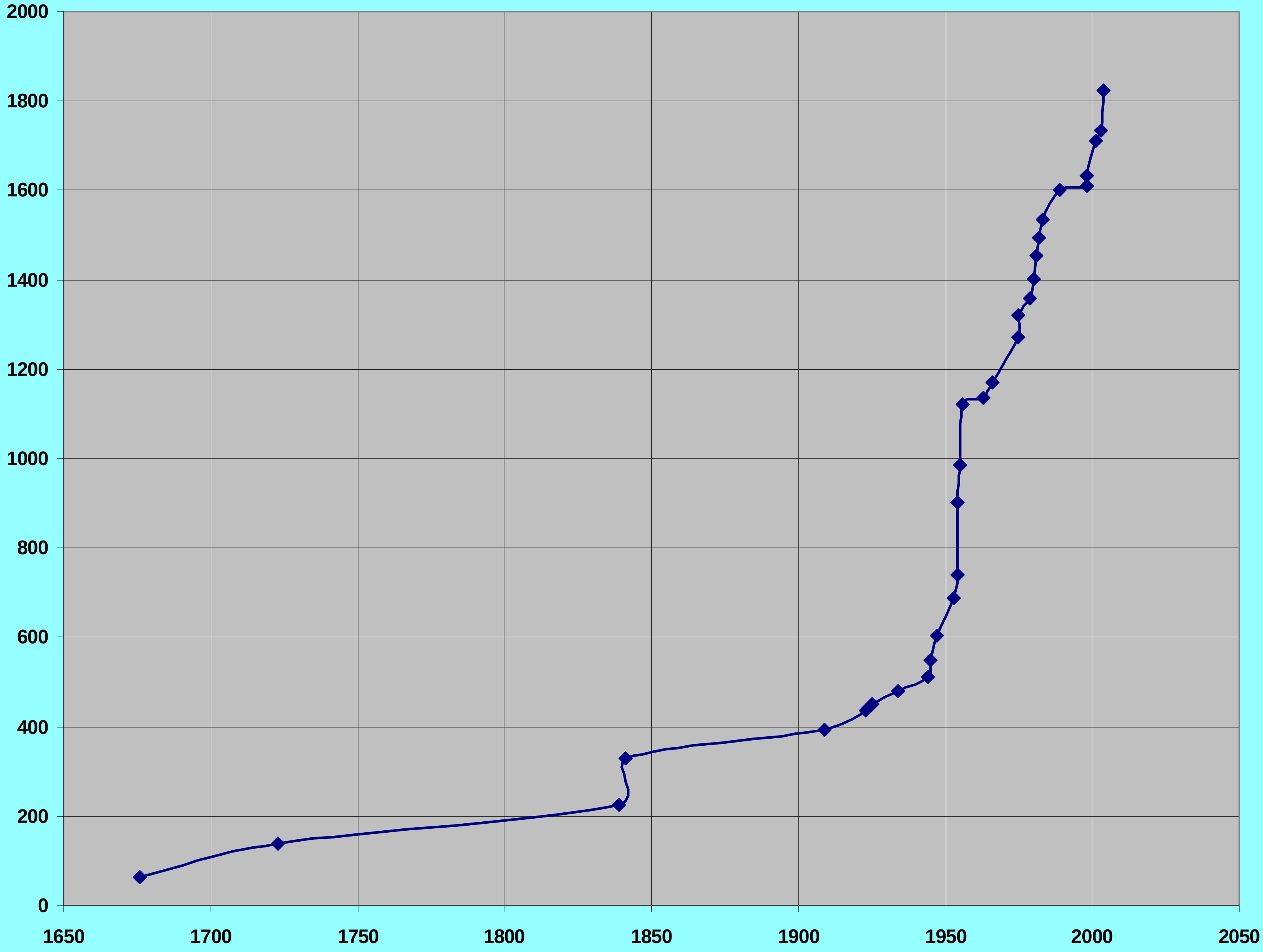


Equipo de Espeleobuceo 2009 J2: 35 participantes; 12 paises; 14 espeleobuzos;
Fechas: 12 de marzo – 30 de mayo 2009
Enternando en Texas para: Sierra Juarez, Oaxaca, Mexico
Municipalidades de San Francisco Chapulapa y San Miguel Santa Flor
Distrito de Cuicatlan

Lista de Cuevas mas profundas del Mundo por Fecha

1676	Lamb Leer	England	64
1748	Macocha Propast	Czech (Czechoslovakia)	138
1839	Grotta di Padriciano	Italy	226
1841	Abisso di Trebiciano	Italy	329
1909	Nidlenloch	Switzerland	394
1923	Geldloch	Austria	437
1925	Abisso Bertarelli	Croatia (Yugoslavia)	450
1934	Antro di Corchia	Italy	480
1944	Système de la Dent de Crolles	France	512
1945	Système de la Dent de Crolles	France	549
1947	Système de la Dent de Crolles	France	604
1953	Sima de la Piedra de Saint-Martín	Spain	689
1954	Gouffre Berger	France	740
1954	Gouffre Berger	France	903
1955	Gouffre Berger	France	985
1956	Gouffre Berger	France	1122
1963	Gouffre Berger	France	1135
1966	Réseau de la Pierre Saint-Martin	France/Spain	1171
1975	Réseau de la Pierre Saint-Martin	France/Spain	1273
1975	Réseau de la Pierre Saint-Martin	France/Spain	1321
1979	Réseau Jean-Bernard	France	1358
1980	Réseau Jean-Bernard	France	1402
1981	Réseau Jean-Bernard	France	1455
1982	Réseau Jean-Bernard	France	1494
1983	Réseau Jean-Bernard	France	1535
1989	Réseau Jean-Bernard	France	1602(?)
1998	Gouffre Mirolda	France	1610(?)
1998	Lamprechtsofen	Austria	1632
2001	Voronja (Krubera)	Abkhazia (Georgia)	1710
2003	Gouffre Mirolda	France	1733(?)
2004	Voronja (Krubera)	Abkhazia (Georgia)	1823

Profundidad de la cueva mas honda del Mundo por Fecha



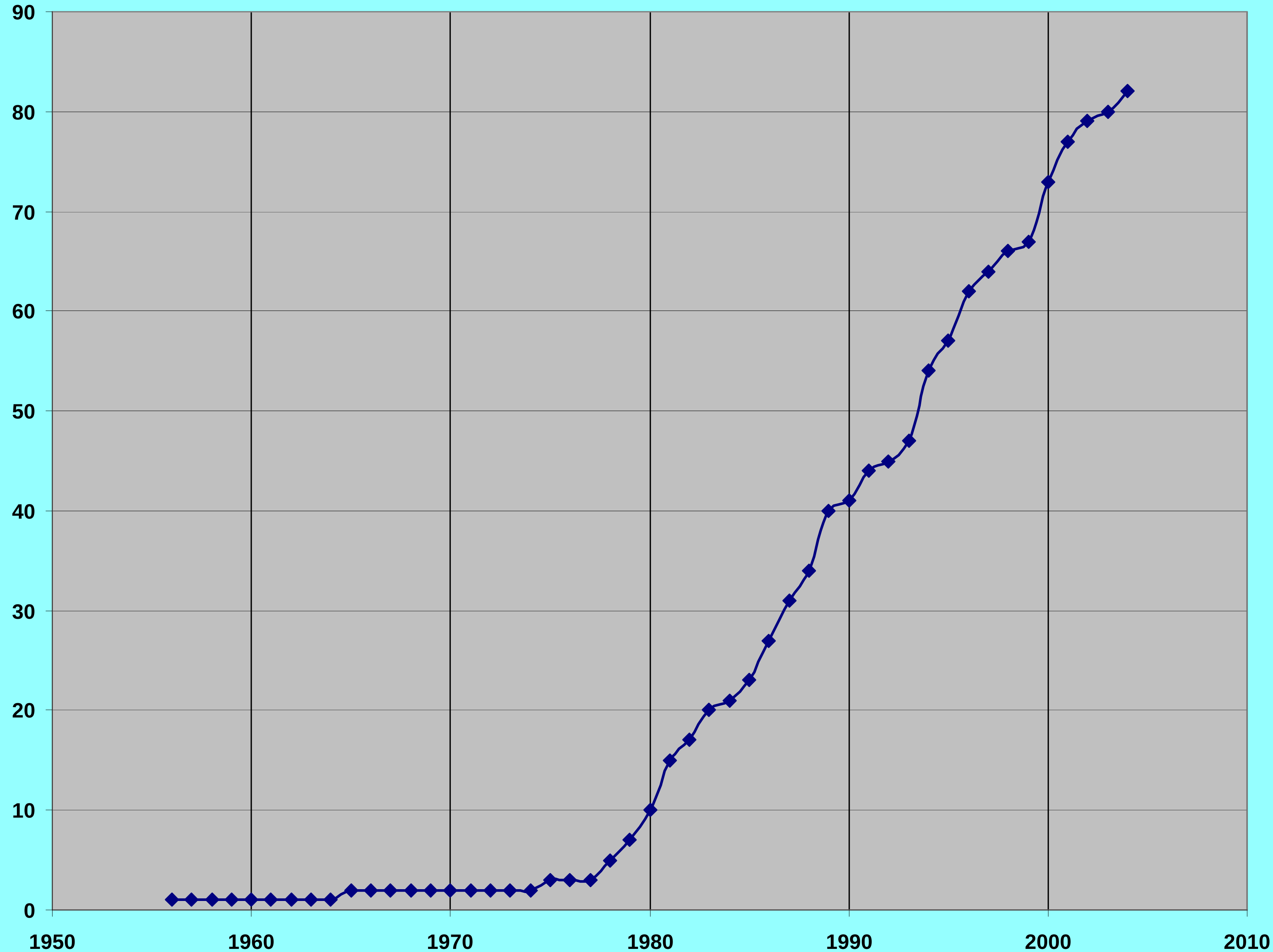
Las Cuevas mas Profundas del Mundo: 1980

1. Réseau Jean-Bernard	France	1402
2. Réseau de la Pierre Saint-Martin	France/Spain	1332
3. Sneznaja	Georgia (USSR)	1320
4. Sistema Huautla	Mexico	1222
5. Illaminako Ateeneko Leizea	Spain	1192
6. Gouffre Berger	France	1148
7. Sistema Badalona	Spain	1149
8. Schneeloch	Austria	1101
9. Sima G.E.S. Málaga	Spain	1098
10. Lamprechtsofen	Austria	1005
11. Réseau de Aiguilles	France	980
12. Réseau Félix Trombe - Henne-Morte	France	975
13. Kievskaja	Uzbekistan (USSR)	964
14. Antro del Corchia	Italy	950
15. Cambou de Liard	France	926

Las Cuevas mas profundas del Mundo: 2004

1.	Voronja (Krubera)	Abkhazia (Georgia)	1823
2.	Lamprechtsofen	Austria	1632
3.	Gouffre Mirolda	France	1626(?)
4.	Réseau Jean-Bernard	France	1602(?)
5.	Torca del Cerro	Spain	1589
6.	Sarma	Georgia	1543
7.	Ceki 2	Slovenia	1533
8.	Vjacheslava Pantjukhina	Georgia	1508
9.	Sistema Cheve	Mexico	1484
10.	Sistema Huautla	Mexico	1475
11.	Sistema del Trave	Spain	1441
12.	Evren Gunay Düdeni	Turkey	1429
13.	Boj-Bulok	Uzbekistan	1415
14.	Illaminako Ateeneko Leizea	Spain	1408
15.	Lukina Jama	Croatia	1392

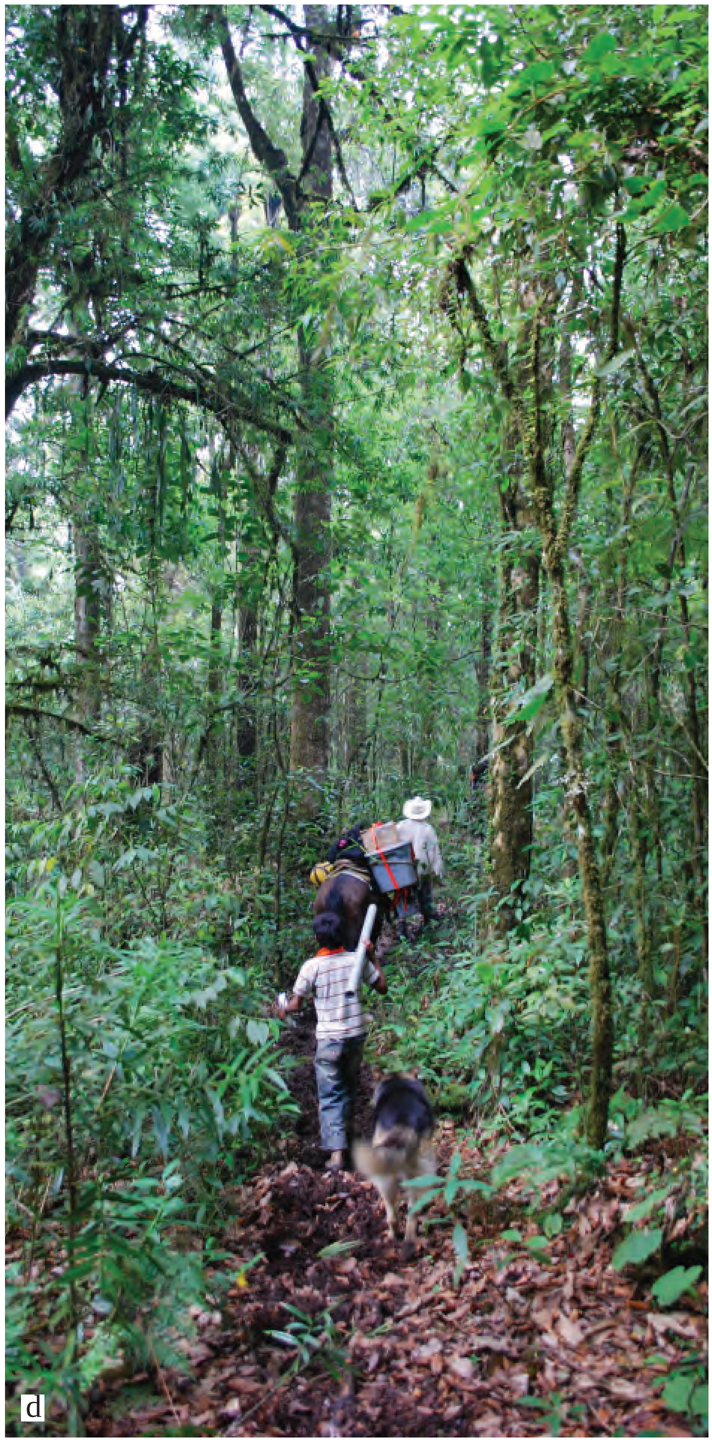
Numero de Cuevas de mas de 1,000 metros de profundidad conocidas por Fecha



la Expedición 2009 J2

En las páginas siguientes se presenta una historia cronológica de la expedición 2009 a la cueva J2 en las fotos. Estos le muestran lo que sucedió a partir de la superficie y proceder más en la cueva hasta que las imágenes finales muestran el límite de exploración alcanzado en 2009.

a) El obstáculo principal en J2 es una serie de túneles submarinos comenzando a una profundidad de -1209 metros bajo la superficie. Todo debe ser ligero debido a la gran distancia. Utilizamos tanques especiales de gas comprimido hecho de fibra de carbono. Los tanques más pequeños en la imagen permitirá a una persona a permanecer bajo el agua durante 3 horas; los tanques más grandes permitirá una inmersión de 6 horas. b) la montaña por encima Chapulapa, c) el campamento temporal cerca de Chapulapa, d) la organización de alimento para durar tres meses.



a) la preparación de material de buceo para el transporte al campo base, b) equipo de buceo especial, incluyendo absorbente de dióxido de carbono que se utiliza en los respiradores especiales, c) en el camino por encima Chapulapa; d) en el bosque Ocotal.

a) grandes helechos en el bosque, b) las flores que crecen en los árboles en el bosque, c) campamento base en 2009; d) Transporte de equipo de buceo a caballo al campo base.

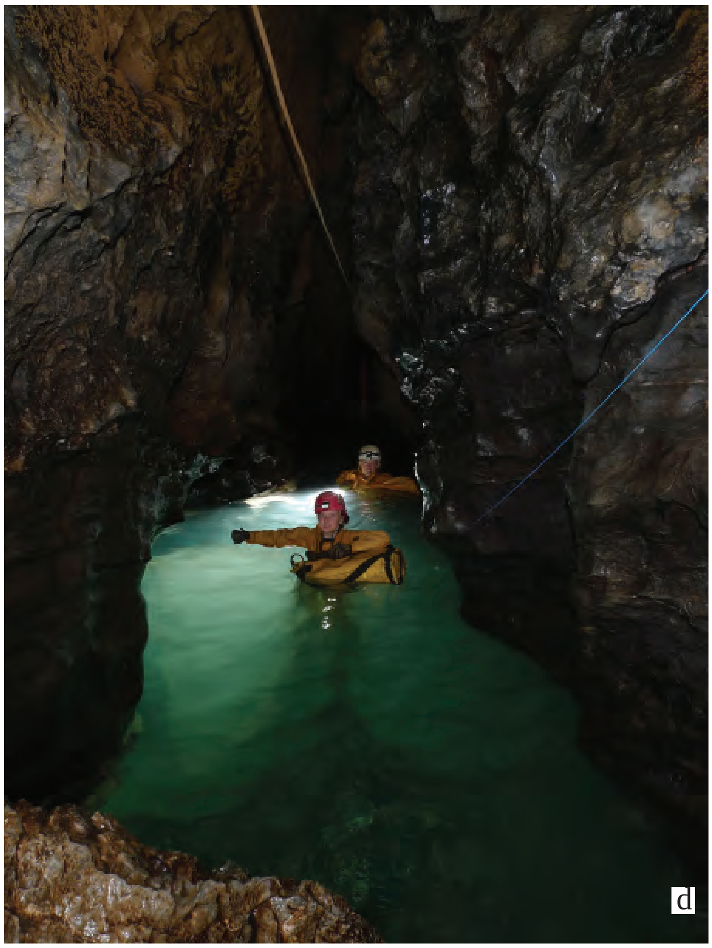
a) Comprobación de equipo de buceo después del transporte; b) la programación de la computadora que opera el equipo de buceo; c) la verificación de las mangueras de respiración para el equipo de buceo; d) el almacenamiento de alimentos para el transporte a los campos subterráneos dentro J2; e) la cena en campamento base.

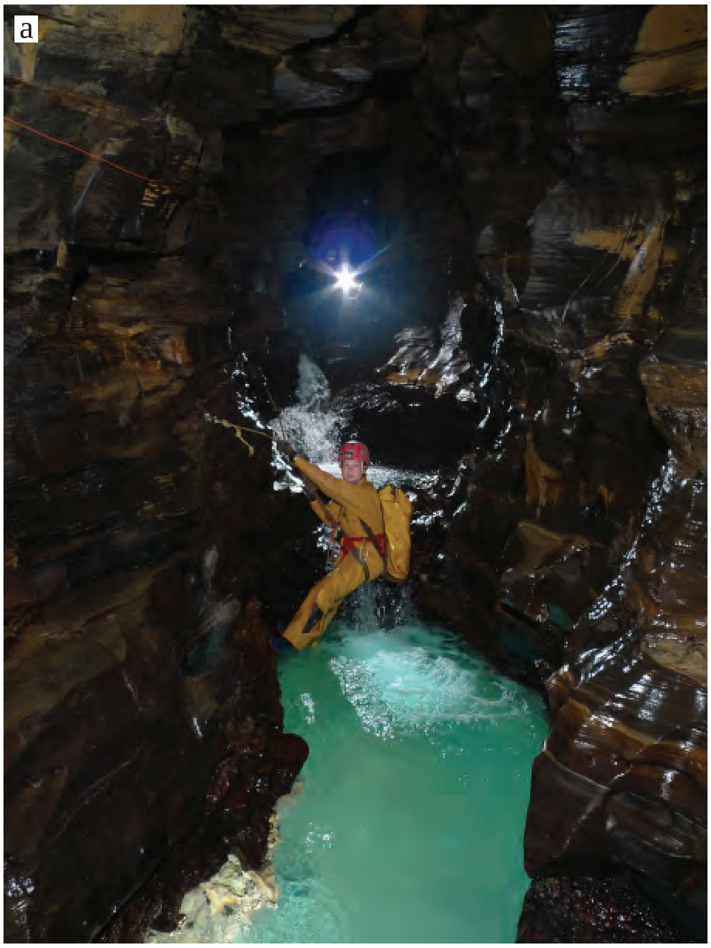
a) reparación de aparato para ascender cuerda en campamento base; b) el uso del teléfono para comunicarse con los campamentos dentro J2; c) Otra vista del teléfono - que funciona con un solo cable; d) la revisión de los planes de exploración; e) la entrada de J2; f) casco y luces estándar utilizado para los viajes en J2.

a) la primera fosa en J2: - 20 metros de profundidad; b) una vista del mismo pozo desde la parte inferior; c) la segunda fosa en J2; d) el cuarto pozo en J2, también unos 20 metros de profundidad. Utilizamos pernos de anclaje para anclar las cuerdas. Utilizamos cuerda de nylon de 9 mm diametro para todos los descensos en la cueva.

a) comenzar el descenso del pozo 140 metros de profundidad, empezando al nivel -300 m en J2; b) a -550 metros de profundidad se estableció el Campamento 1; c) hacer la cena en el Campamento 1. Nosotros usamos los alimentos secos en polvo para reducir el volumen durante el transporte por medio de conductos estrechos. Las botellas de plástico se utilizan para mantener la comida seca. usamos las botellas más grandes para nuestra ropa seca; d) Dormir en el Campamento 1. la temperatura de la cueva es 10C y sacos de dormir debe ser utilizado; e) el desayuno en el Campo 1. la lona de plástico se utiliza para impedir que las gotas de agua de mojar los sacos de dormir.

a) uno de los cientos de maniobras en cuerda en J2 (en el nivel -600m); b) descenso de un pozo de 30 m en el nivel -650 m. el color de las bandas en la roca muestra las diversas declaraciones antiguas de piedra caliza; c) el Campo 2, un campamento temporal usado en 2005 y 2006 en el nivel -630 m; d) nadando uno de los canales mucho más allá de Campamento 2, a -700 m nivel en J2 en la “Quebrada Negro”.





a) La travesía de en la cuerda arriba de un canal profundo, -780 m en J2 en la "Quebrada Negro" b) un cañón típico con corriente fuerte en el nivel -790 m de J2; c) subir las cascadas en el nivel -800 m de J2. A causa del viento y el agua es bastante fría en J2 llevamos un traje de plástico y ropa interior de lana sintética. El equipo se lleva en una bolsa suspendida por debajo de nuestro arnés de escalada.

Una vista de Campamento 2A, en el nivel -800 metros de J2, a cinco kilómetros de la entrada. La tienda de campaña está hecha de tela muy delgada. La tienda entera cabe en una botella de plástico de cuatro litros. La usamos para detener el viento - que puede alcanzar velocidades de hasta 20 kilómetros por hora a través de este túnel; b) Un equipo de siete personas pueden dormir dentro de la tienda, y c) Los tanques de buceo están protegidos con relleno de espuma para que no se dañan durante el transporte.

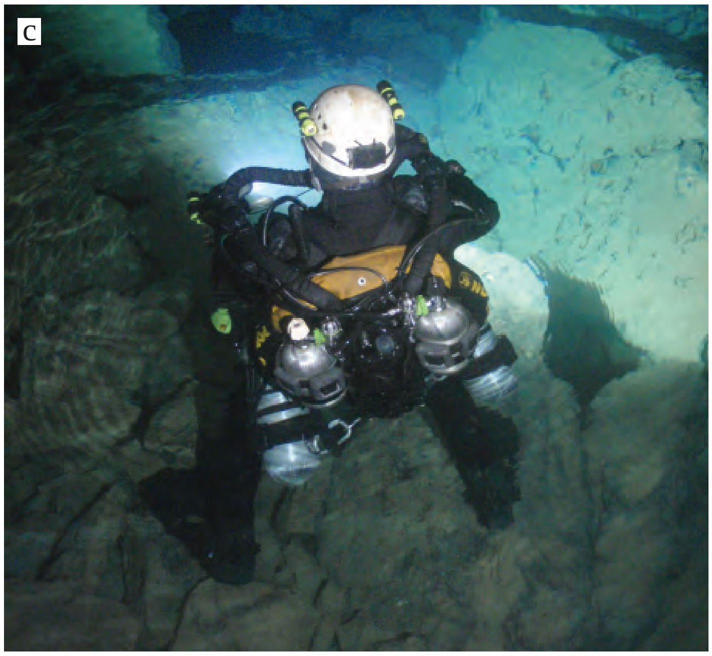
a) Un equipo de cuatro personas en el Campamento 2A con 12 bolsas de equipo destinados a Campo 3. Debido a que cada persona sólo puede llevar una bolsa a la vez que se debe hacer el viaje tres veces. Casi la totalidad de este material es el equipo de buceo. b) Uno de los grandes túneles en el nivel -900 metros de J2. c) Una de las formaciones raras en J2 - lo cual los espeleólogos han llamado “El Bigote” d) Un espeleólogo desciende un gran cañón en el nivel -950 metros de J2.

a) Un espeleólogo en una travesía en el nivel -950 metros. b) Depósito de equipo en el nivel -970 metros. c) Transporte de equipo a través de una sección derrumbada del túnel en el nivel -1000 metros. d) El cocinar de la cena en el Campamento 3, -1.100 metros en J2.

a) El equipo de buceo y su equipo de apoyo en el campo 3 de marzo 2009. b) El montaje de los recicladores arriba de Sifon 2. c) El montaje y la inspección de los tanques de buceo de emergencia arriba de Sifon 2. Los respiradores son el método principal de soporte de la vida bajo el agua, ya que son extremadamente eficientes con el uso de gas. Los tanques más grandes mostrados en la imagen c) sólo se utilizan en casos de emergencia.

a) Una vista de Sifon 2 de 20 metros sobre el nivel del agua. Un ligero plataforma de color naranja fue construida especialmente para proporcionar un lugar para que un buzo para preparar su aparato. b) Transporte de equipo de buceo a la plataforma. c) Un buzo en la plataforma con su reciclador. d) Un equipo de dos personas se prepara para bucear en Sifon 2.

a) Un espeleobuzo flote en la superficie del agua al principio de Sifon 2. b) Sifon 2 es de 220 metros de longitud y alcanza una profundidad de 8 metros de profundidad bajo el agua. Un buzo se muestra aquí nadando a lo largo de la línea de seguridad a mitad de camino a través del túnel bajo el agua. c) El túnel más allá de Sifon 2 está llena de aire que es seguro para respirar. d) En la cumbre de una pequeña colina de rocas en el túnel más allá Sifon 2 a una profundidad de -1190 metros.



a) Un buzo regresa de una exploración de 170 metros de Sifon 3. En última instancia, se descubrió que era posible evitar Sifon 3 por medio del túnel seco que conduce al Campamento 4. Por lo tanto, sólo Sifon 2 y Sifon 4 requieren el uso de equipo de buceo para proceder a lugares mas profundo en la cueva. b) Un buzo prepara para la exploración de Sifon 3. c) El principio de Sifon 3. Esta imagen muestra la vista posterior del equipo de buceo. El reciclador use un tanque de oxígeno y un tanque de aire comprimido. Los tanques de emergencia más grandes se encuentran en las caderas del buzo. d) Cuando las luces de buceo primaria fracasó en mayo de 2009 se creó un sustituto usando tres pequeñas luces de emergencia.

a) Un espeleobuzo se prepara para la inmersión primer reconocimiento en Sifon 4 en abril de 2009. b) Un buzo vuelve a través Sifon 2 con dos bolsas de equipo. Dentro de las bolsas son botellas de plástico que contenían la ropa seca, comida y equipo para acampar. c) el túnel más allá de Campamento 4. José Morales se encuentra en el centro de la foto para la escala.

a

a) En el Campamento 4 durante el empujón final 19 días más allá de Sifon 2. Sólo cuatro personas, dos equipos de dos hombres - Matt Covington y Marcin Gala, y José Morales y Bill Stone - han alcanzado el Campamento 4. b) Un explorador nada en el lago a principios del Sifon 4. Eventualmente, el techo desciende por debajo de la superficie del agua para formar un túnel completamente bajo el agua. Sifon 4 ha sido explorado en dos diferentes túneles a 170 metros y 350 metros de penetración, respectivamente. Los promedios del túnel principal 8 y 10 metros de ancho por 5 a 8 metros de altura. Sigue a 350 metros de distancia horizontal y debajo del agua parece estar aumentando hacia la superficie. La dirección del túnel es casi directamente hacia la Cueva Cheve, a 1,5 km de distancia.

b

Apéndice A:

Informes sobre Sistema Cheve escritas en Inglés

Proyecto Papalo:
Birth of an Area

William Farr and Carol Vesely

The second half of Saknussemm's Well. (Bill Stone)

"I always thought that would be a good area to check..."

By now, it seems we must have heard that line a hundred times. Visible from the Huautla plateau as a high karst area south of the Río Santo Domingo Canyon, the Pápalo area remained unchecked, however, until December 1986, when, acting on a topo map lead given to us by Peter Sprouse, we ventured into the Sierra Juárez in search of new caves.

The Pápalo area is characterized by its high elevation (up to 3200 meters) and relatively uninhabited pine forest. The karst is bounded on the east, west, and south sides by metamorphic rocks that concentrate the surface runoff into streams that sink when they hit the limestone.

Discovery

Our initial target was a large sink that appeared on the map to be two kilometers long by one kilometer wide. After some discussion, we finally decided that the 'valley' we were looking at was indeed the sinkhole, and we descended to the bottom via an abandoned logging road, blocked in several places by fallen trees. Despite having just driven straight from California for over 60 hours, we hardly paused for breakfast before running down the drainage axis of the sink in search of entrances. After passing several cold-air "bugholes," a couple of which took small streams, our first find worth noting occurred where the drainage axis turns from west to north. Here, an arroyo five meters wide by seven meters deep, dropped into a tall, fissure entrance one-and-a-half meters wide by six meters high. Christening our find Grieta de los Bichos for the cloud of gnats that occupied the first ten meters of cave, Bill checked it out briefly. The cave consisted of a couple of parallel fissure passages dropping rapidly down a series of short climbs.

As we were not yet to the bottom of the main sinkhole, we decided to leave this discovery temporarily, and proceed in search of greater booty. Much to our dismay, only a couple of hundred meters farther, we came across a seeping resurgence area giving birth to a small stream that flowed along the floor of the sink. We began to run through the pine forest alongside the stream, eager to see where it went. Then, just as Carol proclaimed, "Wouldn't it be great to find a really grand Mexican-style entrance," there it was. At our feet the stream dropped down a seven-meter waterfall to flow lazily across a beautiful, grassy-green llano, whereupon it was swallowed by a gaping black hole at the base of a limestone cliff, 80 meters high.

The main entrance to Cueva Cheve is 30 meters wide and six meters high and leads to the top of a large, 30-degree-sloping, breakdown room 70 meters wide by 200 meters long by 30 meters high. A second, tall, narrow entrance lies to the east of, and slightly higher than, the main entrance. The stream sinks into breakdown just inside the main en-

Bill Farr approaching the entrance to Cueva Cheve on the day of the discovery. (Carol Vesely) trance and reappears in a waterfall at the bottom of the room. From the Entrance Chamber three large passages are visible, two along the south wall and one at the base of the room. Picking our way down the breakdown to the base of the falls, we followed the stream into a seven-meter-wide by 18-meter-high canyon, which continued into darkness, sucking a stiff breeze. Our single flashlight seemed inadequate for exploration beyond this point.

First Survey

The next morning we began with a perimeter survey of the Entrance Chamber. Then, we followed the canyon passage downstream for 80 meters to a second large room, the Basket Room, named for the pieces of woven basket and mat found amongst the breakdown. Nearby, the stream sank again. Although it was possible to follow the water by crawling through the breakdown, we chose to follow the air instead. We scrambled down between car-sized boulders to a continuation of the canyon and the first drop of the cave. A rappel of seven meters led to more canyon passage. By now, we were beginning to notice one of Cheve's primary characteristics: it's cold!

Continuing the survey of Cool Canyon, we encountered a second breakdown area, which required some digging through rotten rock to get through. Beyond, was an unattractive drop of eight meters, followed shortly by another drop of six meters with a small stream trickle going over it. At this point, we decided to return to camp, instead of going for a long trip, as we had the luxury of being so close to the entrance.

The next day, we continued down the third drop, landing in an ankle-deep pool that trickled into a sump along the side of Cool Canyon. Surveying past the Deceptively Deep Pool, we arrived at the next vertical section of cave, the Double Dip. Here, Cool Canyon dropped eight meters to a deep plunge pool, followed immediately by a second drop, of two meters, into another plunge pool, followed immediately by yet another drop, into darkness. As we were accustomed to much warmer caves in Mexico, we had not yet learned to dress warmly enough for surveying in the windy, eight degrees Celsius passages

The Frozen Chicken passage. (Carol Vesely)

of Cheve. While we debated the best rigging of Double Dip, through the icy cold water or along a high traverse, followed by a drop straight down after the second pool, the cold overcame us, and we headed out instead.

By the time we reached the Entrance Chamber we were warm again, so we decided to survey one of the other two side passages off the room. Choosing the highest one, thinking that it might connect to the upper entrance, we began surveying with consecutive 30-meter shots in ten-meter-diameter borehole sucking a gale of icy wind. Alpine caving in the tropics – who would of thought we would find this in Mexico!

The next day, we had to leave the area to meet Peter Sprouse and company at Conrado Castillo. The surveyed length of Cueva Cheve stood at 0.9 kilometers, with a depth of 100 meters. We knew we were going to be back in Mexico for a Purificación underground camp trip in March, and were already planning to return then to find out if Cueva Cheve was going to really "go big time" or not.

March 1987

Once again, due to time constraints, we had only a few days, but our goals for the March trip were to see if the main cave was going to keep going, and to further assess the potential of the area. In addition to work in Cueva Cheve, we began extensive surface work, locating and tagging numerous entrances for future exploration. From the beginning, it was obvious that the Pápalo area was worthy of a serious project orientation.

Resuming our explorations downstream in Cheve, we descended the Double Dip Drop via the plunge pools. At the base of this drop Cool Canyon continued horizontally for 50 meters to the sloping, Fissure Drop of 15 meters. Past two more short drops, we came to a T-junction, where Cool Canyon rejoined the main stream passage. Heading upstream, we quickly hit Triple-Whammy Falls, a 12-meter-high triple cascade. The downstream lead went over a series of beautiful rapids and falls to a waterfall drop, the Stop Drop, where we turned around for lack of equipment. On the same trip we also finished surveying the large trunk passage that led from the Entrance Chamber to the upper-level entrance. We named it the Frozen Chicken Loop for the cold wind and chicken bones it contained.

When we finally got around to the middle Entrance Chamber lead, we were in for a real surprise. It contained a parallel stream system! Downstream, we stopped at a six-meter drop due to lack of rope, while upstream we surveyed about a hundred meters, ending exploration at eight-meter-high Bold Falls. A side passage of Surprise Stream led to a dry, crumbly, mazey area, El Lluco, where we surveyed a couple hundred meters before becoming too disgusted with the loose crud falling off the walls.

By the time we left the area after four days, Cueva Cheve had been surveyed to 1.5 kilometers long and 200 meters deep, with going leads, and strong airflow and water. In addition, we had located and tagged six new entrances, several taking water and air. We decided to return with more people next caving season to continue exploration.

In the entire seven days we had spent in the area thus far, we had not seen a single local. But since we were planning to bring more people on the next trip, we thought it would be best to contact the local authorities. Despite our very limited Spanish, we managed to secure permission for a return trip from the presidente of the nearest large town, Concepción Pápalo, ten kilometers away. We also learned that the cave we had been exploring had no local name, but that the beautiful llano at the entrance is called Llano Cheve. Cheve is an Indian name, but none of the locals seem to agree on its meaning, or if it even has one.

Christmas 1987

In December 1987, we returned to Cheve accompanied by Peter Sprouse, Susie Lasko, Nancy Pistole, Matt Oliphant, and Don Coons. While caravaning through Texas, we encountered a herd of elephants in the middle of nowheres-ville in a supermarket parking lot. We took the event to mean that we were going to find elephant-sized cave, and hence, elephants became the unofficial symbol of our expedition.

After a day of acclimatization, and setting up camp in the llano, we were ready to continue exploration and surveying.

Peter, Don, and Bill headed downstream past the eight-meter Stop Drop, encountering more fun stream passage. After bypassing the next waterfall with a rope traverse followed by a down-climb, the team encountered an even more impressive waterfall, the Storm Shaft. At the bottom, as they were whipped by wind and spray, they were presented with two choices: either continue following the stream down more cascades, or take a dry side lead that Peter located. Choosing the dry alternative, they rappelled down a 20-meter shaft into a canyon, four meters wide by ten meters high, that appeared to roughly parallel the streamway they had been in. Continuing down a series of two short nuisance drops, the trio came to the finest shaft yet in the cave, the Elephant Shaft. This beautiful, clean-walled shaft dropped 45 meters to a continuing canyon. They could see down another drop to where the passage rejoined the main stream after this pleasant bypass. They ended the survey at the top of the next drop, having passed 300 meters in depth.

Meanwhile, Carol, Matt, and Nancy descended the six-meter drop in Surprise Stream, and followed the water for about 20 meters to a down-climb to a sump. Retreating from this area, the team headed to the Black Elephant Room, which Carol had discovered at the end of the last trip. A perimeter survey of the room located several infeeding passages, a couple with active streams. The main stream, which had sunk in the Basket Room, also reappeared in the Black Elephant Room, where it plunged down a short drop between large boulders.

The next day was spent ridgewalking to the north. Most notable was the discovery of Osto de Puente Natural, an entrance three meters high and wide that led to a room with a deep pit, where rocks rumbled down for ten seconds.

The Christmas Present

The next day, Christmas Eve, Carol, Don, Nancy, and Matt headed into Cheve to continue exploring from the bottom of the Elephant Shaft, while Peter, Susie, and Bill headed downstream from the Black Elephant Room. On their way to the Elephant Shaft, Carol's team decided to check a previously unexplored lead at the top of the Fissure Drop. Don led across a short, exposed, traverse into a huge chamber and a steeply descending passage they dubbed the Christmas Present. Clambering down over huge breakdown blocks, they came to three short rope drops, and finally rejoined known passage at the base of the dry bypass drop from the Storm Shaft. This new route totally bypassed the wet streamway. It was now possible to descend to the furthest limit of exploration without getting wet above the ankles: a great Christmas Present, indeed.

Starting the survey at the base of the Elephant Shaft, the cavers descended the 15-meter Junction Shaft, where they rejoined the main stream, as expected. Another four-meter drop and a short stream passage brought them to the top of 30-meter Angel's Falls. After rappelling alongside the beautiful falls, where the water is close enough to touch, they landed next to a deep pool. A large infeeder comes in from the east at the base of this drop. They followed the stream down the main passage as it got bigger and bigger. Soon they found themselves reeling out 30-meter shots as they

Descending the Giant's Staircase. (Bill Stone) descended a large borehole passage 15 meters wide and 20 meters high, the Giant's Staircase. The stream disappeared in breakdown after about 100 meters, and they followed the dry borehole up over the Camel's Hump and down the other side. Again dropping at 30 degrees, they rapidly picked up depth as they climbed down over car- and house-sized boulders. After 500 meters of borehole, the ceiling lowered, and the passage made a 120-degree bend. The passage opened up again at the top of a large drop. Rappelling 50 meters, the cavers landed on a flowstone bridge, from which the stream could be heard below. They dubbed this impressive shaft Saknussemm's Well, and estimated it to be at least another 50 meters to the bottom. The cave had now passed 500 meters in depth. Their total survey for the day was 660 meters.

Back in the Black Elephant Room, Peter, Susie, and Bill descended a ten-meter drop through boulders to follow the stream in a 15-meter-wide, ten-meter-high passage. After surveying 350 meters down the Río Cuicateca, they came to Terminator Falls, which they presumed would connect to the top of Triple Whammy Falls. Instead of descending, the trio surveyed a well-decorated ledge, Santa's Shelf. Here, Peter found a small hole blowing air, and proceeded to bash it open. This led to the discovery of Elf Land, a small upstream infeeder.

The descent of Mondo Pit in Osto de Puente Natural was the objective of the next trip. Finding our 90-meter rope to be inadequate to reach the bottom, and the lower part of the drop to be much wetter than anticipated, we abandoned the descent. Instead, we surveyed the entrance room and a short upper level directly above the pit.

Returning to Cheve the next day, Carol, Don, and Nancy surveyed their scoop of the Christmas Present. Next, the team ascended the dry drop to the base of the Storm Shaft. From here, they followed the water downstream, surveying down a few short climbs to a sump and up a steeply ascending tube to an overlook of the Junction Shaft. Then they ascended the wet route, derigging the drops and taking photos on the way.

Saknussemm's Well

Meanwhile Peter, Susie, Matt, and Bill descended to the flowstone bridge in the middle of Saknussemm's Well. Rigging the drop with a 90-meter rope, Bill descended, only to find that the rope had been blown under the waterfall, and had become hopelessly tangled around numerous knobs and pendants. After an hour of untangling rope and then rigging a series of rebelays to keep the descent out of the water, Bill was surprised to see Matt rappelling down towards him. The noise of the water had drowned out all communication with those at the top of the pit.

Eventually, the rope just reached to a ledge from which it was possible to free-climb down an additional five meters to the bottom of Saknussemm's Well. Here, the cave went horizontally, picking up an infeeder that doubled the flow of the stream just before a sump that could be bypassed with a tight chimney and high canyon.

The way ahead required swimming. As everyone was cold enough already, the team ended the survey at the infeeder, and headed for the surface. Here, they were greeted not by a rising sun, but by clouds and a cold, bone-chilling drizzle. For the next three days it drizzled, hovering just above freezing. Everyone sat around camp watching the water flow into the cave triple, as dry gullies turned into streams. Everyone did manage one trip into Elf Land, where we mapped 150 meters to Santa's Workshop, a well-decorated room with a tight infeeder that still goes.

With the first day of sun all we wanted to do was dry out, and besides the water levels were still way up – not optimal conditions to push the bottom of Saknussemm's Well. By the next day, everyone except Don and Nancy had colds, putting a damper on enthusiasm. As we were running out of time again, Don, Nancy, and Bill headed in to push the streamway. Peter and Susie's time had run out, so they packed up, leaving Matt and Carol to commiserate on the surface.

Donning wetsuits at the bottom of Saknussemm's Well, the three cavers began the chilly survey of the Salmon Ladder. The Salmon

Ladder consists of a series of progressively larger cascades, which eventually require a rope. At the end of the Salmon Ladder the cave descends steeply, as the stream enters the Turbines, where air and water tend to become one. Here, the survey team stopped. Don rigged the next drop and rappelled down to check it out. Radical, but feasible was the report. At one point the force of the water was so strong that Don had trouble clipping onto the rope to ascend.

In an effort to increase the depth of the cave, Don, Carol, Matt, and Nancy searched the karst above the Frozen Chicken Loop. Their efforts were rewarded with the discovery of two higher entrances, both of which connected into the main cave near the Frozen Chicken Entrance, adding 60 meters to the depth.

With only two days remaining and three people suffering from colds, exploration of Cheve was finished for this trip. At over 4.5 kilometers in length and 700 meters in depth the cave was still going, and starting to get serious. We had one goal left: the descent of Mondo Pit in Osto de Puente Natural.

The Fuel Injector, the final drop in the Turbines. (Jim Smith)

The remaining five of us descended upon Puente armed with a 120-meter rope for Mondo Pit and enough ropes for five additional drops. Bottoming the pit at -100 meters, the group continued down a series of narrow canyons interspersed with short drops of seven to 20 meters. After several hours, Carol and Bill felt quite weak due to their colds, and left early, leaving Don, Nancy, and Matt to continue. They finally ran out of rope after 426 meters of survey. On the way out, Nancy's knee gave way in the middle of a tricky climbing maneuver, causing her to fall backwards three meters into a plunge pool. Despite the pain, she made it out of the cave under her own power, although it was three weeks before she stopped limping.

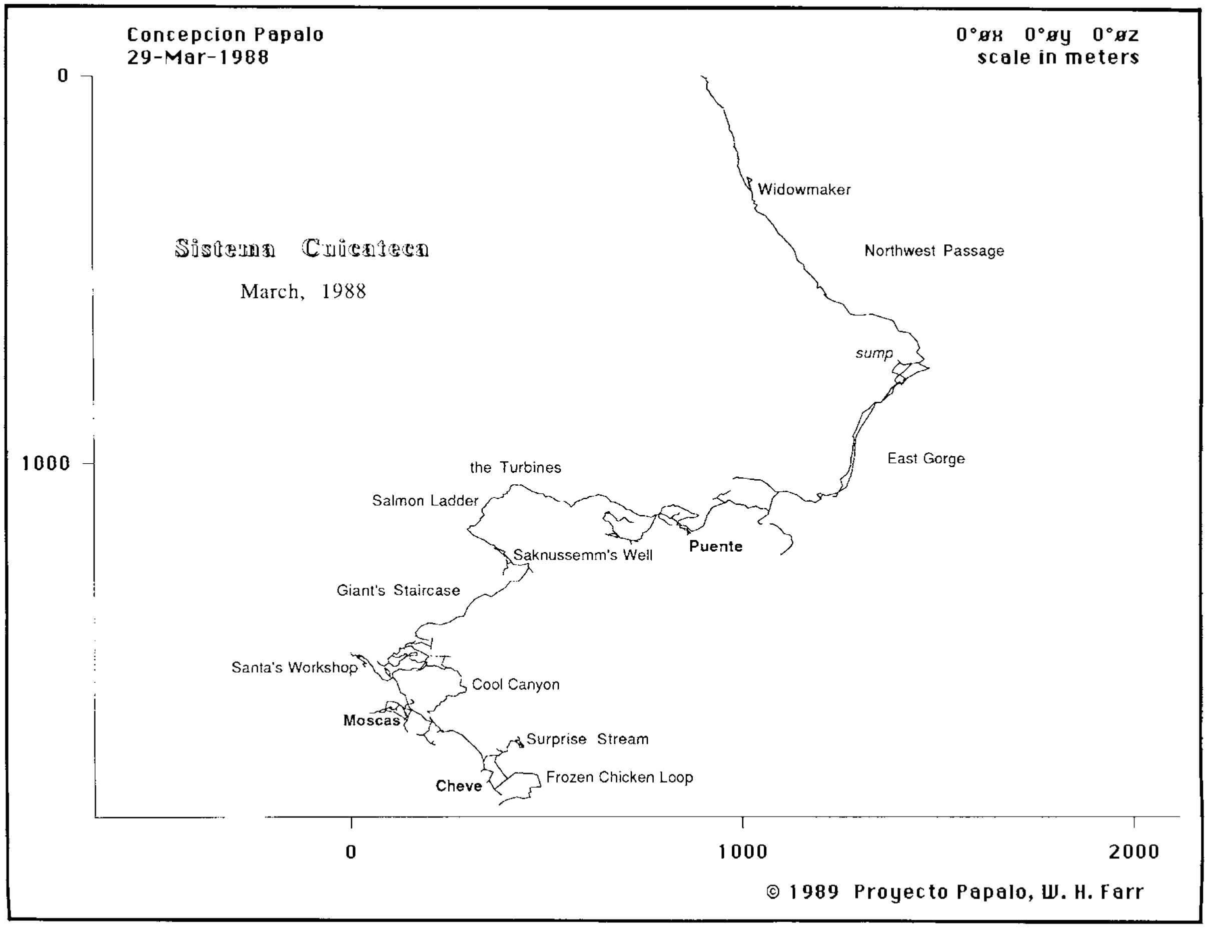
The next day everyone cleaned up the llano and packed out. Dropping Don off at the road to Huautla, the rest of us headed back home, already planning a more extended March return.

Spring, 1988

Word about Cheve was now out, and there was no shortage of people who wanted to help explore the cave. We planned a three-week expedition from the second week in March until the start of April.

Arriving at the llano at our scheduled time with Bill Steele and Mark Minton of Texas, Jeb Blakley, Bob Bennedict, and Steve Zeman of Idaho, and Peter Bosted and Gary Mele of California, we found that Don Coons, Jim Smith, Ed Holladay, Mason Estes, and Lee Perry had arrived from Huautla a few days earlier loaded with ropes and gear. They had done a push trip at the bottom, breaking through the Turbines into gently descending stream passage.

A few days later Karlin and Beth Meyers, and Ernie Garza arrived, having completed their reconnaissance to the Cerro Rabón. Llano Cheve was quite a contrast from the December trip. Then, the green, tree-lined field



had a peaceful, pastoral ambiance. Now, with 17 people and gear everywhere, the place was ablaze with noise and activity.

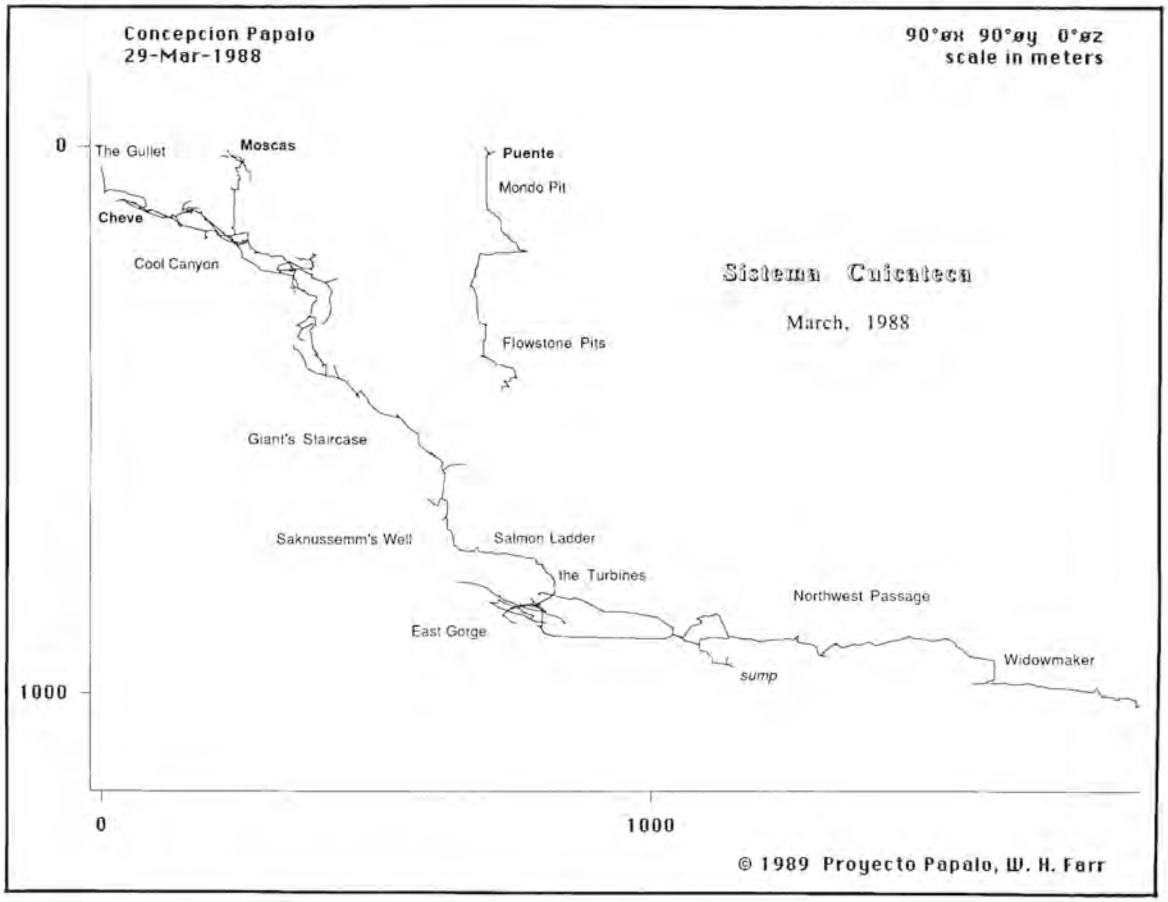
East Gorge

Cheve continued almost horizontally for the next several trips. Water levels were noticeably lower than on the December trip. The main stream was followed, various infeeders were noted, and several sumps were found and bypassed. Finally, a trip by Bill Farr, Mark, Jim, and Bill Steele encountered a distinctive 23-meter free drop into the East Gorge, a borehole in the same black-and-white-banded rock that is characteristic of Huautla. This was followed immediately by a 15-meter drop next to an impressive waterfall. Jim descended this drop and continued following the water down the East Gorge for almost 800 meters.

Returning the next trip with Bob, Jeb, Ed, and Steve, Jim surveyed his scoop, and they continued onwards in the East Gorge. After going horizontally for almost a kilometer, again the bottom dropped out in a short rope series leading down to a large sump at -958 meters.

Part way through the expedition, we were joined by Bill Stone and Matt Oliphant. As trips were becoming over 24 hours long, the three Bills and Matt decided to try an underground camp in the Giant's Staircase at -400 meters. They soon decided that the camp was too near the surface to make much difference, and the three Bills headed out after four days. Matt, who had never camped underground before, stayed for a total of ten days, the full extent of his time in Mexico.

After a photograph and derig trip to the -958 sump, the three Bills and Matt attempted to find a bypass to the sump. Locating a place to climb up out of the East Gorge, they encountered an upper-level borehole, 15 by 15 meters. But progress in the downstream direction was blocked by a pit back into the



East Gorge. So they surveyed upstream instead, netting several hundred meters of easy passage until they reached another pit.

Northwest Passage

On the next trip, Ed and Jim located another climb-up farther downstream that went to a continuation at the same level as the previous borehole. The two-person team surveyed an incredible 800 meters in the Northwest Passage at over 900 meters depth, and had one loop of several hundred meters that closed to within one meter! They ended their survey at a bolt climb.

The bolt climb at the end of the Northwest Passage seemed certain to bypass the -958 sump. For the final deep push trip of the expedition, Ed and Bill Stone headed into the cave early to get Matt so they could start the bolt climb. Matt led an easy traverse that actually bypassed the anticipated bolt climb. On the other side, the passage broke into large borehole, 15 meters in diameter and filled with extremely fresh breakdown. The three cavers scooped ahead for about a half hour, then returned to the traverse to wait for the others. After an hour of waiting, Bob, Jeb, Jim, and Steve finally arrived. They had been taking pictures on the way. The whole group explored through the large borehole. Rappelling a 15-meter drop, they found that the

Bill Stone, Matt Oliphant and Bill Farr at the -958 Sump. (Bill Steele & Bill Stone) borehole continued to another drop, where they could hear water at the bottom. At this point the group broke into two teams. One team headed out, surveying what had just been explored. The others proceeded down the Widowmaker Drop, where Jim set two bolts to redirect the rope away from a large loose rock. They found the stream again; it had now doubled in flow to about two-thirds cubic meters per second. The sump had been bypassed. They followed the water down some small cascades and through two boulder chokes. Exploration finally stopped at a third boulder choke at -1038 meters that has yet to be forced. The group surveyed out and derigged the cave to the top of Saknussemm's Well. In total, the two groups surveyed over a kilometer in a trip that lasted 33 hours.

Cueva Moscas

One of the more obscure entrances discovered on the March 1987 trip was that of Cueva Moscas (Fly Cave), located in a small brush-filled sink. The descending muddy crawlway just inside the Moscas entrance had strong airflow, making this miserable-looking hole worth pushing. After ten meters, the cave opened into walking passage, which split into two descending leads. The right-hand passage began as a meandering canyon that went a few hundred meters and down two short pits before becoming too tight. The left lead went to a pit with good airflow. This led to a room followed by a series of five more pits separated by short stretches of horizontal passage and rooms. Moscas was pushed primarily by Carol, Peter, Mark, and Gary with help from Ernie, Bob, and Steve. After four trips and 790 meters, Moscas connected as an infeeder to the Black Elephant Room in Cheve, adding 70 meters to the depth of the cave and creating Sistema Cuicateca.

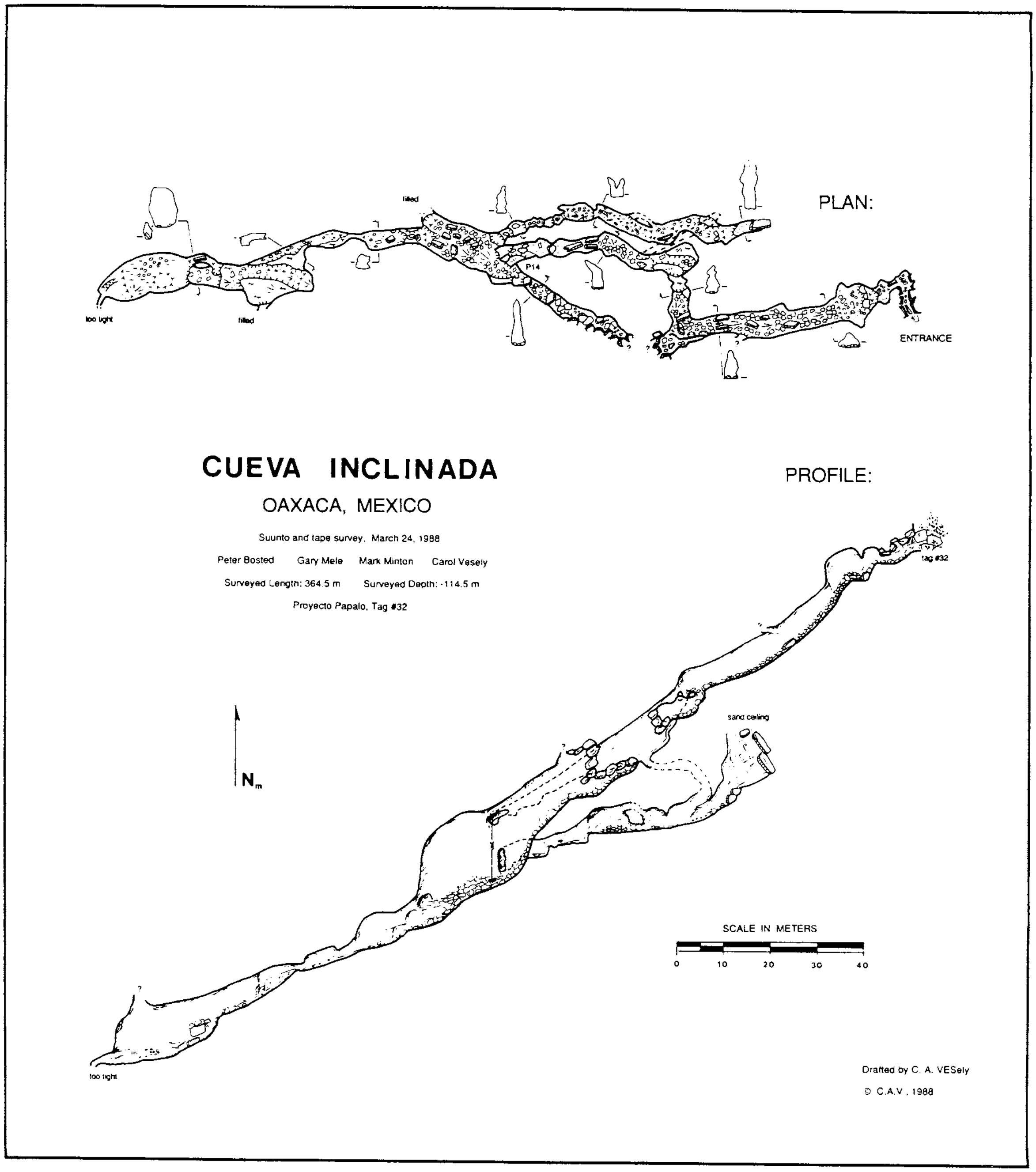
Llano Español

Another objective of the expedition was to begin investigating some of the areas farther from Cheve in the hopes of locating more entrances. After Bill Steele, Mark, and Bill Farr discovered several entrances in nearby Llano Español to the south, Peter, Carol, Gary, and Mark camped there and surveyed the caves. They began with Cueva Inclinada, located next

Mark Minton rigging the drop in Cueva Inclinada. (Drawing by Linda Heslop based on a photograph by Peter Bosted)

to a streambed and issuing a strong breeze. The entrance was in a breakdown pile, but soon opened into a sloping walking passage, which followed the area's 30 degree dip. The canyon passage became progressively larger and eventually led to an 18-meter pit. At the bottom, the passage continued descending, with cobble and sand fill lining the walls. In some places this fill formed significant sections of ceiling more than eight meters overhead. Eventually, the cave ended where the stream channel became completely filled with sediment in a large terminal chamber. The air seemed to disappear into a dome. Cueva Inclinada is 365 meters long and 114.5 meters deep.

The next day the group spent several hours in vain trying to find a way through blowing breakdown in a promising area on the other side of Llano Español. Frustrated, they headed for the last known entrance in the area, Cueva Tutilomo, named for the beautiful orange flowers growing near the arroyo entrance. Tutilomo is formed along a steeply dipping fault. The cave had good airflow but one rope drop and numerous climbdowns eventually brought Mark, Peter, and Carol to the bottom after only 140 meters.



Puente Natural

Throughout the expedition four trips were made to Osto de Puente Natural. On 16 March, Don, Steve, Jeb, and Bob pushed down a series of tight, awkward canyons and short drops to the base of the narrow, drizzly, 90-meter Fissure Drop. The next day Ed and Karlin hauled in massive amounts of rope and surveyed down the second of two Flowstone Drops, each about 30 meters deep, and into the descending canyon passage beyond. Unfortunately, some confusion about the end-of-survey station resulted in a hanging survey. The following day, Carol, Peter, and Gary surveyed the first Flowstone Drop, thereby tying in the hanging survey. They continued their survey down a dry 13-meter pit that bypassed a wet drop. After a five-meter pit and some small crawlways they called it quits. Their survey left the cave length just 40 meters shy of a kilometer long. A final push

Susie Lasko rappelling in Cueva Cheve. (Drawing by Linda Heslop based on a photograph by Peter Sprouse)

and derig trip by Mark and Bill Farr nudged Puente to just over a kilometer long and 442 meters deep. A surface survey places the cave directly over known parts of Cheve, so it is probably only a matter of rope and effort before it ties in to the system.

Continuing surface work has netted over 30 tagged entrances. A couple of other small caves were mapped, but much work remains in the karst to the north of Llano Cheve. Currently, Sistema Cuicateca stands at 1038 meters deep and 9.2 kilometers long. With continued effort, there is a good chance that the cave will develop into a system to rival Huautla to the north. To this end, we have established Proyecto Pápalo to study the speleology, geology, hydrology, and biology of the area.

PROYECTO PAPALO

En diciembre de 1986, Bill Farr y Carol Vesely comenzaron la exploración sistematica de la área llamada Pápalo, en la Sierra Juárez de Oaxaca. Las primeras dos exploraciones en Cueva Cheve llevaron a una profundidad de 200 metros y una longitud de 1500 metros. En diciembre de 1987, un grupo de siete espeleólogos continuaron la exploración hasta -720 metros de profundidad y 4500 metros de longitud. Al mismo tiempo se empezó la exploración de la cueva llamada Osto de Puente Natural, con un tiro cerca de la entrada de 100 metros. En marzo de 1988 un grupo más numeroso exploró en Cueva Cheve las mojadas Turbines y el East Gorge. Una conexión con una entrada más alta, Cueva de las Moscas, resultó en la formación del Sistema Cuicateca, con 1038 metros de profundidad y 9200 metros de longitud. Osto de Puente Natural se exploró hasta -442 metros, y se espera conectar al Sistema Cuicateca.

PROYECTO PAPALO 1989

Carol Vesely

Waterfall drop in the East Gorge, Cueva Cheve (Bill Stone)

A series of underground camps at -850 meters enabled cavers to push Sistema Cuicateco to 16.3 kilometers in length with a vertical extent of 1243 meters. This makes it the second deepest cave in México and the eighth deepest cave in the world. In addition, 890-meter-deep Osto de Puente Natural was connected into the system adding a higher entrance.

INTRODUCTION

The Pápalo area is located in the Sierra Juárez in the state of Oaxaca, just south of and across the Río Santo Domingo from the famous Huautla caving area. There had been a total of four trips to the area prior to the 1989 Expedition. Sistema Cuicateco, the main cave in the Pápalo area, had been surveyed to 9.4 kilometers long and 1038 meters deep, the fourth deepest cave in Mexico and the twenty-sixth deepest in the world.

A ROUGH START

In mid-February, after three days and nights of driving from California, Bill Farr and I arrived in Oaxaca ahead of the rest of the team, to begin making preparations. We were surprised when the Presidente of Concepcion Pápalo denied us permission to remain in the area without approval from a "higher authority." In the past we had never had any problems. But as the size of our expeditions grew, the local people found it difficult to believe that we were there merely for fun and not to steal gold from the caves. We knew that Don Coons, who speaks better Spanish than either of us, had been backpacking in the area for two weeks. With the Presidente's permission, we located Don who was waiting for us at Llano Cheve.

Don and I headed to Oaxaca City to try to obtain permission. For three days we went from office to office explaining our plight. We tried archaeology, tourism, geology, geography, etc., and the reply was always the same: a puzzled look and ambiguous directions to yet another office. Then after three days, we finally got lucky. We met the Head of the Bureau of Mines, who spoke excellent English and understood our situation. He graciously provided us with a letter of permission and even sent one of his assistants along with us to talk directly with the Presidente. Thus, everything was all settled by the time the main group began to

Flowstone Canopy at -400 meters in Osto de Puente Natural (Andy Grubbs)

arrive at the end of February. Trip participants were Bob Benedict, Jeb Blakely, Peter Bosted, Don Coons, Bill Farr, Andy Grubbs, Louise Hose, Tim Jones, Steve Knutson, Mark Minton, Matt Oliphant, Nancy Pistole, Peter Quick, Bitsy Ray, John Schweyen, Ron Simmons, Pam and Jim Smith, Bill and Pat Stone, Carol Vesely, Todd Warren (all from the U.S.) and Rolf Adams (Australia).

To establish good relations with the locals, we arranged to give a slide show on the cave at the Papalo town square. Bill Stone did such a good job of narrating that the townsfolk insisted on a repeat performance for latecomers. In addition, we handed out fifty copies of a description of the project, written in Spanish, to the people attending.

Finally, it was time to begin exploration. In order to push the deepest part of the system, it was necessary to set an underground camp since trips from the surface were exceeding thirty hours. The beginning of Cueva Cheve (the main part of Sistema Cuicateco) consists of a series of dry pitches interspersed with large, breakdown-floored, borehole passage. At -450 meters is the longest drop in Cheve. Saknussemms Well, a magnificent, flowstone-lined, offset pit. Shortly after this, it is impossible to stay out of the water. The stream plunges down the Salmon Ladders and through the Turbines. The latter is a series of canyon passages with rapids and increasingly larger waterfalls. Beyond the Turbines, the cave nearly levels out in the walking passages of the Sumplands. After about a kilometer, two drops lead to the East Gorge, a large, sporadically decorated stream passage. An eight-meter rope climb out of the East Gorge leads to a flat, sandy area that was chosen as the site for Camp II. To reach camp it is necessary to traverse 3.7 kilometers of cave and descend to -830 meters in 33 rope drops.

After Don, Jim, Rolf and Bill Farr rigged the first thirty drops through the Turbines, the first camp crew of Peter Bosted, Don, Bill Farr, Steve, Peter Quick, Jim and I packed our duffles and headed in. Bill Stone lent support by carrying a load of group gear to the base of the Fuel Injector at the end of the Turbines. Fortunately, we didn't have to go through the Fuel Injector (the wettest, most radical drop in the cave) this year thanks to Don's finding a high bypass.

Along the way, disaster struck at eight-hundred-meters depth when Steve took a three-meter, head-over-heels fall with his duffle, injuring a couple of ribs. Steve's condition was stabilized and Jim bandaged his ribs. Bill Farr and I bivouacked with Steve near the accident site the first night. The following morning, Jim headed for the surface to alert the others. Meanwhile, the rest of the Camp II team helped move Steve and his gear to a second bivy site just above the Fuel Injector Drop. Despite the pain, Steve was able to move himself with assistance. Everyone was thankful that stretcher hauling was not necessary. Peter Bosted stayed with Steve the second night and the next morning the surface crew arrived. Steve made it through the wet drops of the Turbines and up 120-meter Saknussemms Well the next day. That night he stayed in Camp I at minus four hundred meters in the Giant's Staircase. Here, Dr. Noel Sloan, who had been summoned from the U.S., was able to reach Steve and assess his condition. The following day, everyone made it safely to the surface. Although he was unable to do anymore caving in Cuicateco, Steve recovered sufficiently to continue with his plan to lead a return expedition to Jul Mas Nim in Guatemala later in March.

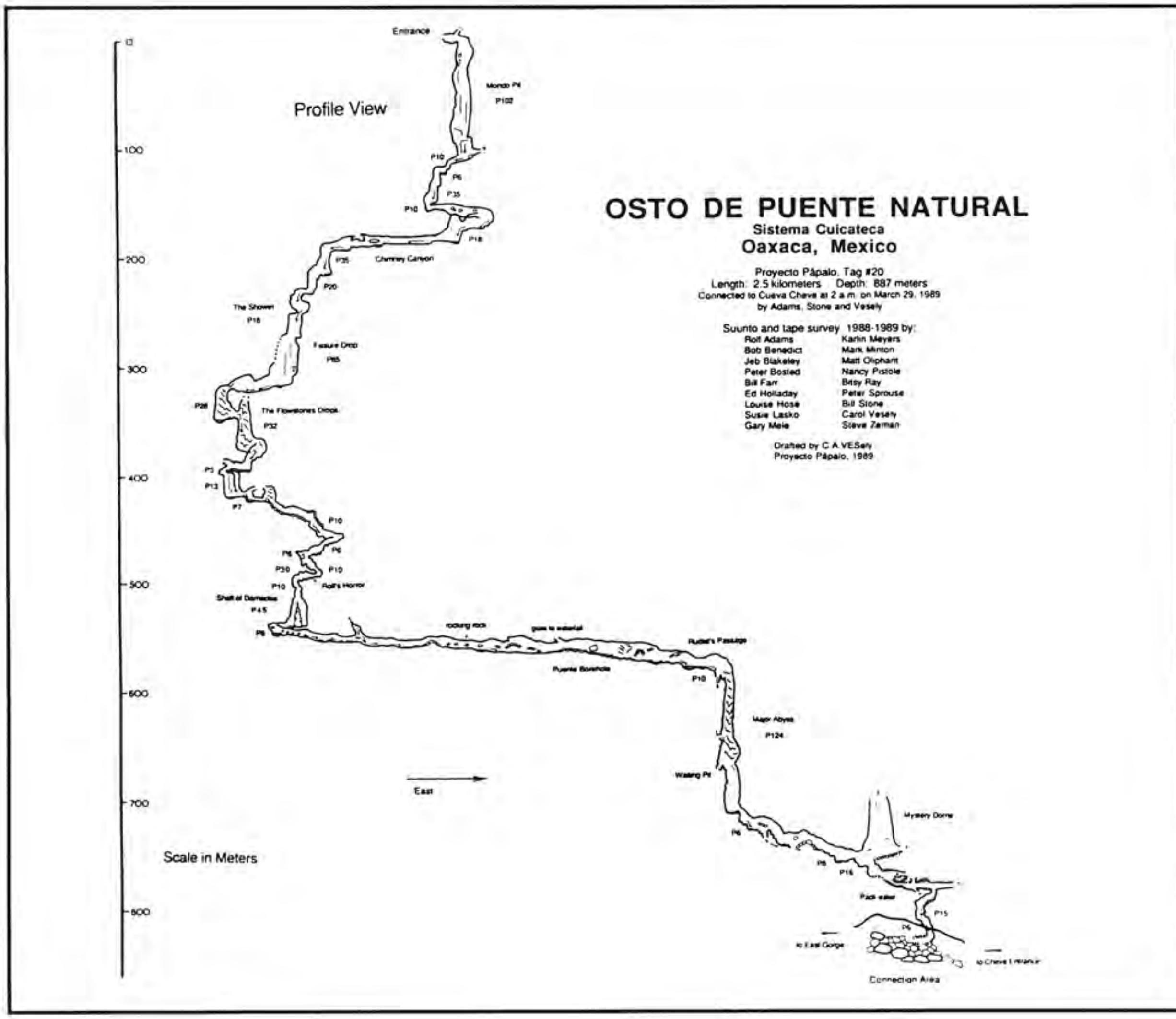
PUSHING DEEP

Back at Camp II after this unfortunate start, Don, Bill, Peter Quick and I surveyed some well-decorated side leads near camp. Two of the leads simply looped back into the main passage and the other two ended after less than a hundred meters. Cheve has very few major side passages.

The next day we set out for last year's endurance limit in the Swim Gym, located over a kilometer and seven drops from camp. To get there we scrambled over the massive, breakdown blocks in the Low Rider Turnpike, then gingerly rappelled past the loose chockstone in the Widowmaker Drop and landed in the wet and sporting Swim Gym. The Swim Gym is appropriately named, for one must climb down the cascades and cling to the walls to avoid being swept away by the raging rapids.

Since none of us had been on the final push trip of the previous expedition, we were not certain where the last survey had stopped. At one point we climbed out of the water and began following a canyon passage filled with huge breakdown blocks. We soon realized that we were in virgin territory. We pushed the canyon until there was no longer an obvious route through the breakdown and then surveyed out. We found a tie-in station where we had first climbed out of the water. From this station it was possible to follow the water down a narrow rift. We chimneyed down to a wide, low, walking passage floored with a series of pools. This route eventually led to a small sump. We were pleased that our survey to the sump had added 42 meters of depth to the cave.

The system had seven sumps, but in each case there is a dry, upper-level bypass. Backtracking to find where the air had gone,

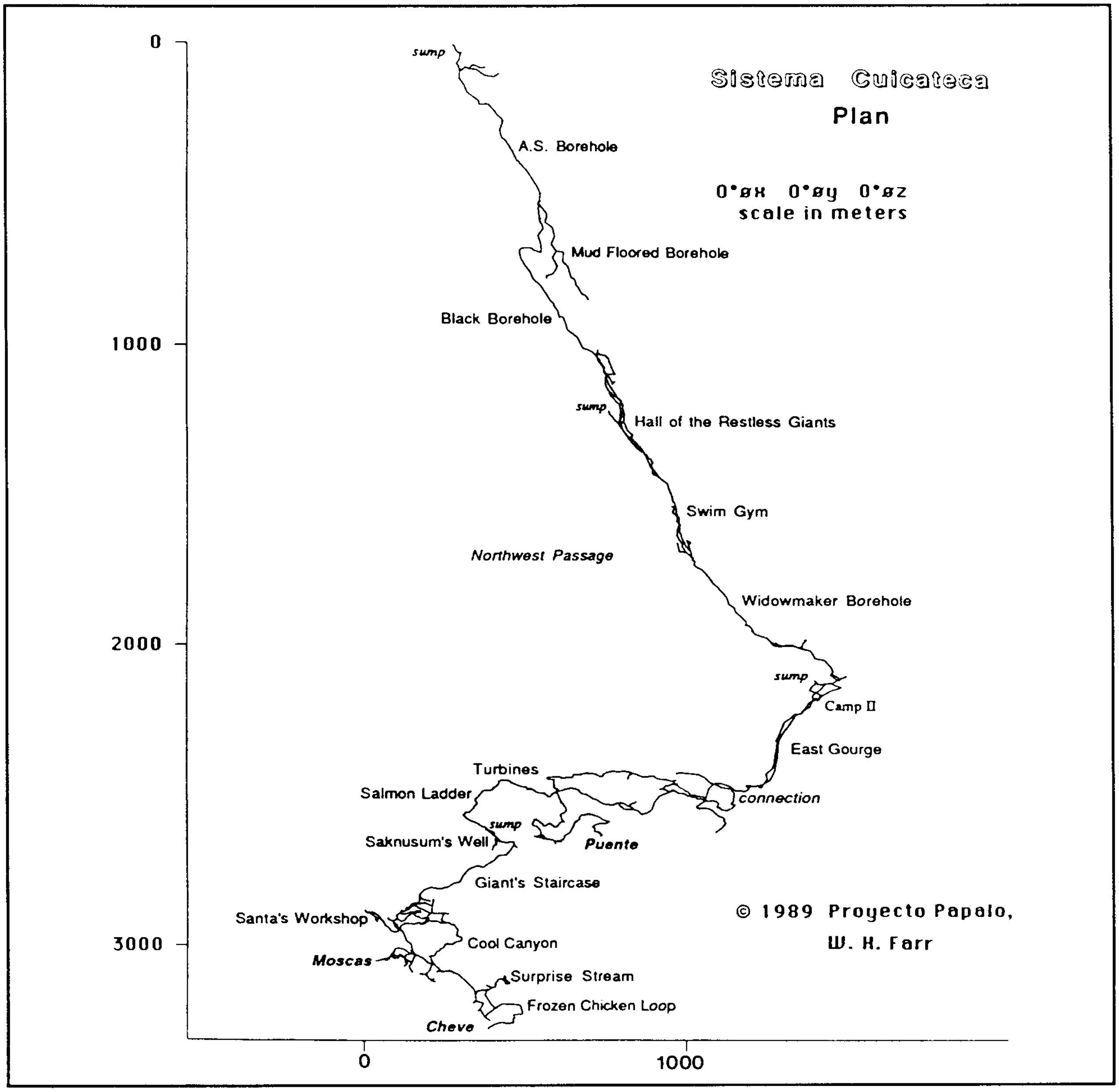


Crew at the terminal breakdown in the A.S. Borehole, Cueva Cheve (Bill Stone)

we began by pushing over the top of the Widowmaker Drop on the next trip. We located a large room and canyon passage directly over the Swim Gym. On the final trip of the camp, a more direct route out of the Swim Gym was discovered leading to The Hall of the Restless Giants, a large borehole filled with massive, cracked formations. The passage averaged 15 meters wide and high and continued for over half a kilometer. At the end was a terminal flowstone choke, but there were good leads left in the breakdown floor at an intermediate point. Team one exited the cave after nine days underground, adding 1.4 kilometers of survey to the length and 42 meters to the depth of the system.

OSTO DE PUENTE NATURAL

While part of the group was at the underground camp, others on the surface contin-

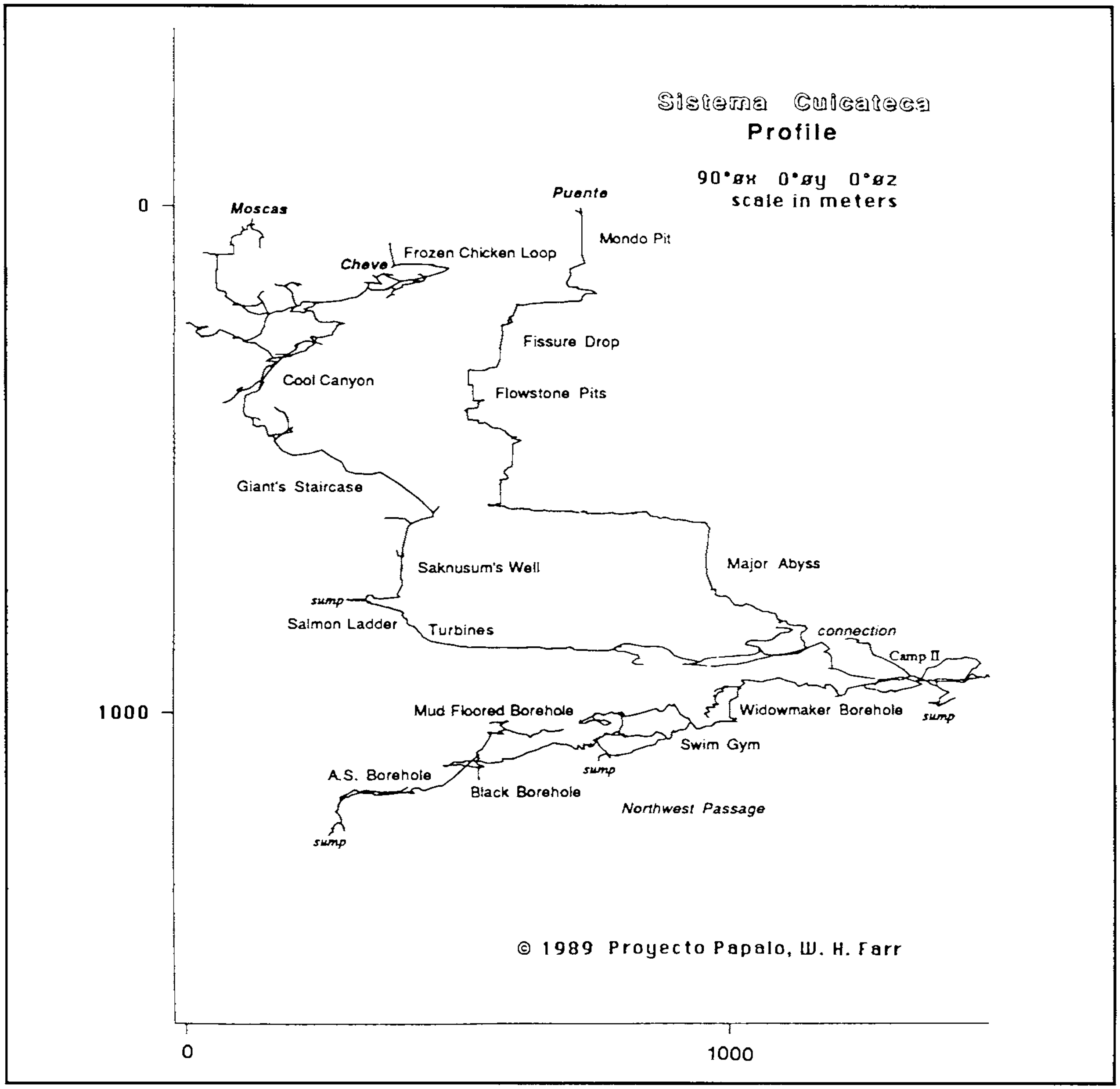


ued exploring Osto de Puente Natural, whose entrance is higher than any other in the system. At the beginning of the expedition, Puente was 422 meters deep, a kilometer long and showed every indication of connecting to Cueva Cheve. In general, Puente is a more difficult cave than Cheve. The passages are narrower, requiring frequent chimneying and the drops tend to be more awkward. It can be difficult to get motivated to push Puente with the more spacious passages in Cheve so near. Nevertheless, one of the goals of the expedition was to connect the two caves, since this would increase the depth of the system. Early in the expedition, a trip by Bob, Jeb and Bitsy pushed Puente to a tight, slowly-descending canyon. The passage was occasionally lined with flowstone and small pools dotted the floor. Despite the good airflow and going passage in Puente, after the first trip, interest was diverted to some new discoveries.

NEW CAVES

On a ridgewalking trip early in the expedition, Peter Bosted and I located the inconspicuous entrance to Viento Frío (Cold Wind Cave), which lies at the base of a grassy sink northeast of Puente. Peter and I surveyed down four short drops to the top of a very deep-looking fissure, where we ran out of rope. Later, Mark and I returned to descend this eighty-meter fissure drop and two more short drops to a total depth of two hundred meters. There are two infeeding passages into the cave so far and the passage size is generally more spacious than Puente. Exploration stopped after a stretch of canyon passage led to the top of an eight-meter drop.

Bill and Pat Stone, Mark Minton and Pam Smith spent several days looking for



new entrances in an area a few kilometers south and about six hundred meters lower than basecamp. They found several interesting caves. The best of these were Cueva Campana and Sumidero Aguacate. In both caves, the crew was stopped by a drop not far from the entrance. Though both caves had airflow, the group concluded that these were separate from the main system.

THE RESURGENCE AREA

During his two-week backpack trip prior to the expedition, Don had set dye receptors in the springs most likely to be resurgences for Sistema Cuicateco. One spring is located at four hundred meters elevation on the Río Seco below the town of Santa María Tlalixtac. The other spring, the Río Frío de Santa Ana, is on the Río Santo Domingo at three hundred meters elevation, fourteen hundred meters below the town of Santa Ana. Bill Stone dove this spring (which he called the Western Resurgence) during the Peña Colorada Expedition in 1984 and found a maze of going passages. The strong flow and cold temperature of the water in the Río Frío de Santa Ana led everyone to suspect that this was the resurgence for Cheve; only a positive dye trace would prove it. While Don and I were in Oaxaca City, Bill Farr dumped optical brightener into the Cheve stream. Three weeks later, Don, Mark and I went to the two most probable resurgences to retrieve dye receptors. Unfortunately, they all turned up negative. But, the trip was productive. We found and explored one cave near the spring on the Río Seco and located three blowing caves near the Río Frío de Santa Ana. The latter three caves seemed promising as our brief reconnaissance failed to find the end of any of them.

CHEVE CONTINUES

While we were at the spring, the second Camp II team, composed of Rolf, Bob, Jeb and Bill Stone headed in for four days. They pushed through the breakdown in the Hall of the Restless Giants and made their way through some very nasty passage to eventually discover the Black Borehole. This was, yet another, breakdown-floored passage, this time with very dark walls. Surveying eight hundred meters on their last trip, they ended at another breakdown choke that Stone described as the worst he had seen in years.

CUATES

Meanwhile, back on the surface, Andy and Bill Farr located another promising, new cave while ridgewalking near Puente. The twin entrances to Cuates are higher in elevation than Puente and have good airflow. Mark and I descended the twenty-meter pit just inside the larger entrance. This led to a breakdown room. After finding a way through the breakdown, we followed the air down three more pits of 28, 35 and 8 meters, to another area of breakdown, which we were not able to get through. We also explored an 18-meter pit in a dead-end room.

Toward the end of the expedition, Mark, Tim and I returned to push the pit inside the second Cuates entrance. Even after considerable "gardening", the top of this pit still contained many small, loose rocks. As Mark was sitting at the base of the drop in a "safe" spot behind a boulder, he was struck on the lip by a falling rock. We left the cave and Mark and I drove to Concepción Pápalo, where he received four stitches in his lip. There was a second pit visible beyond the first. This remains a good lead for next year.

Mark Minton at the larger of the two entrances to Cuates (Carol Vesely)

THIRD DEEP CAMP

Undaunted by the reports of nasty breakdown at the end of the Black Borehole in Cheve, Don, Bill Farr, and Nancy went in to Camp II to check it out. After almost two hours of worming through the boulders, Bill moved a rock and squeezed "Through the Looking Glass" into the A.S. Borehole. Reaching up to forty meters high and forty meters wide, it is the largest passage discovered in the cave to date. Originally, the cavers had picked out another name for this impressive passage, but then they noticed the meter-high initials of A.S. which appeared as a natural inscription on the wall. Perhaps, Arne Saknussemm had been here on his Journey to the Center of the Earth.

Joined the next "caving" day by Andy, Matt, John and Todd, the camp team split into two survey parties. They mapped both upstream and downstream in the A.S. Borehole to net 1.6 kilometers of passage in a day, all over a kilometer deep! Upstream, the A.S. Borehole lead to a tight, flowstone-lined crack that appeared to be the down-cave extension of the Black Borehole. Downstream, the A. S. Borehole ended in a massive breakdown pile with very strong airflow. A second trip to the end of the A.S. Borehole just to poke at the breakdown failed to reveal anyway through. However, all that air must go somewhere.

THE PUENTE-CHEVE CONNECTION

As the expedition neared the end, interest in Puente returned. A marathon trip by Rolf, Louise and Bill Stone pushed through some of the tightest canyon yet discovered in the system and they surveyed 117 stations in a horizontal stretch of passage at -560 meters. Several times the passage narrowed to the point where it was nearly impassable, prompting some to speculate that Puente might become too tight before ever reaching Cheve. Nevertheless, the three cavers were stopped not by a tight crack but by an impressive shaft, The Major Abyss.

There was time for one more trip to Puente before the end of the expedition. Bill Stone said it was 'connect or die". Carrying 250 meters of rope, Rolf, Bill Stone and I made a final assault on the cave. After rappelling the 118-meter Major Abyss, we followed the stream canyon down six more drops. With only seven meters of rope left, we finally connected to Cheve at a small infeeder on the east side of the big, breakdown-floored room just above the drop into the East Gorge. Rather than head back through Puente immediately, we decided to head deeper into Cheve to Camp II. Here, we met the others on the Camp II team who were just returning from their second stab at the terminal breakdown at the end of the A.S. Borehole. There was a combination of excitement and exhaustion as everyone shared their good news. As this was the last day of the underground camp, the Puente crew helped the others eat their remaining food. Then, all ten of us tried to cram into seven sleeping bags for a much-needed nap.

Everyone packed up and headed for the surface with Don, Rolf and Bill Stone surveying the new passage in Puente and the rest of us hauling camp duffles out of Cheve. Matt and Andy began stage-derigging on the way out from camp, with derigging completed the next day by Bill Farr and Tim.

After everyone else had left, Bill Farr and I hiked down to the Río Frío de Santa Ana to retrieve another dye receptor and begin surveying the caves nearby. Unfortunately, this receptor also turned out negative. While we were there, we surveyed over five hundred meters in Cueva del Mano. With its flowstone-lined, warm, dry passage, Mano was quite a contrast to Cuicateco. The passages surveyed continued with good air flow, but we were out of time. There are many leads left in Mano and we haven't begun surveying the other two caves that we know about in the area. Even if this area turns out to be unrelated to Cheve, it still holds promise. Next year a larger push is planned.

POSTSCRIPT

Currently, the Sistema Cuicateco ends in an even more terminal-looking breakdown choke than the Looking Glass. Two trips have yet to find a way through, although air is screaming into it. The push farther will require establishing Camp III at the end of the A.S. Borehole. But, this is not the first nasty breakdown area we've reached and, with good air flow, we're confident the cave still goes.

In total, Osto de Puente Natural is 2.5 kilometers long, 887 meters deep and contains 23 rope drops. The connection between Puente and Cheve added 27 meters of depth to the system. To get to the present end of the system from the closest entrance (Cheve) requires 57 rope drops. Sistema Cuicateco is currently 16.3 kilometers long and 1243 meters deep, the second deepest in Mexico and the eighth deepest in the world.

SPONSORS

We wish to thank our 1989 sponsors for their generous donations: NDC Systems, Bob & Bob, Dogwood City Grotto, the Art of Climbing and the NSS Exploration Fund.

SISTEMA CUICATECO

Una serie de campamentos subterraneos a -850 metros, permitió a los cueveros explorar el Sistema Cuicateco a 16.3 kilómetros y 1243 metros de profundidad, combirtiéndolo en la segunda cueva más profunda de México y la octava en el mundo. Osto de Puente Natural, la entrada más alta conocida hasta ahora, fué conectada al sistema sumando 27 metros a la profundidad previa del sistema. En total, Osto de Puente Natural es 2.5 kilómetros de longitúd, 887 metros de profundidad y contiene 23 tiros que requieren cuerda. Para llegar al presente final del Sistema Cuicateco desde la entrada más cercana (Cheve) requiere descender 57 tiros con cuerda.

SPECULATIONS IN SPELEOLOGY
Sistema Cuicateco - The inside of a mountain

Don Coons & Patricia Kambesis

Southern Mexico's Río Santo Domingo slices the high mountains of the Cuicatlán region into two distinct ranges. Sierra Mazateca, the range to the north, contains world-class Sistema Huautla. The mountains to the south, the Sierra Juárez, hold a cave system of nascent fame, Sistema Cuicateco. The main entrance to Sistema Cuicateco is located in Llano Cheve, a conspicuous depression on the Cuicatlán topographic map. Two kilometers long and half as wide, the llano swallows the waters of three surface streams. Eighteen kilometers to the north and 2400 meters deeper, these waters resurge in the Canyon del Santo Domingo via the Río Frío de Santa Ana springs. Consequently, Llano Cheve is the gateway to what some believe is the deepest cave in the world.

Looking north down the Río Santo Domingo (Carol Vesely)

Metamorphic rocks skirt the llano on its south and west sides. The northeast end holds the sweet spot, an impressive hundred-meter high headwall of limestone with a gaping black hole at its base. This is Cueva Cheve, the main entrance to Sistema Cuicateco. At higher elevations, the Cuicateco karst contains upper entrances that open into short stretches of horizontal passage separated by discrete shafts. These eventually connect to Cueva Cheve, giving the cave greater vertical extent and affording it the status of a system. The tectonic framework of the area, coupled with local lithologic and structural nuances, make for a formidable cave system; one that is physically challenging, psychologically intense and geologically unique.

LITHOLOGIC OBSERVATIONS

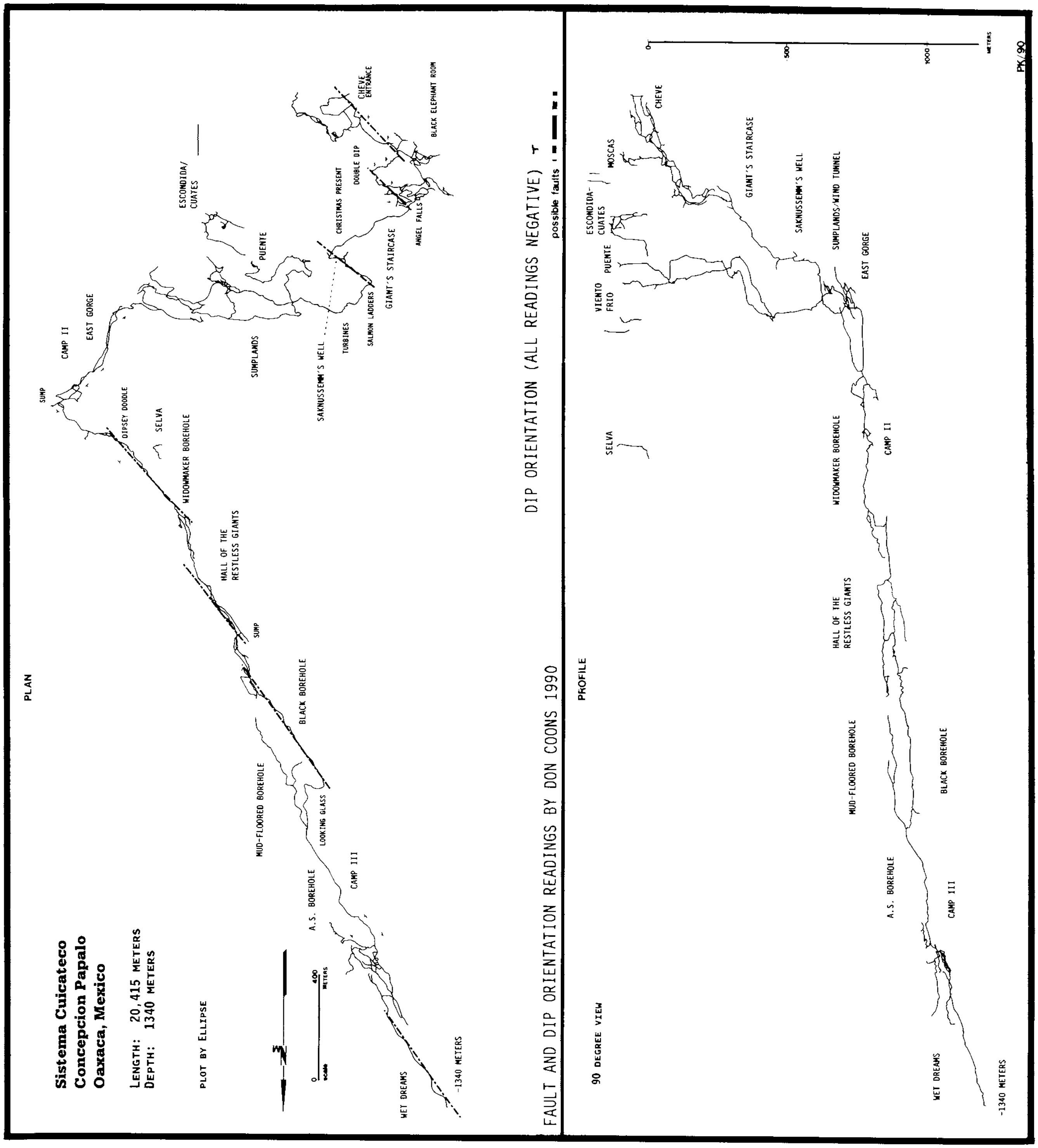
Sistema Cuicateco lies within a three-kilometer-wide swath of Lower Cretaceous-aged carbonates. This swath is sandwiched between metamorphic rocks for a linear extent of twenty kilometers. To the west, a melange of Cretaceous-age metavolcanic rocks (Hose, 1990) come in sharp contact with the Cretaceous carbonates. The eastern boundary of the swath is a three-hundred-meter escarpment which drops into an andesite-floored valley. To the south, near Llano Español, the carbonates pinch out between the metamorphic complex on the west and the andesite on the east. The Canyon del Santo Domingo terminates the system to the north. However, the carbonates continue unbroken northward across the river to the Sistema Huautla Resurgence located a half kilometer downstream of the Río Frío de Santa Ana resurgence.

The overall thickness of the carbonates is at least a thousand meters and beds dip west-southwest. Individual units vary in thickness from less than a half meter to three meters throughout the cave. Lithologically, the rocks range from dolomites in Llano Cheve, to dark-colored, recrystallized limestones through most of the cave (Smith, pers. comm), to a striking white marble in the Wet Dreams section, the deepest segment of survey in Sistema Cuicateco. Some areas, notably the East Gorge through Camp II to the Dipsy Doodle, are interbedded with thin shale units, less than a centimeter thick.

A prominent exposure in the cave is an andesitic porphyry dike located in the Christmas Present Chamber (Estes, Smith 1988). Visible as a massive fin projecting from the east wall, it tumbles boulders downward into the cave as far as the upper Giant's Staircase. Presumably this dike is related to the surface exposure just east of the area.

STRUCTURAL OBSERVATIONS

The upper reaches of Cueva Cheve, from the entrance to the Turbines, seem to be controlled by a series of faults that are separated by short stretches of strike-oriented passage. The Entrance Chamber, Basket Room and Black Elephant Room are aligned on a fault. A short segment of horizontal strike-oriented passage diverges from the bottom of the first pitch to the top of the Double Dip. A second fault dominates here and can be observed at the Christmas Present, Elephant Shaft and Angel Falls. Next, a massive, breakdown-floored ramp (Giant's Staircase), descends downdip for three hundred meters where it is abruptly terminated by yet another fault. The physical expression of this feature is an auspicious 150-meter-deep abyss named Saknussemms Well. The stream which flows under breakdown for most of the route reappears as a waterfall in this pitch and follows the trend of the fault into the Narrows. At this point, the passage takes an abrupt western departure from the faults and


Sistema Cuicateco
Concepcion Papalo
Oaxaca, Mexico
LENGTH: 20,415 METERS
DEPTH: 1340 METERS
PLOT BY ELLIPSE
PLAN
CHEVE ENTRANCE
BLACK ELEPHANT ROOM
DOUBLE DIP
CHRISTMAS PRESENT
ESCONDIDA/ CUATES
ANGEL FALLS
GIANT'S STAIRCASE
SALMON LADDERS
TURBINES
SAKNUSSEMM'S WELL
PUENTE
SUMPLANDS
EAST GORGE
CAMP II
SUMP
DIPSEY DOODLE
SELVA
WIDOWMAKER BOREHOLE
HALL OF THE RESTLESS GIANTS
SUMP
BLACK BOREHOLE
MUD-FLOORED BOREHOLE
LOOKING GLASS
A.S. BOREHOLE
CAMP III
WET DREAMS
-1340 METERS
DIP ORIENTATION (ALL READINGS NEGATIVE)
possible faults
FAULT AND DIP ORIENTATION READINGS BY DON COONS 1990
PROFILE
90 DEGREE VIEW
0
500
1000
METERS
PK/90
CHEVE
MOSCAS
GIANT'S STAIRCASE
SAKNUSSEMM'S WELL
SUMPLANDS/WIND TUNNEL
ESCONDIDA-CUATES
PUENTE
VIENTO FRIO
EAST GORGE
SELVA
WIDOWMAKER BOREHOLE
CAMP II
HALL OF THE RESTLESS GIANTS
MUD-FLOORED BOREHOLE
BLACK BOREHOLE
A.S. BOREHOLE
CAMP III
WET DREAMS
-1340 METERS

the stream picks up gradient as it cascades downdip through the Salmon Ladders and out into the Turbines.

Here, the nature of the cave changes dramatically. What had been a steeply descending series of vertical shafts and ramps, becomes horizontal streamway, shifting from a high, narrow canyon above the Turbines, to a wide elliptical tube through the Sumplands. A tributary just above the Wind Tunnel brings in a major infeeder, possibly draining as far south as Llano Español. The dimensions of the cave increase past the Puente connection and into the East Gorge where the character of the passage changes again to a high, bi-level canyon before plunging into a sump. The passage continues to trend east-southeast at first, then curves to the northeast. Dip and strike readings indicate a structural depression west of Camp II.

From Camp II to the known end of the system, the character of the cave changes significantly. Most of the passage is typified by massive breakdown-floored boreholes which follow the northwest strike of the structural trend. However, perturbations away from this main trend have been observed as a periodic series of eastward-trending "doglegs". Each is characterized by a complex of multi-level passages complicated by breakdown and sumps and may be a result of local faults, fissures, changes in lithology, or as a consequence of some aspect of the initial phreatic development of the lower reaches of the system. Three of these "doglegs" have been passed by explorers at the Widowmaker, the downstream end of the Hall of the Restless Giants, and the Looking Glass. The fourth is the present nemesis at the end of exploration where breakdown is more confusing and the current downward route ends in a sump at -1340 meters below the highest entrance, nine kilometers distance from the Cheve entrance, and 11 straight-line surface kilometers from the resurgence at the Río Frío de Santa Ana.

DESCRIPTION OF SURFACE AND SUBSURFACE DRAINAGE

Sistema Cuicateco drains a surface area of approximately eighty square kilometers, from elevations as high as 2970 meters above sea level. Waters flow across the impermeable metamorphics that make up the steep rock slopes and sink at or near the carbonate/metamorphic contact. The seven known entrances to the system occur on this contact. Gradients of these shaft-drain routes (Osto de Puente Natural, Viento Frío, Cuates, and Cueva Cheve from the entrance to the Turbines) approach 45 degrees. The water is funneled seven to nine hundred meters downward into the main drain of the system via a series of shafts and steep ramps.

Between Camp II and the current end of the cave, the hydrologic trend of the master drainage is to the northwest. The stream gradient is a gentle seven degrees and the water flows under breakdown for most of the route with the exception of the Swim Gym and Wet Dreams. The gradient in these two segments is considerably steeper and the water traverses are quite sporting.

Hydrogeologic conditions for the existence of the world's deepest cave are favorable in Sistema Cuicateco as proven by a successful fluorescein dye trace instigated by Jim Smith in the spring of 1990. Smith dispensed dye at the Cueva Cheve entrance of the system. Eight days later the waters of the Río Frío de Santa Ana ran green. This makes the Sistema Cuicateco dye trace the world's deepest with a vertical extent of 2440 meters and giving the system a proven hydrologic vertical extent of 2570 meters (Smith 1990).

THE RESURGENCE AREA

Eighteen kilometers north of the Cueva Cheve entrance, the Río Frío spring discharges through the lowest levels of a maze complex in Cueva del la Mano. Composed largely of a network of smaller passages which bear some evidence of faulting, the cave is complicated by flowstone and sumps. From east to west downdip, each passage is successively lower in elevation than the last reflecting the gradual lowering of base level due to the combination of uplift and consequent downcutting of the Río Santo Domingo. Though most of this subterranean network is hydrologically abandoned, it forms a distributary system that is still evident in at least three different risings along the present spring run.

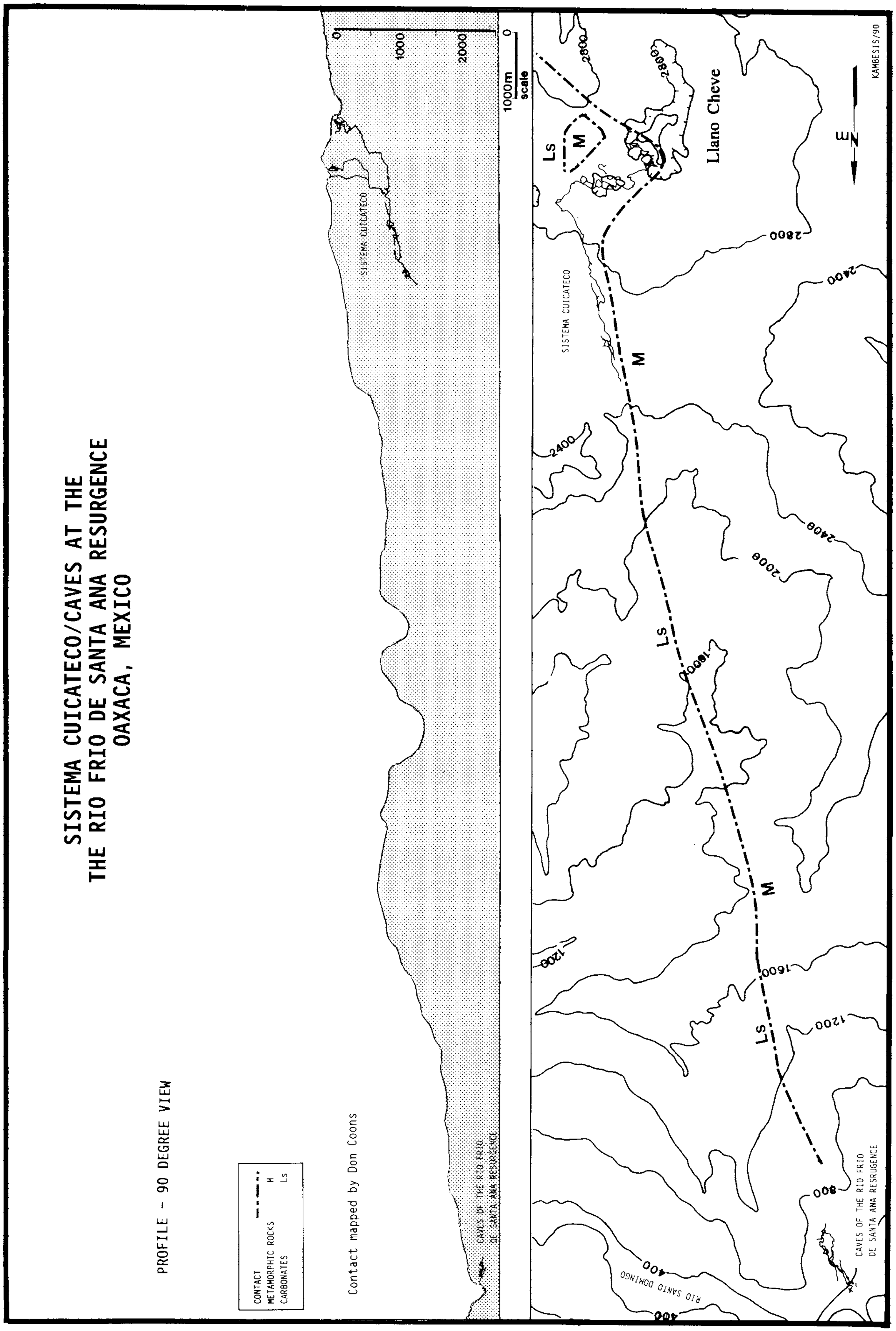
SPECULATIONS

In order to understand the subtleties and complexities of Sistema Cuicateco and its speleogenesis, it is important to first consider the geologic context of the system on a regional basis. The Sierra Juárez is just one of a series of north-south trending mountain ranges that make up the Sierra Madre Oriental, the eastern structural "backbone" of México. The tectonic style of this region is that of a fold/thrust belt. By definition, stratigraphic units have been folded into a series of anticlines and synclines and tectonically transported along a detachment surface. The brittle nature of the rock has resulted in a succession of thrust faults which are closely associated with the folds. This structural style has undoubtedly influenced speleogenesis in the region.

Local hydrogeology (surface and subsurface) and subsequent cave development are a function of the folds and their orientations (Jennings 1971). Because the carbonates have been subjected to stresses resulting from overburden pressures and mountain building (orogeny), fissures (or joints) developed in the folded strata due to tangential stresses. These features tend to be localized in the troughs of the synclines and the upper arms of the anticlines (Jakucs, 1977). Thus, the joints that have formed at or near the axial planes of the anticlinal folds, along with associated local faults, probably play a major role in the vertical development of the system. The fissurization associated with the trough of the syncline may have influenced passage develpment along that trend. Regional deformation, extensive uplift, and erosion have led to the development of a high relief karst.

Over time, as waters drained into the fissure network of the limestone, shaft caverns developed, often to great depths, as is typical in other mountain karsts. Consquently, the high karst caves tend to be predominantly vertical. The upper entrances to Sistema Cuicateco and the upper portion of Cueva Cheve (down to -850 meters) consist of a series of shafts and dip-ramps which are separated by segments of strike-oriented passage. These features are the structural expressions of fissures, local faults and the dip of the bedding which serve to funnel the drainage deep within the carbonate corridor.

Beyond the East Gorge, there appears to be a structural manifestation that overrides the joints, faults and dip in channelling of the waters through the cave. Jennings (1971) observes that in folded structures, fold axes may deflect underground drainage away from the surface courses and notes that synclinal troughs, in particular, act in this way. Perhaps, in Sistema Cuicateco, the upper, vertically-oriented passages intersect the axial plane (or trough) of a faulted synclinal fold. The dominant control on the drainage route would become the plunge of the fold and fault trends associated with that fold.


SISTEMA CUICATECO/CAVES AT THE
THE RIO FRIO DE SANTA ANA RESURGENCE
OAXACA, MEXICO
PROFILE - 90 DEGREE VIEW
CONTACT
METAMORPHIC ROCKS M
CARBONATES Ls
Contact mapped by Don Coons
SISTEMA CUICATECO
CAVES OF THE RIO FRIO DE SANTA ANA RESURGENCE
0
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Llano Cheve
RIO SANTO DOMINGO
KAMBESIS/90

Though these speculations are simplified, they do attempt to put the geologic observations within the context of the regional geology. Of further interest, with respect to speleogenesis, is the dual nature of the cave: the vertical shafts and dip ramps in the upper cave versus the the lower level boreholes. Do the deep, low-gradient boreholes of the East Gorge and beyond reflect karst evolution of a much earlier period; and did the vertically oriented network of passages in the upper karst, which are obviously related to current surface conditions, fortuitously intersect this much older trend? Or, is the development of the Upper Karst and the deep phreatic cave just multiple phases of the same speleogenetic conditions? Continued exploration, survey and geologic observations will help answer these questions.

SUMMARY

In general, the circumstances surrounding the formation of Sistema Cuicateco seem to be a function of the regional structural style, local structural features and their orientations, stratigraphy, and gradient.

Drainage flows across a large upland area of impervious metamorphic rocks. When the water encounters the contact between the metamorphic and sedimentary rocks, it sinks into a long narrow band of carbonates. Faults, fissures and the local dip of the bedding funnel the drainge deep witihin the carbonate corridor until it interesects a strong northern structural trend. The waters coalesce in this master drainage and flow at a low gradient until they resurge via springs into the Río Santo Domingo. This whole setting occupies an area as large as some counties, with a vertical extent deeper than the U.S.'s Grand Canyon.

The current survey traverse in Sistema Cuicateco, from the Cueva Cheve entrance, covers less than four kilometers straight-line distance on the surface heading north. The survey line in Cueva de la Mano covers one kilometer surface distance heading south; eleven kilometers separate the two. Explorers are not certain as to the potential length of a through-trip, or how many years of exploration it would take to find a route. However, of one thing they are very certain - Sistema Cuicateco is a superlative cave.

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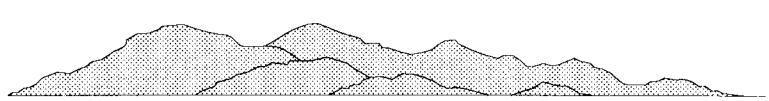
GEOLOGIA DE SISTEMA CUICATECO

Una area extensiva de las terrias altas que esta composdad de piedras metamorphica esta localizada en la Sierra Juárez desur de México. Aguas superficia corren por ariba de las metamorphica impenetrable y se unden entre bandas estrecha de piedra caliza. Dieciocho kilometros para el norte y mas de 2400 metros abajo, estas aguas salen por la base de la montana dentro el Río Santo Domingo por un rio que se llama Río Frío de Santa Ana. Esto se ratificado por un vestigio de tinte conductado por Jim Smith en al ano 1990. El conducto bajo de tierra para este desague es el Sistema Cuicateco. Hasta, horo, veinte kilometros de passage se an trazado en un mapa a una profundidad de 1340 metros. Este report certidica observaciones hidrologica y geologica.



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Front Cover: *Bill Steele on traverse of the 15m pitch marking the end of the East Gorge, Cueva Cheve Cave, Oaxaca, Mexico.*
PHOTOS BY BILL STONE

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Cueva Cheve: A Trilogy of Recent Deep Cave Discoveries

by James H. Smith MN '85, Mark Minton FN '82, Bill Stone FN '79

PHOTOS BY BILL STONE

Parallels have often been drawn between high altitude mountaineering and the exploration of deep caverns. The charting of a 1,000m deep cave can be considered the technical equivalent of scaling an 8,000m peak. A more revealing observation is that deep cave exploration today is where high altitude mountaineering was 60 years ago—when expeditions were fielded to the Himalayas expressly to discover a new 8,000m peak. It is now accepted that there will be no peak higher than Mount Everest, a fact which can be verified by satellite geodesy. It is on this point that the exploration of deep caverns departs from similarity with mountaineering. Despite all of our present technology, the depth of a cave can be determined by only one process: physical exploration and mapping. The element of surprise remains a distinguishing characteristic of this endeavor and it is still anyone's guess where, ultimately, the world's deepest cave will reside. Never was surprise more peaked than in December of 1987 when it was learned that a 700m deep cave had been discovered in the Sierra Juarez, only 30km south of Mexico's present deepest cave, Sistema Huautla. Surprising because the entrance to this new cave—named Cueva Cheve by its discoverers—Bill Farr and Carol Vesely—was set in a tropical pine forest at an elevation of 2,700m, more than 900m higher than the mean elevation of the Huautla Plateau. Those familiar with the region immediately recognized the possibility that Cueva Cheve was the counterpart—a mirror image—of the Huautla System, draining north towards the Santo Domingo canyon rather than south, and with much greater depth potential. With this background it was not surprising that every expeditionary deep cave explorer in the United States worth his/her salt volunteered for the return expedition, then being planned for March of 1988. The three vignettes which follow set a backdrop for the revelations which seem certain to come from this area in the 1990s.

The Rescue Squad: Rolf Adams (left), Noel Sloan, and Mark Minton during the 1989 rescue of Steve Knutson. Following a slip in the -700m borehole before The 23m Drop *Knutson broke several ribs but was able, over the course of 4 days, to ascend under his own power. Sloan, a medical doctor, was flown in from the States on short notice to assist with the rescue. Adams, Sloan, and Minton accompanied Knutson out from Camp I during the final leg of the rescue.*

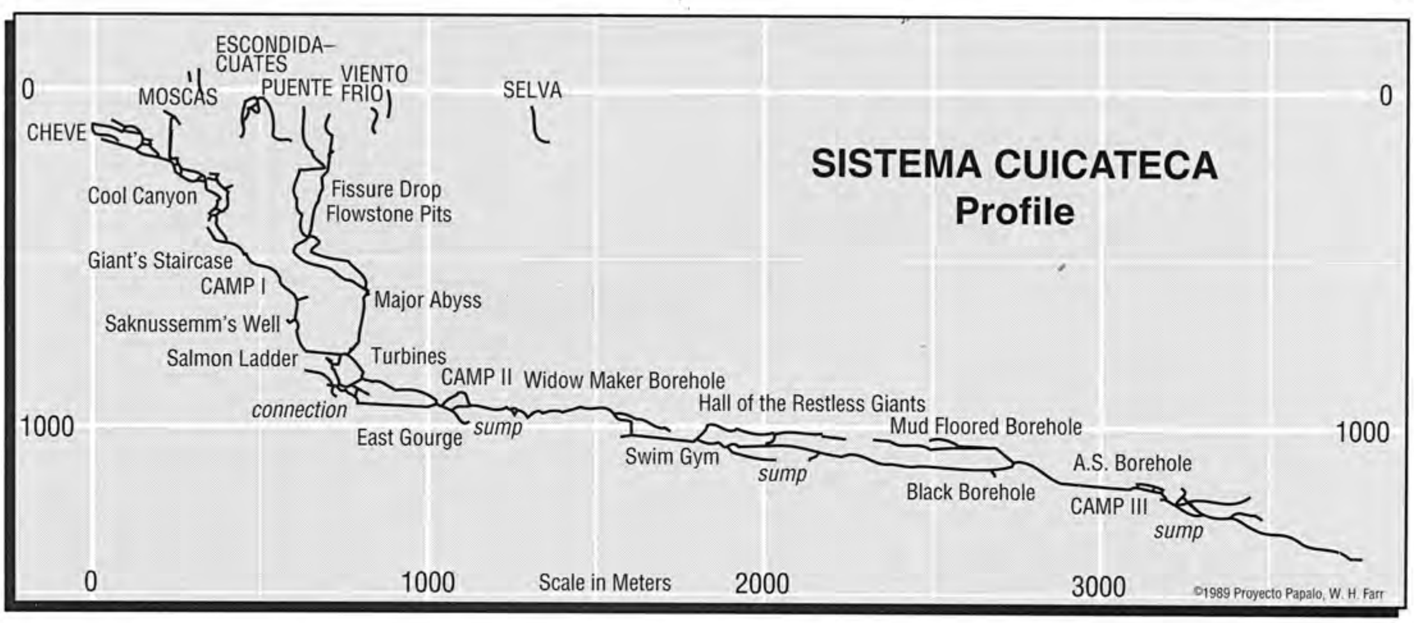
Jim Smith: The 1988 Cueva Cheve Expedition

Ed Holladay, Lee Perry, Mason Estes, Don Coons, and I were in Huautla in March of 1988, winding down a series of hydrologic studies that had kept us occupied for the past three months. Briefed on Cueva Cheve by Coons, who was on the team that had reached the limit of exploration in December, we offered to assist with the upcoming push and arrived at the site a week ahead of the main expeditionary team to begin rigging.

We began our journey to Cueva Cheve in the arid Tehuacan Valley, and ascended steeply eastward along a dusty four wheel drive track past the city of Cuicatlan, then Concepcion Papalo, then—wilderness. Along the way the vegetation changed from red desert sand with prolific organ pipe cactus to tropical cloud forests with trees five meters in circumference, and finally to a sparse subalpine forest of ponderosa pine. Like many large cave systems, the entrance to Cueva Cheve is preceded by a depression. Multiple drainage valleys, founded on metamorphic rock, radiate as far as five kilometers from the entrance. These valleys meet at a small circular, grassy depression known as Llano Cheve and it is here that one gets the subliminal message that something vast, hydrologically speaking, is afoot. Stretching across the entire north side of the llano is a sheer 100m high, 200m wide limestone headwall . . . the "contact" between the surrounding impermeable quartzites and schists and cave-forming limestone. At the base of this impressive feature is a 40m wide, 15m tall black gash leading underground: the entrance to Cueva Cheve. The name Cheve apparently is associated with mysticism and sorcery and has ancient roots in the Cuicatec language. The presence of a voodoo doll at the entrance along with simple offerings that appeared prior to our arrival in March suggests that witchcraft is still practiced by Cuicatec shamans.

There is a distinctly different atmosphere to life in Llano Cheve as compared with Huautla. The nearest village is ten kilometers distant and only rarely do the local Cuicatec Indians pass through the area. Some 20 years ago a forest fire cleared the scrub, leaving only the tallest pines and a carpet of moss and tufted grass, with crystal mountain streams running the course of each tributary valley to the llano. And so this was surface life at Cheve—a dynamic view of that unbelievable headwall and steep grassy slopes rising to the sky with pine trees sticking up like so many blades of grass. And when the clouds came rapidly streaming over from the Gulf of Mexico, as they do at this altitude, it was as if basecamp, the llano, and the sinkhole, were some self-contained world, sailing through the heavens. At night it was not uncommon for our water bottles to freeze solid. Cold, dense air poured down the tributary valleys like water and into Cueva Cheve, fueling a subterranean draft that seemed, during our month on the mountain, to never abate.

Some hold that the weather in Cheve basecamp is too good. Consistently sunny, warm days form a stark contrast to the 47°F stygian dankness that lies beyond the entrance. But there is an undeniable allure to the cave. A trip to the deepest point is nothing short of an Olympic obstacle course, and a seemingly endless one at that. Beneath that awesome headwall the tunnel expands to more than 60m wide by 30m high and descends along a gently sloped mountain of breakdown. The passage is so large that daylight may be seen 800m inside the cave. Shortly beyond twilight the gallery is punctuated by a series of 10–15m shafts separated by a meandering tall canyon through which the wind howls. At a depth of 200m an exposed traverse over a deep pit leads into the Christmas Present, a huge 30-by-40m rubble-floored gallery which parallels, and lies above, the descending stream-carved canyon. Such duality, a large, dry upper level overlying a deeper, and much narrower active stream passage is manifested throughout Cheve. We were later able to play this morphological characteristic to our advantage on several occasions by searching for



the alternate level when it appeared that the cave had ended. At one point along the Christmas Present I was amazed to discover a piece of unusual black rock. Certainly not limestone. Only with greater light did I discover that the entire right wall of this massive tunnel is comprised of an andesite dike, a volcanic intrusion.

More, and ever deepening, shafts lead off the bottom of the Christmas Present with names like The Elephant Shaft and Angel Falls, all products of the imagination of those who had first descended them and recognized the need for labeling such landmarks. The last empties into a 50m diameter borehole at –300m known as The Giant's Staircase. There begins a massive rubble slope which descends at the angle of repose for a remarkable 150m of vertical relief. . . a long descent going down, a seemingly endless ascent as one steps from boulder to boulder on the way up at the end of a long trip. At the bottom of this boulder cascade is Saknussemm's Well, drawn from Jules Verne lore. One look and you know it is headed for the center of the earth –150m straight down. Halfway down the abyss the main stream reenters, scattering silvery spray into the black void. In order to miss the cold sting of that waterfall we employed European rebelay rigging, a relatively new concept in the New World. The approach, simply, involves the use of intermediate anchors (rebelays) on long shafts to allow several members of a team to ascend simultaneously, and the use of climbing aids to pull the line away from sharp edges (redirectionals). This allows the use of smaller diameter 9mm rope, a significant logistical advantage over the American standard 11mm line. It does, however, often result in ropework maneuvers just short of acrobatic, a serious issue when transporting the bulkier equipment needed for prolonged stays at depth. In the past it has been common practice, owing to the toughness of 11mm rope, to rig a deep shaft like Saknussemm's in a single shot. Problems with lines becoming frayed on unseen ledges and long, cold delays waiting at the bottom while a partner ascends have given rise to reconsideration. Cheve has become a melding pot of these techniques, with vocal protests a common facet of nearly every push.

At the bottom of Saknussemm's Well, 650m below the surface, the gradient diminishes as one follows the stream through a tall, narrow canyon known as the Salmon Ladder, which contains numerous small cascades separated by deep pools of cold water. Ahead of this, the water, now quite forceful, barrels down a spiraling, polished shaft with a resonant roar. This point, known as the Turbine, was the deepest anyone had reached in Cheve prior to our arrival in March 1988. Our five-man team pressed onward, past the pummeling spray, stringing lines through the vertical obstacle course. In one place we had to scale a blade-like rib of rock separating two cylindrical wells, up one side, and down the other, all the while thunder boiled below. There was something of a humorous mood in the group that day. The pronunciation of Cheve in Spanish is quite close to that of the American auto nickname "Chevy" and since a turbine is part of a motor our little up and down maneuver became The Piston. We soon encountered an even more formidable obstacle—The Fuel Injector—where two jets of water arced horizontally into the path of the descent line. There was no escaping the deluge. We soon left this cold and windy canyon and were able to explore an additional 600m of walking passage before eventually coming to a sump at a depth of 750m. Estes subsequently discovered a bypass which led a further 400m into the mountain with the route still continuing.

By this time the main team had arrived. Bill Farr, Carol Vesely, Peter Bosted, and Gary Mele came from California; Bill Steele FN '79, Mark Minton, FN '82, Ralph Snavely, and Adrian Garcia from Texas; Steve Zeman, Jeb Blakeley, and Bob Benedict from Idaho; Ernie Garza, Karlin Meyers and Beth Meyers from the Cerro Rabon expedition; and, a week later, Bill Stone, FN '79 and Matt Oliphant from Maryland and California. There was little wasted time before exploration was in full swing. Estes, Holladay, and Karlin Meyers surveyed the 400m of canyon that Estes had previously discovered on his one-man reconnaissance and continued another 300m. They reported retreating in a borehole at –750m. The following day Steele, Farr, Minton, and I entered Cheve following a prolonged feast of carbohydrates for what we knew would be a long trip. It took us seven hours to reach the front. Just 20m beyond the end of the previous team's tracks we climbed down a loose slope that calved flying boulders at the slightest encouragement. At the base of this 80m talus pile we encountered the first pitch requiring a rope in nearly a kilometer and a half of passage. Farr took the honor of the first descent of what, for obvious reasons, became known as the 23m Drop. He touched down in a clean washed canyon where the stream, now considerably enlarged due to the junction of an unseen tributary, emerged once again, only to jet out over another waterfall a few meters downstream. We had been surveying for six hours and were five kilometers from the entrance at a depth of –793m. Certainly a stout warmup trip for Steele and the others. While they climbed the 23m Drop, I took the opportunity to recon downstream a ways and had soon traversed more than 400m through what subsequently became known as the East Gorge. Ahead the floor fell away into an 8m cascade, the end of the line for me that day. I savored the lonely remoteness of this place, felt the smoothness of the clean polished rock, and gazed into the black unknown which lay ahead, then resolutely headed for sunlight.

Not all of our work was devoted to Cueva Cheve. There was a continuing search for higher elevation entrances that might connect into Cheve and boost the depth—part of the game we all play, be it a British, French, Russian, Australian, or American team looking for the world's deepest cave. Above the Cheve headwall a bizarre, and extremely rugged karst landscape leads northward as a thin finger of limestone amidst the flanking metamorphics. As with Cheve, when a surface stream coming off the impermeable rocks meets the limestone one invariably finds a sinkhole, into which the streams vanish. One of these, located some three kilometers from basecamp, was named Osto de Puente Natural by Vesely, Farr, and Coons when they discovered it during a surface reconnaissance three months earlier. Osto is Cuicatec for deep pit, and this place indeed has one, a –102m vertical shaft just beneath the entrance roof—certainly a quick commute to work. Puente, the full name was quickly amputated in the interests of brevity, was 135m higher than the main entrance to Cheve—an attractive plum, if it could be quickly and easily connected to Cheve. It was soon determined that neither of these adjectives—quick and easy—were appropriate for Puente. Only three deep pushes were fielded to this cave during the 1988 expedition, owing to the exceedingly sinuous, narrow nature of the interconnecting fissures which ran between the vertical drops. During the first trip Holladay and Meyers reached a depth of –400m. A subsequent effort by Vesely, Mele, and Bosted, succeeded, during a 20-hour ordeal, in deepening the rift only 22m. On the last trip Farr and Minton increased the length of the cave to just over one kilometer but only a few meters deeper before stage derigging. The way on became increasingly narrow, and there was no prospect for a connection with Cheve anytime soon—the computerized plot of the cave showed the nearest possible link point to be at a depth of at least 750m in Cheve. Enthusiasm waned in favor of work in another lead, closer to basecamp, named Cueva Moscas—Fly Cave, which lay in an obscure brush-filled sink 115m above the Cheve entrance. During the course of four survey trips this was eventually connected to Cheve. And so the depth of Sistema Cuicateco, the union of Cheve and Moscas, grew to 863m.

Following two days of rest I was back at the cascade at the bottom of Cheve that had brought an end to my solo reconnaissance. With me this time were Blakeley, Zeman, Benedict, and Holladay. We had split into two teams with Blakeley and Holladay serving as the rigging crew while the rest surveyed in from the last station recorded by Steele. Blakeley was some distance out along the left wall of the cascade when we arrived. He had swung to a ledge on rappel and placed a chockstone so that he would not swing back into the water. From this perch he leaned out to place a rock bolt clear of the falls. More such acrobatics followed as we strove to avoid the churning cascades below. The passage soon took a sharp turn to the east and dove down the dip of the limestone bedding into a sump. Although this sump was now the deepest point in the system, at 933m below the Moscas entrance, we felt certain that we had missed something along the way. During our ascent we noted a large room leading upward and westward shortly before the end of my previous reconnaissance.

On the surface I found Steele, Stone, Farr, and Oliphant packing equipment for underground camping. Our trip length—more than 24 hours—had convinced them that endurance was going to be a problem and that it was time to set a bivouac deep inside the cave. Oliphant and Stone were fresh off the plane and had just arrived in Llano Cheve the previous morning. They were all gung ho despite the hefty weight of their packs. Those of us who had been in Huautla for the past three months were acclimatized to both the elevation and the rigors of going deep every other day and were not quite ready to face the prospect of hauling a duffel—particularly on some of that European rigging! So we chided the campers and planned to push from the surface as long as we could. As it turned out, they only made it about halfway down the Giant's Staircase (–400m) before having to stop, some 300m above where they originally planned to set Camp I. They had spent some eight hours along the way re-rigging several shafts they felt were awkward and unsafe when hauling a heavy load. A day later they reached the deep lead and discovered a large, dry upper-level borehole heading south and rising steeply. They followed this for some 400m before it ended at a series of deep shafts leading back into the East Gorge . . . this was not the way on we were seeking. They subsequently de-rigged the route leading to the 933m sump, then returned to the initial point where they had entered the upper level. There was something puzzling about the abrupt termination of the big passage in the northern direction. The general trend of the cave was, thus far, resolutely northeast. Oliphant, a skilled Yosemite climber, noted that it would be possible to scale the wall to determine if there were a continuation at roof level, but that he would prefer to do so using a dynamic rope belay owing to the exposure. All they had with them were static caving lines.

Team photo from the 1989 expedition. Left to right, rear: Mark Minton, Jim Smith, Steve Knutson, Don Coons; center: Bill Stone, Rolf Adams, Pat Stone, Carol Vesely; front: Ron Simmons, Pam Duncan, Peter Quick, Peter Bosted, Bill Barr.

The following morning Holladay and I returned to the climbing lead, having received a briefing and some hot chocolate at Camp I. To our surprise we found a sinuous free climbing route up through boulders that paralleled Oliphant's face climb and soon found ourselves at the roof of the canyon. Sure enough, there was a howling breeze up there and it was not long before we found ourselves in a 30m diameter borehole. The two of us ran for more than 700m on a northwesterly bearing before being stopped by an 8m wall. We could see the continuation of the passage at the top but had no climbing equipment with us. Even though we were still above the level of the 933m sump the shift in direction to the northwest was of tremendous significance. We had been concerned that the resurgence for Cheve might be in Condor Canyon to the east, where locals had reported a large spring. This would have limited the maximum depth of the system to around 1,000m. But to the northwest there was nothing until reaching the bottom of the Santo Domingo Canyon—2,600m lower.

During the next several days the team was in transition. Seeing that Camp I was not providing the hoped-for logistical edge, Steele, Stone, and Farr had headed for the surface after five days underground. They had left Oliphant at Camp I, it was his first underground camp and he was still reveling in the novelty of it, with the understanding that a team would be back in a few days for a final effort to crack 1,000m. In fact, it was not until four days later that Stone and Holladay awoke him from a sound sleep and beckoned him to join them on their way to the climb. The remainder of our deep team that day, Zeman, Blakeley, Benedict, and myself, hung back on a leisurely descent, taking photos, to give them time to complete the climb.

When we caught up with them we were chastised for taking so long—they had been waiting nearly three hours. Oliphant had found a delicate traverse that bypassed the vertical wall and within minutes had a line rigged for the others to follow. They had scooped several hundred meters ahead in the 25m-wide, 10m-high borehole and would likely have continued had it not been for Stone's discourse on ethics regarding surveying what you scoop. A minor miscommunication at the start of the trip resulted in our team having all the surveying instruments and, lacking this crucial hardware, they had reluctantly returned to the top of the climb to await our arrival. We thanked them for their patience and continued on as a team for some 400m before coming to a 20m shaft leading down to a lower level. Ahead, I could hear the distant rumble of a stream. Needless to say, we were enthralled by that sound. At the end of this borehole, 100m distant, a much deeper shaft awaited. Stone and I met at the lip and we both gazed down. "I believe we are looking at –1,000m right here," he said. When he stood up the rock we had both been standing on—it was the size of a small car—groaned and rolled forward some 20 degrees. Zeman, who saw this from his perch on a ledge a few meters back, finished a bite of the candy bar he was working on and said, "best be careful there Jim, that's a real widow-maker."

I kept that in mind as I gingerly rappelled past that teetering block. I had descended only 10m before having to set another bolt to keep us out of its fall line. The wall rock seemed hard as steel and it took what seemed ages to set the bolt from my free hanging rappel. From the bolt I could see the Widow Maker suspended above my head and it was a humbling experience. I set a chockstone to swing still further from its path and rappelled toward the increasing roar of a stream. The walls were stained dark from suspended mud during flooding and they were more fluted and sharp than anything I had yet seen in Cheve. I soon found the stream, the signal that we had successfully passed the 933m sump. The dark walls of the stream canyon were con-

Leaving daylight, an exploration party descends towards the end of the entrance chamber and into the stream canyon.

trasted by deep emerald green water. I swam down the two meter high passage expecting a sump but to my delight I entered a tall canyon with solution pendants that looked like Swiss cheese.

I waited for the others to descend the Widow Maker Shaft. Blakeley, who was followed shortly by Oliphant and Holladay, informed me that Stone, Zeman, and Benedict had begun to survey the roughly half kilometer we had already explored. This bit of teamwork gave us the opportunity to push harder below. We began traversing over pools and climbing along ledges. The stream gradient was dropping about one meter in five and the water level had increased again from what we last saw at the 933m sump. We did audacious climbs to avoid the water as none of us had brought wet suits in the interest of honing weight. Finally our progress slowed down as we penetrated a canyon filled with breakdown. We were side by side talking to but unable to see each other in the collapse. Ahead was more breakdown. I drilled a bolt on the left wall as a tie-in station and we began surveying out. It took us six hours to reach the Widow Maker Shaft and by the time we arrived it was 7 a.m. I fought to stay awake while the others climbed. On the way out we stage derigged all drops to Saknussemm's Well. It took 14 hours of nonstop caving to climb 35 drops to reach the surface. The last man was out following a 34-hour stint underground. Together our two teams had explored and surveyed nearly a kilometer of passage. Sistema Cuicateco reached a depth of 1,038m on that trip—the third cave this season in Mexico to break the 1,000m threshold. By the time the expedition was over the length had grown to 9.1 km. We may have seen only the beginning of the world's deepest cave.

Mark Minton: A Deep Rescue and Tales from the High Karst

For the 1989 Proyecto Papalo Expedition everyone agreed that it was time to camp in Cheve. The depth and distance to the front of exploration were simply too great to allow for a significant effort from the surface. Camping can be nice. One wakes up fresh for the next push without the prospect of hours of travel but it also has its drawbacks. In order to maintain a crew for several days underground a large supply of food, clothing, bedding, fuel, and rigging tackle is required. Getting all this gear in and out of the cave places new demands on the explorer, changing the way one moves and climbs. Sometimes it is not always worth it.

At 3 a.m. on March 7 an icy wind was blowing down the 100m entrance drop. My partner Rolf Adams and I had just returned from a 14-hour trip to –460m in Osto de Puente Natural. At the top was an ominous message: "Derig the entrance shaft and bring the big rope and all your gear back to basecamp. A rescue is in progress." The worst thing that can happen on a deep caving expedition is an accident, and this one sounded bad. Steve Knutson, FN'87, had fallen and broken some ribs at –850m in Cueva Cheve.

We got more of the story later in the morning following some sleep. The trip to Camp II in Cheve was more grueling than had been reckoned on. Half the team (Bill Farr, Knutson, and Carol Vesely) had bivouacked at –800m, planning to continue the next day. They then lost the route in a large chamber (ironically the same room where Puente was later connected) and ended up in a small crawl through breakdown. At one spot Knutson removed his pack and pushed it ahead over a small drop off. Instead of landing on a ledge as planned, the bag bounced and fell further, pulling Knutson, who was still attached by a tether, over the edge. Although he fell only three meters, he landed on angular blocks of rock and suffered broken ribs as well as a badly bruised calf. Contact was soon made with the rest of the crew (Peter Bosted, Don Coons, Peter Quick, and Jim Smith) who had successfully reached Camp II, a kilometer further into the cave. After Smith, who was trained in first aid, assessed Knutson's injuries, everyone agreed the situation was not life threatening. But it was unclear how readily he would be able to move out of the cave. His ribs were bandaged and the night was spent in a makeshift camp on a ledge beneath a prolific display of white soda straw formations, 200m before the 23m Drop. The following day Knutson's condition and morale had improved dramatically. With others carrying his gear, he was able to move under his own power and began traveling toward the entrance. During that day the camping team managed to assist Knutson to the top of the Fuel Injector, a kilometer closer to the entrance, but only 50m up. Knowing that the worst would be yet to come Smith left directly for the surface from the bivouc site that morning to rally the rest of the expeditionary team and he had written the note we found at Puente. On the 7th Jeb Blakeley, Bitsy Ray, and Pat Wiedeman left for Huautla (only 30 km to the north, but a full day's drive) to retrieve a Sked litter from the Huautla Project Depot. When they reached the highway at Cuicatlan they telephoned Bill Steele, FN '79, in San Antonio, who arranged for Dr. Noel Sloan to fly down from Indianapolis. Benedict, Simmons, Smith, and Stone headed into Cheve to carry on with the rescue from –800m. With Knutson able to climb, albeit slowly, on his own, the group covered half the distance to the entrance in the course of 18 hours and left Knutson and Bosted at Camp I (–400m) before exiting.

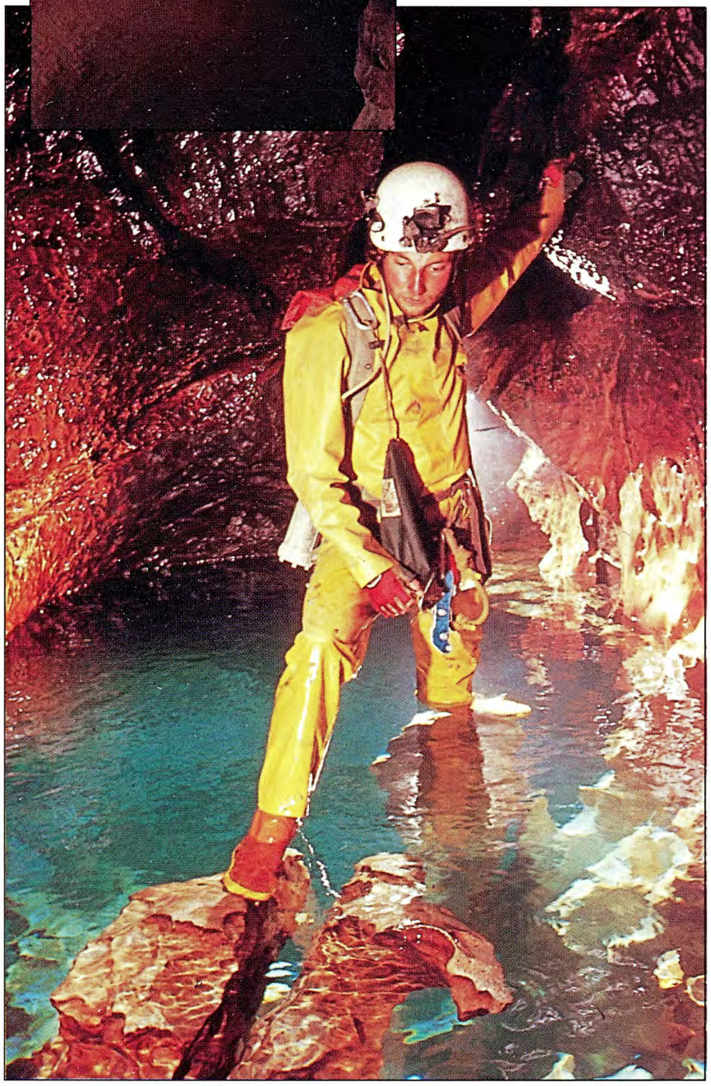
Two days later Adams, Sloan, and I made the trip to Camp I where Knutson was examined and pronounced as fit as could be expected under the circumstances. His ribs seemed to be knitting and he was feeling good after a day of rest. The final trip out required only five hours, with the patient moving faster than his doctor. Four and a half days after the accident, the rescue was over and totally successful. We were very fortunate that Knutson's injuries were not more severe. Had he not been able to climb on his own, the effort required to extricate him would have manifoldly increased. And although his large camp pack was directly responsible for the accident, had the team not been prepared for several days underground, there would have been insufficient food and clothing to sustain the victim until help arrived.

With the rescue behind us we were now able to return to the business of exploration. The highest elevation and best developed karst in the Papalo area lies to the north of Cueva Cheve in the vicinity of Osto de Puente Natural. With the hopes of finding even higher entrances to the system, work was begun in several promising caves there. Sotano de los Cuates has twin entrances in the pinnacles above Puente, and a connection would add 20m of depth to the system rather easily. The route from the larger entrance was pushed down four drops in spacious passage but this was eventually terminated by an impenetrable collapse. Two other routes from the smaller entrance still await exploration, but the extremely vertical nature of the cave makes a quick connection with Puente seem unlikely. Very near Cuates lies the obscure entrance to Cueva Escondida, which appears to lead in several directions. As the highest entrance yet found, this cave will be a prime objective in 1990.

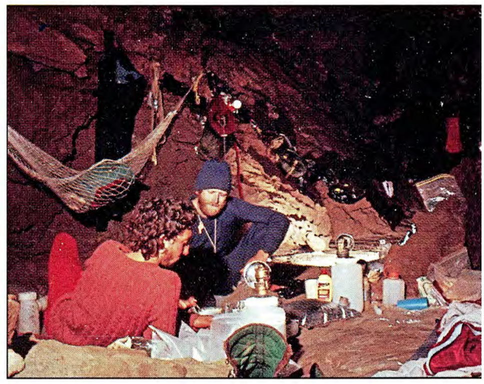
Cueva del Viento Frio lies to the north of Puente and contains generally larger passage. After two trips the cave has been explored to a depth of 200m down seven drops, including an 80m-deep fissure containing a major infeeding stream. With good airflow, this cave should be connected to the system next year. Another as-yet unnamed small cave, the northernmost found to date, is located in a large sink beyond Viento Frio. It has not yet been explored.

Farther to the north the elevation begins to drop as the mountains slope down toward the presumed resurgence along the Rio Santo Domingo. A search of the intermediate area accessible by road turned up little of interest, in spite of extensive karst development. It was our hope that mid-level entries to the system could be found, thus reducing the travel time between the entrance now used and the areas of active exploration underground. Only a single cave, Cueva Campana above the town of

Pat Stone nearing the bottom of the 3rd (12m) pitch in Cheve. A traverse along the left wall avoids the lake.



Rolf Adams takes care to balance on the Stepping Stones traverse in the Swim Gym. The water below is 10m deep and a slip from these polished underwater pendants meant a complete dousing.



Adams (left) and Benedict relax on a day off at Camp II during the 1989 expedition. Unlike the cold, windy canyon of Camp I, the temperature at Camp II was measured at 58°F. Residents of Camp II were the first to notice that the deep sections of Cheve had reversals in the direction of airflow; in the upper reaches of the cave there is a persistent draft which pulls air into the cave and which, apparently, never changes direction.

San Francisco Chapulapa, was reasonably extensive, but it would be too inconvenient for use in pushing the system even in the unlikely event that it could be connected.

Early in the expedition dye bugs, nylon stockings filled with activated charcoal, were placed by Coons in the two large resurgences thought to be the only likely prospects for the discharge of Sistema Cuicateco's water. Optical brightener was then dumped into the Cheve stream in hopes of establishing a hydrologic link. Three weeks later retrieval of the bugs gave negative results. New bugs were installed and collected again at the end of the expedition, but again came up negative. We concluded that either the Chevé resurgence was at another site, or more likely a larger quantity of dye and/or even longer times would be required for a positive trace.

An unexpected benefit of visiting the resurgences to collect the bugs was the discovery of at least two significant caves near the Nacimiento Rio Frio de Santa Ana. This spring was discovered by Stone and company in 1982. Lacking a local name for the spring, they had christened it the Western Resurgence. Although the spring was dived for 180m as part of the 1984 Pena Colorada Expedition, there were no air-filled caves known to be associated with it. Cueva del Mano has significant airflow and heads directly into the mountain above the spring as a pleasant two-meter-diameter passage. On the second bug retrieval trip 300m were surveyed in Mano with several promising leads left unchecked. So far water has not been encountered, and the airflow indicates that a sump is unlikely. The second cave appears to be an overflow resurgence and will probably join the main conduit, although the passages are complex. We thus have the potential to work from the bottom up as well as from the top down, and a two-pronged approach is planned for the return expedition in 1990.

Bill Stone: Discovery of The Black Borehole and The Puente Connection

It was noon when the three of us began our descent into Cheve on March 18, 1989. With me was Bob Benedict of Idaho and our Aussie mate Adams. Our mission was to go to the end of the cave, now at –1,060m and seven kilometers in, and pick up where Rolf and Jim Smith had run out of rope on a three-day blitz following Knutson's rescue. Smith's time had run out and he had flown back to the states, leaving Adams as the sole keeper of the knowledge of the intricate route they had pioneered.

Learning from past experience in this cave, I honed my camping kit to the essentials and, with three weeks of acclimatization at 2,600m elevation behind me, was feeling fit for the task at hand. We were not, however, feeling so fit as to consider tackling this job from the surface. The end of Cheve was quickly becoming one of the more remote points inside the planet. At the beginning of the expedition we had selected a location five kilometers inside Cheve, at a depth of 800m, for our advance operations base. We reached it in just under eight hours, passing now-familiar landmarks—Saknussemm's Well, the Turbines, the 23m Drop, and the East Gorge—before ascending a free hanging 20m rope into the canyon roof. There we entered a dry, high level gallery and shortly arrived at Camp II. After a freeze dried repast sleep came easily.

My watch alarm went off at 8 a.m. I would have slept no longer without it... my back was aching. Whether this was from yesterday's load or sleeping on hard sand was never certain. Perhaps it was internal rebellion at leaving the sunlight and the pleasantness of the llano for the chilly dankness of this dark, windswept tunnel deep inside the Sierra Juarez. I did some stretches, wrapped my sleeping bag around me to stave off the chill of the subterranean wind, and fired my light. We heated some hot water for oatmeal and potatoes and sipped hot cocoa.

My first thought as we left camp and traversed the Northwest Passage, discovered during the final push of 1988, was one of novelty. The last time I had been in this grand tunnel, 50m in diameter at one point, I was fatigued from seven hours on the move, and psychologically burdened by the thought of the 35 shafts remaining to be scaled to reach the surface. Now, working from Camp II, I was fresh and able to take note of that which had previously been a blur. As we hiked through the vast gallery, I saw clusters of stalagmites, no larger around than your forearm, yet 2m tall, standing there, silently, like tan-colored tree trunks of rock with no branches. The trail was the path of least resistance through a vast, and still unstable, field of monochrome grey-brown boulders. The surface rolled and twisted within the confines of the massive gallery like terrestrial hills and valleys. The only sounds, save for the distant pattering of a small, unseen waterfall, were man made. The sound of boots landing on rock, occasionally followed by a brittle crunch or ominous grinding as a thin plate snapped underfoot or a precariously balanced boulder rolled away under virgin load. There were the continuous crinkling and sliding sounds of PVC shell suits being flexed as we stepped from boulder to boulder. And there was the sound of hard breathing as a difficult move was made. The omnipresent silence which otherwise ruled was so total that one could tell what was in store by the sounds being made by a teammate 50m ahead. Even in big passage such as this vision quickly narrows as sweat, body heat, and 100% humidity combine to nucleate a fog which hangs around your head like a halo. The fog, in turn, reflected back the brilliance of our French "ceiling burner" acetylene flames, giving more than a fleeting sense of traveling in your own isolated world. All of these sensations came in subliminal flashes, for we were setting a quick pace. We stopped at one point for a rest. Benedict took in a deep breath, scanned the horizon and nodded to himself. Smiling, he summed up the past kilometer in a word, "Nice." "Yeah," one of us said in agreement. Those were the first words anyone had spoken in nearly an hour and they seemed entirely sufficient. You don't carry on very intellectual conversations on a trip like this. You just experience it with the few teammates bold or crazy enough to be down there with you.

Along the way we did a substantial amount of rigging through cave that had already been traversed. There were places along the 1,038m level where Adams, who was an excellent free climber, would simply traverse across an extremely exposed wall and downclimb to the floor of a drop. Benedict and I tried to duplicate several of these maneuvers until finally each of us concluded we were playing a dangerous game of machismo at –1,000m. I pulled a rope from my pack and began rigging anytime either of us felt the slightest bit uncomfortable, for I knew that at some point we were going to be coming back through this at the end of a 24 hour trip, during the circadian downtime from 3–5 a.m., when you are most likely to make mistakes. In that state, it is far safer to pull out an ascender and clip in than to attempt a free climb. The route soon left the stream and ascended 60m to the Hall of the Restless Giants, a high-level borehole that was thick with large terraced formations, the first we had seen in Cheve. This ended in a flowstone shaft which took us down 40m to a convoluted solution maze 20m above the main Cheve river, which we could hear rumbling beneath us. This was the section that Smith and Adams had pioneered. By the time we reached the limit of exploration we were down to but 40m of rope, having used 80m to rig all the climbs along the way. This did not greatly affect the course of events that day, for the pit that had stopped Smith and Adams quickly led to a sump. We had lunch and surveyed back to the top where Adams discovered a partition wall. To the north of this wall water could be heard falling. We set two rock bolts out over the edge of this new pit to maximize the reach of the rope and Adams descended. When he returned he was soaking wet and quite cold, having rappeled down a narrow slot with a substantial waterfall dumping directly upon him. He related that it led to yet another shaft carrying an active stream. Our 14-hour trip, while netting only 200m of new discoveries, had left us with a clear and beckoning canyon dropping back towards the lost Cheve river.

Following a rest day at Camp II, and three hours on the move, we were back at Adams' dreaded waterfall. By that time we were solidly fired for virgin exploration. Adams found another horrendously tight slot through flowstone that bypassed the wet fissure. I had to take most of my climbing rig off to get through, but it was certainly preferable to being doused in that cold water. Though our PVC suits are waterproof, getting hit by a stream of water just sent a chill through one's body and it took a long time afterwards to warm back up, which was partly due to the constricted nature of the passage, as well as the powerful wind whipping through it. In quick succession we rigged three pitches, all around 20m, although they looked deeper when we first came upon them. We had carried 120m of rope with us, all that remained in camp, and had about 50m left at this point. Following the final pitch Benedict climbed up a steep flowstone slope and up through a fissure. This continued just 60m before opening beneath a 6m-diameter arch into complete blackness. We had been joking in camp that we would go down there and discover two kilometers of galleries today—and it looked as if someone had read our prayers. In what followed we traversed nearly a kilometer of 15m-diameter borehole. It was all breakdown-floored and both floor and walls were coated with a dark manganese crust which had an amazing, and distressing, slickness to it. The manganese absorbed the candlepower from our lamps like a sponge making it a dark world down there. Upon reflection we named it "The Black Borehole." We slowed our pace to ensure foot placements were always along sharp ridges or the joints between boulders — never on the actual face of a piece of breakdown. That was tantamount to asking for a fall, as there was simply no traction. Furthermore, a lot of this rock was weathered and one had to test each handhold or foothold that looked even remotely questionable, and certainly any convenient pendant or projection was to be distrusted as they often simply pulled off in one's hand. We grew more conservative regarding what constituted acceptable risk, for we were very alone down there. And with each meter we advanced further into the unknown, so did we move one meter further in remoteness from anything that might constitute assistance in the event of an accident. Each of us was a vocal contributor when it came time to rig.

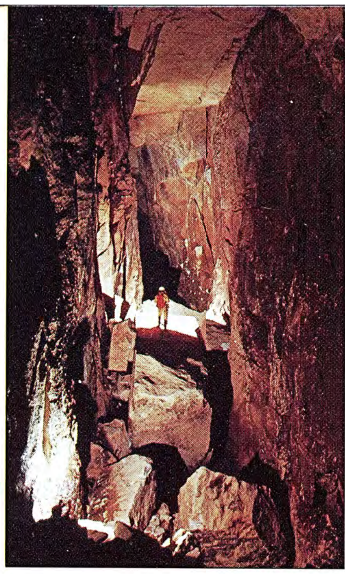
At one point along the way the passage took a 90-degree jog to the east for more than 120m. We had for some time been following a fault on a northwest bearing, evidenced by slickensides where the rock strata had slipped. The jog took us tearing perpendicularly through the beds rather than following parallel to them. It made for significantly more difficult going as we scaled the wildly projecting slabs of limestone. The end of this section was punctuated by a 20m shaft. There was nothing at the bottom. Six meters down, however, we spotted the continuation of the corridor on the opposite side of the shaft. By penduluming on rope we were able to reach it. The tunnel came to an abrupt end just 100m further in a 25m-wide chamber where the ceiling had collapsed. Following a rudimentary poke we concluded we had missed something further back and retreated to where Adams had initially spotted a pit heading down towards the sound of the stream. We now rigged this with our last piece of line and Adams descended. It did not go, but our survey later showed this point, at –1,100m, now to be the deepest in the cave. We returned to the breakdown pile and spent 45 minutes checking for leads. There was a substantial wind only 20m from the collapse and it was obvious that it was simply going through the rocks like a sieve. This did not, however, automatically guarantee that the mesh size of that sieve was of human proportions. I did not get very far in, but then weaseling through unstable chunks of rock has never been my forte. Adams fared no better, but Benedict disappeared for quite some time. When he returned he indicated that he had gotten perhaps 40m into the pile and had stopped where several tight spots led on. He had the wind, but he, as well as Adams and I, was now becoming fatigued. We decided to carry on with the survey at this point, since we had a long way to go before we could pick up speed and get warm.

This marked the deepest I was to reach in Cheve in 1989. Benedict had a plane to catch and so our team made its way towards sunlight after five days down. The torch was passed to Bill Farr, whom we found at Camp II following 22 hours on the move. More reinforcements, including Don Coons, Matt Oliphant, Nancy Pistole, Andy Grubbs, John Schweyen, and Tim Jones, were on their way in on the morrow to pick up where we had left off. They were aware, based on a cheery briefing from Adams, that the "lead" was inside a giant pile of rubble.

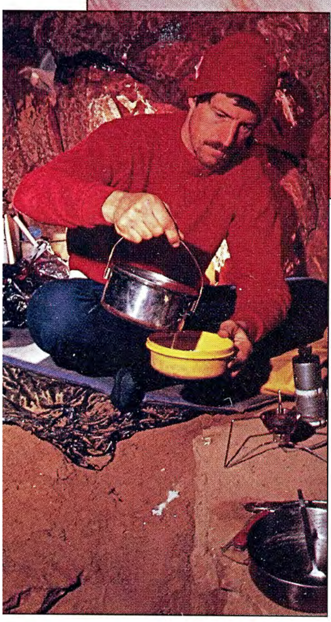
A few days later Adams and I decided to have a go at linking Osto de Puente Natural to Cheve. Given that the limit of exploration in Cheve was less than promising, the extra depth that would result from a Puente connection gained newfound importance. Louise Hose, FN '89, agreed to be the third member of our team. During the past three weeks Mark Minton and Adams had descended to a depth of 460m in Puente before being nearly stopped at a sinuous, jagged squeeze. Adams had slithered through and come to a drop on the far side. There was a howling breeze going through it.

I held a healthy respect for this cave. A few weeks earlier Pat Wiedeman and I had dropped on down to the –200m level on a warm-up trip with Minton and Ron Simmons who went ahead to rig. And all along the words of Smith were coming back to me. He and Steve Zeman had, during a campfire session in 1988, described with some relish the excruciatingly narrow nature of this cave. Unlike Cheve the drainage focus for Puente was diminutive and following the spectacular 102m entrance shaft the passage withered to a narrow, convoluted, multi-level fissure that demanded strenuous, awkward maneuvers with not a few places requiring one to exhale to slide through. It took us four hours to reach the flag marking the end of exploration. We had 120m of rope with us, which we considered at the time to be overkill, given that the previous push had yielded an increase in depth of only 20m. However, no sooner had we passed Rolf's Horror, the tight rift at the end, than we hit a series of five cascades which ended in deep plunge pools. We strung out 40m of our precious rope until coming to the top of a black void. Rocks fell free for four seconds. Adams descended first and, from the tone of his narration, this particular pit in Puente was something unusual. Just over the lip it became immediately

A view looking out from the end of the Black Borehole during the 1989 expedition. The giant boulders on which Rolf Adams (red pack) is standing are wedged between the walls of the canyon 30m above the floor and the exposure is high. Behind the camera a complete collapse blocks the tunnel up to roof level. A sinuous 70m route through the breakdown was pioneered by Bill Barr at the end of the 1989 expedition which led to the discovery of the A.S. Borehole.



At –1,275m Peter Keller crosses the resurgence of the Cheve stream in Wet Dreams. The river was last seen at the –1,215m sump.



Bill Stone making dinner at Camp III-B following a day of exploration and survey during the first 9-day push. To conserve weight only collapsible cartridge "scorpion" stoves were used for cooking. Dinners consisted of freeze dried pack food and potatoes; breakfast consisted of oatmeal and freeze dried pack meals. The temperature at Camp III, interestingly, was 58°F, 2 degrees warmer than Camp II.

apparent that something was sticking up the middle of the shaft. It was a 40m-tall, separated tower of flowstone that had been selectively eroded from its connection to the wall of the pit. It came to a needlepoint just 2m below the head of the shaft and broadened to 6m in diameter at its base. We called it the Shaft of Damocles, owing to the fact that we were dangled by a thread over the sword (in the legend, a sword was dangled over Damocles). It was a quite distinctive landmark. Beyond this shaft the passage narrowed to a 40cm-wide fissure which continued relentlessly for 300m. We took a lunch break, eight hours in, at a momentary widening of the fissure. So depressing was this crack that we seriously discussed whether it was worth going any further. Eventually we decided that we would venture on for another half hour and then begin surveying out. It was fortunate that we made this decision, for 200m further on the passage widened to 2m. Two meters! That was borehole in this cave. Then the totally unexpected happened: it actually did break into borehole; 8m wide by 6m tall. Not as big as Cheve, but absolutely awesome for this place. At the same time the passage widened we noticed that there was a large infeeder coming in from the south and we marked this junction, adding an arrow with the word "Puente" inscribed over it, should anyone someday wander down that upstream passage and come to the same place.

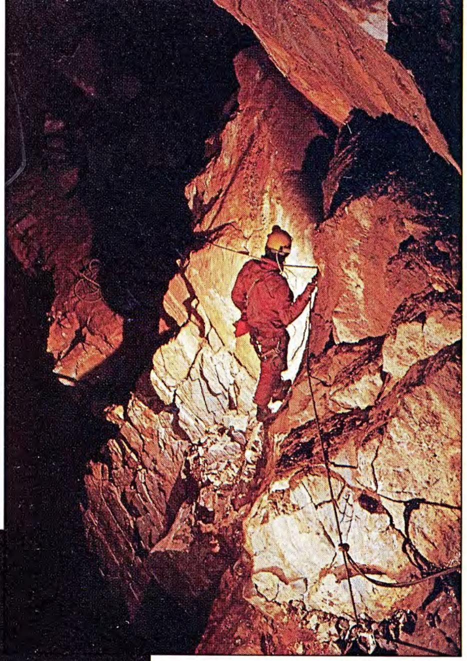
The main borehole lasted all of 30m before narrowing back down to a one-to-two meter wide canyon, still quite manageable. Soon the sound of a powerful falls was audible in the distance, and I thought to myself, "well, this will be a good time to unload the remainder of our rope." I was in the lead through this stretch and ultimately came to a steep fissure that was possibly climbable, but, owing to our remoteness, I asked Adams to pass up the rope. It was quite short, about a 6m pitch. I had scarcely landed on what I had thought would be the canyon floor when I realized that I was perched on a rock bridge and that shafts continued down on both sides, substantial shafts at that. The others came down and we carefully made sure that everyone had an ascender on that line. I had tossed a rock down one side of the pit and the long delay before I heard the first crash assured me that what rope we had left was not going to reach bottom. One side had the loud roar of water pounding down while the other appeared to be a relict, dry bypass. Adams played out the remainder of our rope down the dry side and rappelled over. A few moments later he was back stating that he had reached a pothole in the side of the shaft, 12m down, and there he had run out of rope at the head of at least a 50m pitch. We surveyed out from the lip of the final drop and slowly made our way out of the cave.

We surveyed 800m that day . . . nearly as much as what we had in the Black Borehole in Cheve, which was quite remarkable, given that a great many of our shots were under 4m. It was a grim, cold chore. Although Puente was no colder than Cheve, its constricted quarters meant that one almost always had some body contact with the walls. This, and a persistent wind, just made one shake. It appeared to me that it was a lot longer on the way out than it had been going down. There were countless places where one had to use a lot of upper body moves while working up the inclined, convoluted passage. There were little barbs and hooks everywhere just waiting to snag you right when you had put out a burst of energy to pull through to a resting spot, only to find that you now had to hang by one arm and reach back to undo what was caught. I jogged up the final 102m pitch, riding my second wind on the thought of seeing sunlight far above. I told myself following this 22-hour struggle that this would be my last trip into Puente.

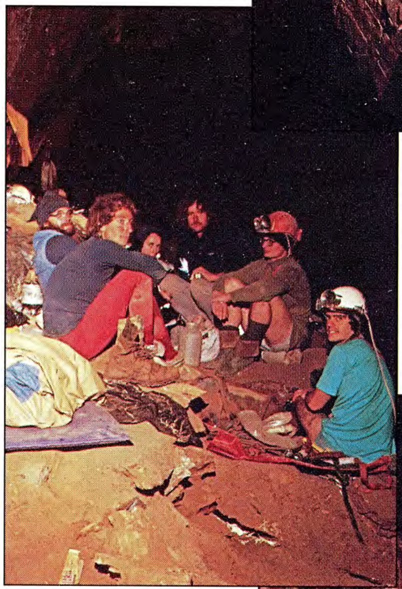
The following day Adams suggested we try to reduce the survey data to see where Puente ended up with respect to Cheve. After two hours of calculations we scaled off a grid on the two computer profiles we had on hand and plotted the data. The result was fascinating. The new depth for the cave was 580m and we had apparently persevered through enough of Puente's narrow fissures to reach the same level, stratigraphically, as Saknussemm's Well in Cheve. Our "50m+" shaft where we had run out of rope, we reckoned, had just broken through into the same layer of rock which apparently formed deep pits in this region. We mused that if it did what Saknussemm's did, that is drop straight for 150m, we would almost certainly connect with Cheve somewhere around the –800m level. Having been convinced that a Puente-Cheve connection was now possible it was understood that we would have to try for it despite my utter dislike for Puente. It is funny how you can psych yourself into these things; but then, there is something magical about connections, particularly a major one like this, that can override all prejudice. Our motto for the next push, uttered in a burst of bravado one evening, became "Connect or Die!"

The dreaded day had finally come. Laden with 220m of rope, the amount we had calculated to be necessary to achieve the connection, we found ourselves at the entrance gearing up for what each of us knew was going to be a grim mission. This time it was Carol Vesely who completed our trio. Once we reached the base of the entrance shaft it became a continuous struggle for the next seven hours—Adams with his 120m coil of rope, me with my 100m coil. I had spooled off some 20m of rope and rolled mine into a log, as we had done years ago in Nita Nanta, a strikingly similar cave in Huautla, to prevent the coil from snagging on the wall. Adams tried jamming his loose into his large backpack, but it did not fit. He had around 25m in a coil that popped out of the top, and caught on every conceivable projection. Vesely, for her part, had taken a good deal of the lighter, bulkier things from our packs. We were soon at the big shaft, which I had taken the liberty of labeling the Major Abyss on our survey sketch during the previous trip. We regrouped in the pothole that Adams had described, finding it to be perched on the side of what clearly was a very deep pit. He tossed the 120m coil into the hole. We watched as all of it snaked out and snapped taut. Then Adams disappeared down the line. Quite some time later we faintly heard him yell "rope free" and we dropped 90m to a ledge where the stream came back in and immediately poured, with a broad fantail, into utter blackness. We tossed rocks and estimated at least another 50m. We were definitely going to need all the rope we had brought, and I mused about that—we had read this cave precisely!

We were all soon regrouped down in a second pothole in the side of the big shaft, 5m in diameter and 4m deep, and were all getting a little punchy from being on the go. Adams started to set a rock bolt over the lip of the pothole and came in for a rest, very unlike him, being only 23 years old—13 years my junior. I finished, and tied on the 100m rope I had been carrying, and continued down the final 25m to a washed breakdown floor. The wind from the falls was whipping up a cloud of fine spray, so I quickly chopped the rope at the bottom, coiled the remainder and worked my way down the canyon that led off. I soon came to another 20m pitch. By my reckoning we were within 50m vertically of the level of the main Cheve borehole. And we still had the wind. We rigged three more pitches and traversed some 250m of canyon passage before coming to a breakdown

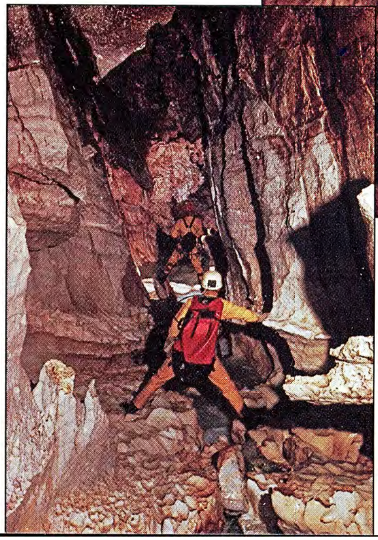


Don Coons on "Oliphant's Owesome Overpass," a hairy traverse across the top of the Camp III-A dome, 35m off the deck. The team invested four days pushing the breakdown pile behind the camera without success.



Camp III team during the final 7-day push of 1990: left to right, rear: Don Coons, Patty Kambesis, Matt Oliphant; front: Rolf Adams, Peter Keller and Karlin Meyers.

Looking back towards Angel Falls from the Camel's Hump at –400m in Cheve. The Camel's Hump marks the beginning of the Giant's Staircase, an uninterrupted steeply descending breakdown borehole which drops 150m vertically.



Rolf Adams and Matt Oliphant at –1,320m in Wet Dreams.

pile. It filled the entire canyon, 20m high. Here Vesely, being diminutive in size came to the fore. She soon had crawled through some stuff I would never have fit through and reported that she was back in the stream canyon. Shortly we found a bypass to the worst of her squeezes and the final one, which initially I could not fit through, was dispatched with a hammer to where it was clean sailing for just about anyone. We were, despite our somewhat stuporous state at this point . . . it was pushing midnight . . . getting fired for something momentous to happen. We soon arrived at a junction. To the west was a 10m pit leading to large passage; to the east was a 2m wide by 5m tall canyon. The canyon took a substantial amount of wind; the pit, quite strangely, was pushing air. We took a lunch break while considering this. I proposed that the source of the wind must be Cheve, since we also had the Puente wind behind us, coming through the breakdown, and this western wind was coming from in front of us. We rigged the drop. This was followed shortly by another 20m pitch that brought us back to the Puente stream. I followed this for less than 60m before coming to another breakdown, 887m below the Puente entrance. Vesely again advanced. This time, however, it was Adams who spotted the black doorway in the roof above us. I was right on his heels as he pulled himself up through. We had each taken a dozen steps into the black void that followed before we stopped dead. For ten seconds no one said anything. The same thought was doubtless going through everyone's mind: this was too big to be Puente. "Carol," I broke the silence, "I think this is Cheve." Ahead, Adams called back, "I think I've come across tracks, footprints." We regrouped. "This looks like the borehole just above the 23m Drop," I told Adams. To be certain, we headed left, towards where I knew, if this were indeed Cheve, we would soon come to the soda straw ledge where Knutson had bivouacked following his fall. And there, 100m away were those shining white soda straws. We shook hands and let out a few war yells.

Then we started considering our situation: it was 2:30 a.m.; we had been on the move for 15 hours and still had a substantial amount of survey ahead of us. There was the matter of whether Puente should now be derigged. More pressing than any of this, however, was the fact that Adams and I each had about 3 charges of carbide left, about 18 hours worth. That would be cutting it close, we reckoned. "We could go to camp, if anyone is still there, and pick up some more carbide," I said finally. As if one, we started up the breakdown pile leading to the 23m Drop. I was first up the rope leading to the camp passage. As I walked into camp I let out a loud proclamation: "I claim this cave in the name of Puente Natural." That brought a rise out of some of the sleeping denizens of this little outpost. I soon came across Nancy Pistole, still wiping sleep from her eyes. Oliphant, Coons, Farr and Grubbs were off pushing she explained. Then it was her turn to lay on some shocking news: Farr had cracked the breakdown that had stopped Benedict, Adams and me. And, they had broken into an even larger borehole: 50m-diameter which they had followed for nearly a kilometer. I smiled and sighed. If only Benedict had gone a little further we would have had that mythical two kilometer scoop we joked about in camp. They were down, she estimated, to –1,195m where they had run into an even more serious collapse. Minus 1,215m we corrected her, now that Puente had been connected!

We got down to the more pressing matters at hand: we found that carbide was available in plenty. What would really be nice, we reasoned, would be to get four to six hours sleep before heading back out. The situation was immediately complicated by the arrival of the deep team whose sleeping bags we had intended on surreptitiously borrowing. We shortly arrived at a series of innovative arrangements and got a restless six hours sleep. At that point Oliphant, who had been having a difficult time cohabiting a single sleeping bag with Pistole, both of whom are big people, came over and said, "is six hours sleep enough?" I thanked him for his patience and returned Pistole's sleeping bag. I was not exactly fresh, but I felt worlds better than I had when we had arrived. Pistole made up a great pot of oatmeal for everyone. In fact, since Farr and Coons' team had failed to penetrate the breakdown they too were ready to pull out, so everyone was ready to unload their food! We ate for close to two hours, standing up in a little circle of six. By and by Adams and I chided Coons that he should bring his camp pack out Puente with us and do a through trip. He seriously wanted to come, but not with a camp pack. Soon a negotiation began between Vesely and Coons with the result that she would remain in camp and head out with Farr the following day via the Cheve entrance carrying Coons' camp pack. Coons would survey with us and we would stage derig Puente along the way out.

Adams and I loaded up on carbide and the three of us kitted up. We lost an hour trying to locate a survey station for a tie-in, as none of them were labeled in the vicinity of the connection. We soon settled into the survey and finished within six hours, pulling ropes up behind us. On the Major Abyss Adams and I tandemed up the 124m pitch. He climbing below me with the survey instruments while I ascended 30m at a time with the notebook and the measuring tape. From there we were back into known territory and moving at a reasonable clip. We took turns at the rear, pulling and coiling ropes. Knowing that we would be surfacing in the early morning hours, Coons urged me to head up the entrance pitch first and start a fire. I soon had a roaring blaze going. The draft entering the cave at that hour was such that the smoke was being drawn horizontally into the entrance from 30m away! It was 4 a.m., 16 hours from Camp II and it was cold outside, with a thick fog filling the Puente doline. We dallied there in front of the fire for some time, with the notion of keeping it stoked until dawn, but finally hiked off in the mist, arriving at camp just before sunrise. Our entire trip, from the time we had entered Puente, was 40 hours long and stretched over three days. Not what we had expected at all!

Epilogue

Following the initial discovery of the A.S. Borehole, the giant, kilometer-long tunnel beyond the ceiling collapse that had stopped us at the end of the Black Borehole, the massive gallery again collapsed in an area fractured by a cross fault. Three separate attempts fielded from Camp II failed to penetrate this blockage. Nonetheless, no one considered the cave to have ended, even though no persuasive evidence existed to support that it continued. But everyone did agree on one point: that it was one hell of a long way out there –9 kilometers traverse distance and nearly 1,100m vertically below the main Cheve entrance.

Early in December of 1989 I received a call from Smith indicating that the banter of summer had coelesced into the formation of a "deep team" which would set Camp III in the A.S. Borehole in Cheve at the –1,050m level in February 1990 and attempt to bypass the breakdown collapse. Although it originally appeared that there would be eight members of this team, March 3, 1990 found Oliphant, Coons, and I the sole occupants of Camp III. It had taken us only six days to get there, thanks to sherpa assistance from two German and three Australian teammates. For the next six days we worked, unsuccessfully, on every conceivable route through the collapse area, including the setting of a 35m aid climb straight up the wall of the tunnel and into a high dome, which also led to an impassable breakdown block. On our return to Camp III following our last push we found reinforcements waiting: Jim Smith, Laura Campbell, and Alan Cressler. Smith had, prior to entering, released a 15-pound block of fluorescein dye at the entrance of Cheve and it was keeping pace with their descent. The stream below Camp III stayed bright green for three days. Charcoal traps were waiting to test the passage of this dye at the known springs in the Santo Domingo Canyon where another portion of the expeditionary team was exploring Cueva del Mano.

Despite the additional manpower we were unable to make any further advance in the breakdown. In frustration a day off was declared. We spent the time touring the A.S. Borehole and

Following a 40m steep breakdown ascent from the Looking Glass one reaches the beginning of the spacious Mud Floored Borehole.

taking photos. Shortly before the terminal breakdown collapse, the main tunnel takes an abrupt 90 degree turn to the east. Continuing north, however, is a narrow fissure which descends another 50m to a sump at –1,215m, the deepest known point in Cheve as of February 1990. Smith insisted upon seeing the sump and taking pictures to prove he had been to the bottom. The entire team followed and the deed was done. On the way out Coons disappeared upstream in a previously unseen crack while the rest struggled up the slick vertical fissure. A while later Coons arrived in the chamber where we were waiting, beaming. "I've found a bypass to the sump. The end is 20m deeper," he said. Believing this to be a rude joke, Smith immediately disappeared down the fissure to verify the claim. He soon returned smiling and exclaimed, "well, it looks like this expedition isn't over yet."

The following day we descended with all the tackle in camp. The new route immediately opened into an 8m wide, 20m tall polished, cream white canyon, quite unlike anything we had thus far seen in Cheve. The Cheve River, last seen at the –1,215m sump, soon burst forth from the west side of the canyon with sufficient pressure that the plume carried 10m horizontally. Ultimately we found ourselves a kilometer further north of any known point on the map and at a depth of –1,340m. In front of us a cobalt blue sump receded into a 6m wide underwater canyon, barring further exploration. After nine days down we retreated to sunlight.

Several days later Coons returned to the llano after having driven down the mountain to pick up the remaining portion of the resurgence team. He had a story to tell. The good news was that the resurgence team had explored 7 kilometers of maze-like galleries in Cueva del Mano. Ultimately, they had reached a point one kilometer south of the spring and had been stopped by an upstream sump. The bad news was that there had been a miscommunication with burro drivers in the village of Santa Ana who had been contracted to haul the equipment for the canyon team back up the mountain resulting in two of the team, Nancy Pistole and Sheri Engler, being left in the canyon until arrangements could be made for another burro run two days later. When they reached Santa Ana the local presidente immediately had them arrested under the suspicion that they were removing archaeological artifacts. The officials were, by the time Coons arrived, demanding 120,000 pesos "ayuda" ("assistance") in exchange for letting them go, despite their efforts to explain the difference between speleologists and artifact hunters. Coons, who has a good command of Spanish and a knowledge of local customs, took charge and resolved the stalemate but not before having to part with 70,000 pesos. "It was probably a good thing they ended up spending those extra two days in the canyon," Coons said grinning, "for the past two days the spring was running the color of this." He produced a chartreuse colored plastic toothbrush. "Smith just got the world's deepest dye trace." Smith, of course, was ecstatic upon hearing this. It also vindicated my long-held hunch that the Western Resurgence, now known as the Nacimiento Rio Frio de Santa Ana in deference to local politics, was the Cheve resurgence –2,600m below the Cheve entrance and 18 kilometers to the north. This astounding discovery, together with the rapid eight-day transit time indicated a predominantly open vadose streamway. Thus, if the sump at –1,340m can be passed, it is likely that the majority of the distance between there and the rising will consist of an air-filled descending canyon.

We returned to Camp III for an additional seven day push at the end of March 1990 but no bypass was found to the –1,340m sump, nor was any further success obtained in the collapse area. Although cave diving now remains the only route forward, a concerted effort is being planned for the spring of 1991 to place a four-person team beyond the sump for a 1-week bivouac. Initial planning has yielded a requirement that the deep level team be underground for nearly 30 days.

The end of Sistema Cuicateco now lies more than 10 kilometers from the entrance to Cheve. At –1,340m it is only 13m shy of being the deepest cave in the Western Hemisphere, and is now the sixth deepest in the world. With the weight of a 2,600m dye trace fueling exploration, it is certain that this system is destined for a level of significance in world speleology which only three years ago would certainly have seemed unlikely. But that is the nature of surprise on the last terrestrial frontier.

Jim Smith, MN '85, *is a graduate research associate in karst hydrogeology at Western Kentucky University. His thesis topic is the caves of Mexico's Sierra Mazateca and its environs.*

Dr. Mark Minton, FN '82, is *a researcher in Organic Chemistry at the University of Texas at Austin. He has been involved with expeditionary caving in Mexico for more than two decades.*

Dr. Bill Stone, FN '79, *is president of Cis-Lunar Development Laboratories, Inc., a firm specializing in the design of advanced life support apparatus for undersea and space exploration.*

Back Cover: *Peter Keller and Karlin Meyers in the 20m x 20m Hall of the Restless Giants, which runs 600m horizontally in Cueva Cheve Cave, Oaxaca, Mexico.*

EXPLORATION IN THE SIERRA JUÁREZ, OAXACA : CUEVA CHEVE 1991–92

Louise D. Hose

The 1991 efforts in the Sierra Juárez began with a winter expedition consisting of Paul Burger and Louise Hose from Colorado, Don Coons from Illinois, Bill Farr, Herb Laeger, Susan and Don Morris, Matt Oliphant, and Carol Vesely from California, John Ganter from New Mexico, and Ed Sevcik from Texas. We intended to visit the area of the resurgence for the water in Cueva Cheve, but we were never allowed near the caves, and the team divided into three groups, those who routed early only to have truck problems destroy their hopes of caving elsewhere, those who spent the entire time driving from one official to another trying to clear up the problems, and those who split their time between sitting out outrageous rainstorms in leaky tents and being devoured by biting flies while trying to dry their equipment in the lowlands. The project had five meetings with the presidente of Santa Ana Cuauhtémoc during a period of a week and a half. Some of us made three trips to Teotitlán and one trip to Oaxaca in an attempt to clear up the problem. A representative from the governor's office accompanied us twice. But each meeting ended with a request for yet another letter of permission from some state agency in Oaxaca. We ended the expedition without having done any significant caving.

After everyone else left, Vesely and Farr drove up to the upper karst and connected Cueva Escondida into the system, making it the deepest cave in the New World. The depth was 1369 meters.

In my mind, Cueva Cheve is the deepest known cave in the world. A visually positive dye trace of the water in the system demonstrated that the hydrologic system is more than 2600 meters in vertical extent. (See Jim Smith's article in *AMCS Activities Newsletter* 18.) True, cavers have physically penetrated only a little over half of the relief, but Mount Everest was the highest mountain before climbers scaled it, and some cavers think that Cueva Cheve is the deepest cave. Everyone will agree that its explored depth makes it the deepest cave in the Western Hemisphere. Naturally, its exploration is a pretty big deal. The plan in the spring of 1991 was to dive in the deepest sump in Cheve. The dream was to have John Schweyen, America's premier sump diver, pioneer a path through the sump into dry passage. Then other caver-divers were prepared to follow. The hope was that they could find a dry way back to the known cave, so exploration of dry passage could continue beyond the sump. Failing that, there were also leads in the air-filled parts of the cave. Peter Bosted, Dan Clardy, Bill Farr, and Bill Storage of California, Jim Brown and John Schweyen of New Jersey, Don Coons of Illinois, Mike Frazier, Louise Hose, and Todd Warren of Colorado, Peter Haberland and Snake Owen from New York, Matt Oliphant from Minnesota, Tina Shirk and Chris Yeager from Indiana, Jim Smith from Kentucky, Ralph Snedley and Bill, Brian, Janet, and Audrey Steele from Texas, John Stembel from Georgia, and Bill Stone from Maryland were the participants in the expedition.

Twelve cavers arrived at the Llano Cheve, the surface base camp, during the first week. Most worked hard to prepare for the dive, and it went off sooner than expected. The depressing news, however, was that the sump became more complex, tighter, and deeper than we had hoped. The dream of a simple bop through the sump into air-filled passage was shattered. Schweyen was demoralized. Even more, he was cold from his decompression stops. The next attempt would require a dry-suit and multiple bottles, all this more than 1225 meters below the lowest entrance and something like eight kilometers into the cave. But there were two pleasant results from that deep camp. The dive had made the cave 17 meters deeper, to -1386, and Oliphant had climbed into an encouraging lead a short way upstream from the sump. The cave had not defeated the cavers, it had only delayed their efforts.

The deep team did not know about the tragedy occurring elsewhere in the cave at the exact time that Schweyen was diving in the sump. The deep team left Camp III for the surface the day after the dive. When they reached Camp II, were they intended to sleep for a night, they found the note. Yeager was dead. They would find his body at the base of the 23 Meter Drop, a short way from Camp II.

Chris Yeager was a young man of twenty-five from Indiana who had been caving only a couple of years. He chose to join a party heading in to camp at the bottom of the cave for his first trip. He was part of a party of four, but, as is common in Cheve, they traveled in pairs. Peter Bosted and Jim Brown moved ahead. Haberland accompanied Yeager. Their objective for the first day was Camp II. Along the way there are thirty-two rope pitches, many with rebelays and redirections. There are also about a kilometer of river passage and several traverse lines. Yeager handled it all well until he reached the 23 Meter Drop, 4.5 kilometers into the cave, 850 meters deep, and only two drops from camp. There he made a fatal mistake.

There is about a kilometer of walking passage just before the 23 Meter Drop. Yeager was using a steel triangular screwlink on his harness, and his rappel rack was attached to the link with a single locking carabiner. It is suspected that the lock on the carabiner worked loose during the long walk between drops. Although he successfully rappelled down the predominantly sloping upper part of the next drop, when he leaned back into rappel on a free section just past a rebelay, his rack came out of the carabiner. Yeager fell about 23 meters to his death, his rack still on the rope above. Haberland ran over immediately, but there were no signs of life. Cardiopulmonary resuscitation, ultimately attempted by all three team members, did nothing. After a night's sleep, Bosted, Haberland, and Brown climbed back out of the cave. The dive team followed a day behind them.

Yeager's father and uncle, a family friend, and two Indiana cavers joined the camp in the llano. With time, the family came to accept the decision for an in-cave burial. Eleven days after the accident, Chris Yeager was buried in sand in the large walking passage above where he fell. A tombstone was erected, and carbide soot identified the grave's occupant. Momentos from his family and a project tee-shirt were buried with him. In accordance with the family's wishes, passages were read from the Bible.

Needless to say, morale was low among the project members after the burial. Chris's family and friends left the llano on March 15. The cave was derigged, and deep exploration was suspended for the year, honoring a promise to the family.

Most of the team left two days later. Haberland and Oliphant stayed. Coons returned from Oaxaca City, accompanied by the Steeles and their entourage of family and archaeologists. Frazier, Hose, and Warren spent two days checking leads in the high karst and a day surveying in the upper part of Cheve. After Coons and Oliphant felt sufficiently recovered, we ventured over to Santa Ana. Three of us were veterans of the New Year's trip; Frazier and Warren were new. Our strategy was not to ask permission to visit the resurgence of this trip, but just to develop better relations with the folks. We wanted to let them know that we were not going to just go away. We drove away two days later feeling good about our efforts. This time, no one threw stones, no one cursed us, and we slept in town for two nights. We bought meals and Cokes locally, mapped a small cave, sampled the local caña, helped carry rocks for a new water tank, and hiked around. We do not know if we will receive permission next time, but we do know that we can safely enter the town again.

The Mexican archaeologists arrived soon after our return. Coons, Hose, Oliphant, and part of the Steele entourage spent most of three days helping with their projects in the area. It was truly a special experience. Finally, we finished derigging the cave, stashed the group gear that was left, and pretty much closed the camp. On March 29, the last Americans left Llano Cheve.

"Poor Matt—how do you plan for an expedition like this?," lamented Mark Minton in the closing line of a letter sent on January 29, 1992. Matt was Matt Oliphant, expedition coordinator for the 1992 expedition to Cueva Cheve. Project members had met the previous summer to decide on the dates for the next expedition and to outline the objectives. The dates were set for February 15 to March 15, and the main objectives were geologic investigation of the deep part of the system, continued pushing of leads in the terminal breakdown, exploration of the high karst-fields and caves, and improving relations with the people in the area. Through no fault of Matt's, the pre-expedition atmosphere was filled with confusion and uncertainty. Our well-laid plans and commitments to sponsors, granting agencies, and employers had been thrown into turmoil only two months before leaving. As of the end of January, most felt that it was unlikely that we would be able to meet most of our objectives. It was even doubtful that we would be able to enter Cueva Cheve at all. Many cavers were jumping ship. Even worse, Mark's letter described how one key member was daily changing his decision whether to go, and another refused to commit to the project, but was hinting at a mid-expedition arrival anyway. Indeed, how to you plan for an expedition like this?

When life hands you a lemon, make lemonade. It was an amazing blend of confidence, competence, persistence, and flexibility by everyone involved that brought a terrific team together at the base of the Sierra Juárez on February 16, 1992. Ultimately, the team consisted of Stan Allison from South Dakota, Manuel Aragón from Oaxaca, Peter Bosted, Dan Clardy, Lisa DeThomas, Matt Oliphant, Nancy Pistole, and Bill Storage from California, Don Coons from Illinois, Mike Frazier and Louise Hose from Colorado, Peter Haberland, Karlin Meyers, and Chris Welsh from New York, Roman Hapka and Pascal Schenker from Switzerland, and Tom Miller from Arizona. Unfortunately, there had been some roadblocks constructed to our work since our last visit, as predicted. The secretary of the jurisdiction including the Cheve area had told the advance party that he did not think we would be allowed in the cave without a special permit from the federal government. Someone from Mexico City had made this point with the presidente, the chief local official of the area, a few days earlier. As the presidente was out of town, the secretary apologized to us, but he would only allow us to establish our camp near the entrance. We were not to enter the cave.

Coons and Aragon drove off to deal with the permit, and the rest of the team worked on backpacking our supplies and establishing our home in Llano Cheve, the mountain meadow at the entrance to Cueva Cheve. Anxious to make the best of the delay, Storage, Allison, Hose, and Miller drove to the "middle karst" to hunt for caves over the middle part of the system, beyond the terminal sump. We stayed with an interesting local family.

Looking down toward Zautla. *Louise Hose.*

Pascal Schenker's Meditation Place. *Roman Hapka.*

Our host, Pedro, was a Mazatec Indian, white-water kayaker, and PADI-certified scuba diver who had studied English at Cambridge. He had also traveled to Peru, Ecuador, Guatemala, and Spain. His wife is a Cuicatec, the dominant culture of the mountains. Their hospitality was overwhelming. Pedro arranged for us to visit local caves and pits during our day-and-a-half visit. Although we did not find any potential connections to the system, the locals were very supportive, and there will undoubtedly be more trips to the area.

By the time we returned to the llano, the presidente had also returned, and he had given permission to go on into the cave. Thus, caving in Cueva Cheve began on the twentieth, when Storage and Hose started rigging and hauling supplies. Others would carry on the rigging during the following days.

Various problems caused Oliphant to decide that there would only be one deep camp this year, instead of the planned two. It would leave in a week. This left some time to fill. Storage was intrigued by a promising karst area about thirteen kilometers east of Llano Cheve. Coons had walked through the area three years before, but he found the people unwilling to talk about caves without permission from the state. The project had letters of permission. Storage wanted to keep the first party small, preferably only two people. He recruited Hose to join him, since she owned the only four-by-four vehicle available. A caver with a four-wheel-drive is never without friends.

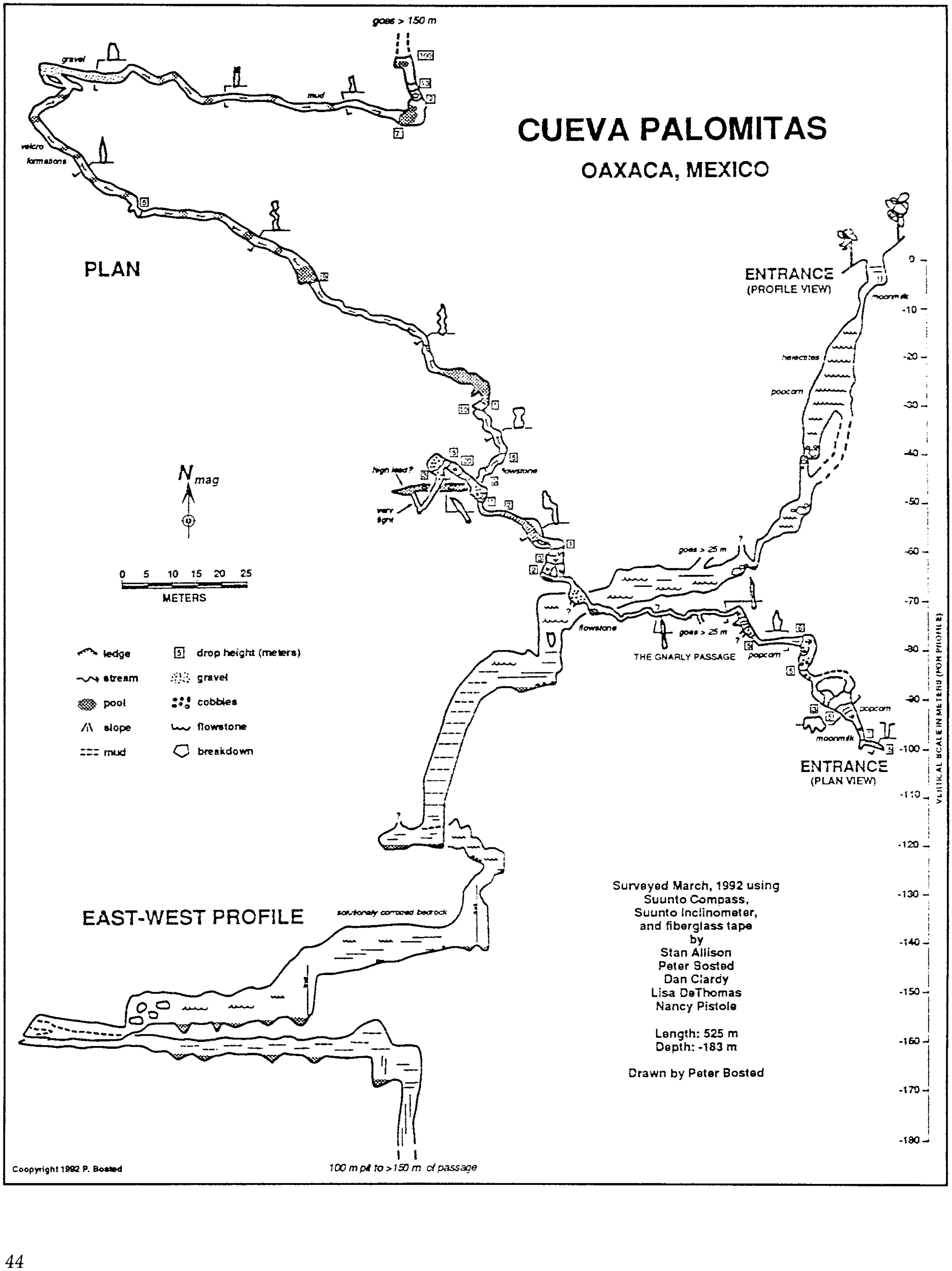
We drove to the end of the road, where the folks in the village of Peña Verde greeted us warmly. Cuicatecs, like the people near Cheve, they were aware of our work, as we have developed a very favorable reputation among the Cuicatecs. They seemed disturbed, however, to learn that our objective was the village of Zautla. "Hmm. They are Chinantecs," we were told. "They are different. You may find it difficult to deal with them." We worried about the potential problems, but resolved to continue and headed down the trail.

With topo maps, we had calculated that the round-trip hike was roughly equivalent to crossing the Grand Canyon. However, the trail proved to be the most illogical path we had ever seen, going up and down for no apparent reason. The map had not revealed its true character. Were we on the wrong trail? Passing locals reassured us that we were headed for Zautla. After about two hours, we arrived at the town of Tecomaltianguisco, also a Cuicatec village. The people were friendly and curious, and they allowed us to stay in the school for the night. As before, concern was expressed about our interest in Zautla. "They are very primitive. The women are not allowed out of their houses. They may not give you a place to sleep. They do not even speak good Spanish." The last warning fell on deaf ears. Our Spanish was not good enough to identify bad Spanish. As we left in the morning, the school teacher insisted on giving us a supply of tacos. "They will not allow you to buy food. You must take this food with you."

After about two more hours, we entered Zautla. The people we passed did not seem hostile, but each said the same thing, "Buenos días," followed by, "You must go see El Agente," the village leader. We decided to directly seek the agente, but we were told that he was in the corn fields. His secretary stored our packs and gave us permission to hike, but we were warned to stay away from pits and caves.

The Zautla area is much wetter than the Cheve area and easily recognizable as tropical. We hiked three kilometers north of town and climbed six hundred meters to visit a large doline that is prominent on the topographic map. We were not disappointed; it was spectacular. We were tempted to leave the trail and look for entrances, but our long-term goals prevailed, and we resisted the temptation to check pits and potential leads. Instead, we returned to town by the time we had promised.

For all the hype from the Cuicatecs



CUEVA PALOMITAS
OAXACA, MEXICO
PLAN
EAST-WEST PROFILE
ENTRANCE
(PROFILE VIEW)
ENTRANCE
(PLAN VIEW)
goes > 150 m
goes > 25 m
THE GNARLY PASSAGE
gravel
mud
velcro formations
high lead?
very tight
flowstone
helectites
popcorn
moonmilk
solutionally corroded bedrock
100 m pit to >150 m of passage
0 5 10 15 20 25
METERS
ledge
stream
pool
slope
mud
drop height (meters)
gravel
cobbles
flowstone
breakdown
Surveyed March, 1992 using
Suunto Compass,
Suunto Inclinometer,
and fiberglass tape
by
Stan Allison
Peter Bosted
Dan Clardy
Lisa DeThomas
Nancy Pistole
Length: 525 m
Depth: -183 m
Drawn by Peter Bosted
Coopyright 1992 P. Bosted

about the primitive Chinantecs, we were amused to find a young Zautla man sporting bleached hair cut in a fashionable layered style. He had cut square holes in his jeans, and he wore a heavy-metal tee-shirt. Yet, like all of the residents of Zautla, he spoke Chinantec exclusively, except in conversation with us, when he spoke Spanish. Basketball is very popular in Zautla, and several men wore gym shorts and tennies during the late-afternoon games.

Heeding the warnings from our Cuicatec friends about Zautla's sexism, it was Bill who negotiated with the agente. He immediately liked our letters of permission. Yes, we could visit the caves in the morning. He would send the police force along to show us the caves. Was there a place where we could sleep? "Sure, here in the municipal building," was his answer. "I will provide guards." We speculated about whether the guards were to protect us from the locals or the locals from us. It was never made clear.

At 6:30 AM, the guards turned on the lights. A hint? We were soon up and going. About eight men, the "police force," led us about 350 meters down into a canyon. Our first cave was a resurgence entrance with a flow of about 3 or 4 cubic feet per second. They called it Ñiay Mahn. Wading in knee-deep water, we left the guides. Beyond the twilight zone, the passage was filled with bats in flight, and the cave sumped after about 100 meters. A little later, our guides took us to what appeared to be an upstream extension. Ultimately, they showed us four small caves and helped us explore three of them. We found the people of Zautla to be extremely friendly and generous. They shared their food, including a plant they were collecting and eating that resembled, or perhaps was, bamboo shoots. We returned to town for siesta. In the late afternoon, about fifteen men and boys showed us pits within the town. Several of the pits were clearly outhouses, and we declined to descend them. We hoped to visit the deep pits above town that they told us about, but there was not enough time. The agente and others made it clear to us in the evening that they would like us to stay one more day and visit the pits. It was tempting, but we had promised the folks back at Cheve that we would be home on the next day, and we feared that a rescue party might come if we were a day late. Our new friends told us that we will be welcomed again, and one man added, "God willing, you will return here next year." We were delighted as we loaded our packs and hit the trail.

Allison, Bosted, Hapka, Hose, Meyers, Miller, Oliphant, and Schenker entered Cueva Cheve on the twenty-fifth, traveling to Camp II, where we ate and slept for the evening. Our hike through this amazing cave continued the next day. After most caving trips, one vividly remembers the obstacles. Of Cheve, however, I vividly remember the only three places during the entire trip where the floor is smooth for more than five meters. Elsewhere, one is constantly clambering over breakdown, climbing rope, descending rope, traversing rope, chimneying, or passing some other kind of obstacle. Our travel was uneventful. After arriving in Camp III, most of us stumbled into bed, while the Swiss, Karlin, and Stan headed out to examine the terminal breakdown pile.

On the twenty-seventh, the Swiss left the cave, while most of us headed for the breakdown. Bosted and Hose chose to map a side loop and work on its leads. The others did some serious poking in the main part of the breakdown. There was no success, however, and all six cavers remaining in Camp III worked on the breakdown the next day. Several survey lines were run into the mess, in an effort to better define it. We squeezed, we hammered, we tried to coax the rock away. The wind teased across our faces, but no open passage was found.

The breakdown had proven frustrating, and it was time to do something else. There had been some spoken and written speculation about the geology at the end of the cave, but there was virtually no hard data. Hose was collecting data each day, but this work needed bedrock, not breakdown. It made a good excuse to visit Wet Dreams, the deepest passage in the explored system. Allison, Hose, and Miller headed for the terminal sump, while Meyers and Oliphant worked their way up Matt's high climb from the previous year. Wet Dreams is a visually and geologically spectacular passage, caving at its finest. After our visit to the sump, Stan and Tom headed back to camp, and Hose moved more slowly, collecting data. Matt's Lead had not gone, and our allotted time in Camp III had ended. We packed up and headed out on the thirtieth.

There turned out to be a second deep camp after all. Frazier, Haberland, and Pistole left for Camp II on March 6. Allison, Clardy, and Hose packed lighter duffs this time and headed into the cave on the seventh, joining the others in Camp II. The first group had been occupying their time by cleaning and improving the camp and checking leads in the Sumplands area above the 23 Meter Drop. They were ready and anxious to move on. Hose wanted to map the geology in the middle part of the cave, and Allison volunteered to stay and help.

All of us headed north through the Low-Rider Turnpike. At the start of the Swim Gym, Clardy, Frazier, Haberland, and Pistole continued toward Camp III, and Hose started "geologizing" on the way south. Allison unrelentingly checked leads. In one particularly interesting area, we split up for nearly an hour. When we reunited, Stan told me that the passage he had explored was a borehole and beautiful. We agreed to survey it. It trended parallel to the Low-Rider Turnpike and extended 206 meters along a fault. The floor was entirely breakdown, but much of it was covered by chocolate-colored flowstone with large, glittering crystal faces. We named the passage Hollywood Boulevard, for its glitter. Allison and Hose left the cave on the ninth.

Bosted and Clardy had discovered a cave close to the Cheve entrance, which they named Cueva de las Palomitas. Exploration of the new cave was continued this year by them, Allison, DeThomas, and Frazier. The cave was surveyed as exploration progressed, and total survey reached 540 meters. On the last trip, Allison and Clardy rigged a pit about 100 meters deep, descended it, and found going passage at the bottom. They were not prepared to survey the pit or to continue exploration, and hence they turned around with the passage still going.

Bosted, Coons, and DeThomas had left for the middle karst at the start of the second deep camp. Everyone is now hoping for another entrance into the system beyond the terminal breakdown and the Wet Dreams sump. The logical area to look for such a cave is near the town of San Miguel Santa Flor. The three found the local Cuicatecs to be friendly and supportive. One of the local men understood their desire for a cave with wind, and he took them to a place where a small stream sinks and steam rises from the ground on cold days. Coons was pessimistic, but Bosted and DeThomas dug right in. In a short time, they were in a cave with a strong breeze. The cave was tight, but the breeze drew them farther into the passage. After their reconnaissance trip, Bosted had to return to the States. Coons and DeThomas returned to the llano to recruit help.

Meanwhile, solitude in the llano was broken when Frazier arrived back at the llano from Camp III. Pistole was not far behind. They, too, had a successful trip to the bottom of the cave. Much of their attention was given to cleaning up Camp III, maintaining the latrine, and making an inventory of the equipment there. It was needed and appreciated work. They also salvaged some survey notes that had been inadvertently left by the earlier trip. More attempts were made in the frustrating breakdown pile, and, of course, a trip was made to the Wet Dreams sump. It was news from this trip that sparked a hope in everyone. Frazier estimates that he climbed about 100 meters up from one point in Wet Dreams. He reported walking passage at the top of the climb, but he did not pursue it, as he was alone. Besides, the lead will be an enticing carrot to bring cavers back to this important area of the cave.

Allison, Coons, DeThomas, and Oliphant returned the next day from their trip back to the middle karst. Cueva de Rancho Palomora had been pushed and mapped for 307 meters, where progress was stopped by a flowstone choke. It was a disappointing set-back.

The expedition wound down after Clardy and Haberland safely returned to the surface on the thirteenth. They had poked in the terminal breakdown during their extra day in Camp III, but with, again, no success.

We met our four stated goals for the project, despite unfortunate obstacles. We have a much better understanding of the geology of the system, finally having data to provide interpretations. We spent a great deal of time pushing leads in the terminal breakdown. Several new caves above the system were explored, and excellent relations were established with four new villages. There was even a brief public-relations visit to the village controlling the resurgence area, but Aragán and Oliphant were told "the presidente is not here." These successes are a tribute to the members of the expedition. They all contributed and kept their focus on our objectives. The expedition's success is also a tribute to Matt Oliphant and Nancy Pistole, who never wavered in their dedication to the project and to the expedition. When the usual, and unusual, problems confronted them, they always found a way to resolve the concerns. They are probably the only project members whose total commitment to this year's expedition was never in doubt from the meeting last July in Cobleskill though the middle of this March. Their steadfastness allowed the rest of us to anchor our plans.

The sponsors of this year's expedition were also key elements of our success. They were the Richmond Area Speleological Society, the National Speleological Society's International Exploration Fund, the Dogwood City Grotto, Pigeon Mountain Industries, and Bob and Bob.

Cueva Cheve is a remarkable cave and has to rank among the world's most outstanding. Its explored portions now extend 1386 meters deep and 22.5 kilometers long.

Exploraciones de la Sierra de Juárez, Oaxaca

La expedición del Proyecto Cheve, el cual se llamó Proyecto Pápalo, continuó la exploración de la Cueve Cheve y sus alededores. En el invierno de 1991 se intentó visitar una resurgencia, sin embargo el presidente municipal del poblado de Santa Ana Chiquihuitlán les detuvó. No obstante se conectó la Cueva Escondida con El Sistema Cheve haciendola así 1369 metros de profundidad y continuando así como la más profunda en las Américas.

En la primavera de 1991 se buceó un sifón que se escuentra a 1225 metros de profundidad y a una distancia de 8 kilometros desde la entrada, ganando 17 metros mas a la profundidad del sistema. También se hicieron intentos para pasar el derrumbe final sin buenos resultados. Tragicamente el espeleólogo Chris Yeager tuvo una caida fatal de 23 metros al desprenderse de su descensor tipo marimba. Posterior a esto no se hizo exploración alguna, exceptuando el estudio arqueológico de la entrada del cual se concluyó.

La expedición de la primavera de 1992 también falló al no encontrar pasaje alguno del derrumbe final, sin embargo se encontró otro pasaje prometedor. Se realizó una exploración meticulosa en la superficie sobre el área de el poblado de Zautla la cual se encuentra a trece kilómetros al este de Cheve. La Cueva de las Palomitas se topografió por 540 metros hasta a un tiro de 100 metros. También así la Cueva del Rancho de Palomora fue topografiada por una distancia de 307 metros.

PROYECTO CHEVE EXPEDITION 1993

Compiled by Mike Frazier

This article is a compilation by several authors about the history and current exploration of Sistema Cheve in the Sierra Juarez in the state of Oaxaca, Mexico. Contributors are Peter Bosted, Peter Haberland, Nancy Pistole, Carol Vesely, and Mike Frazier. Other participants 1993 in te expedition were Stan Allison, Eric Brand, Don Broussard, Harry Burgess, Don Coons, Ruthy Diamant, Ramón Espinasa, Luís "Thompson" Fernando Guinea, Louise Hose, Joe Ivy, Gerardo González Jimenez, Patty Kambesis, Herb Laeger, Matt Oliphant, Steve Porter, Ed Sevcik, James Wells, and Skip Withrow. Thanks to this year's sponsors: the Richmond Area Speleological Society for a generous grant for cave gear, Pigeon Mountain Industries for great rope, Dogwood City Grotto for a fully equipped Sked stretcher, and the NSS Exploration Fund for cash. We sure do appreciate their help.

Frazier: From the discovery of Sistema Cheve's main entrance in 1986 by California cavers Bill Farr and Carol Vesely through the 1993 expedition of almost two dozen cavers, dreams of a deeper cave filled the heads and hearts of its explorers. Through the combined efforts of over fifty cavers representing six countries (Australia, Canada, Germany, Mexico, Switzerland, and the United States), ten expeditions have surveyed 23 kilometers of cave to a depth of 1386 meters. Cheve is now the deepest known cave in the Western Hemisphere and eighth deepest in the world. Camp III, at the end of the cave, is one of the most remote underground camps. Jim Smith and the 1990 expedition demonstrated the roughly 2500-meter vertical hydrologic extent of Cheve by tracing with fluorescein dye. The straight-line horizontal extent was shown to be at least 17 kilometers. The dye, introduced at the main entrance, was observed emerging from Nacimiento de Agua Fría (which may be referred to by several other names) in the Santa Domingo Canyon, which connects to Cueva del Mano. See the article by Louise Hose in this issue for the latest information about the depth of the dye trace.

Cueva del Mano at the resurgence has been surveyed to 7 kilometers in length, and it spans 1 kilometer of straight-line distance. The upper cave, Sistema Cheve, spans 3 kilometers of straight-line distance. A gap of about 13 kilometers horizontal distance and 1100 meters depth is still unexplored. A new entrance in the middle karst, which lies between the upper cave and the resurgence, could be the key to unlocking the system.

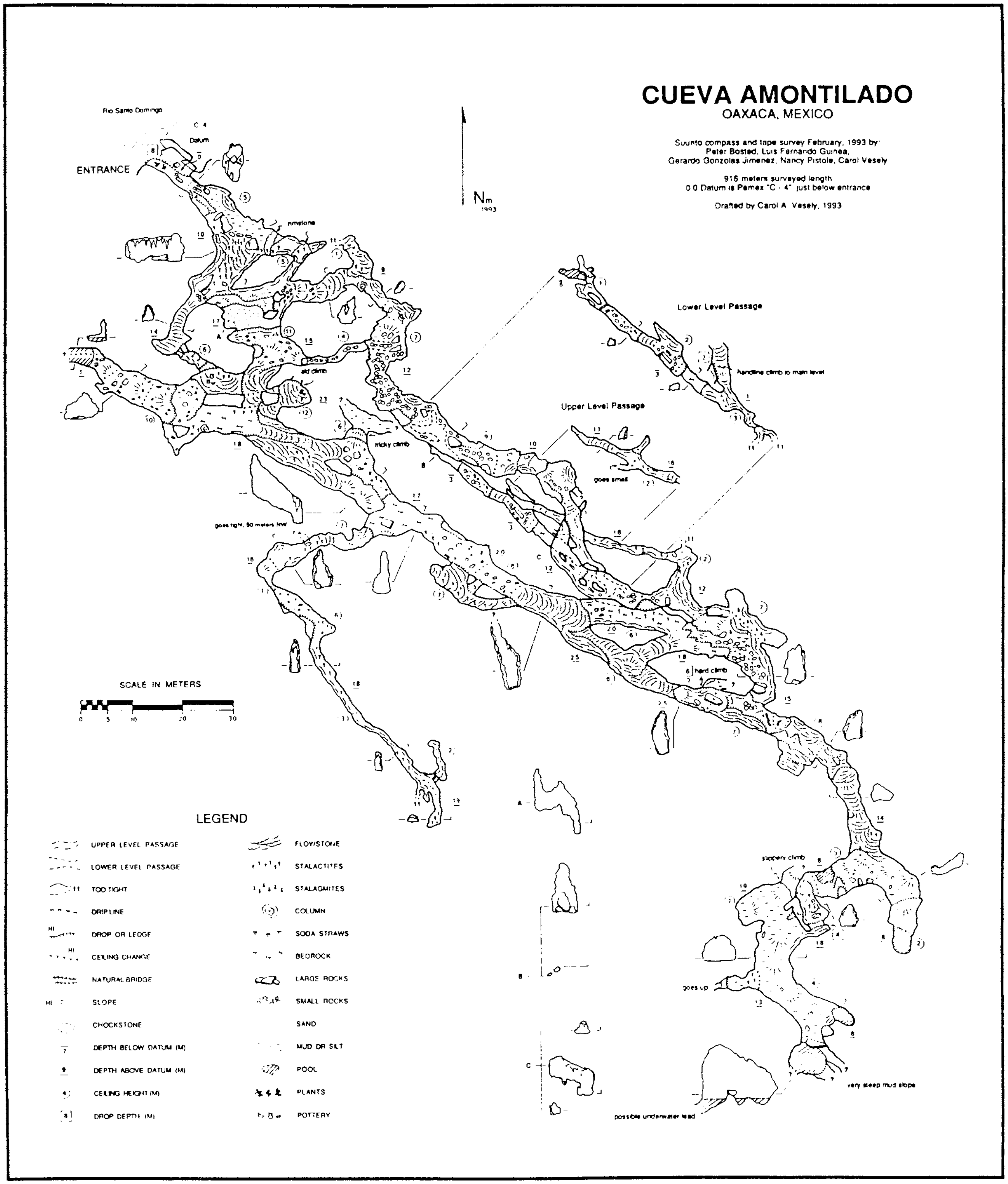
Pistole: In January 1993, Louise Hose was in Concepción Pápalo, close to Cheve. Louise, with Skip Withrow, Emi Janecek, Matt Oliphant, and me, was recording the locations of cave entrances with two Global Positioning System receivers. The trip was funded in part by a grant from the National Geographic Society Committee for Research and Exploration. Louise, Matt, and Emi went to Santa Ana Cuauhtémoc with fresh optimism, because elections had been held in November, and there was now a new presidente. The new presidente was very cordial, looked at the permission letters, and said yes, we could go into the canyon. A date was set, arrangements were made for burros, and the three returned to Pápalo to pack for the trip. Louise, Matt, and I returned on the appointed day, ready to go. When we found the presidente, he apologized profusely, and said the town's people did not want us to go into the canyon, so we couldn't go. We needed to bring a government official from Oaxaca City, and the presidente would call a town meeting so a vote could be taken on giving us permission. He refused to tell us any reasons for the denial, or why the town insisted on an official. Louise, Skip, and Emi had to return to the United States, so Matt and I went to Oaxaca and found a government official who would go to Santa Ana to represent us. The official, Luís Javier Valeriano González, was an outdoor enthusiast who was interested in caves, so he genuinely wanted to help us with the project. When Luís, Matt, and I arrived in Santa Ana, the presidente wasn't there, but we were assured that the encargado, second in command, would hold the town meeting, since they were expecting us. Meanwhile, the secretary wanted to take Luís around and show him all the things the town was lacking, such as medicines for the health center and telephones. (Ah, the reason for the official from Oaxaca). The meeting was set for 6 P.M., but it didn't start until 8 P.M. It was very formal. Matt and I were seated at one end of a big meeting room with the officials of the town and Luís. Individual local people and small groups were brought in and seated according to some set order. The encargado introduced us, and then Luís presented the Cheve Project and explained why we wanted to continue exploration, emphasizing the scientific aspect. When it was time for questions, everybody was silent. Finally, several different people told stories of why they didn't trust us. Two of the more outrageous stories were that a big helicopter flew in to take out the cavers and bunches of gold and silver during the trip in 1990. The other story concerned the same trip; cavers supposedly entered the caves and never came out again. After each account, Luís explained that the rumor was not true, and reiterated the benefits of our work. When the townspeople ran out of excuses, a vote was taken, and we were granted permission to go to the resurgence. The stipulations were that Matt and I could go down for one day with Luís and an escort from the town. In February we could have several more people go down for five days, again accompanied by a Oaxacan official and a town escort. The February trip would coincide with the Cheve trip, so other cavers would be available, and Louise would be back with the GPS units.

The next day Luís, Matt, and I were up at first light and ready to go before 7 A.M. We were accompanied by five men from the town, and one tough little dog. We wasted no time hiking from the town to the Río Frío, over 6 kilometers with almost a thousand meters in elevation loss, in less than two hours. Luís, Matt, and I took a quick tour of Cueva del Mano, the longest of the resurgence caves. Matt and I selected a site for future GPS readings. We were prepared to give a mini geology lesson, but the Santa Anans did not seem very interested in any of our activities. After lunch we headed back to Santa Ana.

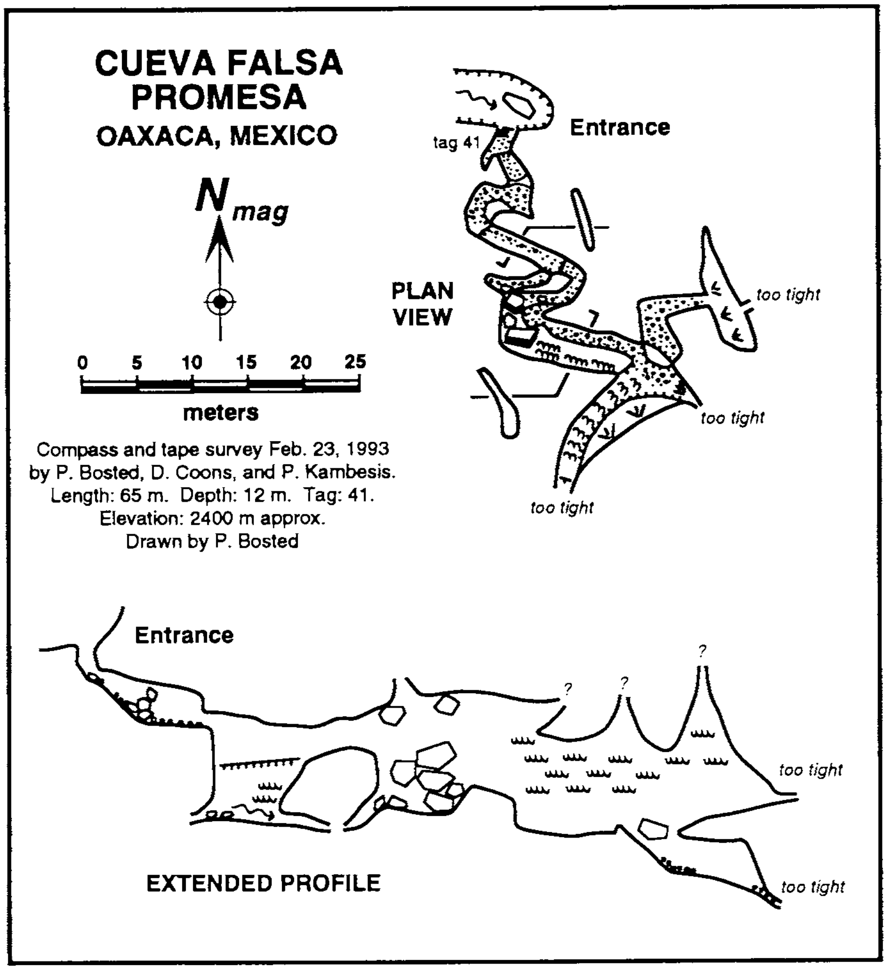
Although Matt and I had made it down to the resurgence once, there was no guarantee that Santa Ana would not renege on the February trip. After Louise arrived for the Cheve trip, she continued down to Oaxaca to pick up Luís. Luís could not leave the office for a week, so he appointed two Oaxacan Cruz Roja volunteers to go instead, Luís "Thompson" Fernando Guinea and Gerardo González Jiménez. Louise stopped by Cheve to set up synchronized time schedules for GPS readings with Skip, then headed to Santa Ana with the two Oaxacans and Don Broussard. They talked to the presidente to confirm our permission and arrange burros for the next day. I drove to the middle karst, near San Miguel Santa Flor, to pick up Carol Vesely and Peter Bosted. They had just returned from a long caving trip, so we did not get to Santa Ana until the next morning. The next day the burros were loaded and ready to go by 7 A.M., so Don started down into the canyon with the burros and the driver. Louise, Thompson, and Gerardo started down about an hour later. Peter, Carol, and I drove into town about 9 A.M., packed our stuff, and then headed down. Out of the three groups, Don and the burros were the only ones that got to Río Frío quickly and uneventfully. No one in Louise's group had been down to the resurgence, so they were going on verbal instructions. Within half an hour on the trail, they took a wrong turn, and they spent the rest of the day bushwhacking their way into the canyon. Peter, Carol, and I followed the trail most of the way, and then got off the track within sight of our goal. It was frustrating, because all three of us had been down there before, and we all knew where we were supposed to be going, but we couldn't find the trail. We also ended up bushwhacking. By late afternoon, everyone had found the campsite and set up camp. We did a little looking around at the cave entrances, but decided to save our energy for the next day. After breakfast, Louise and Don went right to work setting up the GPS unit and making surface surveys from the cave entrances to the GPS site. The readings would actually be taken in the afternoons. Peter, Carol, Thompson, Gerardo, and I went to Cueva del Amontillado. The cave had been found at the very end of the 1990 trip, and a lead climb had been required to get to the entrance. A bolt had been placed, and a small wire had been run through the hanger so that a rope could be pulled up without redoing the climb. Much to our surprise, the wire was still there. With a little bit of finesse, we pulled a rope through the hanger, and then Peter went up to secure the rope properly and tie it to a backup anchor. The cave had several big interconnecting passages, but was mostly smaller walking passage, with some crawlways. We headed back to camp after dark, even though we had not quite completed mapping. The next day, Peter, Carol, and Thompson went back to Amontillado to finish the map and check out any last leads.

Louise and Don were satisfied with the GPS reading site from the day before, so they had time to explore until the afternoon readings needed to be taken. The three of us hiked and swam down the Río Santo Domingo several kilometers to the Huautla Resurgence. We tried taking GPS readings near the resurgence, but the canyon walls are steep and tall, and the

Louise Hose and Don Broussard monitoring the satellite receiver in the Peña Colorada. *Nancy Pistole.*



CUEVA AMONTILADO
OAXACA, MEXICO
Suunto compass and tape survey February, 1993 by:
Peter Bosted, Luis Fernando Guinea,
Gerardo Gonzolas Jimenez, Nancy Pistole, Carol Vesely
916 meters surveyed length
0.0 Datum is Pemex "C - 4" just below entrance
Drafted by Carol A. Vesely, 1993
Rio Santo Domingo
ENTRANCE
Datum
rimstone
Lower Level Passage
Upper Level Passage
old climb
tricky climb
goes small
hard climb
slippery climb
goes up
very steep mud slope
possible underwater lead
SCALE IN METERS
0 5 10 20 30
LEGEND
UPPER LEVEL PASSAGE
LOWER LEVEL PASSAGE
TOO TIGHT
DRIPLINE
DROP OR LEDGE
CEILING CHANGE
NATURAL BRIDGE
SLOPE
CHOCKSTONE
DEPTH BELOW DATUM (M)
DEPTH ABOVE DATUM (M)
CEILING HEIGHT (M)
DROP DEPTH (M)
FLOWSTONE
STALACTITES
STALAGMITES
COLUMN
SODA STRAWS
BEDROCK
LARGE ROCKS
SMALL ROCKS
SAND
MUD OR SILT
POOL
PLANTS
POTTERY



units could not find enough satellites for a position. We went up the Peña Colorada canyon a little ways, until it was time to head back to camp. Most of the traveling in the river canyons is swimming and hiking. It gets very hot during the day, so the swimming is the best part of the trip.

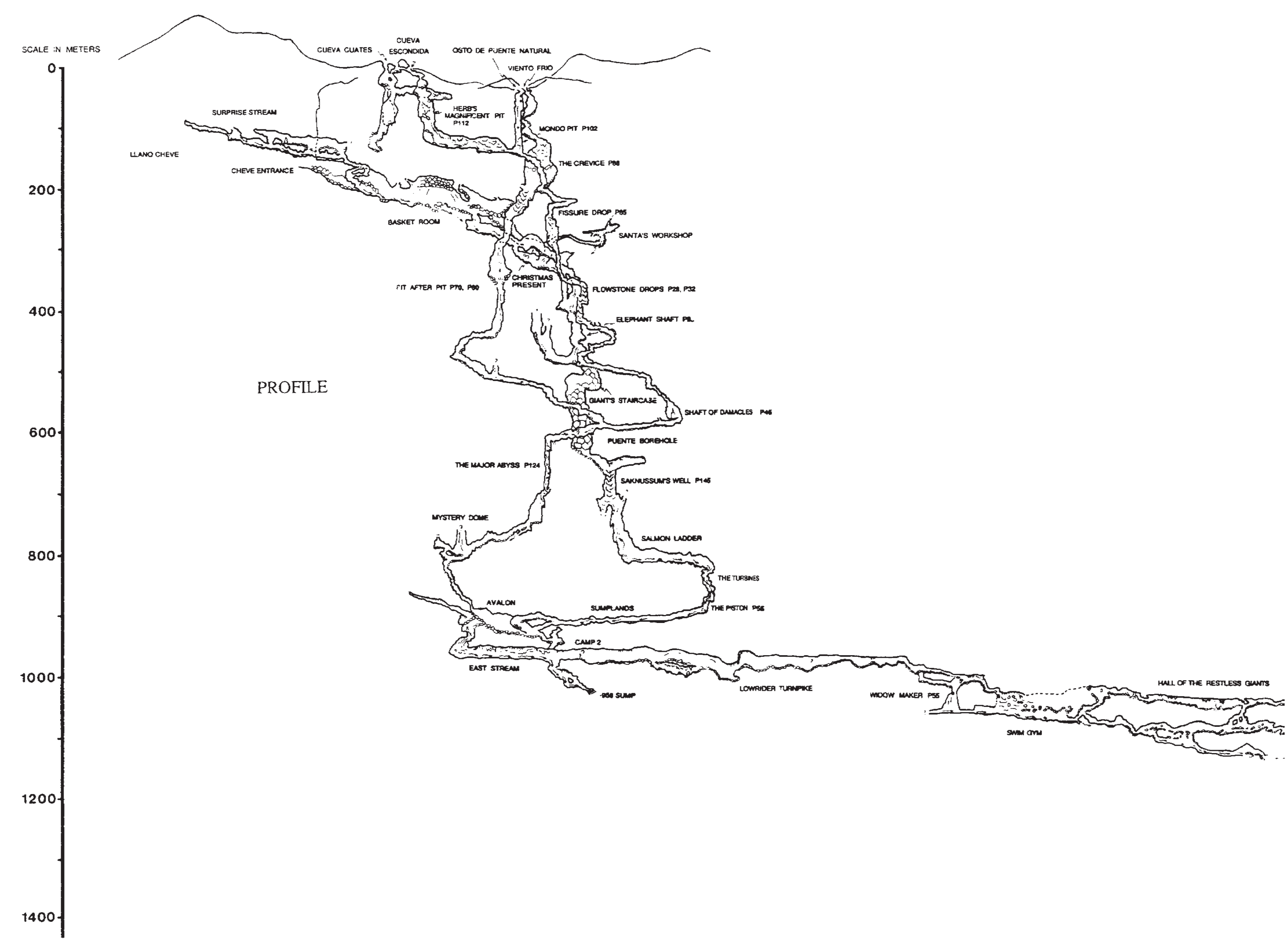
On the last caving day, Peter and Louise made a trip to the very end of Mano to assess the feasibility of diving some of the sumps and to look at the geology. While Louise was looking in the last sump with a face mask, Peter found a narrow passage that was blowing air. A little ways up the passage, they found a small stream. This is the first running water that has been found in any of the resurgence caves so far. They had limited time and no survey gear, so they had to turn around and leave. Meanwhile, Carol, Thompson, Gerardo, and I mapped the connection between Mano and Cueva del Mono. The connection had been made on the 1990 trip, but a map would help tie in some sumps to get a better idea of where the water is in the system. When we reached Mano, I noticed the air flow; on the one-day trip I had made the month before, the air had been stagnant. We speculated that since it was later in the dry season, a sump might have opened up further in the cave. With Peter and Louise's discovery lead and the renewed air flow, we got excited about returning to the area for more exploration.

On the last day, the hike out of the canyon was steep, but quick and uneventful compared to the hike in, since we stayed on the trail the whole way. When we left, everybody seemed to be on friendly terms in Santa Ana. The area deserves more attention, but we can only wait and see what surprises Santa Ana might produce.

Vesely: On February 16, 1993, Peter Bosted, Don Coons, Pat Kambesis, Ed Sevcik, James Wells, and I set out for the long four-wheel drive to a field camp in the middle karst. Matt Oliphant and Nancy Pistole accompanied the crew to San Miguel Santa Flor, where we showed our letters of permission to the town officials. Arriving in the late afternoon, we established camp in beautiful Llano Cantando, a small clearing surrounded by tree-covered hills, located below Cerro Monte Flor. Water was available at a spring about fifteen minutes away, and the main road and a trail junction were nearby. It was very foggy and began to drizzle soon after we arrived.

After establishing camp, the group split into three teams that went on short scouting trips to familiarize themselves with the area. In 1989, a trip by Bill and Pat Stone, Mark Minton, Pam Smith, and Noel Sloan had located three promising entrances on the eastern side of the mountains. The big question was whether these caves were part of the Cheve drainage or if they headed east, towards the Río Seco. Another scouting trip by Bill Farr, Eve Laeger, and I in 1990 had revealed three additional entrances high above the town of Santa Flor. There was no doubt that these were a part of the Cheve drainage. Finding these leads based on descriptions in the written reports made when the entrances were tagged became one of our first priorities.

On the first half-day ridgewalk, Peter, James, and I independently relocated an unnamed cave labeled with tag 73. According to Stone's tag report, this cave went down two short drops to a probable sump, with the water likely resurging at a doline 2 kilometers to the east. This did not sound especially promising. But the cave's easy access, its entrance 4 meters wide by 8 meters high, and the air flow made it our most appealing prospect. In addition, the cave seemed to be located along a north-south trending lineament or possibly a contact between two different limestones. The following day, Peter, James, and I returned and began surveying at the entrance, which is located at the bottom of a grassy doline just to the south of the main road. We immediately


SCALE IN METERS
0
200
400
600
800
1000
1200
1400
PROFILE
CUEVA CUATES
CUEVA ESCONDIDA
OSTO DE PUENTE NATURAL
VIENTO FRIO
SURPRISE STREAM
HERB'S MAGNIFICENT PIT P112
MONDO PIT P102
LLANO CHEVE
CHEVE ENTRANCE
THE CREVICE P88
BASKET ROOM
FISSURE DROP P65
SANTA'S WORKSHOP
CHRISTMAS PRESENT
FIT AFTER PIT P70, P60
FLOWSTONE DROPS P28, P32
ELEPHANT SHAFT P8L
GIANT'S STAIRCASE
SHAFT OF DAMACLES P46
PUENTE BOREHOLE
THE MAJOR ABYSS P124
SAKNUSSUM'S WELL P145
MYSTERY DOME
SALMON LADDER
THE TURBINES
AVALON
SUMPLANDS
THE PISTON P56
CAMP 2
EAST STREAM
-958 SUMP
LOWRIDER TURNPIKE
WIDOW MAKER P55
HALL OF THE RESTLESS GIANTS
SWIM GYM

SISTEMA CHEVE

OAXACA, MEXICO

Suuntos and tape survey from December 1986 to March 1993 by:

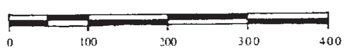
Rolf Adams	Stan Allison
Bob Bannedict	Jeb Blakely
Peter Bosted	Don Broussard
Harry Burgess	Laura Campbell
Don Coons	Alan Cressler
Michael Denneborg	Ruthie Diamante
Ramon Espinosa	Mason Estes
Bill Farr	Mike Frazier
Ernie Garza	Andy Grubbs
Peter Haberland	Ed Hallaray
Louise Hose	Joe Ivy
Pat Kambesis	Peter Keller
Steve Knutson	Herb Laeger
Gary Mele	Karlin Meyers
Tom Miller	Mark Minton
Matt Oliphant	Luke Perry
Nancy Pistole	Steve Porter
Peter Quick	Bitsy Ray
John Schweyen	Tina Shirk
Bill Steele	Janet Steele
John Stembel	Bill Stone
Bill Storage	Georg Tetzlaff
Carol Vesely	Todd Warren
Nancy Weaver	Steve Zeman

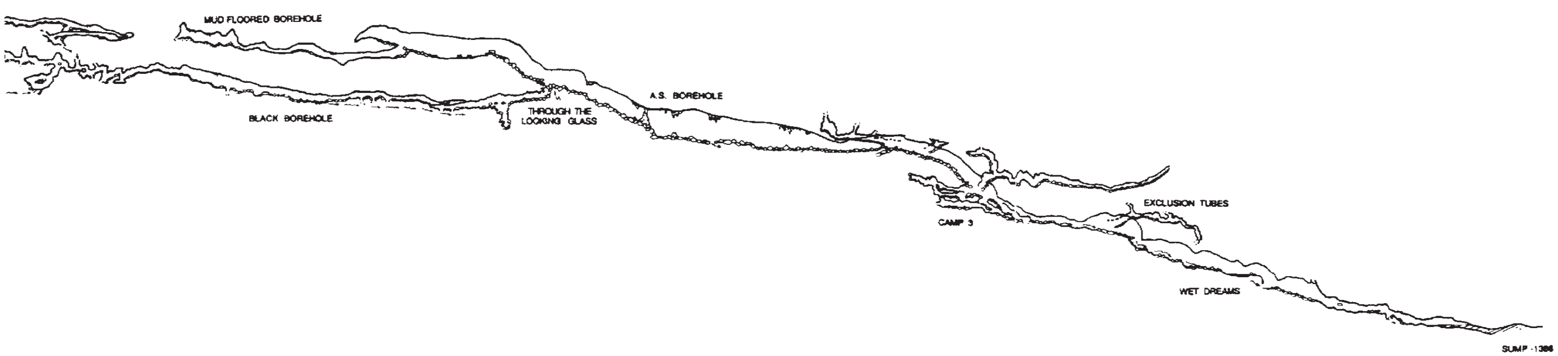
Total surveyed length 23.3 kilometers.
Depth -1386 meters.

All measurements in meters.

Drafted by Carol A. Vesely, 1993.

SCALE IN METERS

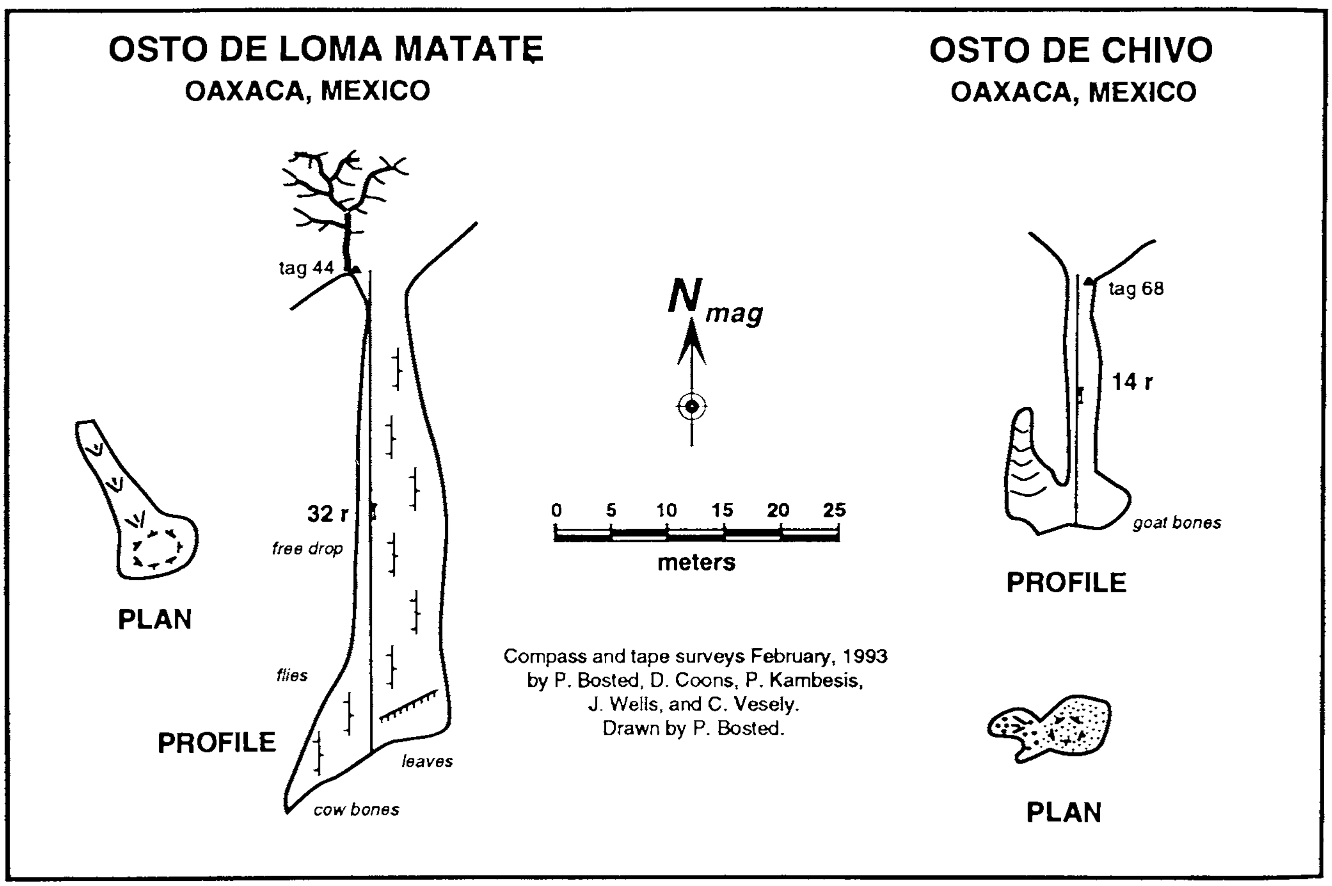


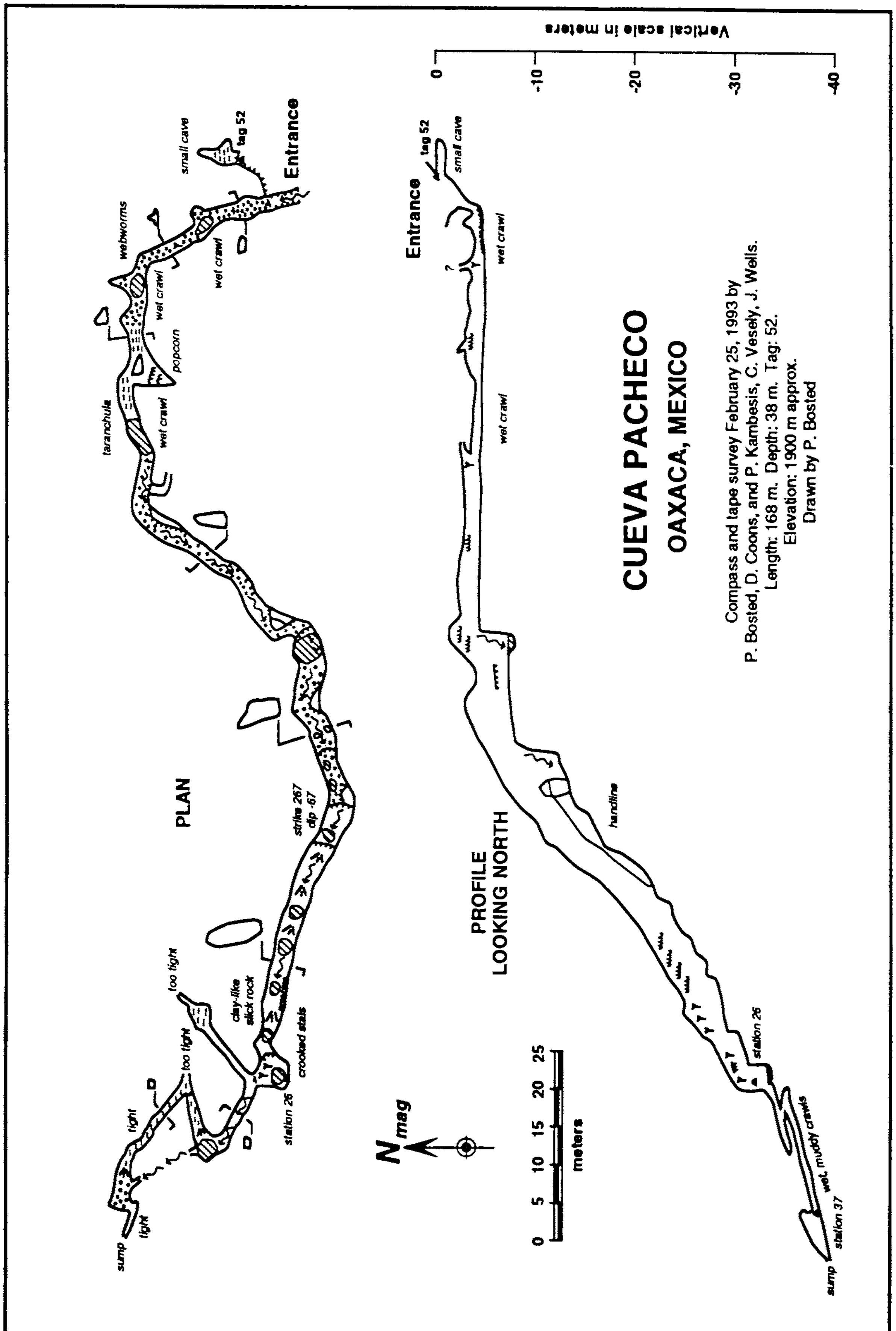


descended a 5-meter dirt climb. The clean-washed passage continued to stair-step down. A 4-meter climb led immediately to a 5-meter climb, both requiring rope due to the slickness of the rock. Beyond this, the ceiling dropped suddenly to a low squeeze floored with water. This was the "probable sump" that had stopped the original group. Peter, who was lead tape, said that it looked grim, with maybe only 5 centimeters of air space. Next, James crawled into a better position to assess the situation, and reported it looked tight with maybe 15 centimeters of air space. While completing my sketch, I listened to them discussing methods to lower the water level and mentally prepared myself for the worst. When it turned out better than expected, I exclaimed, "Why, it's only a puddle!" This inspired the name Cueva Charco, Puddle Cave. After this, no one had any problems surveying through the "puddle." On the other side of the puddle, the cave opened a little, but soon dipped back down to another pool, longer than the first. We continued down a series of chimneys and climbs interspersed with short crawls and squeezes. There were more puddles, and finally my survey book took a dive into one. The wet paper made it hard to keep the book neat, so I ended the survey. We had surveyed 250 meters in fifty-seven stations, for a depth of over 90 meters. Although the passage was not particularly spacious, the air flow was good.

Two days later, Peter, Don, and Patty returned to Charco with more rope and vertical gear. They continued following the water down more fissures and pothole passages. Soon they came to a 12-meter drippy pit, where they rigged a rope in the water. The cave continued as a low horizontal passage to a very tight spot. Then, it opened into a canyon, leading to a 9-meter pit. A few infeeders joined the main passage at this point, making it a little wider and much taller. They continued down a series of progressively longer climbs, rigging a handline for one. Finally, Don went down an "intimidating" climb only to be stopped at the top of an impressive pit. At this point the passage was more spacious than it had been since the entrance. But after 295 meters in seventy-seven stations, the team was out of rope. The cave was then over 180 meters deep and seemed more promising than ever. The hot topic was whether Charco was headed towards Cheve or to the east. Back at camp, a quickie line plot revealed that the last survey station was, in fact, directly below the entrance.

The next day, James, Ed, and I took our turn pushing Charco. We were impressed with the amount of grim passage the others had surveyed. As James put it, "there are many places where you can stand or sit comfortably, but you can't move anywhere without crawling or climbing." Ed, the largest of our group, had to try the tight spot from several different angles before he was able to squeeze through. We finally reached the pit where the others had stopped. A small stream cascaded down the 33-meter drop to a 15-meter-long room. The water continued through the breakdown floor, and we followed it down more




CUEVA PACHECO
OAXACA, MEXICO
Compass and tape survey February 25, 1993 by
P. Bosted, D. Coons, and P. Kambesis, C. Vesely, J. Wells.
Length: 168 m. Depth: 38 m. Tag: 52.
Elevation: 1900 m approx.
Drawn by P. Bosted
PLAN
PROFILE
LOOKING NORTH
Entrance
tag 52
small cave
webworms
wet crawl
popcorn
taranchula
strike 267
dip -67
clay-like
slick rock
too tight
tight
sump
station 26
crooked stals
N mag
0 5 10 15 20 25
meters
Vertical scale in meters
0
-10
-20
-30
-40
handline
wet, muddy crawls
station 37

pothole passage. This led to another low water crawl, only this time it was more than just a puddle. The 20-meter-long wet crawl had at least one ear-dip section, or more if you weren't careful. But the air flow beckoned us on. Beyond was the most pleasant part of the cave, a narrow walking-height passage with a stream on the floor and flowstone decorations. Next, we rigged a 5-meter drop, but after a few more stations the way got grim again. Ed, who was lead tape, could feel the cold breeze in his face as he looked ahead another 8 meters through a low air-space bellycrawl. With thirty-seven survey stations, making Charco 268 meters deep, we headed out. We arrived back at camp at 6:00 A.M. after a seventeen-hour trip. The line plot revealed that Charco was 735 meters long and finally heading west towards Cheve; additionally, its bottom was 100 meters lower than Cheve's deepest point.

A few days later, Patty, Don, and James returned to Charco. They descended the 33-meter pit and continued to the end of the previous exploration. Don pushed the low, wet lead until it opened into about 10 meters of 1-meter-high passage. Then it degenerated to a very wet, gravel-floored bellycrawl with a small ceiling channel. Patty took the lead. She pushed the gravel ahead of her to enlarge the passage enough to wiggle through the 3-meter-long Horror Crawl. On the other side, it opened up again to stooping- and walking-size passage. The air flow was still good, but more digging would have been needed for the others to fit. The three then derigged the cave, and there are plans to return again next year.

Peter and I decided to try to relocate the three caves Bill Farr and I had discovered above San Miguel Santa Flor five years ago. I remembered the caves as being along the contact between the metamorphic rocks and the limestone. All had small crawlway entrances. Two had good air flow and two took small streams that ran off of the metamorphics. To get to the area from field camp required a three-hour hike gaining about a thousand meters in elevation, through the fields and forest on the trails above town. I quickly relocated the first cave, which is right near the power lines and only about 20 meters from the trail. It had three entrances and took a small stream, but it got very tight after only about 20 meters. The second cave had better air flow and opened up just inside the crawlway entrance. We explored it for about 50 meters, and it seemed to be getting larger and more promising as we went. I wasn't able to relocate the third entrance. When Patty, Peter, and Don returned to survey the second cave a few days later, they discovered that it ended only 15 meters further. They named it Cueva Falsa Promesa, False Promise Cave.

Much of our time was spent ridgewalking for new entrances. Just above Charco, James and Peter located two caves. Cueva de Loma Matate was basically a fissure cave, mostly open to the sky. While James was checking this lead, Peter and I were defending our gear from an overly aggressive steer that had decided that webbing looked tastier than grass. Next, Peter descended Osto de Loma Matate, which turned out to be a 32-meter dead-bottom pit. On another ridgewalking trip, Don, Pat, and Ed hiked downhill from Hierbabuena and rediscovered Osto de German. Ed dropped the 37-meter pit and followed the cave down for a vertical total of 50 meters. After this they continued hiking uphill towards Cerro Monte Flor, passing a spring and a small cave, before locating another osto (the local word for "pit"). Don dropped the 40-meter pitch and ran out of rope. The cave continued sloping steeply down another 40 meters and he could hear water below.

Another day, a local man who lives at the base of Cerro Tepalcate showed James, Don, and Pat two cave entrances located in the sink behind his house. The upper hole was a small, dry cave, and the lower one was too tight, but took a small stream. The next day, Don and Peter returned to the lower Cueva Pacheco and dug through the cobble fill into ever-enlarging passage. They returned to camp and enlisted James, Pat, and me to help them survey. The cave began low and sleazy, with a small stream over a cobble floor and a couple of slimy mud wallows. Patty had the joy of reading instruments only 30 centimeters away from a tarantula resting on a mud bank in the water crawl. Finally, the cave opened into walking passage with slick, dark, clay-like bedrock. We descended a series of three climbdowns, one requiring a handline due to the slippery rock. The cave was getting bigger and better, but unfortunately there was no air flow. After a couple more survey shots we came to a nicely decorated room. But the only way on was a tight, muddy tube that headed down about 30 meters past more cow bones to a disgusting sump. Cueva Pacheco was surveyed to 168 meters in length.

Peter and I left for the resurgence area, and Don, Pat, James, and Ed drove across the San Miguel valley to the town marked Joya Durazno on the map. They had a letter of permission for Joya Durazno, but, unbeknownst to them, they were actually in the neighboring town of San Felipe de Jesús. Fortunately, the locals were friendly, and after a few hours of small talk the group was able to "correct their political incorrectness." Accompanied by some local guides, they went in search of an osto high on the hillside. They never found this pit, but the next day the guides led them to two others. These were both located just above the river in the Cañon de Cerro Bravo (or the San Miguel Canyon). The first was 22.5 meters deep, and the second was 30 meters deep. Both were dead-bottomed, and the first contained bats. The next day, they hiked back down to the river, encountering several springs along the contact with the metamorphics. They found a small shelter cave and a pit, the bottom of which was below the river level. The locals told them of other holes nearby, but the group ran out of time. A larger expedition to the middle karst area is planned for next year.

Bosted: During the 1990 expedition, Dan Clardy and I had discovered Cueva Palomitas, Popcorn Cave. It is a tight, wet, cold cave located high above the headwall of Cheve. In 1992, this cave was surveyed to a length of 525 meters and a depth of 183 meters, with exploration stopping at the top of a 150-meter pit. In 1993 there were two trips into Palomitas. Stan Allison and I talked James into joining us and hiked up to the entrance, which is about 100 meters higher than the main

Cheve entrance. The cave was colder and wetter than I remembered, and the infamous Gnarly Passage had gotten no easier. Five hours later, after rigging all the drops on the way in, we finally arrived at the big pit. We intended to replace the 8- or 9-millimeter rope left from last year with a thicker one, but it turned out the one we had brought was the same thickness. Stan spent the next two and a half hours putting a bolt in the incredibly hard, cherty rock to keep the rope out of the small waterfall that had severely chilled both him and Dan Clardy when they had dropped the pit last year. The bolt also served to protect the rope from abrasion. By this time, James and I were really cold, and Stan had chipped his tooth, so we fought the altitude and gnarliness to emerge finally under a star-lit sky well after midnight.

Frazier: Late in the Cheve expedition, there was a second Palomitas trip, when Skip Withrow and I returned to the gnarly Popcorn Cave. After reaching the end of the known cave, I placed a hanger and bolt where Stan had drilled earlier. I hooked a bolt in rebelay fashion to avoid the water and reduce the load on the anchor above. I proceeded down the rope to its end, still 5 meters above the floor. The rebelay had served its purpose of preventing rope damage, but had left the remaining rope a bit too short. With no way to reach the ground and no way to stay warm, I ascended back up the rope, warming as I went. At the top I found Skip shivering. Skip had found a longer piece of rope stashed behind a rock. We discussed re-rigging, but decided instead to leave.

Frazier: On Monday, February 22, 1993, Matt Oliphant, Stan Allison, Joe Ivy, and Herb Laeger entered Cheve bound for Camp III. The next day Ramón Espinasa and Ruthy Diamant from Mexico, Peter Haberland, and I followed after the first group. The two groups met at Camp III Wednesday evening. The first group had spent that day pushing the breakdown pile. Thursday morning, Herb decided to investigate a stream-level passage, while Ramón, Ruthy, Peter, and I went to the Wet Dreams area. We split into two teams just above Nightmare Falls, and Ramón and Ruthy went to visit the terminal sump, while Peter and I pushed a high fissure climb found the previous year (see *AMCS Activities Newsletter* 19). The climb went almost straight up, before breaking into walking passage. Peter and I surveyed for several hours, bagging about four dozen shots and encountering a drop. We left for camp and needed rest. Meanwhile, the crew at the breakdown pile returned with no success. On Friday, Herb, Stan, and I returned to the passage above Wet Dreams. Herb christened it the Pray for an End Passage. It had everything you don't want to find in a passage and more, including wet, muddy, exposed climbs, rock fall, and uphill fissure squeezes with sharp, snagging protrusions. Who goes to Mexico to crawl, anyway? We rigged a rope where Peter and I had stopped previously, and Stan descended to find that all leads were dead ends except for the possibility of another fissure drop. Having neither rope nor enthusiasm for fetching more, we left the area.

Near the beginning of the Wet Dreams area, the BO survey connects to the BQ survey. This is the westernmost passage in Cheve, and perhaps the most promising passage to circumvent the breakdown pile. Stan and I opted to explore this possibility. After a few wrong turns, we reached the end of the BQ survey. We pushed several small crawls in an effort to find a way through. Lacking success, we elected to return fresh the next morning. While we were pushing the crawls, Joe and Ruthy were pushing the stream passage Herb had found the day before. The rest of our gang continued banging their heads against the breakdown pile.

The morning of February 27 saw Ruthy, Ramón, and Herb routing for the surface. Peter and Joe left to survey Herb's passage, said to be the most beautiful found in the cave to date. Matt, Stan, and I returned to the BQ survey, hoping to find a way through this time. After we used a crowbar and rope to remove a few wedged rocks, Matt and I were able to lower Stan head-first down a squeeze where the ceiling and floor soon became close friends—too close to let a mere caver come between them. We extracted Stan by his feet and left the area.

On our way to the Wet Dreams area, we had noticed a lead marked with a tantalizing "?" on the map. Because of the wind direction, we surmised that it connected to Wet Dreams, but we weren't positive, of course. Matt lent his whistle to Stan, who then headed down the lead. Matt and I headed back toward camp. Although we never heard the whistle back at camp, Stan did verify that the passage connected to Wet Dreams.

The next day, Peter, Joe, and I left camp ahead of Matt and Stan, who caught the two of us by the time we had reached Camp II. Matt and Stan continued their march to the surface, arriving at the llano after midnight. Peter, Joe, and I stayed the night in Camp II, reaching the surface and feeling glorious sunlight on our faces around noon.

Pistole: On Thursday, March 4, Steve Porter, Don Broussard, Harry Burgess, and I headed into Cheve for a second deep camp. Even though we had done most of our packing the day before, last-minute details kept us busy all morning, and we didn't get started until 1:30 P.M. The trip to Camp II was rather uneventful, for me, at least. Steve, Don, and Harry had not been past Saknussemm's Well, so most of the trip was covering new territory for them. Steve got a bit of a work-out at the end of the Salmon Ladder. He rappeled down a low-angle waterfall, but the end of the rope was tied off on the other side of a pool. His rack got stuck at the low point in the rope, and he couldn't get his weight off the rack to remove it from the rope. Even worse, he was chest-deep in running water. With some help from Don, and a lot of struggling, he was able to free himself. After that we moved at a steady pace, but it still took almost twelve hours to get to Camp II. It is always such a nice feeling to arrive at an underground camp that is completely stocked with supplies. We laid out sleeping bags and pads and cooked a big dinner of freeze-dried food. In no time at all, we were sound asleep.

Needless to say, we were not up at the crack of dawn, if that is even possible in an underground camp.

We had been planning to move on to Camp III, but none of us was up to another long trip. Instead we went back upstream to the 23-Meter Drop to check out some leads in the Sumplands area. Our first lead was right at the base of the 23-Meter Drop, where the route rejoins the stream. Upstream about 20 meters, there is a 2-meter waterfall into a pool, but the passage is big and continues above the waterfall. There is also an 8-meter waterfall going into the center of the same pool, but that water is coming out of a crack in the ceiling. Previous exploration had stopped here because it looked like it would be a wet and cold push, requiring wetsuits. We decided to try to climb past the waterfall at the end of the day, so if we did get wet, it would be a short trip back to camp.

Close to the top of the 23-Meter Drop is a 12- to 15-meter drop through some house-sized boulders that had never been checked. We rigged it, surveyed our way down, and came to a small stream passage. First we went upstream, but the passage seemed to quickly choke in breakdown. Then we went downstream, and after some squeezes, the passage opened up to a tall canyon. The floor soon became too steep and slippery to climb down without a rope. From what we could see, however, the water disappeared in a waterfall just like the 8-meter waterfall at the base of the 23-Meter Drop. We tied a piece of flagging tape to our last survey station, which was as far down as we could safely reach, then continued back to the beginning of the survey and derigged the rope.

Our next lead was in the Connection Room (named after the Puente Natural connection), not far from the top of the 23-Meter Drop. The Connection Room is now known as Avalon, in memory of Chris Yeager. There were some holes along one wall. After some scouting, we found a place to climb down, and we found some walking passage with pretty formations. The passage ended in a sandy squeeze, and through the squeeze we could hear water. We followed the sound of the water through some breakdown, and, lo and behold, we came to the stream we had just seen in the previous lead. It turns out we had just not checked the upstream breakdown closely enough. We surveyed from the stream back into Avalon. We checked out several more leads, but did not find any more passage.

On the way back to camp, we attempted the upstream section at the bottom of the 23-Meter Drop. Harry climbed on the wall above the pool and found plenty of holds. He was easily able to climb up to the top of the 2-meter waterfall, and he found walking passage with knee-high water. Don and I followed him, but the passage only continued 30 meters before we were faced with an 8-meter waterfall climb. Harry tried traversing along the wall to get close to the waterfall, but the walls were overhanging and did not have very many holds. The climb would have to be a technical climb with aid. We hadn't brought the survey gear, but now that we know we can get to the passage without getting wet, we can survey that section on the next trip to the area. We went back to camp to hot food and dry sleeping bags.

On Saturday, the plan was to continue on to Camp III. Although Steve and Harry were ready for the trip, Don said he was not up to a potentially long and tiring trip. After some discussion, we decided that Don would stay at Camp II while the rest of us went to Camp III. We made sure that Don had enough to do to keep busy without going far from the camp. I had been to Camp III the previous year, but now I was the only one who knew the way, and I wasn't sure how much I would remember of the route. We also had directions written out by Mike and Matt. Between my memory and the directions, we had almost no trouble finding the way. I like the trip between the two camps, because the passage varies so much. However, there is a lot of climbing up and down for just a little overall elevation loss. Camp III was a welcome sight, and we unpacked sleeping bags and cooked dinner.

The next day, the three of us set off to familiarize ourselves with the end of the cave. A lot of exploration had been done since I had been there, and of course Harry and Steve had not seen anything. With map in hand, we went to the Wet Dreams area. It was as beautiful as I had remembered it. The handlines had seen better days, after several seasons of being beaten by the water. On one climb, a rope was missing, so we tied all our spare pieces of webbing together for a makeshift

Nancy Pistole and Harry Burges between Camp II and Camp III in Cheve. These natural wall markings give the name to the A.S. Borehole. *Steve Porter.*

Ruthy Diamant and Peter Haberland between Camp II and Camp III. *Mike Frazier.*

handline. When we got to the sump, we took a lunch break, and Steve took pictures of us at the end of the cave. There aren't many leads left in Wet Dreams, so we headed out and over to the formidable breakdown wall that has stopped major exploration for several years. We found the leads that were marked on the map, and poked around some. Since it was getting late, we were trying to get a sense of the area more than find a breakthrough. To get back to camp, we went a small and windy way that had been found the year before. Over dinner, we got psyched for pushing the breakdown and finding the long-sought passage to the resurgence.

On Monday, we headed straight for the breakdown. The first lead we checked was up a previously rigged climb on the other side of a very exposed (and rigged) traverse. The lead called for a small person, which pretty much eliminated Steve and me, but it had Harry's name all over it. Harry gave the push his best shot, but whoever said the lead was for a small person must have been thinking of the little people in *The Hobbit*. Next we went to another area, where air had been blowing the previous day. The air had been blowing out of the cave that afternoon, and it was still blowing out of the cave in the morning. We had been told that the cave "breathes," but the air-flow direction never changed for the two days we were in the breakdown. The baffling thing was that the air had been blowing in the opposite direction during our trip in from Camp II to Camp III. Later we found out that a weather system had blown in for the two days we were in the breakdown, so the barometric pressure had changed greatly, causing an interruption in the cave's normal breathing cycle. We could follow the air in our lead for a while, but then the flow seemed to dissipate into many holes in the breakdown. Harry was determined to find a way through. In the afternoon, Steve and I headed back to camp to look for some digging tools. Steve found a hammer and crowbar, so he went back to give Harry the weapons. I started packing up the camp and doing an inventory.

We had made arrangements with Don to be back in Camp II by Tuesday night. We tried to get an early start, but by the time we packed up everything, it was late in the morning. Our last job was to burn all the burnable trash from the past two years. We made a pile of trash and doused it with gasoline. Harry bent down to light the pile with his carbide lamp, and got a big surprise when he found out how volatile gasoline is. Luckily he was unhurt, and didn't even singe his beard. We immediately started up the A.S. Borehole, where we watched the fire light up the whole passage. We left quickly, but the smoke still caught up with us before we got Through the Looking Glass.

The trip out was uneventful. Even though there is about 200 meters of elevation gain between the camps, the trip out took the same amount of time as the trip in. We had been dreaming of a big, hot dinner waiting for us when we arrived at Camp II. Don didn't have a dinner cooked for us, but he had the fixings ready, and when he heard us coming, he started heating water. Don had tried to push two streams that entered the cave close to camp, but didn't find any new passage. He had also done an extensive camp inventory and read several books while we were gone. He was well-rested, and ready for the trip out of the cave.

On Wednesday, we headed out of the cave. As usual, we did not get an early start, and we actually left camp after 1 P.M. We burned the trash at Camp II right before we left, and this time Harry was a bit more careful with his carbide lamp. Steve and Don went ahead, and Harry and I surveyed the stream passage we had found at the bottom of the 23-Meter Drop. The passage required only a few survey shots, and we caught up to Don and Steve at the Turbines. Since it is slower for four people to travel through the cave, especially at drops, Harry and I took a snack break, while Don and Steve continued on. We met again at Saknussemm's Well, but there are enough rebelays on the climb there that everyone could keep moving. At the top of the Giant's Staircase, Harry went ahead of the rest of us, because he was getting cold. Don, Steve, and I set a steady pace for the rest of the way out. We got to the surface about 3 A.M., which is about the worst time to leave the cave. The temperature outside was below freezing. The moon was full, so the llano was bright and pretty. The three of us decided that warm sleeping bags were more inviting than freezing outside while trying to cook dinner, so we went to our tents and snacked in bed.

Haberland: Stan Allison, Mike Frazier, Herb Laeger, Carol Vesely, Skip Withrow, and I hiked to the upper karst in an effort to find another entrance to the system. The plan for the three days was to spend the first day hiking and establishing a temporary camp, the second day exploring, and the final day returning. Our original plan was to travel light and move fast, but the lack of surface water negated this idea. Thus we carried three days of water per person, a six-person dome tent, two ropes, two sets of vertical gear, food, stove, fuel, GPS receiver, and so on.

This is definitely not West Virginia karst. These rocks are rough and sharp. They stick up like loose teeth, or razor blades meters high with pointed tops; and no matter how large or how densely clustered, at any step the rocks can shift or break off. Deep, dark fissures in between are ready to swallow an incautious leg. The sparse, thorny vegetation is in collusion also. Either the thickets hide crevices, or they hold you back bodily. Or the cacti prick your hands, arms, legs, or ass and draw blood just as you struggle to make this climbing move across a 5-meter-deep and 1.5-meter-wide fissure. Why are we here? The view of course. At 2800 meters, we are well above the strato cumulus, and we have a clear view of many other high ridges and, of course, some of the sinkholes and enclosed valleys that we need to check. Why are the ridges so denuded of top soil and the rock exposed like bony fingers? The bedrock has dissolved around the very abundant joints, so it has turned into a sieve. The soil was just sucked down and presumably is being washed away in numerous small or awesomely large cave passages. The drainage from the surface is so diffuse that I don't expect any large cave development near the surface. But then I am surprised and stupefied to be shown a 50-meter-deep pit, right at the very top of a karst ridge. The ridge descends very steeply on both sides. There is no modern drainage into this pit. After a second, offset 16-meter drop, this cave is choked by flowstone, with no connection anymore to passages below.

Between the ridges are deep valleys with abundant moss and hardwoods; we aptly chose names for the valleys such as Enchanted Forest, Emerald Sink, Murk Wood. As we thrashed through these lush depressions, we often realized that we were surrounded by ridges on all sides. Instinctively we descended to the bottom center of these large sinkholes, expecting some kind of entrance. Usually we were disappointed, and found only that the vegetation, mud, and forest soil had choked off what may have been the drain. One spectacular but dashed hope was a 30-meter-deep, steep-sided sinkhole, with the sheer cliff wall on the west holding a tall, cathedral-arched opening. After negotiating the scree slope at the bottom of the entrance, we squeezed past some large wedged boulders, came upon dry, gnarly, popcorn-encrusted chambers, and soon reached a total breakdown and flowstone choke. Historically there may have been large, open drains here, but long ago they have been abandoned and sealed themselves.

As we descended down yet another wooded karst slope, the view ahead through the trees appeared rather strange, as if we were entering a fog-shrouded volcano crater. The bottom of this depression was a large, flat, treeless meadow of grass grazed short. After hours of scrambling on uneven ground, the easy walking on the short grass was like paradise. About a dozen obvious sinks were scattered throughout this meadow. Somewhere beneath our feet the soil was being sucked away. Visions of deep pits and huge chambers played in my mind. Reality was, though, that all the sinks were closed by mud and soil; some held green slimy standing water mixed with cow urine. While this llano had been our major goal and was very disappointing in terms of cave entrances, we still had some leads left. Beyond the far wall of this large sink starts the northward, continuously descending drainage of the Aguacate. The tributary valleys and gullies that we hiked through were predictably dry. Boulders and washouts indicated, however, that water flows here at some times. Perhaps there is still a chance of finding openings here into the system below. We did find Hummingbird Pit, just over 30 meters deep, but nothing else of note.

F*razier:* We're all excited about returning to this fine system. The lure of exploration continues to challenge us as we plan next year's trip to connect Cheve to the resurgence.

Expedición del Proyecto Cheve 1993

Durante la expedición del Proyecto Cheve en 1993 finalmente se obtuvo permiso para asi regresar al area de el cañon de Santo Domingo. Algunas cuevas cerca de la resurgencia fueron topografiadas, las cuales se localizan entre Cueva Cheve y la resurgencia. La más profunda fue Cueva del Charco con 300 metros de profundidad. Dos campamentos subterráneos fueron elaborados en Cueva Cheve, sin grandes resultados.

SISTEMA CHEVE WORLD'S DEEPEST KARST CONDUIT SYSTEM

Louise D. Hose

Cueva Cheve is the eighth deepest explored cave in the world, exploration having extended to a depth of 1386 meters. Cavers working in the area, however, have suspected that the actual extent of the system is much greater, perhaps the greatest vertical extent in the world. This spring, we confirmed our suspicions. The system has a proven depth of 2525 meters, including a hydrological link not yet explored. A combination of precision Global Positioning System work, a visually positive dye trace, dry cave exploration, two sump dives, and traditional cave surveying was used to measure the depth of the system. (The second deepest measured karst hydrologic system is Napra Cave in the Caucasus, Republic of Georgia. It is reported by Kazharsky (*ref. 1*) and A.B. Klimchouk to be 2355 meters deep.)

Exploration by Proyecto Cheve in the upper part of the system began in 1986. The depth of the upper part is now 1386 meters, and its length is 23.3 kilometers. The highest entrance, Cueva Escondida at an elevation of 2798 meters, was physically connected to Cueva Cheve by project members (*2*).

In 1990, Smith (*3*) placed fluorescein dye in the stream entering the main Cueva Cheve entrance. Explorers in the cave reported that the dye reached Camp III, near the terminal sump, in three days. Sheri Engler and Nancy Pistole observed green water emerging eight days later from a spring in Santo Domingo Canyon at an elevation of 291 meters. The spring, Agua Fría de Santa Ana, had been dived to a depth of 18 meters in 1984 by Bill Stone and John Evans, who called it the Western Resurgence (*4*). The dive connected the spring to Cueva Mono, a dry cave discovered and explored by Peter Quick on the same expedition.

In 1989, Mark Minton discovered the entrance to Cueva del Mano. This cave has been connected to Cueva Mono by project members, and the explored length of the lowest portion of Sistema Cheve is presently over 7 kilometers. The explored limit of the

Louise Hose exploring upstream in the Cheve resurgence. *Don Broussard.*

elevation of Cheve entrance	2654
elevation of water level at Agua Fría	291
vertical extent of dye trace	2363
elevation of Escondida entrance	2798
elevation reached by cave dive	273
vertical extent of karst conduit system	2525

All figures are in meters; elevations are above mean sea level.

resurgence part of the system ends in dry, going passage.

To determine the precise, relative positions of the Escondida and Agua Fría entrances, double-differenced differential GPS was utilized. Using two Navpro 5000 receivers, the absolute elevation of a point near the Escondida entrance was determined. A second series of tests determined the precise relative locations and elevation change from this control point to two sites near Agua Fría de Santa Ana. Using Magellan Systems version 2.10 carrier phase processing, multiple tests varied by less than 2 meters. The distance of this one "survey shot" was over 18 kilometers.

Traditional compass and tape surveys, using backsights with only one-half-degree tolerance, were made to connect the control site and the two GPS stations to the Escondida and Agua Fría entrances. The final depth of the system also includes the depth reached by the 1984 dive.

Once our primary objective was accomplished, the GPS receivers were used extensively for less precise applications. One unit was carried by a Cheve Project team while they successfully searched for a specific sinkhole noted on the topographic map. Another unit was used to great benefit while mapping the geology of the area on a very foggy day. The locations of new caves were quickly and accurately established using the units. We were quickly convinced that we will all want GPS receivers soon.

Support for this project was provided by the National Geographic Society Committee for Research and Exploration, UNAVCO, Magellan Systems, and the University of Colorado at Colorado Springs. My team was Don Broussard, Emily Janecek, Matt Oliphant, Nancy Pistole, and Skip Withrow. Valuable help was provided by Mark Minton and by Manuel Aragón Arreola, Gerardo González J., Luis "Thompson" Guinea, Dr. Germán Cruz Martinez, and Luis Javier Valeriano. The assistance of our five friends from the city of Oaxaca was absolutely critical in achieving access to the resurgence area, as the Cheve Project had been denied access for the previous two and a half years. I am especially grateful to them for their support.

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(1) Kazharsky, O., 1991, Deep Hydrologic Systems in Caucasus, *GEO*^{2}, v. 20, p. 34-35.

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(3) Smith, J.H., 1991, Hydrogeology of the Sierra Juárez, *AMCS Activities Newsletter*, n. 18, p. 82-86.

(4) Stone, B., 1988, Vine Cave and other Tales from the Peña Colorado Canyon, *AMCS Activities Newsletter*, n. 14, p. 50-58.

Sistema Cheve

"El Conducto Subterráneo de Karst Más Profundo del Mundo"

En la primavera de 1993, radio recibidores del *Global Positioning System* satélites fueron usados para así medir exactamente las elevaciones de la entrada de la Cueva Cheve, Oaxaca, y la resurgencia en el cañon de Santo Domingo. La diferencia vertical entre Cheve y la resurgencia es de 2363 metros. Añadiendo también la profundidad del sifón de la resurgencia y otros puntos hidrológicos arriba de la entrada de la Cueva Cheve, extiende así el potencial a 2525 metros.

CUEVA DEL MANO EXPLORING THE BOTTOM OF THE DEEPEST KARST SYSTEM

Carol Vesely

Could it really be true? Could the highly decorated, friendly passages of Cueva del Mano really be the bottom of the world's deepest cave? With a vertical relief of less than one hundred meters, Mano certainly couldn't lay claim to any depth record as it now stands. But with the successful dye trace between Cueva del Mano and Cueva Cheve, some twenty-four hundred meters higher in elevation, the possibility of a 2.5-kilometer-deep cave system now exists.

The Río Frío de Santa Ana Resurgence in Oaxaca, Mexico, intrigued cavers the first time they laid eyes on it. The water is cold and clear, unlike the water in the Río Santo Domingo, into which the spring empties. It issues from a scenic four-by-three-meter entrance in a cliff decorated with pink algae, blooming bromeliads, and hanging cacti. Bill Stone and company first spotted this impressive *nacimiento* while searching for the Huautla resurgence during the Peña Colorada expedition in 1984. Stone called it the Western Resurgence, since it was the western-most of the springs the team located. Despite the fact that it was on the opposite side of the river from Huautla, the cold water and volume of flow encouraged the Peña Colorada cavers to hope that Sistema Huautla was the source of the spring. Bill Stone dove there and found a spacious maze of passages with strong current. At one point, he surfaced in a small air-filled chamber. Here, he was able to talk with Peter Quick, who had come in through a dry entrance nearby. After his dive, Bill concluded that the Río Frío was unlikely to be the Huautla resurgence, so the Peña Colorada cavers concentrated their efforts elsewhere.

In wasn't until 1988, a year and a half after Bill Farr and I had begun the exploration of Cueva Cheve, located on the south side of the Río Santo Domingo, that cavers' interest in the Río Frío de Santa Ana resumed. By this time, Cueva Cheve had been pushed to over a kilometer deep, and everyone was curious about its total depth potential. On a solo backpacking trip, Don Coons located three possible resurgences. The first was to the east of Cheve on the Río Condor, which would have given the cave a maximum depth potential of a little over a kilometer. The second was northeast on the Río Seco, but it seemed to issue from the wrong side of that river. The third, the Río Frío de Santa Ana, was due north. All bets were on the latter, for the water was colder, indicating that it may have come from higher elevation, and Cheve was heading in that direction.

At the beginning of the spring 1989 Proyecto Papalo expedition, Bill Farr dumped optical brightener into the Cueva Cheve stream. Midway through the expedition, we returned to the resurgence to retrieve the dye bugs that Don had placed while backpacking. Before hiking down the mountain, we asked and received permission from the presidente of the friendly town of Cueyamecalco, in whose jurisdiction we mistakenly thought the resurgence was located. As we hadn't been planning to do any serious caving, Mark Minton, Don Coons, and I had only one flashlight apiece. On the hike to the Río Frío de Santa Ana, we passed a small creek bed not more than 500 meters upriver. We followed it upstream to a low rock outcrop containing a stoop-sized entrance, blowing air. Flashlights in hand, we explored perhaps a hundred meters of mazy passages, leaving many leads. At one point, my light began to fail. As I sat in the dark waiting for the others to return, I noticed a tiny glowing bug, not more than a couple of millimeters long.

We continued to follow the cliff face down the Santo Domingo toward the spring. We came to a large, dry entrance Don had seen when he placed the dye bugs. It was an obvious shelter with the head of a monkey (*mono* in Spanish) carved and painted on an old column. At the back of the shelter was a short belly crawl that opened into a walking passage after only a meter. Don was amazed at the strong breeze blowing out of the crawl. He swore there was no noticeable air flow on his earlier trip only a few

The Río Santo Domingo. *Peter Bosted.*

Reprinted, slightly revised, from the *California Caver*, summer 1990.

weeks before. We had only explored a short distance when my light began to fade again. Don and Mark went another 20 meters to a narrow fissure blowing air.

We finally made it to the resurgence. While Don retrieved the dye bug and I took photos, Mark went searching for more caves. After about a half hour, Mark returned to report that he had found the most promising cave yet. Don and I were skeptical and hardly very enthusuastic about having to cross the cold and swift spring waters in order to get there. But Mark's enthusiasm convinced us. After crossing the stream, we climbed a near-vertical, jungle-covered, unstable hillside to reach a small hole. Just inside, we found a *mano*, an old hand tool used for grinding. Don christened our latest discovery Cueva del Mano. The wind in Mano was the strongest yet, and the passage dimensions were seldom less than walking. Dry formations lined the walls and ceilings. Despite our failing lights, we explored over a hundred meters before turning back. We passed numerous side leads. After seeing the Río Frío de Santa Ana ourselves and finding the blowing caves nearby, we were certain that the water from Cheve had to come out there. We were very disappointed when the dye trace came out negative.

At the end of the 1989 expedition, Bill Farr and I returned to the resurgence area to begin surveying the caves. We packed light for the long 1400-meter descent to the river. We planned to spend three days there, one day surveying in each of the three caves. We began with the most promising, Mano, of course. We quickly surveyed the 150 meters that Mark, Don, and I had scoooped. At this point, we reached a junction. We chose to climb up an 8-meter-high breakdown pile to the right. At the top was another junction room, festooned with 3-meter-long draperies, large flowstone mounds, and cave pearls. Numerous bats distracted us as they flew by, inspiring the name Bat Junction. From Bat Junction, we surveyed down a 6-by-6-meter borehole heading south into the mountain, in the direction of Cheve. The borehole became larger and better decorated the farther we went. We were excited by the thought that we might be headed into the heart of the bottom of Sistema Cheve. But it was all just too easy. Reality caught up with us after another 100 meters. The passage ended in a flowstone plug with no airflow.

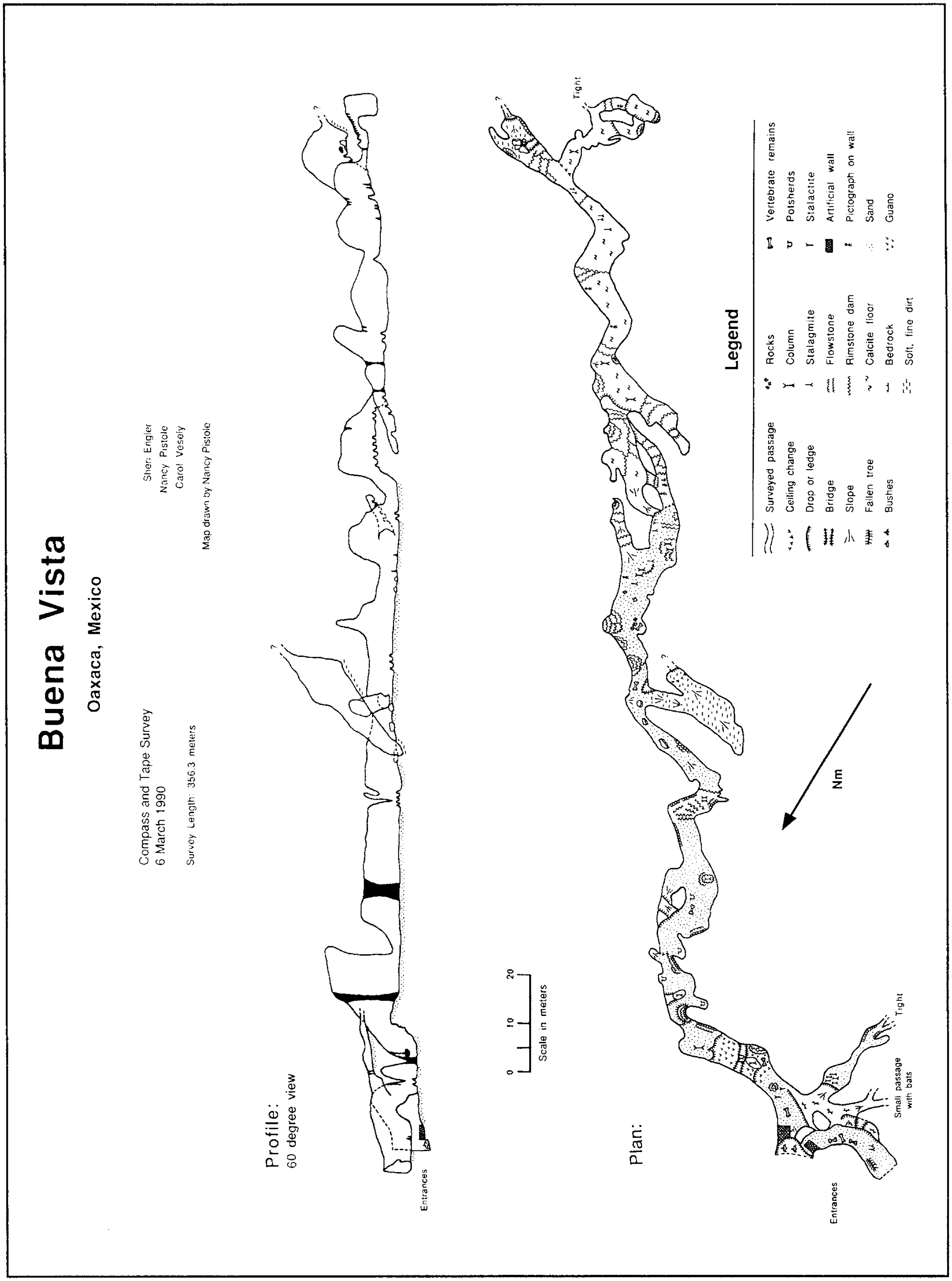
We returned to Bat Junction and followed another well-decorated passage, this one heading northeast and blowing strongly. But at station 45, Bill suddenly felt very ill. His head and stomach ached, and he was running a fever. I scouted ahead about 50 meters to yet another junction. Then we headed out. We had surveyed about 350 meters.

Bill slept fitfully that night and awoke feeling even worse. He was certainly in no shape for caving. If we both got sick, we would be stranded in the canyon with little food and no one to help. We decided to try to hike out. I managed to stuff nearly all of our gear into my backpack. Bill was able to carry a light day pack with the few remaining items. It was a long, hot six-hour hike back up the mountain, me with a heavy load and Bill so sick. Mysteriously, Bill's illness disappeared a day later, as quickly as it had come.

Helictites in Cueva del Mano.
Peter Bosted.

I was anxious to return to Mano, so as part of the 1990 expedition, I planned a two-week trip to what we were now referring to as the resurgence area. Without a positive dye trace, we still weren't certain that these caves were related to Sistema Cheve, but I was 99 percent convinced that they were. On February 25, we met in Cuicatlán before driving up the mountain. On the resurgence trip were Peter Bosted, Bill Storage, Nancy Pistole, Joe Razo, Herb Laeger, Eve Laeger, and I from California, Sheri Engler from Kentucky, Jerry Fant from Tennessee, and Randy Spahl and Ian McKenzie from Canada. Don Coons, Bill Stone, Matt Oliphant, Michael Denneborg, and Georg Tetzlaff (the last two from Germany) accompanied us to the friendly mountain village of Cueyamacalco, where we spent the night. We had recently learned that the caves were under the jurisdiction of the town of Santa Ana Cuauhtemoc, so in the morning we went there to get permission. We had official letters from Oaxaca City, and Joe speaks excellent Spanish, so permission was no problem. The Santa Ana presidente did insist that we hire burros from their village and use their shortcut to the river. We had originally planned to go through Cueyamalcalco, as we had in the past. We agreed, and at 8:00 A.M. the next morning we loaded six mules and burros with our group gear and food. We carried our own backpacks full of caving and camping gear. The Santa Ana shortcut turned out to be a real improvement over our original route, shorter, shadier, smoother, and somehow less steep as well.

We established base camp under an immense tree about 200 meters up river from the resurgence and just before the narrows along the Río Santo Domingo. The jungle was full of life, most of it to be avoided. Bug repellent was the most popular item in the first-aid kit, as we all adjusted to the fact



Buena Vista
Oaxaca, Mexico
Compass and Tape Survey
6 March 1990
Survey Length: 356.3 meters
Sheri Engler
Nancy Pistole
Carol Vesely
Map drawn by Nancy Pistole
Profile:
60 degree view
Plan:
0 10 20
Scale in meters
Entrances
Tight
Small passage with bats
Nm
Legend
Surveyed passage
Ceiling change
Drop or ledge
Bridge
Slope
Fallen tree
Bushes
Rocks
Column
Stalagmite
Flowstone
Rimstone dam
Calcite floor
Bedrock
Soft, fine dirt
Vertebrate remains
Potsherds
Stalactite
Artificial wall
Pictograph on wall
Sand
Guano

Carol Vesely descends the Contact Climb in Cueva del Mano. *Peter Bosted.*

that you could get fifteen bites on your exposed flesh in the time it took to use the latrine. Once we arrived, we never stopped itching. In addition, we saw three monkeys and a coral snake near camp. Nevertheless, everyone agreed it was a beautiful place.

The next morning, February 27, we divided into three survey teams, one for each cave. Nancy, Sheri, and Peter headed into the cave farthest from the resurgence. At the entrance, they encountered a swarm of butterflies, and they named it Mariposa. They found a maze of sand- and mud-floored passages averaging 3 to 4 meters high and wide. They surveyed 251 meters and left leads.

Meanwhile, Bill, Jerry, and Herb entered Cueva del Mono. Rather than surveying in, they explored ahead and soon located the lake where Peter Quick had spoken to Bill Stone on his dive; the dive line was still in place. Wading through the lake and following a blowing side lead brought them to a junction at survey station MA13. They had connected Mono to Mano. They followed the Mano survey back to its entrance and decided to go ridgewalking for the rest of the day.

I took Randy and Ian to the place in Mano where Bill and I had stopped surveying the year before. We followed the spacious walking passage northwest to an end only 70 meters farther. Next, Randy led the way up a series of exposed climbs to a small, blowing entrance. We tried for about two hours to dig and bash our way through the opening, but it was just a bit too tight. We retreated with 219 meters surveyed and another airy climb left unchecked.

The next day, I volunteered for camp and cook duty to get this chore out of the way. It seemed unwise to leave camp unattended for any length of time. Therefore each person had to spend one day guarding camp and cooking dinner for the group.

Nancy and Sheri returned to Mariposa, this time accompanied by Joe. They rigged a 3-meter drop and surveyed a big loop that rejoined the known cave at a pit found the day before. Next, they mapped a formation-filled crawlway with good air, stopping at a grim spot after surveying 181 meters.

Before heading into Mano, Peter reviewed the survey notes from the year before and spied a "major lead." Ian, Randy, and Peter discovered that this went to a large, sloping rift passage with holes to a lower level in the floor and large flowstone rooms updip, on a higher level. They chose the middle level. This headed south to Pothole Way, a clean-washed passage with a beautifully scalloped floor. At the junction with the upper leads, the passage headed down and got bigger, still clean-washed. Suddenly, it went down a sandy slope to a large sump. Randy climbed a nearby dome, but could not find a way to bypass the lake. Their total survey was 435 meters.

Meanwhile, Herb, Bill, and Jerry took up the arduous task of searching the area for more caves. From the cliffs on the north side of the river, you could see many enticing holes of the south side. The problem is that you have to climb through cactus jungles to get to them. The ridgewalkers discovered a small blowing hole and shelter.

On March 1, I was eager to return to Mano with Peter, Randy, and Ian. We began by surveying the lower-level leads off the sloping rift. One lead went to a 10-meter pit. We eventually came to the bottom of the same pit via a different route. Finally, we took an upper route off the rift, and this led to a beautiful room, 15 by 25 meters, with bats flying from unseen passages beyond. We ended the survey at this enticing spot, after a total of 458 meters.

The Mariposa crew of Nancy, Sheri, and Joe surveyed another 177 meters of crawlways and loops. They returned to camp excited by the cool airflow in their last lead, a going passage 3 by 4 meters. They were convinced that their reward for surveying all the tight stuff lay just around the bend.

The next day, Nancy, Sheri, and Joe anxiously returned to Mariposa. They followed their blowing passage to a sump pool and a drop with no air. The air appeared to vanish in an impossibly loose climb near the sump. Disappointed, they checked a few side leads and called the cave done. A total of 700 meters had been surveyed in the four trips.

Peter, Ian, and I returned to the great formation room, later named the Backstage, where we had stopped the day before. We began by surveying a crawlway, the Canadian Borehole, off the base of the room. It got progressively smaller and ended in a fissure that was too tight. Next, Ian and I tried to find a way to climb down the 30-meter pits in the floor. Meanwhile, Peter managed to squeeze behind the meter-thick flowstone curtain that gave the Backstage its name. He came back with tales of borehole. We were dubious until we saw the 8-meter-diameter passage for ourselves. Peter's Perfect Borehole had a hard-packed mud floor, nice formations, and, best of all, it headed southeast. After several stations, we came to an overlook into a massive junction room. The Fin Room had a large projection of rock that jutted out from one wall, making the room very confusing to traverse. We chose a lead heading south from the room and came to an area of curved stalactites over a meter long. All the formations were bent in the direction of the entrance and the prevailing wind. The Curved Stalactite Passage continued down a rimstone slope and through a formation squeeze. On the other side, it followed the contact between a reddish-brown limestone on the ceiling and a smooth, gray, marbleized rock on the floor. The dip was to the west. The Contact Passsage was headed in the right direction, and it felt as if it would keep going forever. We surveyed for hours and finally called it quits at station 99, after 586 meters. The passage showed no signs of ending, but we wanted to get back to camp before midnight.

Also that day, the ridgewalking crew returned with news of an exciting new discovery about 70 meters above the river and half a kilometer downstream from camp. Buena Vista had two entrances with a breathtaking view both up and down the river. Herb had reached the cave by a 70-meter rappel.

On March 3, after a short night's sleep, the three of us resumed surveying in Mano where we had left off the night before. At one point the passage sumped, but we managed to find an easy bypass. A little later the passage abruptly seemed to end at a climb along a fault. At the top of the 8-meter climb, we crossed some small pools and again found ourselves following the contact. The sloping rift became wider, until the walls were 60 meters apart. Finally, the passage took an abrupt turn downdip to a terminal-looking pool, which we did not check closely. Hoping to find a bypass, we headed updip over 100 meters, but this way to the south pinched out. Our only consolation was a beautiful little helictite garden at the top of the rift. With 650 meters surveyed, we headed out, arriving at camp around 1:00 A.M. Field calculation indicated that we were a kilometer south into the mountain at our farthest point.

That day, Bill rappelled down from the top of the cliff and rigged a 70-meter rope from the entrance of Buena Vista to the river. Eve, Nancy, Joe, and Randy ascended the river rope. But they were not the first to visit the cave. Despite the difficult access, the ancient Indians had been there and built 1.5-meter-high walls in the entrances. Buena Vista turned out to be a classic Hollywood-style cave, spacious, warm, dry, and well decorated, with a smooth, hard-packed floor. The only large side lead contained lots of bats and guano. The air was stale, and all passages appeared to be choked with flowstone.

The next day, since our southern lead in Mano had presumably ended, Peter, Randy, and I decided to try a different tactic, to head north, updip, and see if we could intersect an older passage that might bypass the sump. We began surveying one of the larger leads off the Fin Room. This went to an immense overlook 20 meters above

Carol Vesely admires the formations in the Curved Stalactite Passage, Cueva del Mano. *Peter Bosted.*

the floor. As we were setting up to take a photograph, Nancy and Ian entered the Fin Room. They had just finished checking one of the pits in the floor of the Backstage. Instead of going to a stream passage as hoped, the 30-meter pit only led to a deep pool. From the overlook, we had a bat's-eye view of Nancy and Ian wandering around the Fin Room looking for the borehole that led out. We finally shouted directions and resumed surveying. Our walking-height passage headed up a steep slope covered with white flowstone. This was the prettiest passage we had found to date, and Peter named it the Red and White River. We surveyed 242 meters and stopped at what appeared to be the crest of a drainage divide.

On March 5, Nancy and Ian tried to return to Buena Vista to survey, but they found that someone had stolen the bottom 20 meters of the rope. Muddy bare footprints indicated that he must have used the rope to scale the cliffs, cut off a section, and doubled it for part of the descent. This was very disconcerting, and we were glad we had had someone in camp watching the rest of the gear.

Ian and Nancy, as well as Herb, Eve, Joe, and Bill, spent the day ridgewalking. New holes were always being spotted, but most were extremely difficult to reach. Nearly everyone agreed that an eight-hour cave trip was easier than ridgewalking.

Sheri, Jerry, and I headed into Mano to check a very promising lead Ian had briefly scouted three days earlier. This turned out to be an excellent choice. Initially, we climbed a 20-meter-wide breakdown pile to reach a 15-meter-diameter borehole filled with knee-deep guano. We saw no bats, only tons of slimy, smelly guano. After about 200 meters, the I-Guano-Go Passage came to a flowstone overlook into a huge passage below. Sheri and I talked Jerry out of climbing down without a rope. Retreating to the Curved Stalactite Passage, we surveyed a series of small tubes with good air, returning with 235 meters of survey.

Meanwhile, Peter, Randy, and Joe surveyed side leads off the Contact Passage in hopes of finding a way farther south. They found many loops and a sump, but no way on. They surveyed 345 meters.

Armed with a rope to do the long rappel from the top of the cliffs, Nancy, Sheri, and I headed for Buena Vista the next day. There was a spectacular view from the cliffs, even if we did have to fight our way through cactus and thorns to get there. Rushed for time, we quickly surveyed the 356 meters of known cave. I took several pictures, but you could easily spend a day in Buena Vista for photography. Surprisingly, there was some airflow in the cave this time. We didn't have time to check the high leads, since we wanted to get back down the treacherous cliffs before dark. We derigged both ropes on our way.

Sheri Engler looks out of one of the entrances to Buena Vista from the top of an ancient stone wall. *Carol Vesely.*

Randy, Jerry, and Ian returned to the I-Guano-Go Passage armed with a 15-meter rope. At the bottom of the pitch, the borehole continued south, the guano quickly giving way to clean-washed floor and many formations. This appeared to be a major section of the cave, with numerous side leads. They surveyed south as much as possible, eventually reaching an overhung 5-meter drop. With 655 meters surveyed and many going leads, they left the cave after a long trip.

On March 7, with so many good leads in Mano and time running out, I felt it was important to send as many teams as possible into the cave. Bill, Jerry, and Joe headed back to the place where the survey had ended the day before. They got even farther south, in mostly large passages, evenually reaching another sump, farther east but almost as far south as the one at the end of the Contact Passage. A muddy climbing lead near the sump was left.

Ian, Sherri, and I also headed to the big passages below I-Guano-Go Drop. We surveyed a bunch of loops and discovered a promising high climbing lead near the end of the day. It looked as though it opened into a large upper level. On the way out, we met Bill's team; the two teams had gotten another 800 meters of survey.

Peter, Randy, and Herb again tried to push south in the side leads off the Contact Passage. At the highest point in the rift maze, they found directional aragonite. They also found some beautiful helictites and a long lake they took their boots off to cross, but no way on. They netted 530 meters of survey, with more tubes left in the area.

On the final day in Mano, Peter, Sheri, Randy, and I headed back to the Red and White River Passage. There was not an inch of wall, ceiling, or floor not decorated with flowstone. After taking plenty of pictures, we split into two teams to do a leapfrog survey. Randy and I went down the walking passage about 100 meters to begin surveying. We came to an 8-meter climb up that led to an interesting breathing hole through the flowstone. For several minutes there would be no air flow at all. Then the air would slowly build until it made a loud, continuous noise. After another minute, it would die down again. We thought we must be hearing the wind along the cliff face. But no daylight was visible. I wrote the date and station number on a piece of flagging tape and threw it through a small crack in the flowstone. Perhaps some day we will find it on the other side. The four of us surveyed only 178 meters. When we plotted the data at home, we discovered that the breathing hole is not near the cliffs, but very close to the end of Buena Vista.

Nancy, Ian, and Jerry were more successful. Jerry was able to bash footholds in the muddy, crumbly rock and make it up the climb near the sump. Unfortunately, it didn't go. However, it was full of the prettiest helictites in the cave. Jerry was also able to find a way to climb into the big lead our team had spotted the day before. They surveyed down a gorgeous borehole with dry crystal pools and lots of flowstone. They returned to camp at 6 A.M. with 489 meters surveyed. On one of their rest breaks they decided to play a joke on me. They made up a phony page of survey notes, complete with a sketch showing a huge borehole leading to a breakdown pile with Camp III in Cheve on the other side. No wonder they had such a long trip.

March 9 was our last day at the resurgence area; the eleven days had gone by so quickly. We had added over six kilometers of new passage to Mano and surveyed 700 meters in Mariposa and 350 meters in Buena Vista. And the day before, the ridgewalking crew had found their most promising hole yet, Cueva Amontillado. Sheri and I stayed in camp to pack group gear, while the majority of the group went on a river trip through the narrows to retrieve a dye bug that Jim Smith had placed in the Huautla resurgence. Meanwhile, Peter and Joe ascended a rope that Herb and Bill had left hanging in Amontillado. They explored a few hundred meters to a promising bolt climb. Back at the cliff entrance, they set a bolt and rigged a doubled wire so that we could pull a rope up when we returned.

Half of the group decided it was worth an extra five dollars each to have their personal packs hauled back up the mountain. They hired additional burros from Salamon, a very kind man who lives on a farm a kilometer up-river. They left early to hike up the trail to Cueyamacalco with Salamon. By 8:00 A.M., the rest of us were packed and ready for the burros from Santa Ana to arrive to haul the group gear. But the burros never showed. We were stranded with the group gear. After waiting two hours, we decided that the vehicle drivers (Ian and I) and those people with planes to catch would hike up to Santa Ana and arrange for burros to come down the next day for the others and the group gear. Peter, Joe, and Jerry made it to their planes on time, but Sheri and Nancy ended up stranded at the resurgence for two extra days. Luckily, there was plenty of leftover food to eat. We finally convinced the people of Santa Ana to send burros.

Nancy and Sheri's only reward for this unfortunate inconvenience was seeing the resurgence water turn bright green from dye that Jim Smith had dumped into the Cheve stream only eight days earlier. It took the water two days to travel to Camp III, near the deepest point in Cheve, and then only six more days to go the remaining 17 kilometers. Thus, Mano truly is the bottom of the world's deepest cave, hydrologically at least. This gives the system a total depth potential of over 2500 meters. Now, all we have to do is find the way through.

Despite the burro problems, overall this was one of the best trips I've been on. The people were great. Everyone was highly motivated to cave, ridgewalk, write trip reports, reduce data, and help with group chores. There was lots of beautiful cave to explore, and there were no personality hassles to ruin the fun. It made all the months of preparation well worthwhile.

Many thanks to all the sponsors of the 1990 expedition: Bob & Bob, PMI, Patagonia, Koehler Wheat Lamps, and the NSS. Also thanks to all the people who bought T-shirts and expedition reports to help support the project. The generosity and support of these groups and people were very important to the success of the expedition. We certainly appreciate it.

Cueva del Mano

Cueva del Mano es la cueva de mayor dimensión en las cercanías de las resurgencia del Sistema Cheve en Oaxaca. Cueva del Mano fue descubierta en 1989, y en la primavera del 1990 más de 6 kilómetros han sido topografiados y la cual se dirige basicamente en la dirección de la Cueva Cheve. Se registró el sistema de rastreo en la Cueva del Mano proveniente del Sistema Cheve. En la zona de los nacimientos también se topografiaron 700 metros en la Cueva de la Mariposa, 350 metros en la Cueva Buena Vista, y descubriendo también la Cueva del Amontillado.

Cueva Mariposa

Oaxaca, Mexico

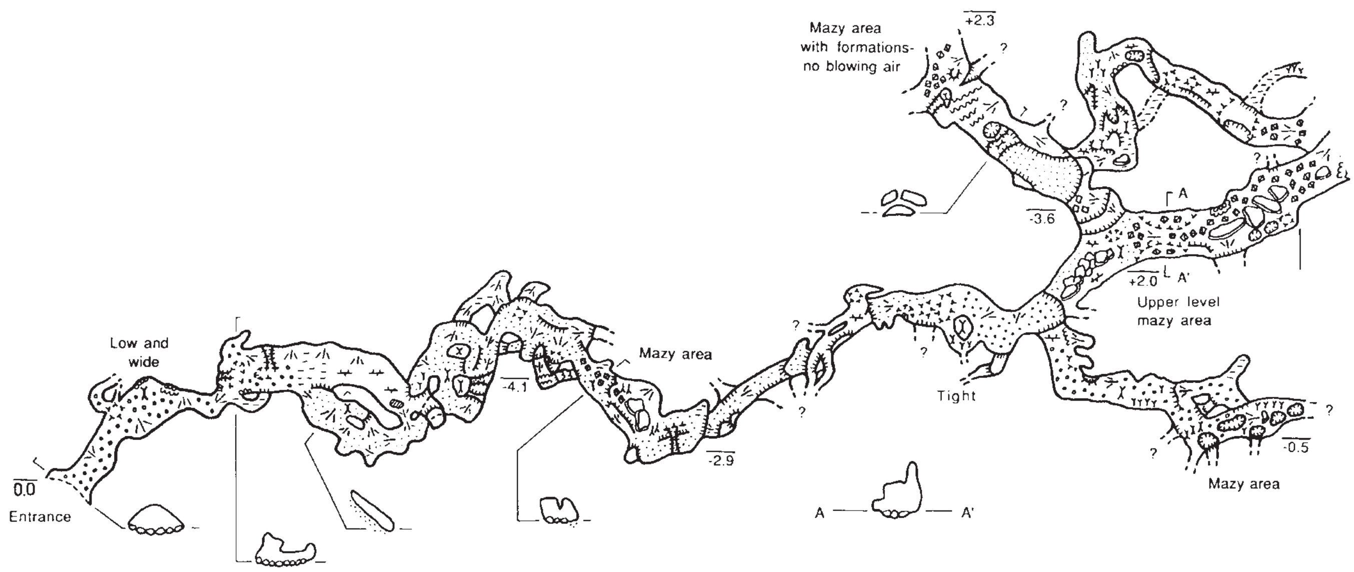
Nm

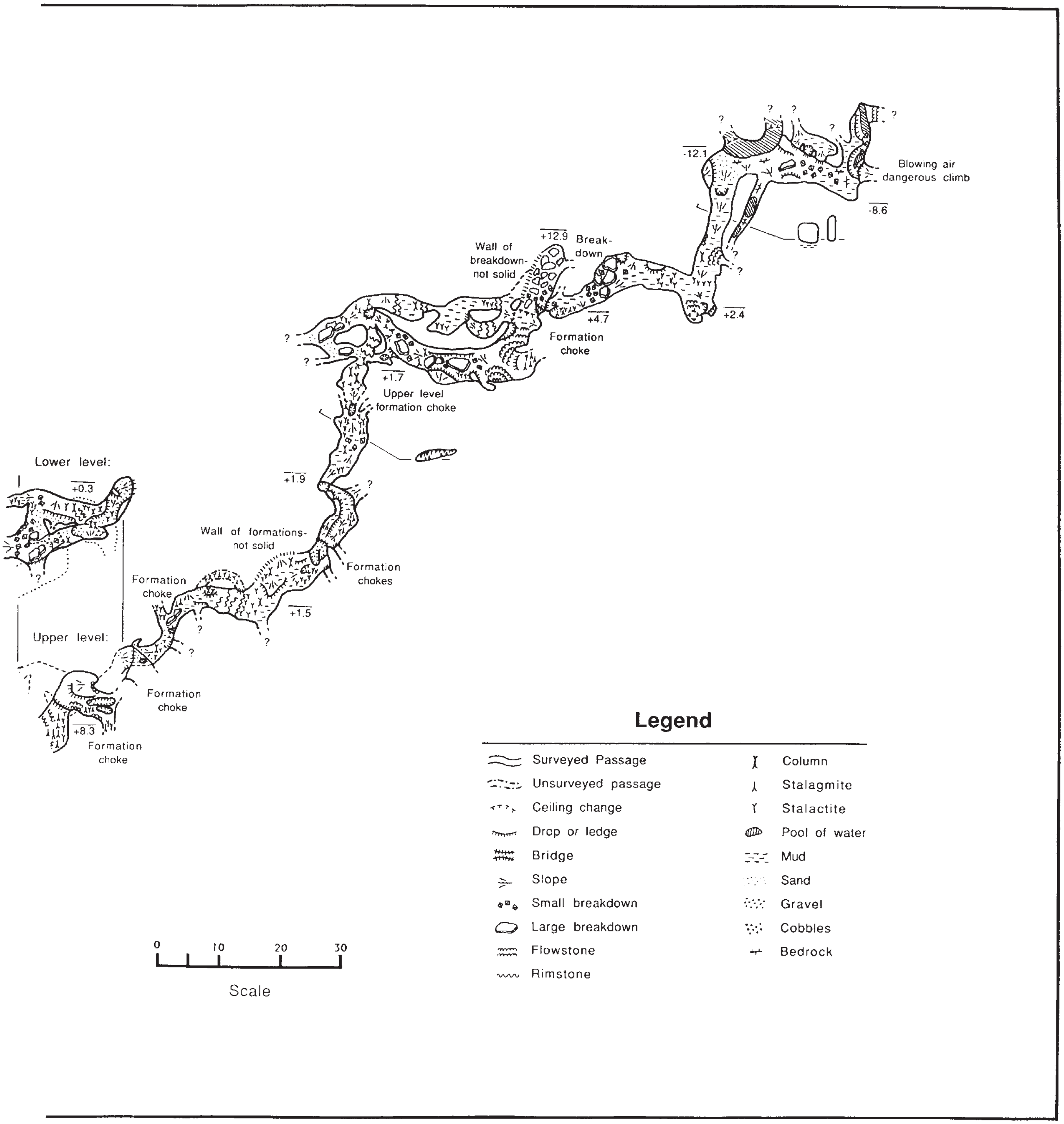
Compass and Tape Survey
February-March 1990

All units in meters
Survey length: 658.7

Peter Bosted
Sheri Engler
Nancy Pistole
Joe Razo

Map drawn by Nancy Pistole





Blowing air
dangerous climb
-12.1
-8.6
+12.9
Break-
down
Wall of
breakdown-
not solid
+4.7
+2.4
Formation
choke
+1.7
Upper level
formation choke
+1.9
Wall of formations-
not solid
Formation
chokes
+1.5
Lower level:
+0.3
Upper level:
Formation
choke
Formation
choke
+8.3
Formation
choke
Legend
Surveyed Passage
Unsurveyed passage
Ceiling change
Drop or ledge
Bridge
Slope
Small breakdown
Large breakdown
Flowstone
Rimstone
Column
Stalagmite
Stalactite
Pool of water
Mud
Sand
Gravel
Cobbles
Bedrock
0
10
20
30
Scale

CHEVE 1995

Mike Frazier

Beavis punches Butthead.
"Ouch!" said Butthead. "That sucked."
"No it didn't," said Beavis. "That was cool."
"But it hurt," said Butthead.
"It's got to hurt to be cool," said Beavis.
"Do it again," said Butthead. "Do it again."

The 1995 expedition to Sistema Cheve in Oaxaca officially began on Sunday, February 19. The main goal was to push the massive breakdown choke near the bottom of the cave. This area had been checked several times on past trips, starting in 1989, when the area was discovered by cavers working out of Camp II. In March 1990, Camp III was established in the AS Borehole, about half an hour from the terminal breakdown. During the first of two nine-day camps, cavers found the Wet Dreams section, about a kilometer of beautiful, clean-washed stream passage ending in a sump. During the second camp, cavers concentrated mainly on finding a route through the breakdown that ended the upper-level borehole, hoping to find a way to bypass the sump. In spite of considerable effort by both teams, no significant breakthrough in the breakdown was made. In 1991, efforts were concentrated mainly on a dive in the sump. Two deep camps pushed the breakdown in 1992, and two more in 1993, all of five to seven days each, but no significant progress was made. This is my personal narrative of the breakdown push in 1995.

This article appeared in the spring 1995 *Rocky Mountain Caving* in somewhat different form.

On Thursday, February 16, I inadvertently showed up a day early for my flight and ended up paying thirty-five dollars extra to leave Denver. I arrived in Mexico City and got a hotel room. On Friday, I visited a museum, then waited for Joe Ivy and crew in the airport until 1 A.M.

Saturday, February 18. After being introduced to Charley Savvas, Carl Blankenburg, David Shand, Gary McDaniel, and John Green, all from Texas, we packed my bags onto the already loaded-down vehicles and set off for Llano Cheve. We arrived at the Cheve parking area around 1 P.M. Saturday and met up with Matt Oliphant and Nancy Pistole from California. They had just arrived, after spending a couple of days in Oaxaca getting letters of permission. We spent the rest of the day carrying gear the kilometer to our camp in the *llano,* the meadow outside the Cheve entrance. Early the next morning, we began setting up the group-gear tents and rigging the tree for rebelay practice. The weather was overcast and soggy. Oliphant, Savvas, McDaniel, and I started rigging the cave to the top of Angel Falls.

Tuesday, February 21. Oliphant, Savvas, Green, and I rigged through the Turbines. When we were climbing the walls in the Salmon Ladders, Green slipped into a pool well over his head, submerging himself and his pack. It would have made a great action photo. On the way out of the cave, we ran into Angela Morgan and David Quillen from Georgia and Pete Haberland from New York, who were doing a warm-up trip to the top of Saknussemm's Well.

Wednesday, February 22. Ivy, Green, and Blankenburg taught a very thorough first-aid course, including how to administer IVs, the ins and out of tracheotomies, patient packaging, and more.

Thursday, February 23. Michael King from England and I headed into Cheve. We finished rigging to Camp II, ate a gourmet meal of freeze-dried food, and slept. Meanwhile, Savvas, Blankenburg, and Green went to scope out Cueva Palomitas, a gnarly little cave above Cheve's main entrance that had been discovered by Dan Clardy and Peter Bosted in 1991.

Friday, February 24. King and I woke up at 3:30 A.M. in Camp II. We finished rigging the cave to Camp III. Two drops before the Black Borehole area, we free-climbed a pitch where the rope seemed to be missing, and we finally arrived at Camp III around 10:30 A.M. We ate and took an inventory of the supplies in camp, then set off to find a lead in the breakdown that Harry Burgess had written about. After much contorted crawling and digging, all in the wrong places, we headed back to camp for some much-needed rest. The heel of my boot decided to go its own way, leaving me with a rather awkward cant. Ivy and Blankenburg did a warm-up trip from the surface to Saknussemm's Well, while Oliphant and Savvas carried food and gear to Camp II, placing a new rebelay on the way.

Saturday, February 25. We left Camp III at 6:00 A.M. for the surface. After repeating the climb at the Black Borehole, I located the missing rope and was able to rig it for King. We stopped at Camp II

Wishful thinking? Peter Haberland at Camp III. *Matt Kramer.*

for a hot meal and then pushed onward to the surface, arriving at 5:30 to watch a beautiful sunset. Oliphant and Savvas had reached the surface at about 2 P.M., and Haberland, Morgan, and Quillen made a trip in that day to stash gear at the top of Saknussemm's Well.

On Wednesday, March 1, Taco van Ieperen from Canada and Ivy left for Camp II around 10 A.M. Matt Kramar from Minnesota, Ken Davis from Pennsylvania, Haberland, and McDaniel went in on a warm-up and photo trip at about 11 A.M. Oliphant and Savvas left for Camp III around noon.

Thursday, March 2. Long Bob Riley and Peter Hartley, both from England, and Denis Provalov from Russia arrived at the *llano.* That evening, King and I headed in to Camp III. Ivy and van Ieperen left for Camp III from Camp II. Meanwhile, Oliphant and Savvas worked on setting up Camp III for the rest of us.

Friday, March 3. King and I rolled into Camp III just as the P.M. shift was getting ready to head out to look at the breakdown pile. There were seven sleeping bags, and fourteen people were planning to show up at Camp III. We arranged a schedule that gave everyone a twelve-hour shift with a sleeping bag, which worked out pretty well. I grabbed a quick bite to eat and also went to the breakdown. King found an unoccupied sleeping bag and opted to sleep. Ivy and Oliphant looked for high leads, while van Ieperen, Savvas, and I crawled in and out among the breakdown blocks.

Saturday, March 4. Ivy and van Ieperen set out to check a lead in the Cowboy section. They surveyed thirty-two stations before it ended in a breakdown choke. Savvas, Oliphant, and I once again began pushing hard at the breakdown pile, with little progress. At one point, Oliphant and I had to leave the area we were working in to refill our carbide lights. On the way back, Oliphant took a series of wrong turns in the complicated pile and could not find us for two hours. He swore he would bring a dive-line in to avoid getting lost again.

Sunday, March 5. As usual, back to the breakdown. Savvas, Oliphant, and I laid the line and pushed, while Ivy, van Ieperen, and King surveyed behind us. By the time they caught up, Savvas had managed to work his way through a squeeze into a sizable area among the massive blocks. We realized that this area was virgin. After we "Ivy-sized" the squeeze so Joe could get through, we began pushing the area hard, but we didn't make much more progress that day, unfortunately.

Monday, March 6. Motivation to return to the breakdown pile was dwindling. It was hard work checking leads. However, there was an encouraging flow of air into the breakdown, hence the jokes about how the cave sucked. Van Ieperen and King decided to do a sightseeing and photo trip to the Mud-Floored Borehole. Ivy and Oliphant decided to check in the vicinity of a side-lead that parallels the breakdown maze for a good distance. Savvas and I planned to go back into the breakdown to have one more look before derigging a rope. I guess Savvas and I were in a masochistic mood. Savvas, Oliphant, Ivy, and I ended up procrastinating for a few hours before going our separate ways. It was starting to look like a mellow day. We couldn't have been more mistaken. Savvas and I got to the last survey station. We split up for a few minutes, and then we both called out that we had found ways on. Savvas decided to come up in my direction, which was very tight and icky. We were passing through a medium-size breakdown room some distance above the last one when Savvas paused and said, "Hey, I've been here. But it was easier my way." Sure enough, there was his rock cairn. Together we went upward, taking turns dilating our dream passage. If only we could penetrate this seemingly endless pile of oversized marbles into a chamber with a solid roof. It looked a little darker than usual in an adjoining chamber, so we crawled under a rock to see. "Whooo, Charley, yes, yes. Borehole!" Savvas was still diligently laying out dive-line, which he ran out of only a couple of steps into the chamber. Savvas was quite torn. The guideline was our route back through the pile, and it took a few moments for him to let go of it. Once he did, we began hopping about like mad children, throwing rocks into the air. This was short-lived, however, when we discovered subterranean gravity. We decided to make a big cairn, then to stay within view of the right wall and work our way downhill to glory. Seeing the walls wasn't a problem, and the floor was relatively flat. The area was decorated with soda straws and flowstone. Five minutes later, we reached the end of the borehole. It turned out our borehole was nothing more than a big 200-meter-long room. But it sure beat the breakdown.

We decided we would have a bit of fun before we let the others in on our find. Walking up to Ivy and Oliphant in camp, we did our best to look exhausted, taking turns cursing the pile of rocks. I swore I had had enough of that, and my body could take no more. Neither of us could look them in the eye, though, as they asked questions, which each of us answered differently. When Oliphant asked which wall we had been working, Savvas said right and I said left. They caught on that something was fishy, and we let them in on our game. At first they didn't believe us, but finally the news sank in. We had run out of time on our shift, so the A.M. shift would survey and push.

Tuesday, March 7. We woke up at 11:30 A.M. We looked at the survey of the new find that had been made by Haberland, Kramar, and Davis. The sketch was nice. Then we got the run-down on how the push had gone. Provalov and Long Bob had pushed muddy tubes on the right side of the room and, a bit, in the breakdown on the left side. After comparing the new notes to the map, we found that one side of the room lay directly over known cave. Although the room had been surveyed, we decided to take another look. Ivy, who wasn't into the tight breakdown, stayed in camp, intending to head out with someone during the next shift. We got to the beginning of the main breakdown about 2 P.M. and to the new room about 6 P.M. After lunch, we began probing and moving rocks in the new rock-pile. The prospect was looking pretty grim. The solid-bedrock, sloping ceiling and the wind were all that kept us going, but by the time we had to head back, we hadn't found much. Back at camp, we learned that van Ieperen and King had already left and Long Bob would be heading out with Ivy. They left for the surface about 2 A.M.

Wednesday, March 8. My shift woke for breakfast. Oliphant and Savvas were talking about going back to Camp II for more food and fuel. Then we found a new can of fuel that had apparently reached camp unassisted. Morgan and Quillen solved that mystery when they appeared out of the overflow area of the camp. We now had fuel, and I had carried enough food to last us for three more days. This, along with the rations donated by the ones who had left, would feed us all well. Morgan and Quillen had met van Ieperen and King at Camp II and Ivy and Long Bob at the constriction in the Looking Glass. We traded snacks, then talked and ate all day. At one point, Oliphant walked up with a serious look on his face and said, "That's one big breakdown pile. Do you know what we need for big breakdown? A big hammer!" Then from behind his back came a 3-foot-tall inflatable plastic hammer, with which he proceeded to pound our heads.

Thursday, March 9. Haberland, Davis, and Kramar arrived back at camp. They poked and surveyed a bit and took many fine photos. They were discussing leaving for Camp II on Saturday. We, along with Morgan and Quillen, left for the breakdown. At the end of the day, we found an area with flowstone, taking wind, though badly choked with rocks.

Matt Kramer on a traverse in the Swim Gym. *Ken Davis.*

An interesting climb in the Cowboy Passage. *Ken Davis.*

Friday, March 10. Provalov and I were the first to arrive at the push site. After rolling a few rocks aside, I attempted to take a closer look up a 3-meter chute. Without warning, the right wall collapsed, trapping me uninjured with my face against my knees. My calls for help were somehow interpreted by the others at announcing a breakthrough, and they all came running, only to find more work. After they got me out, we found that it was now possible to climb up into a small chamber with formations, where only Provalov was small enough to make the squeeze up into another room. By digging from the top down, he was able to make it possible for the rest of us to proceed. From here, the wind was going up through the nastiest stuff we had encountered yet, the grimmest of the grim. You could even go so far as to say it sucked. Oliphant and Savvas went back down to the big room to refill their lamps and eat. Meanwhile, Provalov and I set to work on the tightly packed muck. Before long, we were back to crawling through boulders. Just as Provalov was preparing to go after a crowbar, I noticed a beckoning blackness through the rocks. Soon Provalov and I were hearing echoes in a chamber even larger than the last. After placing a cairn, we found the left wall and worked our way along it past an aragonite bush, some helictites, and a nice set of columns. Provalov volunteered to go back and tell Oliphant and Savvas about our find, while I continued to look around. After a while, I worked my way over to the right side of the room. Lost for a while among the large breakdown blocks, I finally found the columns we had admired earlier, but I still had no idea exactly where we had entered the room. I must admit that I was relieved to see Provalov's light again. The others had said they'd wait while we looked around. I couldn't believe that the others did not want to see this. Our lights also needed recharging, so we decided the room would have to wait. When we got back to Savvas and Oliphant, it turned out that they had misunderstood Provalov about the dimensions of the new room, and plans for heading back to camp were abandoned. We all ate snacks and headed for the new room, the Gypsy Palace. We looked around for a few hours and found a climb up through breakdown to a soccer-ball-size restriction with big blackness beyond. Having no crowbar, we had to leave this lead until the next expedition. It was 2:30 A.M. when we arrived back at Camp III. There we said goodbye to Davis, Kramar, and Haberland, who were leaving for Camp II.

Saturday, March 11. Morgan and Quillen packed and headed for Camp II. To avoid queues at the drops, Savvas, Provalov, Oliphant, and I stayed to clean up camp, leaving several hours later. Provalov and I split up from Savvas and Oliphant at the start of the Looking Glass. On the way back through the Hall of the Restless Giants, we found a note from Peter Keller and Christian Preiswerk of Switzerland. They had been doing core samples to date the formations and were asking for help in carrying out six drill extensions. After dividing them among ourselves, Provalov and I once again were on our way. Before long, one of them fell out of Provalov's pack and down a baseball-size hole. Although we searched for forty-five minutes in gnarly and presumably virgin passage, we had no luck in recovering it. When we arrived at Camp II, we heated a meal. Haberland, Davis, and Kramar then got up, ate, and started the trudge out. Soon after

More interesting climbing in the Cowboy Passage. *Ken Davis.*

that, Oliphant, Savvas, Morgan, and Quillen arrived at Camp II. The Swiss team woke up and gave us a few more items to carry out. Provalov and I left for the surface.

We got out of the cave and into the *llano* about 11 A.M. on Sunday, March 12. It was a beautiful day, and it felt good to see sunshine. By evening, everyone was out except the Swiss, so we had a big fire and bull session after dinner. Our job was not over, though. In the next week we would have to derig the cave and pack everything away for the next expedition. But at least for one night we could brag about our accomplishment, finally getting somewhere in the terminal breakdown, where we had surveyed 224 meters. The last room was not surveyed. All of the new passage went up, a total of 80 meters from the tie-in station, so the cave's depth still stands at 1386 meters. We are hoping that the climb up through the breakdown will eventually lead to open passage going down.

Peter Haberland in the Swim Gym. *Ken Davis.*

Sistema Cheve 1995

Durante la expedición Cheve en la primavera de 1995 los cueveros que permanecían en el profundo campamento III pasaron varios días en explorar los derrumbes terminales. Al final de el viaje se habían encontrado grandes salones a 80 metros sobre el fondo de los derrumbes. Estas son buenas posibilidades para investigaciones futuras.

Proyecto Cheve Update

Nancy Pistole and Matt Oliphant

We had a mission: 1997 was the year we were going to find the elusive way though the breakdown at the end of Cheve, and regain the title of Mexico's deepest cave. We had reason to be confident. On the last push trip in 1995, we had crawled into a passage at the end of a newly discovered room in the breakdown, and saw a small squeeze with a big, black, empty space on the other side. Of course this happened on the last day of the trip, and there was no time for further exploration.

HISTORY

First, a brief background of the Proyecto Cheve and the frustrating breakdown. The main cave, Cheve, was discovered in 1986. In the four years following, Cheve was a caver's dream. On every trip, we explored and surveyed kilometers of big passages and deep pits. The cave was making a beeline for the resurgence, 17km away.

Several other entrances were connected, making it a system. In 1991, the system reached a depth of –1,386 meters, the deepest in Mexico. In 1990, we encountered a breakdown choke that filled an enormous passage, almost seven kilometers from the entrance.

Since there were many other leads to check, our efforts were turned elsewhere. After all, who wanted to traverse seven kilometers of big passage just to grovel through tight breakdown? In '91 and '92, the other leads were checked off, one by one. The terminal sump was even pushed, but to no avail.

Finally, the inevitable was accepted: all the air went through the breakdown, and that is where we would have to go to continue towards the resurgence.

In 1993, two week-long underground camps were set, with the specific goal of finding a path through the breakdown. After all, there were several other breakdown chokes in the cave, and we had managed to find a way through those (the longest one requires a 50m crawl). But at the end of the '93 trip, the passage we imagined beyond the breakdown was still unknown. All we had determined was that this breakdown choke was very, very big.

In 1995, the plan was to expend all efforts to push in one direction, taking the path of least resistance. A dedicated group of cavers camped underground for thirteen days. In order to use the camp most efficiently, we used the "hot bed" technique. While the first shift worked on the breakdown, the second shift slept, and every twelve hours we switched.

The chosen path headed up, in an attempt to find a ceiling or a wall to follow. It was grueling work—moving rocks, digging, hammering, and squeezing. By the end, we had penetrated 300m into the breakdown. Along the way, we had found several good-sized rooms, the last one, and biggest, measured 80m by 50m. It was from this room where we saw the blackness past a squeeze.

CHEVE 1997

In early February, the first wave of cavers showed up at the "llano," the meadow just outside the main entrance of Cheve. The cave is located in the Sierra Juarez, about three hours north of Oaxaca City, in the state of Oaxaca, at an elevation of 2700m. The llano is a beautiful place to camp. It is surrounded by a pine forest, and has a waterfall and stream running into the cave.

We use an old logging road to get close to the llano, and this year the road had been improved. With a little more work on our part, we were able to drive to within five minutes of the llano.

In the next six weeks, a total of thirty-one cavers would show up for various lengths of time. We had cavers from the United States, United Kingdom, Mexico, Canada, Germany, and Russia. Even with a promising lead, only a few cavers had returned from the 1995 trip. This was not going to be easy work.

The first week and a half were spent in the usual way—setting up the llano for camping, rigging a tree for vertical practice, rigging the cave, getting ready for underground camps, and getting used to the altitude.

February that year seemed to be wetter than normal—it rained about every third day. We set up a big group tent so we could cook and socialize even in the rain. Another tent was set up for group gear, and then individual tents were scattered all over the llano.

We rigged two trees for vertical practice, complete with knots and rebelays. Most cavers run through the rigging to brush up on vertical skills and to make sure all their equipment is working and adjusted correctly.

Many of us were also learning pick-off techniques—ways of retrieving a caver who gets stuck on a rope. This year we also rigged the headwall, the big limestone cliff that holds the cave entrance. There is a rebelay at the top, to protect the rope from the lip, and then an 86m free drop. Ascending the rope makes a great workout, and the view at the top is quite a reward.

Because of the high water in the cave during the wet season, we don't leave any of the drops rigged. It usually takes about three killer day trips to get all the ropes in place down through the Turbines. Then the rest of the cave can be rigged on the trips in to the underground camps.

One of our other goals this year, besides the breakdown push, was to replace many of the well-worn ropes and re-rig the drops using stainless steel bolts and hangers. When the entrance drops had been rigged years before, nobody imagined what a thoroughfare the main route would become.

We wanted to rig the drops to make it as easy as possible to safely negotiate the cave while carrying heavy camp packs. We used a gasoline-powered hammer drill to install $^3/_8$-inch stainless steel bolts.

With a generous sponsorship from Cancord, we were able to replace the ropes on the drops all the way to Camp II. About half of the ropes were replaced with nylon, the standard material in use now for most caving rope.

On some of the wet drops we used polyester rope. This polyester rope has much less stretch, even when the rope is wet. It was a pleasant surprise to be able to take one step on a rope under a stream of water, and already be off the ground. The drawback is that polyester rope has to be rigged extra carefully, since there is almost no stretch to absorb a sudden shock load.

By February 12, the first group was ready to go to Camp II. Mike Frazier, Peter and Alec Hartley, and Todd Warren loaded up their camp duffs and headed in. Their job was to set up Camp II so it could be used as an intermediate camp on the way to Camp III at the end of the cave.

They didn't know what they were going to find. A group of Polish cavers had been in the cave the year before, and some of our ropes had been stolen. Several years earlier another group of Polish cavers had used the Camp II spot and left trash everywhere. They were prepared to do a big clean-up if necessary.

The group returned the next day, and said it didn't look like anyone had been to the camp since we left it in '95. Camp II was now stocked and ready to go. It was time to send the first breakdown pushers on to Camp III.

CAMP III

Two days later, Lance Mattson and Mike were packed and eager to get started. They planned to spend the first night at Camp II, and then go on to Camp III. Because there were only five sleeping bags at Camp II, cavers would have to go in groups of five or less. The next day, Peter, Alec, Todd, Bob Riley, and Daniel Laos followed them in.

Mike and Lance set up Camp III. When the rest of the group arrived, they realized there were only six sleeping bags for the seven of them. Daniel didn't want to share a bag with anyone, so he spent an uncomfortable night, huddled only in his long underwear (at Camp III it is 13°C).

The next day, after two years of anticipation, the group eagerly headed for the lead. After a lot of hammering on a rocky protrusion, they finally got through the squeeze. Just as hoped, the blackness was a gigantic room, 120m by 90m. Even more exciting was that the 40m high ceiling was solid.

Maybe they finally reached the top of the breakdown and could find the continuing passage on the other side! They made one lap around the new room, but didn't see any obvious leads. The room contained some of the prettiest formations in the cave.

When they got back to Camp III, Daniel was anxious to exit the cave. Since Bob, Mike, and Todd did not have much vacation time left, they all decided to exit the next day. When they got to the surface, we were thrilled to hear the news. The next group started preparing for their chance to explore further.

THE RESCUE

The same night the first group headed into Camp III, Carl Bern and Steve Wells went into the entrance section of the cave to find a passage called Santa's Workshop. On the first trips into the cave in the '80s, quite a bit of passage was explored near the entrance. Santa's Workshop was one of the few that was heavily decorated with formations.

The area is very mazy, and no one had ever gone back, since that section did not lead to the rest of the cave. Carl and Steve were trying to get out of the bad weather on the surface, and thought it would be a good warm-up cave trip to find the fabled passage.

They left in the afternoon, and were not expected out until late in the evening. At 9:30 PM, Steve crawled up to our tent. He said that he and Carl had been scrambling over some big boulders that broke loose. He fell and sprained his ankle, but Carl was pinned by a boulder and was still trapped inside the cave.

Matt and Page Ashwell went directly to Carl. They got to him in less than half an hour, and were relieved to find him in good spirits. Miraculously, the enormous boulder that trapped him had a groove in it, and Carl's leg was in the groove. Matt and Page were able to budge the boulder just enough to restore full blood circulation in Carl's leg.

Meanwhile, a bigger crew on the surface gathered more gear—a sleeping bag, food, scissors jack, rigging gear, etc. Joe Ivy, Becky Jones, John "Rocco" Stembel, and Nancy went to the scene loaded with equipment.

The entire area is full of loose boulders and exposed climbs, so ropes were rigged along the way so no one else would get hurt. After examining the position of the rock, we decided that it was too risky to move it, so we stabilized it with the jack and some rope.

Then we took turns hammering off the parts of the rock that were preventing Carl from extracting his leg. In about an hour, his leg was free. Carl's carbide generator was a mangled mess, and the steel shank in his boot had almost been folded in half, but his leg seemed to be okay. We were prepared to help Carl out of the cave, even carry him if necessary, but when he found he could walk without assistance, he headed slowly for the entrance.

On the surface, Susan Sanders had prepared a big pot of boiling water, so we were all treated to soup and hot chocolate. We examined Steve and Carl more carefully. Steve's ankle was badly bruised and swollen, but we couldn't tell if it was fractured. Carl had a nasty cut on his toe and a lot of skin abrasion. We wrapped and bandaged them up, and then tucked them in their tents with pee bottles nearby so they wouldn't have to get up again during the night.

When the local clinic opened, Carl and Steve went to see the doctor. He told Steve to stay off his ankle for a week, and he didn't think anything was broken (there was no x-ray machine).

Steve did not have the patience to stay off his ankle for a week, and two months later he found out it was broken (ouch!). Carl was given some antibiotics so none of the cuts would become infected, and was also told to take it easy. His cuts healed without any problems, but his leg was sore for a while.

THE SECOND PUSH

On February 21, Matt, Page, and Glenn Randall headed in to Camp III, with an overnight stop at Camp II. The next day, Don Broussard, José Soriano, and Javier Vargas went to Camp II. Lance, Steve, and Rob Evans left the same day, but went directly to Camp III to avoid a sleeping bag shortage. It was a long trip, and painful for Steve because of his ankle.

When we all arrived at Camp III, we started shifts for hot bedding. Our goals were to survey everything that had been explored up to that point, and to find a lead that continued out of the new room, which we were calling the, "Big better cave passages."

Even though Harbinger Hall is not that far from Camp III in distance, there is a lot of hideous crawling and squeezing, so it takes about three hours to get there from camp.

Soriano and Javier had planned on visiting Wet Dreams, the section that leads to the terminal sump, so they didn't go to Harbinger Hall at all.

The rest of us spent two days searching the new room for leads, but with no luck. The air definitely flows into the room, but about half of the room is covered with a scree floor, and we are afraid the air is filtering out through the floor.

After three days, Rob, Glenn, and Page had had enough, and they left for the surface. Don, Matt, and Lance took one more long trip to Harbinger Hall and finished the survey. The next day Don and Steve headed out. Matt and Lance waited twelve hours to prevent a pile-up on the drops, then they also exited the cave.

THE PHONE LINE

One of the projects we had on this trip was to lay a phone line into the cave. Joe and Becky borrowed some military field phones and acquired kilometers of indestructible stainless steel communications wire.

Joe was confident that we could lay the wire all the way to Camp III, but other people were less optimistic. However, just about everyone participated on at least one of the many trips into the cave to lay the wire. After four weeks of diligent work, over 3.5km of com wire was laid to Camp II.

The main idea was to have a line already in place in case anyone got hurt and a rescue was needed. Because of the durability of the wire, we should be able to use it on future trips.

Luckily, we did not need it on this trip for a rescue, but used it instead to inform the surface of where the cavers were in the cave. The novelty of the phone never wore off, and we came up with endless jokes when we answered the phone. We used everything from "Domino's Pizza" to "Your party is unable to come to the phone. Please press one if you would like..."

THE PHOTO TRIP

It was frustrating to find such a beautiful, big room, and yet not have it continue. In the last two weeks of the trip, Ken Davis, Peter Haberland, and Ilia Zharkov arrived. They were enthusiastic to see Harbinger Hall and take photos.

On March 2, the three of them, along with Nancy, left for Camp II. Ken had taken a lot of photos in '95, and he had certain areas in mind to take photos on the way to Camp III. Our other goals for the trip were to take another look at Harbinger Hall for leads, and to pack up the camps.

Because of the photos, it took two long days to get to Camp III. We had planned on spending three nights at Camp III, so we would have two days to explore Harbinger Hall. The hassle of dragging all the camera gear through the breakdown changed our minds, so we decided to make only one long trip to the room. We were also at a disadvantage because none of us had been to the room before, so we had some route finding to do.

When we got to Harbinger Hall, we made the most of it. We poked into every nook and cranny we could find around the perimeter and took photos until we ran out of flashbulbs. The conclusion was the same—it looked as if the air was filtering through the floor. Twenty-two hours later we stumbled back to Camp III.

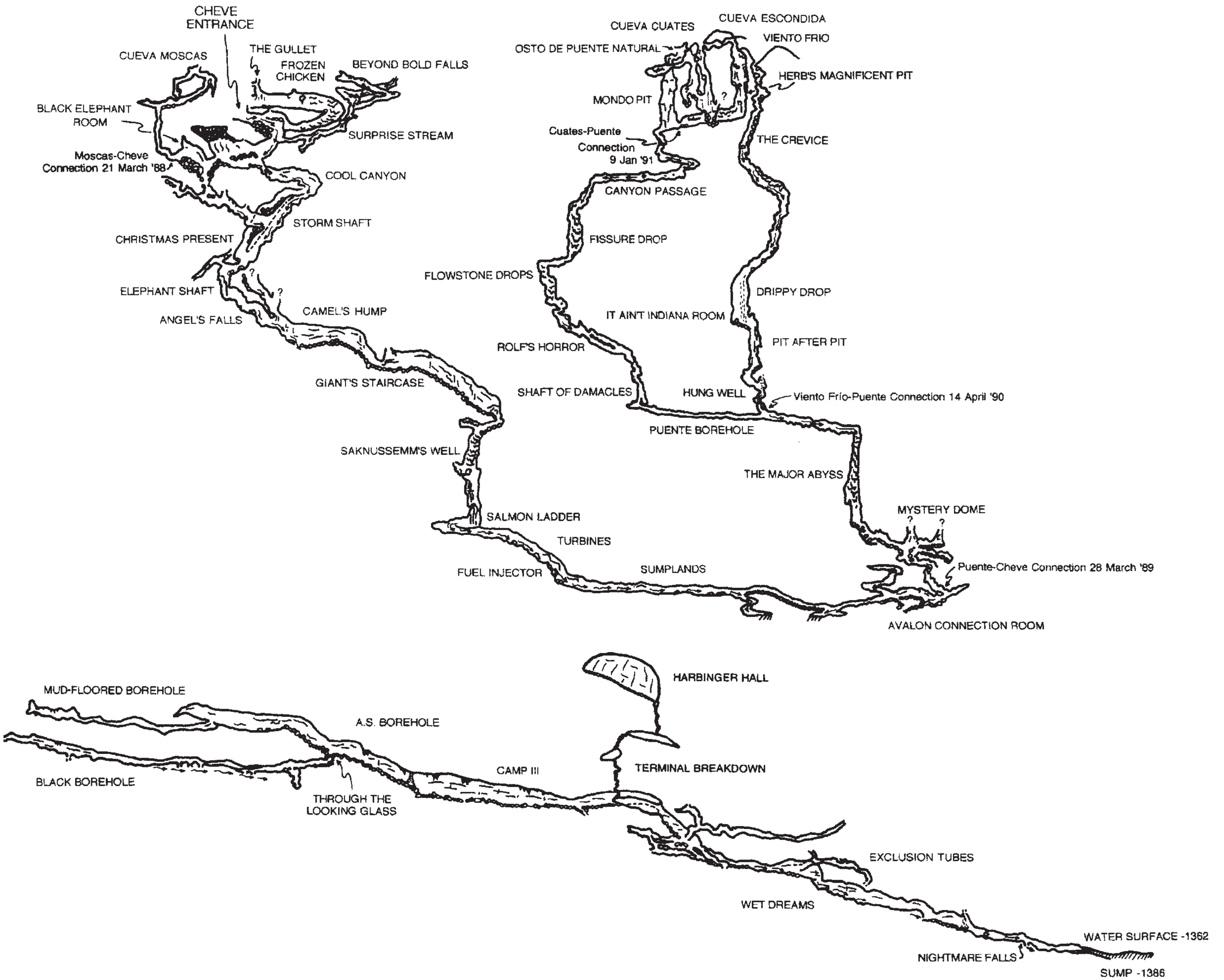
We had a good night's sleep, and then packed up Camp III. We were already running behind schedule, so we were not going to dilly-dally on the trip back to Camp II.

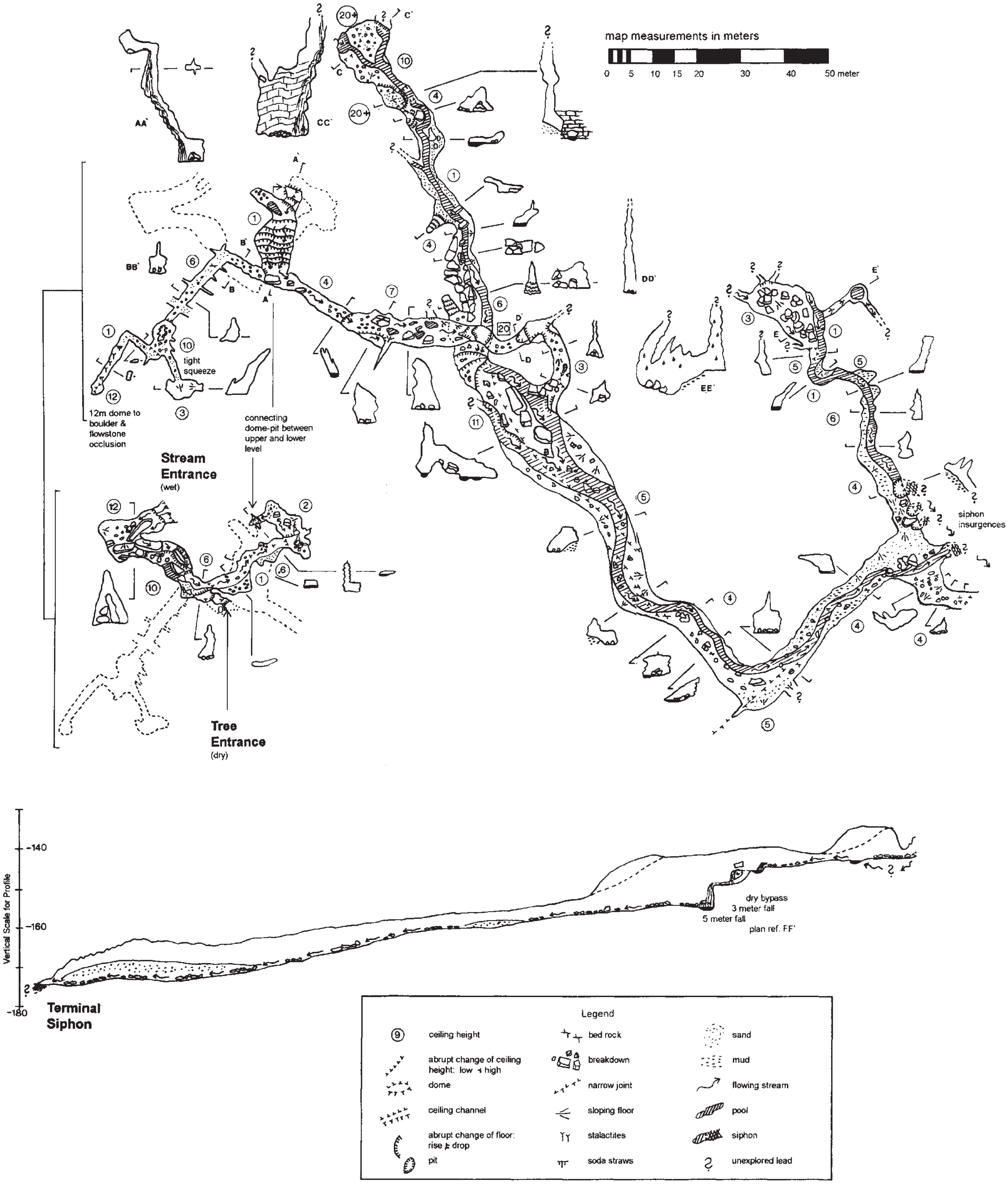
The first time we saw the stream on the way out, we were in for a big surprise. The stream level was over half a meter higher than we had ever seen it. It had already been high on the way in, and we had several water sections to go through. We decided to continue, assured that if we couldn't get through a passage, we had camping gear with us.

We did manage to get to Camp II, but it was not an easy trip. Small trickles of water had turned into


SISTEMA CHEVE
Municipio de
CONCEPCION PAPALO
OAXACA, MEXICO
SCALE IN METERS
0
200
400
600
800
1000
1200
1400
CUEVA CUATES
CUEVA ESCONDIDA
OSTO DE PUENTE NATURAL
VIENTO FRIO
SURPRISE STREAM
HERB'S MAGNIFICENT PIT
MONDO PIT
LLANO CHEVE
MAIN CHEVE ENTRANCE
THE CREVICE
FISSURE DROP
BASKET ROOM
SANTA'S WORKSHOP
CHRISTMAS PRESENT
FLOWSTONE DROPS
PIT AFTER PIT
ELEPHANT SHAFT
PROFILE VIEW 240 degrees
GIANT'S STAIRCASE
SHAFT OF DAMACLES
PUENTE BOREHOLE
THE MAJOR ABYSS
SAKNUSSEMM'S WELL
MYSTERY DOME
SALMON LADDER
THE TURBINES
AVALON CONNECTION ROOM
SUMPLANDS
PISTON
THE 23-METER DROP
CAMP II
EAST GORGE
-956 SUMP
LOW RIDER PARKWAY
WIDOW MAKER SHAFT
SWIM GYM
HALL OF THE RESTLESS GIANTS
Total surveyed length: 24.3 kilometers
Depth : -1386 meters
Suuntos and tape survey from December 1986 to March 1997
by members of the Cheve Project
Rolf Adams
Stan Allison
Bob Bennedict
Carl Bern
Jeb Blakeley
Peter Bosted
Don Broussard
Harry Burgess
Laura Campbell
Don Coons
Alan Cressler
Ken Davis
Michael Denneborg
Ruthie Diamante
Ramón Espinasa
Mason Estes
Bill Farr
Mike Frazier
Ernie Garza
Andy Grubbs
Peter Haberland
Ed Halladay
Louise Hose
Joe Ivy
Becky Jones
Pat Kambesis
Peter Keller
Michael King
Steve Knutson
Matt Kramar
Herb Laeger
Susie Lasko
Lance Mattson
Paul Medhurst
Gary Mele
Karlin Meyers
Tom Miller
Mark Minton
Matt Oliphant
Lee Perry
Nancy Pistole
Steve Porter
Peter Quick
Bitsy Ray
Susan Sanders
John Schweyen
Tina Shirk
Jim Smith
Peter Sprouse
Bill Steele
Brian Steele
Janet Steele
John "Rocco" Stembel
Bill Stone
Georg Tetzlaff
Taco Vanleperen
Carol Vesely
Todd Warren
Nancy Weaver
Steve Zeman
0
100
200
300
400
SCALE IN METERS
Drafted by Carol A. Vesely, 1993
Updated and prepared for publication by Nancy Pistole, 1997

PROFILE VIEW OF UPPER SECTION 150 degrees





map measurements in meters
0 5 10 15 20 30 40 50 meter
AA'
CC'
BB'
DD'
EE'
light squeeze
12m dome to boulder & flowstone occlusion
connecting dome-pit between upper and lower level
Stream Entrance
(wet)
Tree Entrance
(dry)
siphon insurgences
Vertical Scale for Profile
-140
-160
-180
dry bypass
3 meter fall
5 meter fall
plan ref. FF'
Terminal Siphon
Legend
ceiling height
abrupt change of ceiling height: low ⊣ high
dome
ceiling channel
abrupt change of floor: rise ⊧ drop
pit
bed rock
breakdown
narrow joint
sloping floor
stalactites
soda straws
sand
mud
flowing stream
pool
siphon
unexplored lead

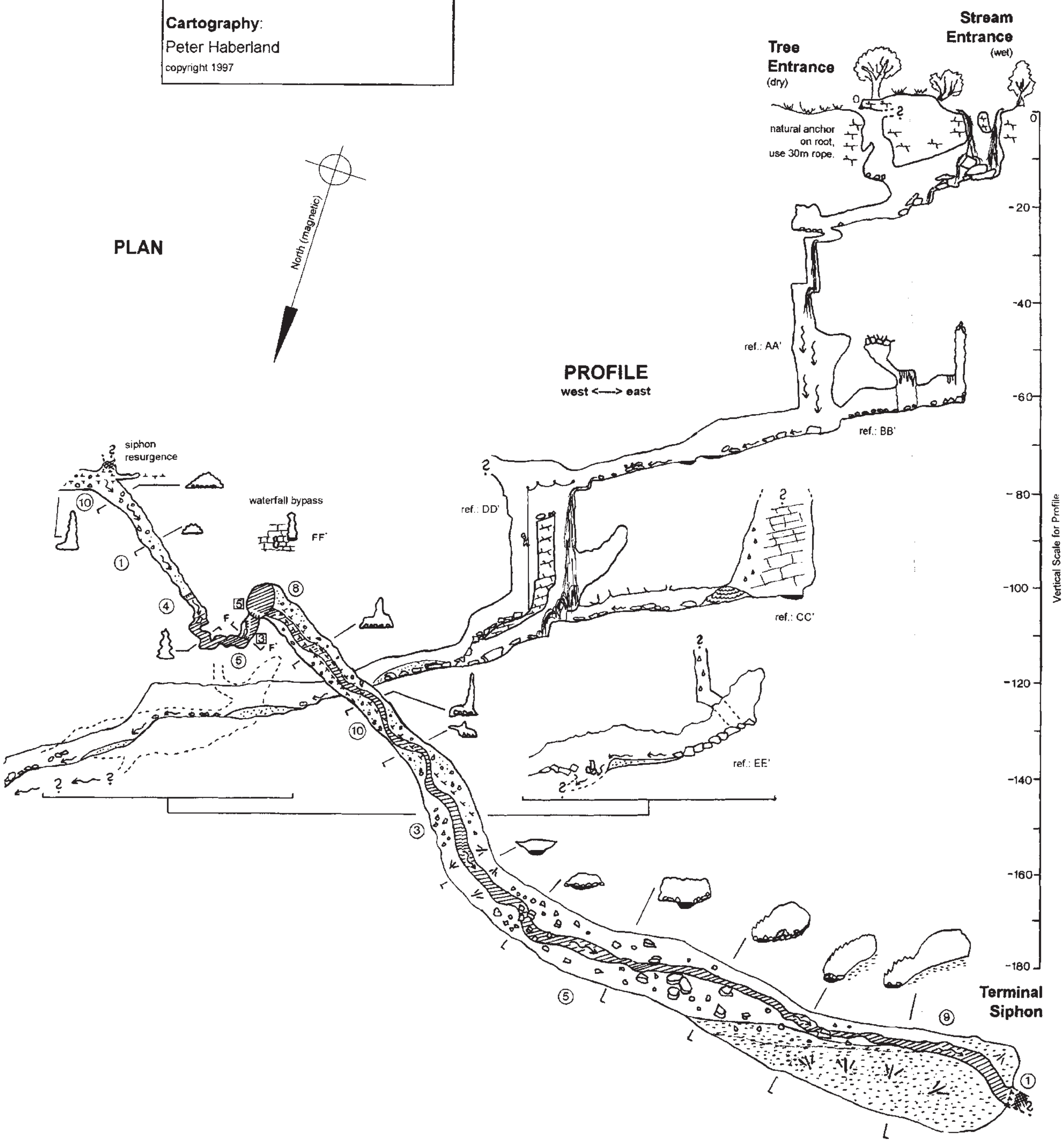
Sumidero
Aguacate
Chapulapa, Oaxaca, Mexico

Tape and Compass Survey by
Proyecto Cheve in March 1994

Total mapped length: 1053.8 m **depth: -174m**

Survey Team:
Harry Burgess
Rich Close
Chris Gibson
Peter Haberland
Peter Hartley
Joe Ivy
Doug Pflugh
Carol Vesely
Chris Welsh

Cartography:
Peter Haberland



raging torrents in some places. We couldn't resist taking "before and after" photos of some of the stream passage that we had shot on the way in.

When we got to Camp II, we called the surface. Our originally scheduled five-day trip had turned into seven days, and Ken had a flight to catch.

We were hoping that we could leave most of our stuff at Camp II and head out, and then another group could come in and pick up the rest of Camp II, but no such luck. It had been raining heavily on the surface, and many people had already left. We would have to break down Camp II and carry everything out ourselves.

We decided to first get some sleep and hope the water level would recede. After we woke up, we packed up Camp II and headed out. Thanks to the phone, we were able to make elaborate plans with the surface.

We carried the Camp II phone with us, so when we got to the Turbines, we called the surface and told them where we were. Matt met us at the bottom of Saknussemm's Well, and took Ken's pack. The two of them rushed out of the cave, so Ken could pack up his tent and leave for his flight. Ilia was right behind them.

Peter and Nancy didn't want to miss a farewell dinner for Ken, so we dropped our packs in the Giant's Staircase and rushed out, too. We all had a good dinner in a restaurant, then sent Ken on his way.

PALOMITAS

While some cavers were busy at the underground camps, several trips went into Cueva Palomitas. This cave was discovered in 1991, and is located above the Cheve headwall. The cave has a good flow of cold air, so we assumed it would connect into the main cave fairly quickly.

However, after 900 meters of passage and 280 meters in depth, it actually started heading away from the main cave, with no sign of connecting, yet the amount of air was indicative of a big cave.

Most of the cave is easily negotiable, except for one part after the -60m entrance pitch. This passage is aptly called the Gnarly Passage, and weeds out all but the most determined explorers. It is a very sinuous rift, with popcorn covered walls. In 1995, a series of trips went into the cave, but all ended because of some kind of misfortune, and very little survey was done.

Rocco, Glenn, and Paul Medhurst made the first foray into the cave in '97. They thought it would be a good shakedown trip before going in to an underground camp. They got to the stream passage at the bottom of the "100-Meter Pit" (which is really 90 meters), and found the last survey station.

They continued on and re-found the next deep pit (found but not descended by Charley Savvas in 1995), which looked equally as deep. It took quite an effort to rig it safely, but then they ran out of rope near the bottom. They returned to the llano twenty-four hours later, muddy and exhausted, but full of stories of going cave.

Rob and David Quillen were the next team in. They got a late start, but managed to re-rig the new pit with enough rope to get to the bottom. After they rigged the pit, they came back out.

It took almost a week to get a group together for another push. Paul, Rocco, David, and Angela Morgan loaded themselves down with rope and headed in. After the last big pit, they found more passage, and more pits, and it kept going. They finally ran out of rope and couldn't continue.

They had planned on surveying the new passage, but being cold and tired, they headed out. Another twenty-four hour trip, with more stories of going passage and lots of air.

Rocco estimated the lengths and drops of the route they followed, and it looks like Palomitas will connect with Cheve much lower than we originally thought. Perhaps it will connect around Saknussemm's Well or the Salmon Ladder.

Near the end of the expedition, no one else was motivated to go on a long, exhausting cave trip to survey. David and Angela made a gallant trip in to shuttle rope through the Gnarly Passage (by far the worst part of the ordeal) so that it would be ready for the next big trip. We left it as a good, going lead with a big question mark.

THE RESURGENCE

The first exploration of the resurgence to the Cheve system occurred before the main cave was even discovered. Bill Stone led a large expedition to dive the Peña Colorada resurgence in 1984, located on the north side of the Río Santo Domingo Canyon.

The group was looking for a connection into the Huautla system. During a recon trip in the canyon, several divers dove in a big, cold resurgence on the south side of the canyon, which they called the Western Resurgence.

They also checked out some dry leads close by. The divers surveyed 150m of underwater passage, and came up into air-filled rooms several times. Although the leads looked promising, the resurgence was not the one the group was looking for because it was located on the "wrong" side of the canyon, so exploration was not continued.

After Cueva Cheve was discovered, the search for the Cheve resurgence started. The Western Resurgence, known locally as the Río Frío, seemed to be the likely resurgence: cold water coming out of a cave directly in line with the northward trend of the Cheve system. The distance between the Cueva Cheve entrance and the Río Frío is 17km.

In the Spring of 1989, dye bugs were placed in Río Frío and several other resurgences. During the expedition, optical brightener was released into the stream in Cueva Cheve. The retrieved bugs tested negative, which was disappointing but not conclusive.

During the bug retrieval trips, exploration was pursued in the dry caves around the Río Frío resurgence. Three entrances were documented that had walking-sized passage and blowing air.

In the most promising of these caves, Cueva de la Mano, almost

350m were surveyed, with many leads remaining. Although the Río Frío had not been confirmed as the Cheve resurgence, it was obvious that the area had a lot of potential for new caves.

THE FIRST BIG TRIP

In February and March of 1990, eleven cavers from the United States and Canada spent eleven days pushing the known caves by Río Frío and looking for other entrances.

The hike into the canyon is over six kilometers with more than a 1200-meter elevation loss, so burros were arranged to carry the group gear and food, while we carried all our personal gear. Camp was set up on the bank of the Río Santo Domingo, close to the Río Frío. All three cave entrances were within five minutes walking distance.

The caving routine was very regular. Three or four caving and ridgewalking groups explored and surveyed during the day, then we shared our discoveries in the evening during dinner, and plans were made for the next day.

Cueva de la Mano was the biggest of the three caves found. By the end of the trip, we had surveyed over six kilometers of passage in Mano, with a total penetration into the mountain toward Cheve of just over one kilometer.

One of the other entrances, named Cueva del Mono for the monkey face carved into a column in the entrance, connected in to Mano. The third cave, Cueva Mariposa, had over 650 meters of passage before ending in a sump.

Mano and Mariposa were similar in nature: both contained mazy passages of different characters—some muddy, some clean-washed—and both caves had many formations. The average temperature of the caves was a pleasant 16°C. When a sump was reached, checking for a passage going up the predominant dip and to the southeast was usually the key for finding a bypass.

Ridgewalking was the most difficult activity of all. The area is tropical at elevation of only 300 meters. There are many types of cacti and other spine covered flora, as well as snakes and scorpions.

We found several other caves, the biggest being Buena Vista. The two entrances to Buena Vista are 60-meters high on a cliff face, with spectacular views looking both up and down the Río Santo Domingo Canyon.

There was a lot of evidence of previous use by the people in the area—stone barriers, abandoned tools, and markings on walls—but no signs of recent use. The cave is all walking passage, with big rimstone dams and flowstone draperies.

Another major find was Amontilado, but we discovered it near the end of the trip. There was not enough time to survey it. Most of the other caves that we found did not have blowing air, and therefore were not considered very important.

During the trip, Jim Smith released fluorescein into the stream in Cueva Cheve. After eight days, the fluorescein was unmistakably detected at the Río Frío resurgence, confirming that it was connected to Cheve. The elevation difference between the highest Sistema Cheve entrance and the resurgence is over 2500 meters.

PERMISSION DENIED

Another trip was planned for Christmas of 1990, but when we arrived, the town that controls the access to the resurgence area, Santa Ana Cuauhtémoc, would not grant permission for anyone to go down into the canyon. After one and a half weeks of run around (more letters of permission, visits from officials from Teotitlán, etc.), we finally ran out of time and did not get into the canyon.

In March 1991, a small group of cavers went to Santa Ana to talk to the presidente and to make friends with the town. The townspeople gave the impression that the cavers were welcome, but the presidente still denied access to the canyon. In 1992, two more cavers returned to Santa Ana with higher level letters of permission, but the presidente wasn't there, so again no one went into the canyon.

In January 1993, Louise Hose and a few cavers were in the Cheve area recording the locations of cave entrances with two GPS units. A new presidente was in office, so hope was renewed for permission to go into the canyon. With help from a government official from Oaxaca, two cavers were granted permission for a day hike into the canyon, and arrangements were made for a bigger group later in the season.

A month later, five cavers from the US and two Mexican members of the Cruz Roja of Oaxaca spent five days at the resurgence. Most of the exploration took place in Amontilado, and 916 meters of passage were surveyed.

GPS readings were taken for three days to get an accurate position to tie in the cave entrances. There weren't enough people nor enough time to do extensive ridgewalking, so most of the time was spent cleaning up and adding to the surveys done on previous trips.

On the last caving day, two people went to one of the far leads in Mano to check the sumps. While they were there, they noticed a strong breeze coming from a small fissure. With the help of a hammer, they were able to squeeze through the fissure, and found about 200 meters of passage and a small stream. Due to lack of time and survey equipment, they had to turn around. This was the first running water found in any of the resurgence caves so far.

THE SECOND BIG TRIP

After our successful trip in 1993, we planned another big trip for April 1994. Sixteen cavers showed up in Santa Ana. The townspeople were friendly, and we had no trouble getting permission and arranging mules and horses to carry equipment and supplies.

We spent eleven days camped by the Río Santo Domingo, ridgewalking and exploring caves every day. The first lead to be checked was the one from the previous year—the one with running water. Unfortunately, it quickly narrowed into a tight squeeze and was impassable.

According to the data, Mano and Amontilado were very close. When we were exploring Mano, we found that if a passage ended in a sump, it could usually be bypassed by backtracking a bit, then going up-dip.

Since Amontilado was on the up-dip side, we were confident we could find a connection. Trip after trip into both caves did not produce a route between them. By the end of the trip, almost two kilometers were surveyed in Mano, and another 120 meters in Amontilado, but no major leads were found.

We checked most of the area for new caves in 1990, but now we wanted to make sure we hadn't missed anything. With a set of walkie-talkies, two groups simultaneously hiked on opposite sides of the canyon. It was easier to see cave entrances from a distant vantage point, and then one group could direct the other group to the entrance.

A new cave called Viento Cantando was reached this way. The entrance had been spotted in '90, but it was on a cliff face. With the radios, we knew where to rig the rope above the cave, and then how far to rappel.

Viento Cantando turned out to be rather short, only 400m long, but very pretty. The entrance section has some potsherds and drawings, and then a tight squeeze leading to a big passage with some very pretty columns and decorations. The stagnant air convinced us the cave did not connect into the resurgence system.

However, at the end of a long crawlway, we found a small room, and at the back of the room, we could hear wind blowing. It was coming from a small flowstone crack. We couldn't feel it, but it was definitely air, so we named the cave "Singing Wind."

At the same time we were camped in the canyon, Bill Stone and his crew were camped downstream diving in the Huautla resurgence. Since the two camps were less than a kilometer apart, we visited each other several times.

Bill Farr borrowed some of the Huautla Project equipment, and made a series of dives in the Cheve resurgence. The water that emerges from the cliff face actually comes from deep down. The pools of water that are exposed in the caves have no current—they are overflow pools. By the end of the trip, Bill had laid more than 500m of dive line. On the last dive, he found the strong current again in a nice underwater borehole.

MORE UNDERWATER EXPLORATION

Bill Stone and a small group of cave divers were in the canyon in January 1997, doing some reconnaissance on some other springs. When their leads petered out, they returned to the Cheve resurgence.

First, they pushed the end of Bill Farr's lead another 300m. They found an airbell, and were disappointed to also find a pink survey flag. After studying the map of Mano, they concentrated their efforts on the southernmost sump in the cave.

They didn't have enough diveline to push very far, so they had to retrieve diveline from some of the springs they dove earlier. They extended the southernmost sump 351 meters. Exploration ended (due to air limits) in a 12m by 10m tunnel with very clear visibility, at a water depth of -33 meters.

THE MIDDLE KARST

Soon after Cheve was discovered, and even before it was confirmed that the resurgence really did belong to the Cheve system, cavers started looking at the "Middle Karst." This $60km^2$ area extends from the edge of the highland plateau just north of the main cave entrance to Santa Ana.

Because there is a lot more water coming out of the resurgence than going into the higher entrances of the cave, it seems logical to assume the system continues to collect drainage along its route. We hoped that we could find other entrances into the system, and the Middle Karst was the place to look.

Small recon trips took place in 1988, '89, and '90. A number of caves were found, but most were small, tight, and wet, and soon became impassable. Since there was so much to do in the main cave at this time, not much effort was put into systematically exploring the area.

In 1992, a local hunter showed a sinkhole to a small group of cavers. He said that steam rose from the sink on cold mornings. After a lot of digging, they broke into the top of a dome that had good airflow. They called the cave Palomora, named after a nearby ranch.

More exploration revealed a tight, canyon stream passage and several short pits. Two hundred fifty meters of passage were mapped, to a depth of -142 meters. The cavers were stopped by a narrow bedrock squeeze, but the cave headed directly to the projected path of the Cheve system.

THE 1993 TRIP

Six cavers set up camp in the Middle Karst for two weeks. Their goals included pushing some leads from earlier recon trips, including Palomora, and to systematically look for new cave entrances.

Due to lack of proper permission for certain areas, they could not explore Palomora. Instead, they pursued a lead that was found on the '89 trip. The notes said the cave ended in a near-sump, which turned out to be a puddle, so they called the cave Charco ("puddle" in Spanish).

It is obvious that the cave drains a fair amount of water, and there is good airflow, but the passage alternates between tight, wet crawls and nice-sized pits. At about -200 meters, there is a big 33-meter pit. They were hoping that this indicated the cave would open up, and would get easier. No such luck. At the bottom of the pit the passage gets even smaller and requires a belly crawl through a stream. This is where the survey ended for the year. The cave was 735 meters long and 269 meters deep.

Ridgewalking uncovered a number of new entrances, but most of them had little airflow and quickly ended. The amount of area to explore is enormous, and the group had barely scratched the surface.

THE 1994 TRIP

It was time to do some serious looking in the Middle Karst. We were frustrated by the breakdown choke in the main cave, so we had even more vivid dreams of finding the magic tunnel in the Middle Karst that would bypass the breakdown and lead us deeper into the system.

Twenty-five cavers camped in an old schoolhouse for two weeks in the small village of La Hierbabuena. Every day for the first week, groups went out completely scouting the area around the town. Since most of the area is farmed, our best leads came from the local farmers.

They showed us many obscure pits and cave entrances, although few of them had any airflow. During the second week, the weather turned bad. It was too hard to ridgewalk in near zero visibility, so more effort was put into the going caves.

One cave that seemed promising, called Aguacate, had been noted by cavers on previous trips to the area. The Aguacate stream flows into a pit, and there is evidence that the cave takes on large amounts of water during the wet season.

There is a spring about 500 meters down the valley with a comparable amount of water flow. It seemed reasonable to assume the two were connected, but we wanted to confirm there were no other leads in the cave.

For more than a week cavers explored and surveyed farther into the cave, and found some nice-sized passage (10 to 12m wide in places) and big pits. But after one kilometer of survey and -174 meter depth, the stream the cavers were following went down into a narrow, muddy, foamy sump. There were no other unchecked leads.

The intriguing part is that the cave trended for 400 meters in a west-northwest direction—away from the spring and in the direction of the projected line of the Cheve system.

Charco was high on the list of caves to be pushed. The first group in planned to survey through the belly-crawl stream passage and continue exploring. The crawl was as hideous as it was described, but finally opened up. The passage continued in the same fashion as before: tight, miserable squeezes opening up to fair-sized down-climbs.

It was hard to persuade a second survey team to continue, because the word got out on the true nature of the cave. The second team found more of the same, and finally turned around at a vertical flowstone crevice that would allow only the smallest of cavers to pass.

Several hundred meters were surveyed, bring the total length to 940m and the final depth to -316m. Even with the nice breeze and water flow, we estimate that we will need to go to at least -500m in that area to reach the main system. Another 200m depth in typical Charco style could only be pushed by the most masochistic cavers.

The other lead to check was Palomora. The tight passage that had stopped the previous explorers was widened, but it needs more work before a caver will be able to get through. The cave still has enticing airflow.

Although our dream cave was not found near La Hierbabuena, there are still much more of the Middle Karst to check. At least we can cross one area off the map for potential leads.

ACKNOWLEDGMENTS

Proyecto Cheve has received generous long-term sponsorship and support from the Richmond Area Speleological Society (RASS), the Dogwood City Grotto, and the NSS International Expedition Support Fund.

On the most recent trip we received much-needed help from Cancord Rope Inc., Gonzo Guano Gear, and the Huntsville Grotto.

We would like to thank the townspeople of Concepción Pápalo, San Juan Bautista Cuicatlán, La Hierbabuena, and San Miguel Santa Flor for their kind cooperation.

We would also like to thank Lic. Diódoro Carrasco Altamirano (Governor of Oaxaca), Dr. Germán Cruz Martínez (Director of Civil Protection), and the Cruz Roja of Oaxaca for their interest and assistance in helping us work towards our goals.

Proyecto Cheve, Oaxaca

En 1997 se realizó otra expedición a la cueva Cheve, en el estado de Oaxaca. Se rearmó la cueva usando nuevos anclajes (bolts) y cuerda de nylon y poliéster. Se preparó también el Campamento II como un lugar de descanso al entrar y salir de la cueva desde el Campamento III. Ya instalados en el Campamento III los espeleólogos se dedicaron a buscar la continuación al "agujero oscuro" dentro del Derrumbe Final. Esta posible continuación a la cueva fue encontrada en el viaje anterior al área, en 1995. Este paso a la oscuridad sigue hacia un gran salón, de 90 por 120 metros y con un techo de roca sólida a 40 metros de altura, sin derrumbe. Desgraciadamente no se encontraron posibles continuaciones a este salón. Se retrasó el viaje para fotografiar el Campamento III y el nuevo salón cuando al regreso aumentó el nivel del agua. Mientras tanto, un espeleólogo se fracturó un tobillo y otro más estuvo brevemente atrapado en el derrumbe por un bloque flojo en un área compleja cercana a la entrada. Este último fue rescatado con heridas menores. Se exploró a partir de la superficie la Cueva Palomitas sin tener éxito en conectarla con Cheve. En el área de la resurgencia, a lo largo del Río Santo Domingo, se topografiaron poco más de dos kilómetros de pasaje fósil en la Cueva de La Mano. De esta misma cueva se colocaron más de 800 metros de línea de buceo en la resurgencia activa. Se buscaron también, sin éxito, otras posibles entradas al sistema Cheve en el karst localizado entre la cueva y su resurgencia. De estas entradas, Aguacate fué la más profunda contando con 174 metros. En Charco se avanzó hasta llegar a una profundidad de 316 metros encontrando todavía un buen flujo de aire pero un paso muy pequeño y difícil.

2001 INNERSPACE ODYSSEY EXPEDITION

Bev Shade and Bill Stone
with contributions by Jason Mallinson and Rick Stanton

During the winter and spring of 2001, the U.S. Deep Caving Team fielded a three-and-a-half-month expedition to Sistema Huautla and Sistema Cheve in Oaxaca and Sistema Purificación in Tamaulipas. The effort was aimed at identifying potential avenues for breakthroughs in these three caves, where no changes in depth had taken place in eight or more years. Twenty participants from five countries were involved in the project.

At the beginning of Phase 1, Page Ashwell, Bev Shade, José Soriano, Bill Stone, Gustavo Vela, and Andy Zellner arrived in the village of San Agustín Zaragoza on the Huautla Plateau in Oaxaca on January 21, 2001. We rented two houses in the village for kitchen and sleeping space and started unpacking. The next day, Mark Crapelle arrived; he had been vacationing on the east coast before heading up into the mountains to join us.

The next four weeks were spent rechecking previously explored caves trying to find a continuation of the Río Iglesia, which sinks in the Penthouse chamber of Sótano del Río Iglesia at –280 meters. The motivation for this was the 1994 discovery of an underground junction of what is presumably the Río Iglesia with the San Agustín River beyond the San Agustín sump at a depth of 1450 meters, forming the long-sought main drain for Huautla. [See *AMCS Activities Newsletter* 21.] The water entering lower San Agustín arches out from a 6-by-6-meter borehole in the form of a 12-meter waterfall. The trick, now, was to find a way into that tunnel other than diving 655 meters through the San Agustín sump. Many previous teams, including Huautla Project expeditions in 1978 and 1980, had scoured Río Iglesia pretty hard. But we thought it was at least worth another look.

Another option in the pursuit of the Río Iglesia was Cueva de San Agustín. Cueva de San Agustín is a fossil river cave located less than 200 meters from our mess hall, on the mountain knoll behind the village. We had noticed on the 1969 Canadian map that the final room, known as the Sala Doble, contained a high dome with a waterfall pouring in. The chamber is at a depth of 474 meters beneath the entrance and measures 250 meters long by 30 meters wide. Entry into the chamber is by way of a spectacular 115-meter freefall shaft known as the Sima Larga. The Sala Doble is at the same elevation inside the mountain as the Río Iglesia where it disappears below the Penthouse. Just 100 meters separate the two rooms underground. Our plan was to set an underground camp in the Sala Doble and use hammer drills to scale the big dome at the far end of the chamber. We hoped it would lead up over a drainage divide to passage that might go south, cross under the Sótano del Río Iglesia, and connect with the active river.

There are nineteen vertical pitches to the bottom of Cueva de San Agustín. By January 26 they had

Phase 1 team: Bill Stone, Bev Shade, Gusa Vela, Andy Zellner, Page Ashwell, Jose Antonio Soriano, Jason Mallinson, and Mark Crapelle. *Bill Stone.*

Hiking to work, Bev Shade passes through the stalactite curtain in the center of the Sala Double, Cueva San Agustín. *Bill Stone.*

been rigged with some 600 meters of PMI rope, and the first underground camp had been established. During the next six days, Crapelle, Shade, Soriano, and Stone took turns leading the climb up the waterfall, while Ashwell, Vela, and Zellner pushed other climbing leads around the Sala Doble.

At the conclusion of our first climbing effort, we had scaled 90 meters and were looking across the top of the shaft into an infeeder canyon leading south toward Río Iglesia. Getting into this canyon required more rope and drill batteries, so we returned to the surface. Three days later Crapelle, Shade, Soriano, and Stone returned for a second five-day push. A day after our arrival in the underground camp, a storm upstairs dumped some 15 centimeters of water, and the 90-meter waterfall emptying into the Sala Doble quintupled in volume, filling the chamber with a fine mist. The waterfall on the route to our lead also noticeably increased in flow, which meant that everyone got wet between camp and the new lead. One of the real luxuries of the first camp had been staying dry. The infeeder canyon gained another 50 meters of elevation in a series of shorter pitches led by Crapelle and Soriano, passing through several spectacular collections of helictites. Unfortunately, the photo strobes chose this time not to work, so we were not able to take any pictures of what are surely some of the best formations in Huautla. At an elevation of 140 meters above our underground camp the new route connected back into Cueva de San Agustín at a short branch off the main tunnel previously thought to have no outlet. We added 566 meters to the length of the cave. The new passage has several climbing leads that we did not have time to check. The largest dome can be reached rather quickly by taking the only left-hand tunnel off the main route to the Sima Larga. Neither did we have time to pursue the source of the waterfall in the dome we climbed out of the Sala Doble. It enters via a steep flowstone slope just above roof level of the Sala Doble, while the more obvious route we followed to the connection did not carry water.

It is worth mentioning that there are three downtrending holes taking water in the Sala Doble, all along the north wall. Unfortunately, all end in very compacted breakdown. The water filters down the wall in a series of impassably small crevices. Clearly that water goes down and connects with Río Iglesia somewhere under the Penthouse.

After connecting our climbing route to the main passage, we broke camp and derigged. Since our new discovery connected to the main route, our four-person team split into two groups, each derigging one way up to the passage junction. In this way, we were able to recover virtually all of the gear we used in the bolt climbs. The cave was derigged on February 8 and 9.

Meanwhile, during the second camp at the bottom of the Cueva de San Agustín, Ashwell, Vela, and Zellner rigged Sótano del Río Iglesia down to the –280-meter level and set a three-day camp in the huge Penthouse, a roughly circular room measuring 130 meters in diameter. There the cave splits. The water sinks into breakdown, while the main downstream tunnel, leading to the deepest portion of the cave at –535 meters, has been blocked by debris since sometime shortly after its discovery in 1967. This debris was washed in during the summer rainy seasons. Because no one had seen this section of the cave since the late 1960s, we hoped to find some climbing leads that had been overlooked. Jason Mallinson had arrived from England, and after several days of sorting dive gear, he joined them in the cave

Eight flashes illuminate the Sima Grande, the spectacular 115-meter shaft at the bottom of Cueva San Agustín. Bev Shade fired the flash every 14 meters during her ascent. *Bill Stone.*

Crossing the Río Santo Domingo at dusk. The cliffs in the distance rise 500 meters above the river. *Bill Stone.*

camp. They dug open the blockage to the deeper sections of the cave and came to the lip of a shaft leading down, probably Taffy's Terror on the old Canadian map. Excited by their success in reopening this section of cave, they left the cave to fetch more rope and rigging hardware. Their arrival on the surface coincided with the beginning of the three days of heavy rain that created the spectacular waterfall in the Sala Doble. When the team returned to Sótano del Río Iglesia, the dug crawlway was flooded shut again.

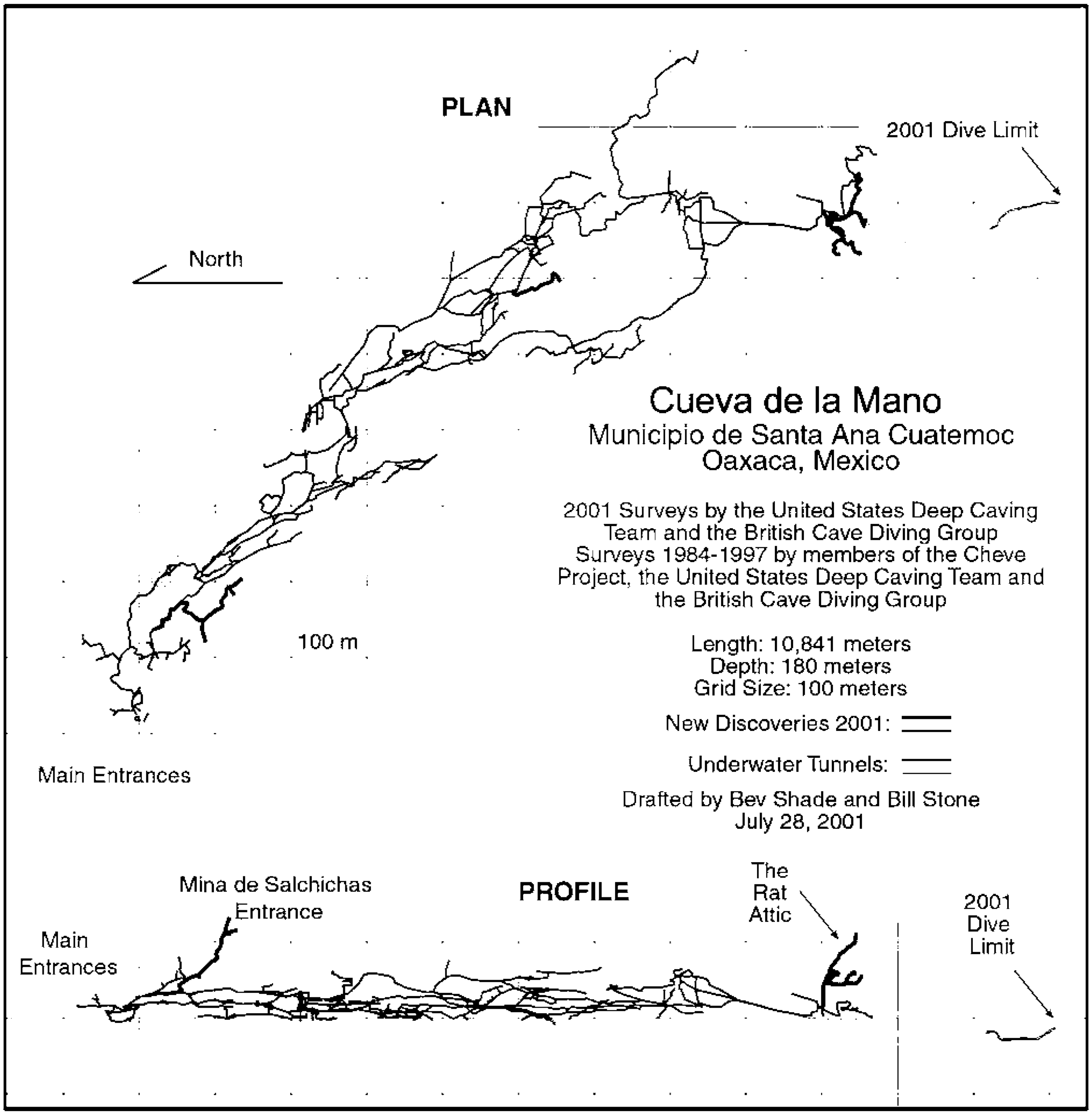
Following the derig of the Cueva de San Agustín, we were joined by Marcin Gala and Kasia Biernaka from Poland. Most of the team then returned to the Penthouse on a single-day recon. Although the downstream crawlway remained impassable, Ashwell discovered a new canyon tunnel entering the Penthouse from the south and carrying a substantial flow of water from the recent rains. Several weeks later, Shade and Stone returned to this canyon with climbing gear and scaled three waterfall shafts, mapping 184 meters of passage in the process. It still continues to the southeast. Further work in Río Iglesia was deferred due to the arrival of the Phase 2 team on February 18, when Zellner and Ashwell returned home to the United States.

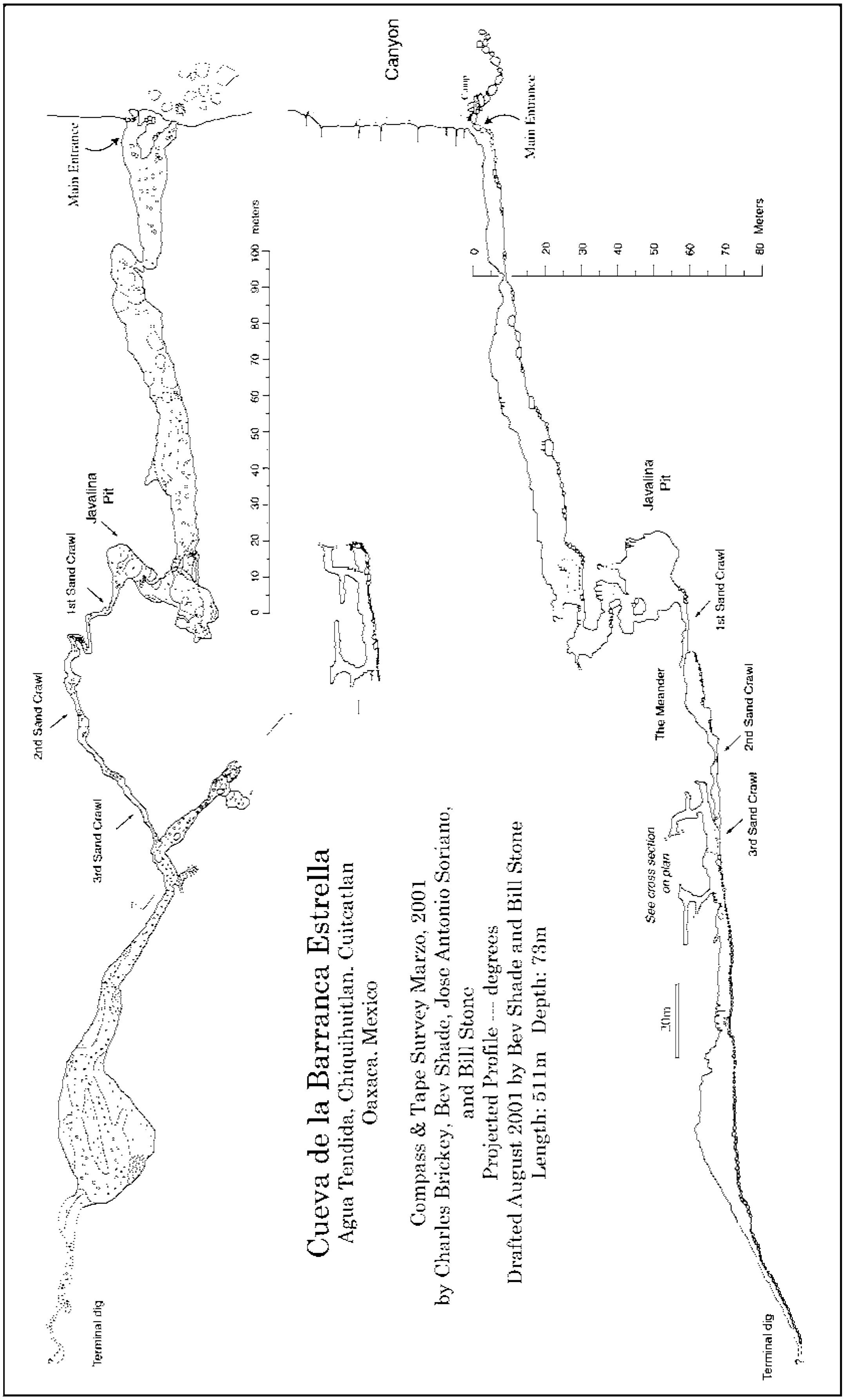
For Phase 2, we were joined by new team members Rick Stanton, Greg Horne, and Charles Brickey. The primary focus of this part of the expedition was the fossil resurgence cave known as Cueva de la Mano. This dry cave is located in the Santo Domingo Canyon and lies immediately above the springs that drain Sistema Cheve. It is connected in several places to the active spring tunnel. While the canyon and cave are both hot and muggy, the water coming out of the Cheve is beautifully cold (16°C) and clear.

Cueva de la Mano had been explored extensively by several previous expeditions between 1989 and 1995, and we knew progress would be difficult. The general consensus was that the dry cave was finished, but in 1997 our team had explored a sump at the end of the cave that continued beyond the range of the limited diving equipment on hand. Those dives had been made by Jason Mallinson and Rick Stanton, who were both interested in a second attempt with more sophisticated equipment. Furthermore, discussions with Nancy Pistole, Matt Oliphant, and Peter Bosted revealed the existence of several climbing leads near the southern end of the dry passage.

Bev Shade during the derig of Cueva San Agustín. Thirty pieces of rope were tied end to end for hauling up the drops. *Bill Stone.*

On February 21 we hired sixteen burros and guides from the small village of San Simon, on the northern edge of the Santo Domingo Canyon where a new road had just been completed from Mazatán, and transported equipment to establish a six-week basecamp near the entrance to Mano. Since Mallinson had stopped in 1997 only due to a shortage of air in a tunnel measuring 8 meters high by 5 meters wide at a water depth of 30 meters, the diving effort merited first priority. If a team of divers got through the sump and into dry chambers beyond, they could survey back toward the known dry cave and look for leads that bypassed the sump. During our first several days, the entire team transported diving gear, including new carbon-epoxy tanks containing helium-oxygen and several compact rebreathers, to the southernmost sump. Mallinson and Stanton then began a series of sixteen solo dives, on alternate days except those required for gear repair. They reached a maximum penetration of 458 meters from dive base before running out of leads. Just beyond where Mallinson had stopped in 1997, the tunnel began branching into ever-lower bedding-plane openings. Ultimately, all of these were pushed to a point where it was physically impossible to dive any farther, even by crawling underwater. On his last dive, Mallinson took a hammer with him. After removing his rebreather and bailout tanks he bashed on the fractured bedding-plane roof until he was able to move forward a few meters, pushing both bailout bottles

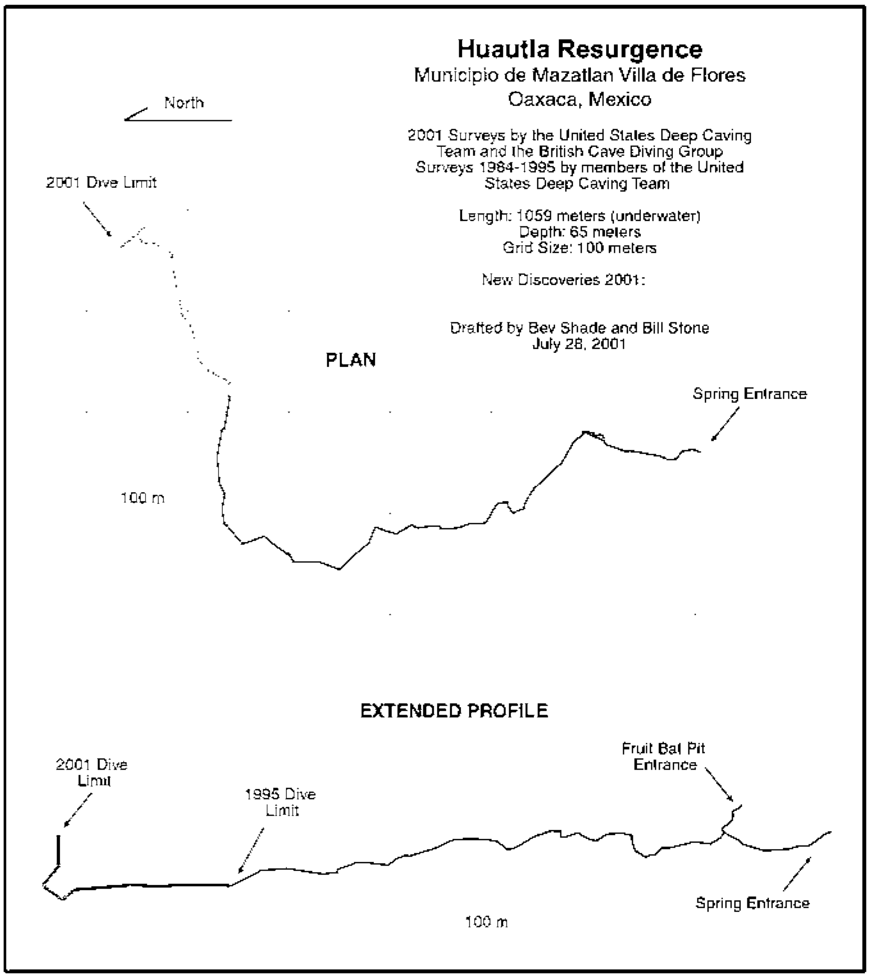



Cueva de la Barranca Estrella
Agua Tendida, Chiquihuitlan. Cuicatlan
Oaxaca. Mexico
Compass & Tape Survey Marzo, 2001
by Charles Brickey, Bev Shade, Jose Antonio Soriano,
and Bill Stone
Projected Profile --- degrees
Drafted August 2001 by Bev Shade and Bill Stone
Length: 511m Depth: 73m
Main Entrance
Javalina Pit
1st Sand Crawl
2nd Sand Crawl
3rd Sand Crawl
Terminal dig
meters
Canyon
Camp
Main Entrance
Meters
Javalina Pit
1st Sand Crawl
The Meander
2nd Sand Crawl
3rd Sand Crawl
See cross section on plan
20m
Terminal dig

ahead of him, until the bedding plane lowered again. Hopefully, this is not the only connection from the resurgence area to Cheve and Charco.

While Mallinson and Stanton pushed dive leads, the rest of the crew looked for dry leads, pushed climbing leads, and went ridge-walking. By wading around the head of the southern sump, we could reach a small crawlway that led to the southernmost dry passages. This crawl leads to a decent-sized room, but all the passages beyond this room are fairly small and unpleasant. Horne and Shade visited this section to look at potential climbing leads that Nancy Pistole had kindly marked on old survey notes. They did not find some of them, found several that were not marked, and were nonplussed, finally settling on a different lead entirely. This area backs up during high water, so the walls are coated with damp brown mud. However, we felt that we could see a bit of white limestone high in the room and estimated the dome to be at least 20 or 30 meters high. We pushed this lead for a month. Shade and Stone led the first series of pitches up the big shaft to a complex intersection at a point 40 meters vertically above the sump. Close to the floor, the wall was layered mud and soft flowstone. This hard-to-protect combination gave way to sharp, horizontal marble fins. Forty meters up, we were relieved to reach a big ledge with several horizontal leads. One passage went through a very well decorated section named the Rat Palace. Most of the passages at or above this ledge were well decorated with both calcite and aragonite formations. In all, 436 meters of new horizontal tunnels were mapped in this area, including a spectacularly beautiful gallery completely lined with pristine dogtooth spar.

Gala, Biernaka, and Soriano now joined the climbing teams in this area. A total of eight pitches were scaled in different directions from the junction ledge. The highest point was reached four pitches above the ledge, 99 meters vertically above the sump. All of these climbs ended where large boulders wedged into fractures in the ceiling blocked farther progress. Apparently we had climbed up into a fracture zone, perhaps beneath the base of an enormous room. Although air flowed up into several of the ceiling leads, none of them could be pursued safely, at least not from below while on rope. This breakdown appears to be both vertically and horizontally extensive.



One mystery of Cueva de laMano was resolved this year. The entrance, located about 20 meters above the active spring, usually has a strong wind blowing either in or out, suggesting the presence of a large cave system with a higher entrance. However, the air is not strong enough or cold enough to signal a direct connection with Cueva Cheve. Furthermore, beyond a large junction located 300 meters from the entrance, the wind dies, and the remaining 925 meters of travel to the southern sump are humid and stagnant. During our month-long stay at Mano basecamp, we were visited several times by villagers from the small town of Santa Ana Cuatemoc, on the south side of the canyon. They made these trips despite a four-hour trek on horseback through stiflingly hot jungle. Although we had obtained official permission, these parties were nonetheless armed, usually with rifles and shotguns, and confrontational at first. We laid out the map we had been working on and offered tours of the cave. Ultimately, two groups entered the cave, the second one taking a four-hour trip with us to the sump. Suspicion waned as their understanding improved. Soon, they informed us that some 140 meters vertically up the mountain toward Santa Ana, one of their hunting dogs had come across a shaft leading down into the canyon wall. Rapid negotiations followed. They guided us to the pit, which our

Diving in Cueva de la Mano

These reports on diving in Cueva de la Mano appeared, in somewhat different form, in the *Cave Diving Group* [Great Britain] *Newsletter,* numbers 124 (July 1997) and 142 (January 2002). The telegraphic style, only slightly ameliorated by editing, is traditional in that journal.

January 11, 1997. The static terminal sump was dived by Stanton with two 4-liter cylinders. Twenty-seven meters of line was laid, to surface in the full flow of the Cueva Cheve river. A large fossil passage was also evident. Thinking we had hit the big time, Stanton returned for Mallinson, who, not having a wetsuit, borrowed Stanton's jacket, leaving Stanton to dive through in his long johns. On the far side, the water welled up from another sump. The large, rising tube led back to a blockage and onward to another sump. It was clear that it had been visited before, probably via a bypass to the sump. While Mallinson investigated this, Stanton continued the dive. The smaller, continuing sump reverted back to a larger passage, then choked. A small tube bypassed this and was followed to –16 meters. This contained only some of the flow, so the line was wound back to a belay and time was spent looking for other alternatives.

January 13. Mallinson proceeded past Stanton's limit down a descending tube requiring side-mounts to –23 meters, where it entered a low, hading rift. Seeing dark spaces lower, he belayed the line and swam down through a rift until it broke out into the side of a large tunnel at –26 meters, heading north and south. The diver swam south, in a tunnel 15 to 20 meters wide and more than 5 meters high, until he reached –33 meters. Here not having a buoyancy compensator was causing difficulties, so he surveyed back. The passage continues big.

January 15. Mallinson pushed on from the previous limit, this time with streamlined BC and stage bottle. It was awkward squeezing through the rift with wings. The large tunnel continued, and 115 meters of line was laid at an average depth of 30 meters to a narrow canyon. Mallinson tried to surface from –23 meters in the canyon, but falling silt and debris caused a silt-out and the roof pinched out at –7 meters. This is probably a dead end, and the main tunnel has been missed, which would be easy due to the width of the tunnel preceding this section. Mallinson surveyed back to the previous limit and returned to the entry point at the rift.

The large passage heading north, downstream, was lined. This ascended for 50 meters up a boulder ramp to a chamber at –10 meters with a possible air bell above. Surfacing was not possible due to the amount of deco required. This point may be on the far side of boulders noted in the initial part of the sump where the current is evident. The diver returned, surveying, to the rift and spent his deco time doing underwater aerobics to keep warm.

February 20, 2001. Carry team of eight sherpas took all dive equipment to the 1-kilometer sump, ready for Mallinson and Stanton the next day.

February 21. Mallinson dived first on a chest-mounted homemade rebreather with open-circuit side-mounts as bailout. The sump line was repaired as far as the junction with the deep tunnel. The sump was then followed to Mallinson's 1997 downstream limit beneath an aven. Meanwhile Stanton had dived with his homemade rebreather to the boulder choke above this aven. Here Mallinson's bubbles were seen to emerge from a small hole beneath the diver. Eventually Mallinson managed to squeeze through, minus rebreather, and make the physical connection. This connection was obviously not large enough to use the back-mounted Cis-Lunar rebreathers. Thus all dives in this sump were done using the homemade rebreathers in various modes of closed, semi-closed, and something in between, depending on whether an oxygen sensor was being used or not.

Stanton then followed the upstream tunnel to the shaft upward at approximately 330 meters into the sump that was Mallinson's limit in 1997, when he had surfaced at the shaft in on off-route airbell. Stanton then found the main continuation of the tunnel, a short section of passage to a deep-looking shaft that was not descended.

February 22. Stanton and Mallinson ascended the second shaft to a small airbell at the top. This was clearly off route, so the divers made plans that Mallinson would continue into the new deep shaft while Stanton tidied up the line in the shaft area. This done, Stanton returned to the new main tunnel and laid some more line from Mallinson's limit up to a depth of 16 meters.

February 23. Mallinson continued from the limit at –16 meters to a large boulder choke that blocked the passage. A small hole up through boulders was seen but not attempted. A side passage was noted and partially explored. It emits strong current.

Stanton dived to the end of the line, surveying all the new passage. The end fans out to a choke of boulders with no apparent way through, but most of the current is coming through small passages below this level. One small passage was spotted, but it was a committing squeeze that was left for another dive, when the disturbed silt had settled. Dive time 90 minutes.

February 25. Mallinson swam to the present end and removed his rebreather to pass a small hole in the boulder choke. The hole had to be hammered to remove an obstruction. Beyond the hole, inside the choke, a passage went for 10 meters to a dead end. Various holes were looked at, but no way on was found. It is very silty inside the choke, indicating little current. Back on the correct side of the hole, he donned the rebreather, and other side passages were looked for. A possible shaft upward was noted on the return, but the rebreather then flooded, requiring the diver to use his open-circuit side-mounted bail-out tanks. Dive time 2 hours.

Stanton surveyed all the uncharted passage.

February 27. Mallinson ascended the possible shaft noted on the previous dive to an airbell that is a dead end. A further upward passage in the deeper section was ascended, but this pinched out after 10 meters in a silt-out. A side passage was noted farther towards the terminal boulder choke. This was left for a later dive due to the decompression requirements already accumulated.

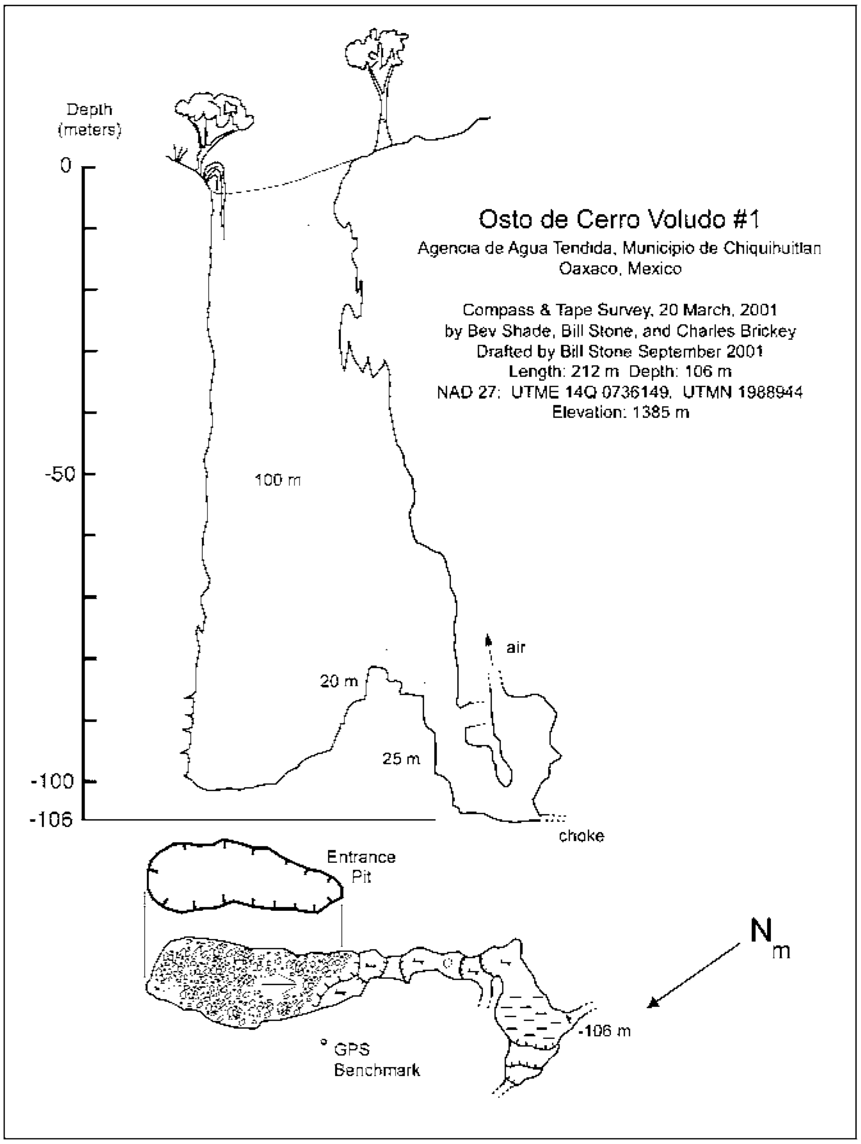
March 1. This dive was aborted 200 meters into the sump when Mallinson realized the Sofnolime in the rebreather was spent and unusable. Open-circuit bailout was used to regain the surface.

March 3. Stanton attempted to push the lead found on the last dive. Technical difficulties with his rebreather curtailed the dive.

March 4. After removing his rebreather, Mallinson followed a small tunnel emitting a strong current for 20 meters along a low passage with fallen (and falling) slabs to an obstruction caused by a larger slab. The passage could be seen to continue beyond, so an attempt at moving the slabs was made. After 10 minutes digging, the diver had to return to the rebreather and then to base. Dive time 2.5 hours.

March 5. The slabs at the end point were again attacked by Mallinson, and after a further 15 minutes excavation, a way through was made. The tunnel enlarged slightly, but after 5 meters more, the current could be seen coming from a very tight spot. This was the last dive in this cave for this expedition.

—Rick Stanton and Jason Mallinson



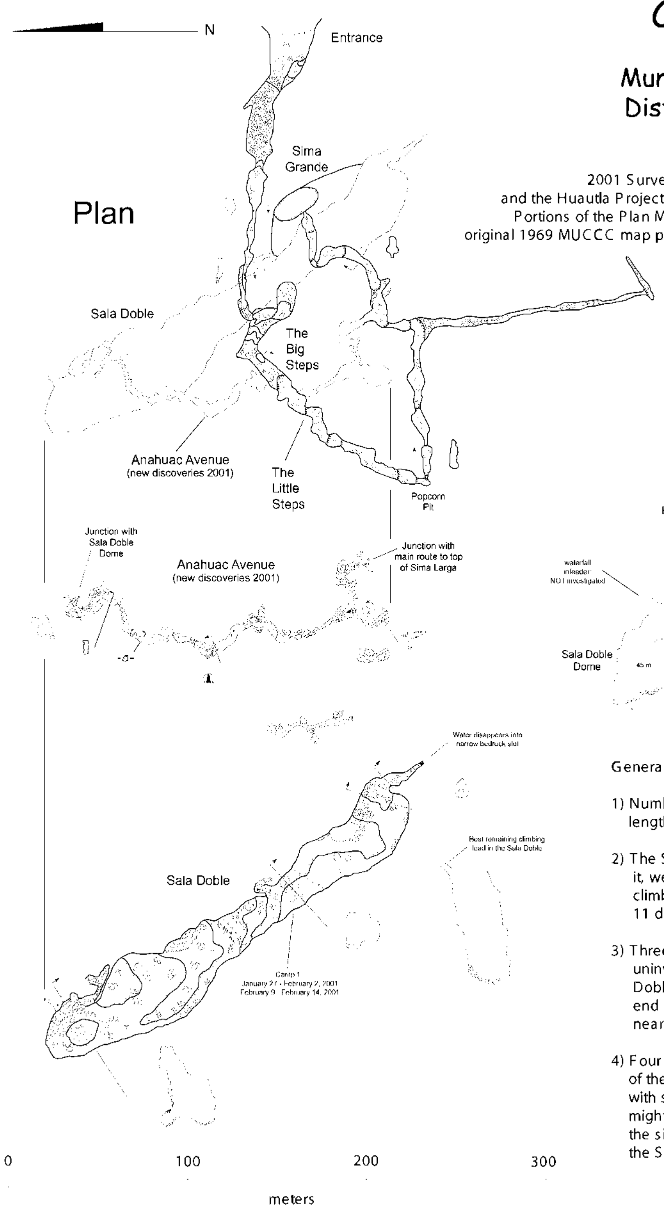
teammate Soriano ultimately named Mina de Salchichas, the Hot Dog Mine.

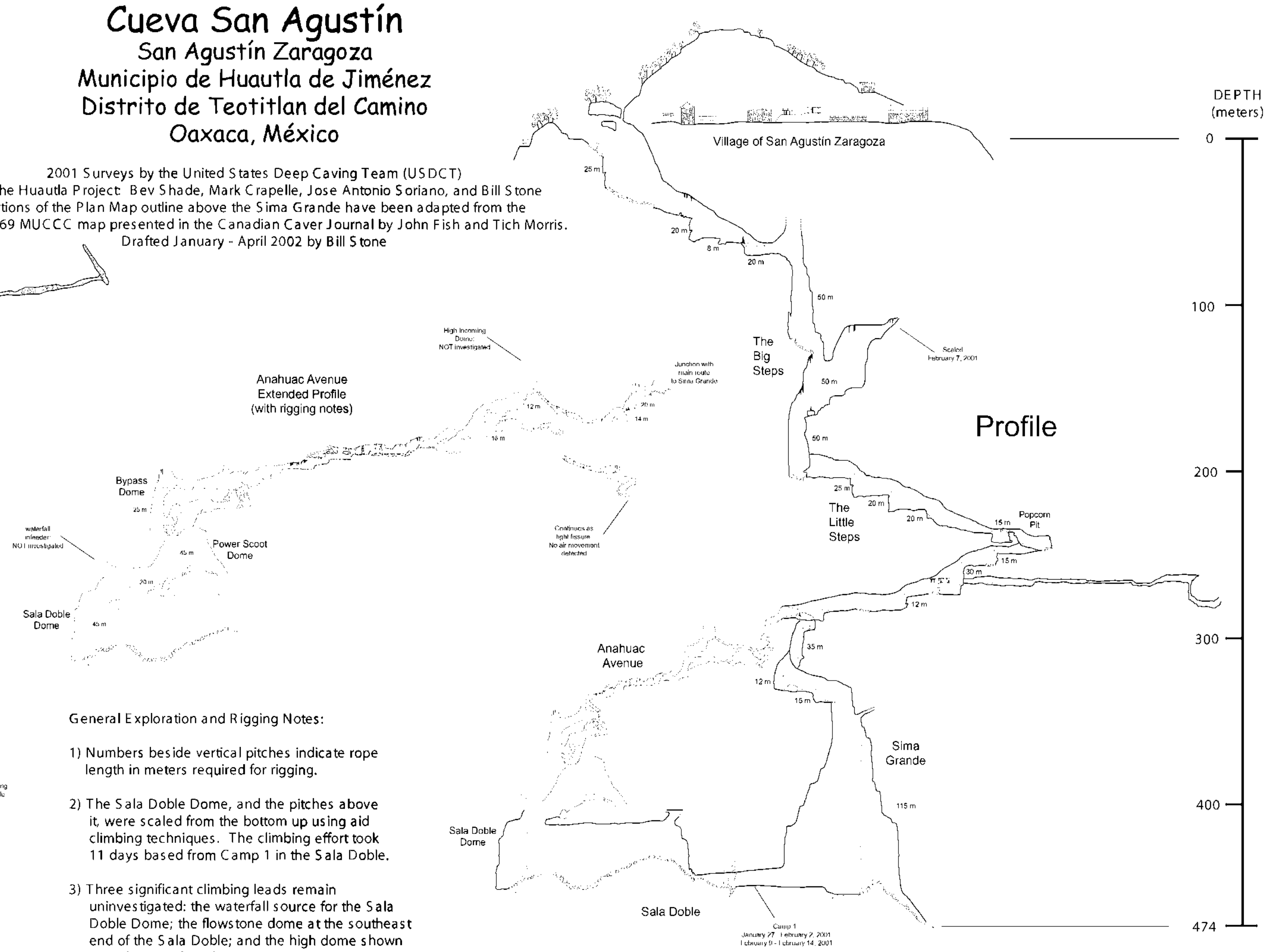
Salchichas was full of surprises, including extensive archaeological remains and stepped terraces along the tunnel wall that almost certainly host burial sites, probably dating back 1500 years. The extensive construction and large artifacts are even more impressive considering that it has a pit entrance with several drops. The second drop ends in waist-deep bat guano and, of course, thousands of bats. The guano slope trailed off for nearly a hundred meters into a heavily decorated Carlsbad-like chamber and continued below to a borehole measuring 8 meters in diameter. Initially, we hoped that this might be a tunnel parallel to Cueva de la Mano, but survey stations were found in this passage. Fortunately a recoverable station was found near the junction of the Mina de Salchichas and the main passage, so that our survey was easy to connect to the old survey data. We were grateful for the careful work of previous expeditions to mark survey points. This passage joins the rest of the cave at the main junction in Mano where the air disappears. So the mystery of the airflow had been solved: the high entrance at Mina de Salchichas provides a driving force for the wind due to its significantly higher elevation. It is also the main entrance for the significant bat population in the cave, easily several thousand. It is worth a note of

Cueva San Agustín

San Agustín Zaragoza
Municipio de Huautla de Jiménez
Distrito de Teotitlan del Camino
Oaxaca, México

2001 Surveys by the United States Deep Caving Team (USDCT)
and the Huautla Project: Bev Shade, Mark Crapelle, Jose Antonio Soriano, and Bill Stone
Portions of the Plan Map outline above the Sima Grande have been adapted from the
original 1969 MUCCC map presented in the Canadian Caver Journal by John Fish and Tich Morris.
Drafted January - April 2002 by Bill Stone





General Exploration and Rigging Notes:

1) Numbers beside vertical pitches indicate rope length in meters required for rigging.

2) The Sala Doble Dome, and the pitches above it, were scaled from the bottom up using aid climbing techniques. The climbing effort took 11 days based from Camp 1 in the Sala Doble.

3) Three significant climbing leads remain uninvestigated: the waterfall source for the Sala Doble Dome; the flowstone dome at the southeast end of the Sala Doble; and the high dome shown near the top of Anahuac Avenue.

4) Four separate water sources sink into the breakdown floor of the Sala Doble along the northeast wall. It is possible that with significant effort the sink closest to Camp 1 (see profile) might be followed. It is plugged with jagged breakdown, but the size of these boulders is smaller than elsewhere seen in the Sala Doble.

All-Digital Cartography

warning that two members of the expedition, Gala and Horne, subsequently contracted histoplasmosis, with Gala spending two weeks in the hospital following his return to Poland. Both had visited the I Guano Go tunnel that leads to the southeastern-most sections of Mano, which is far from the Mina de Salchichas entrance.

The 2001 expedition mapped 942 meters of new tunnels in Cueva de la Mano, bringing the total length to 10,841 meters and increasing the depth significantly, to 179 meters. The route onward toward Cueva Cheve, however, remains elusive.

With Mano finished, pending a breakthrough to the other side of whatever geologic feature is blocking current exploration, we turned our attention to the Huautla Resurgence. Due to the unusual geology of the Sierra Mazateca and the Sierra Juárez, it turns out that the springs for the two vast, deep systems in these two mountains, respectively Huautla to the north and Cheve to the south, are both in the same canyon. From Mano basecamp it was only a kilometer and a half downstream to the Huautla springs, or about an hour's strong hiking with dive kit, including a good deal of river traversing in chest-to-neck-deep water. We began staging MK5 rebreathers and carbon-epoxy SCI tanks down there at the end of the first week of March.

On an earlier expedition in May of 1995, Jill and Paul Heinerth and Noel Sloan had reached 769 meters penetration at 55 meters depth in the Huautla Resurgence, with the tunnel headed downward. Rick Stanton and Jason Mallinson managed to re-line the first 769 meters; rainy-season flows in the intervening six years had shredded the original guide line. They extended exploration an additional 290 meters to where, on March 9, Mallinson surfaced in an airbell at a penetration distance from the entrance of 1059 meters. This location is approximately 100 meters inside the east wall of the Peña Colorada canyon. The airbell is 15 meters in diameter and is connected to another airbell of equal size by a swim-through fissure with air overhead. An 8-meter-wide, 5-meter-high air-filled tunnel with stalagmites could be seen leading off from the roof of the first airbell. Unfortunately, there was no beach, and the only way out of the water will be via a 10-meter aid climb.

Jason Mallinson tops off a pair of tanks for a dive in the southern sumps in Cueva del Mano. *Bill Stone.*

The maximum water depth reached during these four dives was 65 meters, at a point almost directly beneath the floor of the Peña Colorada canyon. Approximately 1200 meters north of this point is the Cueva de la Peña Colorada, an extensive cave explored in 1984 by the USDCT. The discovery of an air-filled tunnel beyond the Huautla resurgence marks an important breakthrough in the exploration of Sistema Huautla. It now remains for a dedicated expedition, or several, with waterproof bolting equipment and a much larger cave-diver complement to link the Huautla Resurgence to the Cueva de la Peña Colorada and extend exploration from there to the Sistema Huautla, 9 kilometers to the north.

The remainder of the month of March was spent on long reconnaissance hikes based out of the village of Santa Ana Cuatemoc. Two of the visitors to our basecamp in the canyon lived in this town and offered to host us for exploration work in the middle karst zone between Sistema Cheve and its resurgence.

Phase 2 team: Greg Horne, Elizabeth Gutierrez, Jason Mallinson, Jose Antonio Soriano, Bev Shade, Bill Stone, Rick Stanton. Not shown are Charles Brickey, Mark Crapelle, Marcin Gala, and Kasia Biernacka. *Bill Stone.*

Diving the Huautla Resurgence

These reports on diving in the Huautla Resurgence appeared, in somewhat different form, in the *Cave Diving Group* [Great Britain] *Newsletter,* number 142 (January 2002). The telegraphic style, only slightly ameliorated by editing, is traditional in that journal.

March 6, 2001. It was expected that most of the line installed in 1995 would have been washed out and shredded by the current, so this dive by Stanton was to repair and replace it far as far as could be reached. Following the trail of old line remnants eased what would have been complicated route-finding. Sump 2 had multi-level passages in a maze-like configuration, and all the tubes here are clean-washed with sharp erosion features. Beyond, the passage did not fit the description, and the second air chamber with the 1-meter cascade could not be found. This may have been due to higher water levels. The passage changed nature to a 6-meter-diameter phreatic tube with whalebacks of silt on the floor. The diver turned back to base when all the line carried had been laid. The swim out from approximately 600 meters from the entrance was much faster than the inward time due to the strong current. Dive time 2.5 hours.

March 7. Mallinson continued relining the known passage from Stanton's limit of the day before, using a Cis-Lunar MK5 rebreather and two side-mount tanks. The route finding was easy due to remnants of the old line, which needed repair in places. The end of the old line was reached at 900 meters and 40 meters depth. Here a gravel ramp led down to –60 meters, and from the base of this a large passage rose up to –50 meters, where it leveled off and continued large. Silt and gravel banks showed high-flow current patterns, indicating this was the main way forward. Before the diver returned to base, 100 meters of line was laid beyond the old limit. On the return, an hour of decompression was required before the airbell between Sumps 1 and 2, due to the need to surface momentarily there. Dive time for the 1-kilometer penetration was 3.5 hours.

March 8. Stanton continued on from Mallinson's limit. The passage remained at 52 meters depth. The visibility was such that it was hard to maintain contact with both walls of the large tunnel. After about 150 meters of progress, the depth had increased to 65 meters at a marked elbow in the passage, beyond which it rose steeply over walls of large boulders to a chamber with a floor at 30 meters depth. A full circumnavigation of the walls was completed, only to return to the starting point with no obvious continuation having been found. As it was clear that this was still the main flow, the only way on had to be vertically upwards, so an ascent was made to a depth of 16 meters along one wall of the vast chamber. At this point it was felt that a second diver, arriving here in a much shorter time, would be able to achieve more due to less decompression obligation, so a return to base was made. Dive time 4.5 hours.

March 9. The objective of Mallinson's dive was to progress to the limit of Stanton's line at –16 meters as quickly as possible to minimize the decompression required to surface at this point. Mallinson reached the end of the line after 45 minutes, and at this point the computer showed 45 minutes of decompression. Forays around the shaft during decompression stops every 3 meters tended to dislodge fine silt from above, so these were kept to a minimum, although a route upwards was found.

After completing the final stop at 3 meters, Mallinson surfaced into a large airbell with mud-covered slopes and vertical walls. Swimming around the edges of the airbell showed there was no easy exit from the water, and in fact finding somewhere to tie off the line was difficult. A narrow rift on the surface led through to another large airbell, but this was domed, with no possible above-water exit. Back in the first airbell, a hole in the roof could be seen leading into what looked like a further fossil chamber with two large stalactites hanging from the roof. Unfortunately no safe exit from the water was possible without backup from another diver. Losing a mask, fin, or cylinder into the 30-meter-deep pool would be disastrous.

Forty-five minutes after surfacing, Mallinson descended to the base of the shaft and headed back to the elbow at –65 meters, looking for alternate routes. This was continued back along the deep tunnel, but nothing obvious was found. Visibility at this time was not good for route-finding, so things could have been missed.

Mallinson eventually decided to head for home, and after 1 hour 40 minutes of decompression, the last dive out through Sump 1 could be started. The total dive time for this penetration was 5 hours. The copious amounts of mud and silt in the shaft above –16 meters at the end leads Mallinson to assume that this is off the main route and a continuing passage has been missed somewhere.

—*Jason Mallinson and Rick Stanton*

From this new base, we were guided to three new caves. Osto de Cerro Voludo #1 contained a spectacular freefall 100-meter entrance shaft. It ultimately reached a total depth of 106 meters and a length of 212 meters before being plugged with dirt fill.

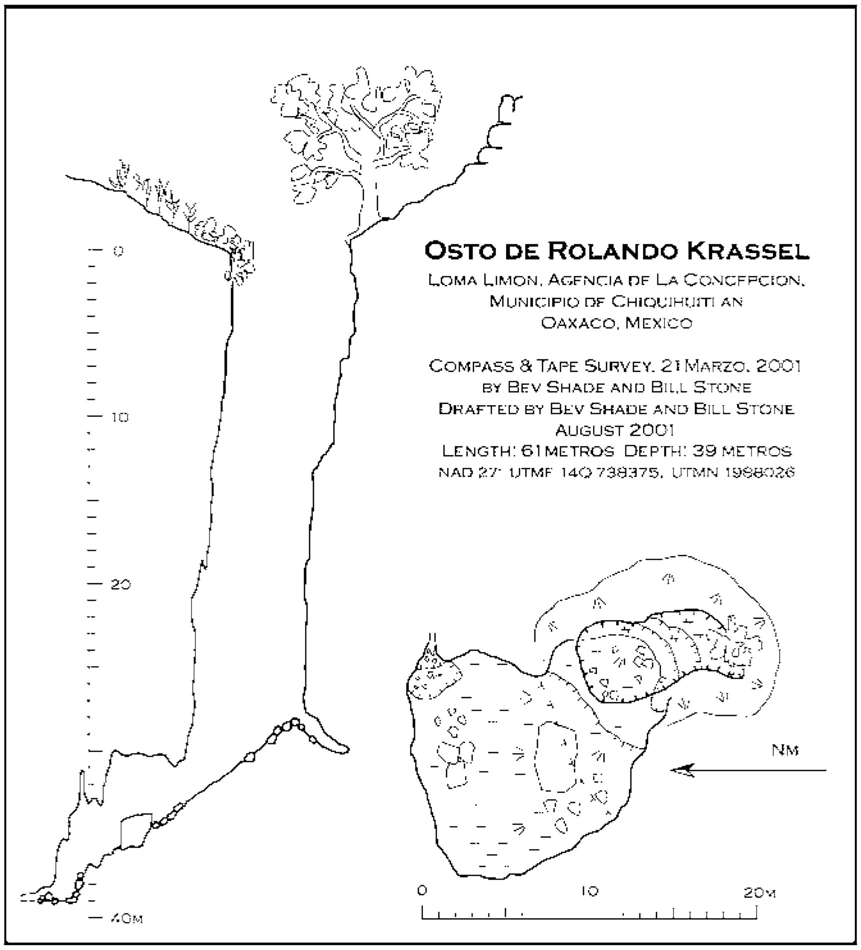
Several kilometers farther north, in the depths of the Barranca Estrella, Star Canyon, we were guided to Cueva de la Barranca Estrella, a fossil river sink, now dry, which we explored to a depth of 73 meters and length of 511 meters. Almost the entire cave is composed of large passages, indicating that it was once the path of a significant river, but in many places this large passage contains a lot of dry surface dirt and debris, which shows that it has been inactive for a long time. In several places this fill makes the cave unpleasantly small. The end of the cave is plugged by debris and has poor airflow. After several days of exploration, we noticed a decline in air quality just from our presence. Local hunters have filled the entrance with logs to keep their quarry from escaping into the cave.

During our retreat from this gorge we resolved a long-standing question about Sistema Cheve. The resurgence spring that boils up below the entrance to Cueva del Mano flows an enormous amount of cold, clear water, as mentioned previously. Only two cave systems, Sistema Cheve and Cueva Charco, are currently known to contribute to this flow of internal drainage from the Sierra Juárez. Both of these caves have been dye-traced to the Cheve resurgence. But the flows observed at the deepest points of exploration in these two caves do not account for even a quarter of the flow seen at the resurgence. Somewhere, something significant makes up the missing flow. While undertaking our long-range hikes to Cerro Voludo, we daily crossed a substantial river issuing from the head of Durazno Canyon into Star Canyon. Local Cuicatec residents in this area told us that the majority of the flow originates from large springs a short distance up the canyon. At the time, we thought nothing of this. However, as we approached Cueva de la Barranca Estrella it was apparent that the substantial river had disappeared, because the arroyo we were in was completely dry. After three days of exploration at Barranca Estrella, we decided to bushwhack back up the gorge to find out why. On the way, we discovered an amazing karst feature. The river flowing from Durazno canyon plummets over a 5-meter waterfall into a boiling plunge pool and sinks immediately. The upstream side of the waterfall is luxuriant, verdant jungle; the downstream side is a bleached-white, dry arroyo with rounded cobbles. The entire river had disappeared over a distance of 3 or 4 meters. Shade and Brickey swam into the plunge-pool lake, but could only find narrow fissures where the river sank. Although there is no humanly passable entrance, it is clear that this river accounts for a significant portion of the flow that boils up at the Mano resurgence.

Country still making *aguardiente caña* from cane sugar. *Bill Stone.*

Our final piece of work in this area was the exploration of Sótano de Rolando Krassel, located at the bottom of a giant doline in the middle of a lush sugar-cane plantation. This is a blind pit of 48 meters depth and 61 meters length. There are no other significant karst features on the property, but Krassel's plantation does harbor a remarkable still. Rolando's father was a German engineer, and his handiwork was evident in the mostly stainless-steel construction of the continuous-feed still. It uses steam, temperature control, and pre-heaters to finely tune the output, which appears as a roughly 100-proof rum at the end of the Brobdingnagian contraption. It is probably the only *aguardiente* in the

Imar Playas on the Main Traverse 400 meters inside Cueva del Mano. *Bill Stone.*



sierra that is safe to drink. He also grows very good coffee.

At the end of March, the expedition packed up houses that had been rented since January in the village of San Agustín Zaragoza, loaded equipment, and began the two-day drive north to the coastal lowlands town of Ciudad Victoria in the state of Tamaulipas. The only remaining team members by now were Shade, Soriano, and Stone. Along the way we had the unusual opportunity to see guerilla-leader Subcomandante Marcos's convoy returning from Mexico City to Chiapas following his historic meeting with *Presidente* Vicente Fox.

On Sunday, April 1, we met new team members for Phase 3 in a tree-lined park in downtown Ciudad Victoria, Tamaulipas. Cave divers Robbie Warke and Pete Mulholland flew in from England. James Brown drove in from Oregon with Bart Hogan. Mark Minton drove from New Mexico, and Yvonne Droms and Joe Meppelink arrived from Texas, bringing the team to ten. From Victoria our caravan of five four-wheel-drive vehicles proceeded four hours up into the Sierra Madre Oriental range to the west before setting camp at the edge of the Infiernillo Canyon.

Our objective was to revisit the Infiernillo Sumps, last investigated in 1993 and left with two going underwater leads. These sumps are the lowest part of Sistema Purificación, 953 meters deep and 93.8 kilometers long. The cave has seven mapped entrances, of which Infiernillo is the lowest and closest to the sumps. Our hope was to dive through one of these sumps and surface to the west in a borehole that would continue the cave's descent toward springs located near the coastal lowlands. The Infiernillo cliff entrance is a fossil passage. Local residents claim that after extremely heavy, persistent rains, water can back up from the sumps and actually flow out the entrance, which is roughly 50 meters higher than the sump levels while we were there. Even if a given year's high water level does not reach the entrance, there is still a huge difference between the high and low water levels. For this reason, we planned to visit the cave at the driest time of the year.

The entire team spent one day moving all the diving and camp gear up the arroyo to the cave entrance, where the loads were moved efficiently up the 40-meter entrance drop on a 100-meter-long tyrolean line. The next day most of the group continued to move gear farther into the cave, where an underground camp was set just 100 meters from the sumps. The dive team was well equipped, with two MK5 rebreathers, nine large-capacity carbon-fiber tanks charged with heliox 86/14, HID underwater lights, and a kilometer of dive line. Learning from the 1993 visit, when divers used wetsuits and found the water bitingly cold, we used argon-inflated drysuits and wore heavy pile undergarments. The dive team was made up of Mulholland, Warke, Brown, and Stone.

While all this staging was going on, Minton and Shade hiked up the steep arroyo directly west of the entrance. They gained about 250 meters of elevation from the canyon floor, and went a short distance both north and south at this elevation, but got stopped by cliffs. They found one shallow shelter cave and some cascades of tufa or old flowstone on cliff faces above us. At the end of the day, the non-divers met back at the vehicles and drove higher up the mountain, past the small town of Revilla.

About fifteen years ago, William Russell and Mark Minton discovered a shaft on the ridge south of Revilla, almost 1500 meters above the Infiernillo entrance. They named it Sótano del Caracol, Snail Pit. During ten years of intermittent work Caracol was pushed to a depth of 232 meters, just 323 meters distant from the entrance.

The Infiernillo Sumps have the potential to add a significant amount of depth to Sistema Purificación at the lower end of the system. Caracol has the potential to add another 400 meters of vertical extent to the top of the big cave system. Our hope in the spring of 2001 was to get through the tight stuff in Caracol and deep enough that sufficient infeeder passages had joined to form large corridors that would lead north, and down, toward Sistema Purificación. Caracol is at the top of a big anticline that plunges to the north, so this situation is geologically feasible. For this reason, many groups have worked on the same ridge for more than twenty years. There is no shortage of pits and caves on this ridge, but they are usually short and clogged with surface debris. Caracol is very unusual in this area for going more than 50 meters deep and also for its consistently strong airflow. Although there were no known going leads, Mark was interested in several possible climbing leads.

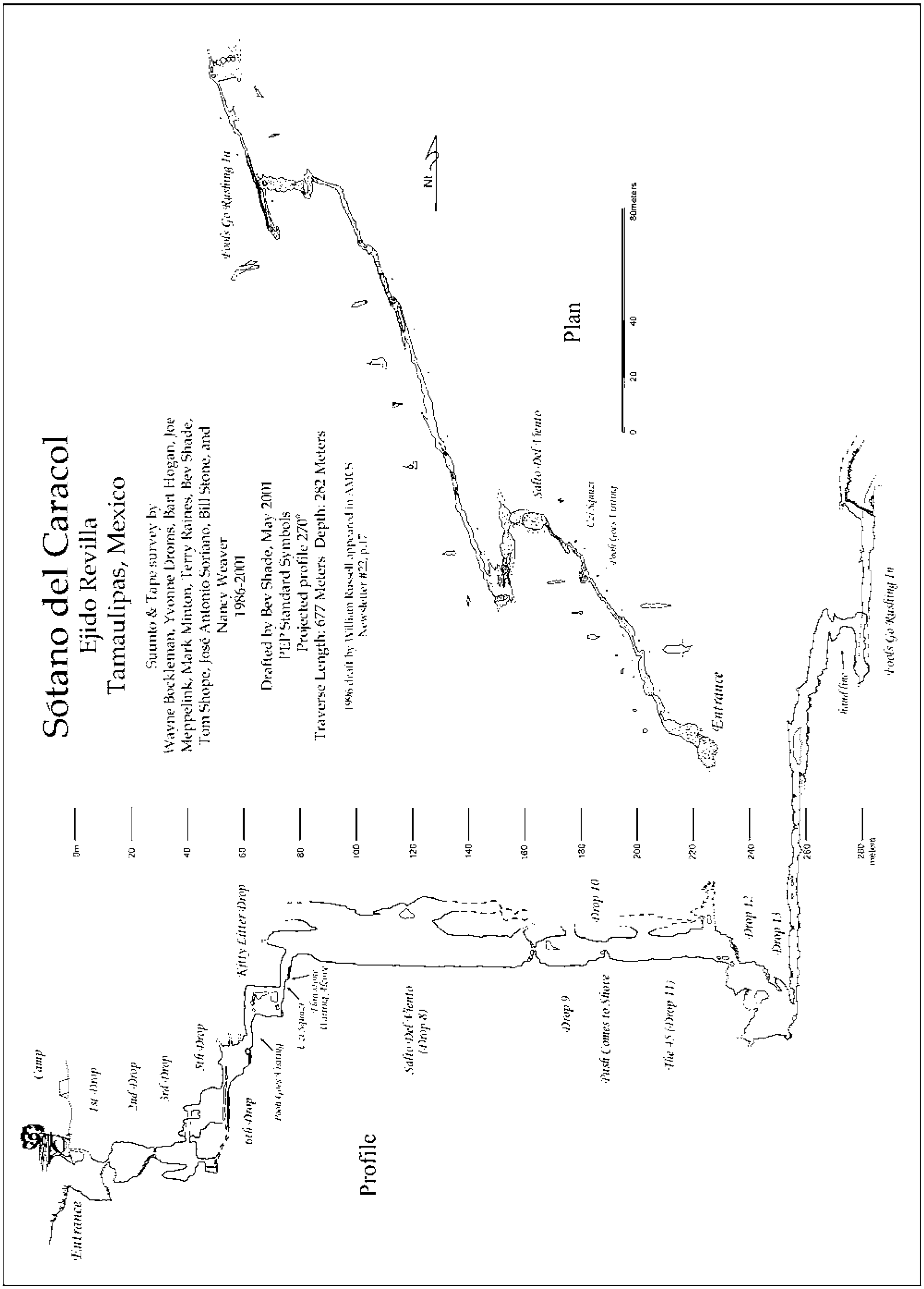
During the first week at Caracol, those not in the dive camp at Infiernillo started work near the previous end of exploration, at the bottom of the last long drop, The 45. They split into two groups, one, consisting of Minton, Droms, and Meppelink, to push climbing leads and the other, of Hogan, Shade, and Soriano, to survey the two short drops below The 45, which had been explored briefly by Minton in November 1998. At that time the cave had been wetter and the drops had appeared to end at a blind dome. The first climbing lead ended quickly. By that time, the survey team had found a very low passage at the base of the known cave. It had surely been below water on the previous trip. The passage was too small to get through, but it had very strong airflow. The airflow encouraged the survey team to give up the survey temporarily in favor of this exciting dig. The same group returned the next day to continue the dig. Droms and Minton took over the dig effort on the following day, and got through into a phreatic tube of stoop-walking size, which they followed about 80 meters to a short drop. On the next day, Hogan, Shade, and Soriano surveyed the new section of cave to 270 meters depth, where the passage suddenly took a sharp turn down dip and dead-ended against a rock wall. A short climb by Soriano revealed that there was a very narrow crevice on the other side of this wall. The bottom of the crevice was marginally passable for a few meters, before it could be seen to make a sharp switchback to the southeast for about 15 meters and then return to a northwest heading. The passage was very small, and they were not sure if it was passable.

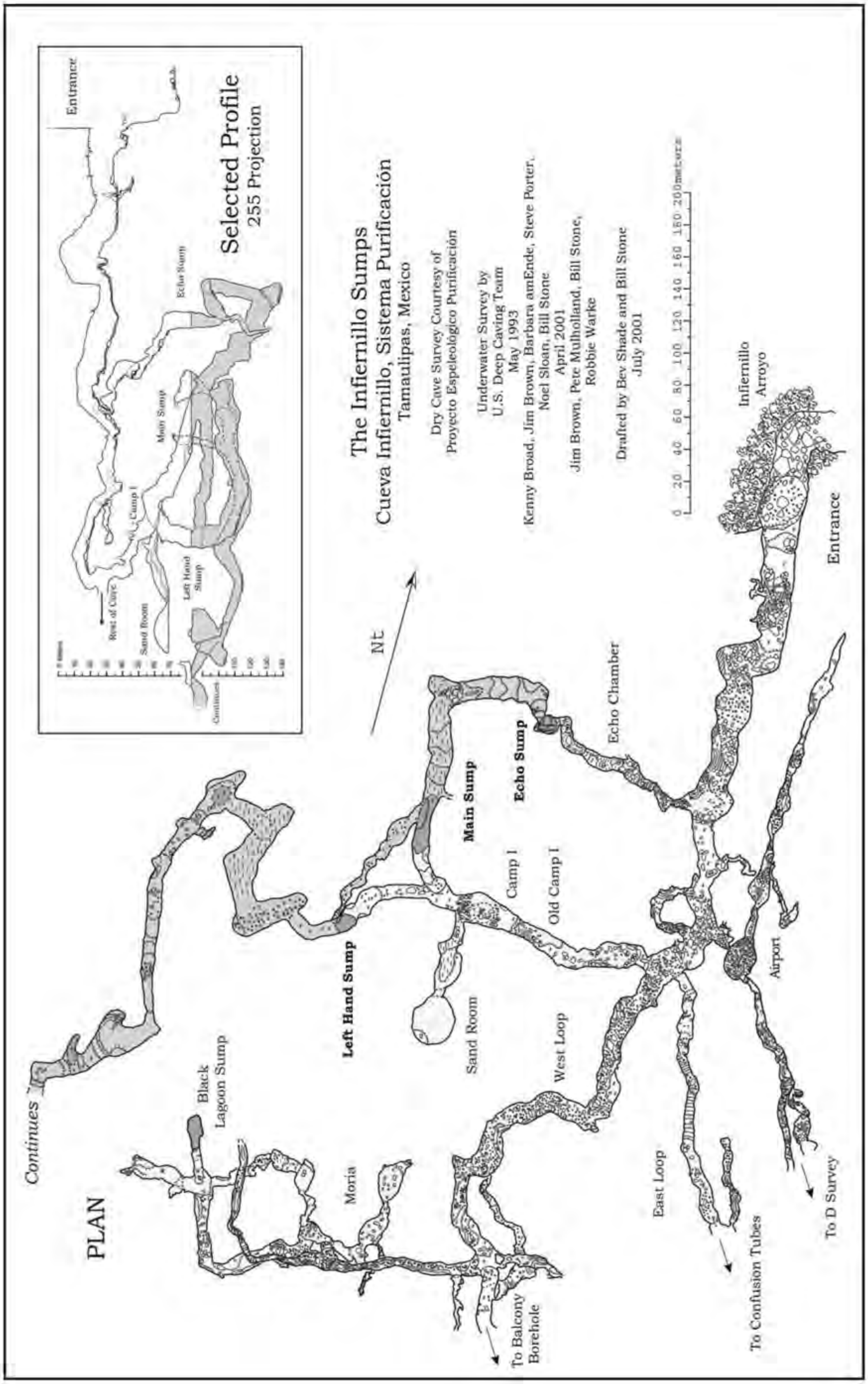
By this time, the diving recon team from Infiernillo had traveled up the mountain to the Proyecto Espeleológico Purificación field house in Conrado Castillo, after a five-day camp. The Left Hand Sump had been extended westward by Brown, and the Main Sump had been connected by Stone and Mulholland to the Echo Sump, another underwater tunnel located some 300 meters closer to the entrance at the bottom of a 10-meter vertical shaft. Many leads remained, but the plan called for a team meeting at Conrado Castillo after the first week's work to see which area merited further attention. Since most of the non-divers were going to leave in another week, the entire team moved up to the Caracol camp.

During the next week at Caracol, two climbing leads were investigated, one in The 45 and the other in the Salto del Viento, the big, 90-meter freefall shaft that is the centerpiece of Caracol. Neither inspired great hope, although they did not definitively end. The lead at the bottom of the cave had been so discouraging that everyone was looking for better options. When those options had been exhausted, Droms, Hogan, Shade, Stone, and Warke returned to the bottom of the cave to see if the airflow that had been felt at the dig could be found lower in the cave. Droms and Warke elected to improve rigging in higher parts of the cave, while Hogan, Shade, and Stone pushed through the nasty tight crawlway at the end of the cave, Fools Go Rushing In. On the other side of the Fools crawl was a breakdown-floored chamber about 12 meters in diameter. There are several leads with airflow out of this room, which is at a depth of 282 meters. The cave now has a surveyed length of 677 meters.

When Minton, Droms, Hogan, and Meppelink returned to the States in mid-April, the remaining six cavers launched a second underground camp in Infiernillo. Over the course of the five-day camp, efforts focused on pushing the Main Sump lead from the Echo Sump shaft. In 1993, divers Noel Sloan, Steve Porter, and Bill Stone had reached a penetration in the Main Sump of 155 meters. In April 2001 the line was extended to 306 meters penetration during the first diving camp. When Mulholland surfaced in Echo Sump and looked up the

Camp in Infiernillo for the second dive push at Echo Sump. Pete Mulholland, Robbie Warke, Bev Shade, Jim Brown, and Jose Antonio Soriano. *Bill Stone.*


Sótano del Caracol
Ejido Revilla
Tamaulipas, Mexico
Suunto & Tape survey by:
Wayne Bockleman, Yvonne Droms, Bart Hogan, Joe Meppelink, Mark Minton, Terry Raines, Bev Shade, Tom Shope, José Antonio Soriano, Bill Stone, and Nancy Weaver
1986-2001
Drafted by Bev Shade, May 2001
PEP Standard Symbols
Projected profile 270°
Traverse Length: 677 Meters Depth: 282 Meters
1986 draft by William Russell appeared in AMCS Newsletter #22, p.17
Plan
Profile
Entrance
Camp
1st Drop
2nd Drop
3rd Drop
5th Drop
6th Drop
Kitty Litter Drop
Cat Squeeze
Salto Del Viento
Salto Del Viento (Drop 8)
Drop 9
Drop 10
Drop 12
Drop 13
Push Comes to Shove
The 45 (Drop 11)
Fools Go Rushing In
hand line
0
20
40
80meters
0m
20
40
60
80
100
120
140
160
180
200
220
240
260
280 meters


The Infiernillo Sumps
Cueva Infiernillo, Sistema Purificación
Tamaulipas, Mexico
Dry Cave Survey Courtesy of
Proyecto Espeleológico Purificación
Underwater Survey by
U.S. Deep Caving Team
May 1993
Kenny Broad, Jim Brown, Barbara amEnde, Steve Porter,
Noel Sloan, Bill Stone
April 2001
Jim Brown, Pete Mulholland, Bill Stone,
Robbie Warke
Drafted by Bev Shade and Bill Stone
July 2001
0 20 40 60 80 100 120 140 160 180 200 meters
Selected Profile
255 Projection
Entrance
Echo Sump
Main Sump
Camp I
Left Hand Sump
Sand Room
Rest of Cave
Continues
NE
PLAN
Continues
Black Lagoon Sump
Moria
To Balcony Borehole
Left Hand Sump
Sand Room
West Loop
East Loop
To Confusion Tubes
To D Survey
Main Sump
Echo Sump
Camp I
Old Camp I
Airport
Echo Chamber
Entrance
Infiernillo Arroyo

Mulholland and Brown gear up for a dive in the Left Hand Sump in Infiernillo. *Bill Stone.*

sheer-sided shaft rising more than 10 meters above him, he thought he had arrived in virgin territory. A look at the survey data, however, convinced us that a connection had been achieved. Sure enough, when we hiked down that tunnel and rigged the shaft, there was Pete's dive line, pristinely white, tied off to the wall. But that gave us an idea. If we had some sort of diving platform down at the water level, we could cut off 300 meters of underwater tunnel and proceed directly into unknown territory. Everyone quickly bought into the idea, and a platform was designed at the PEP field house in Conrado Castillo. During the second week at Caracol, workers at the nearby sawmill in Revilla cut fresh pine to our specifications, and the platform was fitted together, then disassembled for transport to the cave.

Subsequent dives in Echo Sump by Mulholland and Stone led downward to a depth of 50 meters underwater. Exploration stopped at a restriction 1 meter tall and 2 meters wide. Normally this would not have presented much of a problem, but a deep layer of silt reduced the visibility to zero as Mulholland searched for a line tie-off. A second attempt by Stone the following day failed because the visibility remained zero from the previous day's efforts, which suggested there was little or no flow. The underwater survey data showed the passage doubling back under the previously surveyed dry passage toward the main cave. Together with the small size, poor visibility, and lack of flow, the fact that the tunnel headed east instead of west led to the conclusion that this was not the main drainage route.

The following day Mulholland made a through-trip from Echo Sump to the Main Sump, largely for the purpose of transporting the diving apparatus back to the Main Sump in preparation for further dives in the Left Hand Sump. Along the way, following discussions with Stone, he rechecked the deepest point in Sump 1, in an area where the passage makes an abrupt bend, but found no continuing tunnel. This bend, at 57 meters water depth, remains the deepest point in Sistema Purificación.

In 1993 the Left Hand Sump had been surveyed to a penetration of 195 meters by Jim Brown. During the first diving camp in 2001, Brown extended that to a penetration of 486 meters. Brown subsequently made a diving through-trip from the Left Hand Sump to the Main Sump via a tunnel discovered by Kenny Broad in 1993 but never fully explored. This opened access to the Left Hand Sump from the much easier sandy beach entry of the Main Sump, as opposed to the 10-meter rappel into the Left Hand Sump. During the second diving camp, Jim Brown and Pete Mulholland found several air bells along this route, but found no dry tunnels leading out of them. The Left Hand Sump is consistently large, approximately 10 to 12 meters wide and 8 meters tall, with very good visibility. It is currently heading west-southwest in the general direction of Moria and the Isopod River, two large upstream passages that have been known for over two decades. We speculate that the Left Hand Sump may intersect the water from Moria and the Isopod River before continuing north.

The Infiernillo Sumps appear to be a backwater to a hypothetical main flow. Altogether 591 meters of new underwater passage were discovered in April 2001, bringing the total underwater length of the Infiernillo sump complex to 969 meters and the cave to 94.8 kilometers.

With the final dive by Mulholland and Brown in the Left Hand Sump, the Inner-Space Odyssey expedition came to a close. We managed to map 3.7 kilometers of virgin territory in caves considered long finished. Nearly all of it was due to the diving and climbing technologies that were

Sorting gear back in Texas at the end of April. *Bill Stone.*

used by the team. It is of some note that team members scaled nearly 500 meters of vertical shafts with a perfect safety record. Likewise, the cracking of the Huautla Resurgence at 1059 meters from the spring rising is an important milestone that may open a back door to Sistema Huautla. A return trip to Caracol is planned for March-April of 2002.

Team Members during Phase 1, in Oaxaca, were Page Ashwell (U.S.), Kasia Biernaka (Poland), Mark Crapelle (Canada), Marcin Gala (Poland), Jason Mallinson (U.K.), Bev Shade (U.S.), José Antonio Soriano (Mexico), Bill Stone (U.S.), Gustavo Vela Turcott (Mexico), and Andy Zellner (U.S.).

Team Members during Phase 2, also in Oaxaca, were Kasia Biernaka (Poland), Charles Brickey (U.S.), Mark Crapelle (Canada), Marcin Gala (Poland), Greg Horne (Canada), Jason Mallinson (U.K.), Bev Shade (U.S.), Jose Antonio Soriano (Mexico), Rick Stanton (U.K.), and Bill Stone (U.S.).

Team Members during Phase 3 were James Brown (U.S.), Yvonne Droms (U.S.), Bart Hogan (U.S.), Joe Meppelink (U.S.), Mark Minton (U.S.), Pete Mulholland (U.K.), Bev Shade (U.S.), Jose Antonio Soriano (Mexico), Bill Stone (U.S.), and Robbie Warke (U.K.).

The U.S. Deep Caving Team gratefully acknowledges the support of the following sponsors: Proyecto Espeleológico Purificación, Sopakco, Structural Composites Industries, Hitachi, Diversified Fastening Systems USA, Air Products and Chemicals, Pigeon Mountain Industries, Underwater Kinetics, Dogwood City Grotto, NSS Cave Diving Section, Oregon Freeze Dry, Dive Rite, Liberty Mountain Sports, Cis-Lunar Development Labs, Sue Shade, and A. James King, Jr.

Expedición Odisea del Espacio Interior

En invierno y primavera del 2001, el U.S. Deep Caving Team pasó tres meses en México. El primer mes estuvieron basados en San Agustín Zaragoza, cerca de Huautla, Oaxaca, en búsqueda del río que desaparece en el fondo del Sótano del Río Iglesia. Además de revisar Iglesia, en donde se hicieron varias escaladas de domos con buriles, se escalaron 140 metros por encima del campamento en Cueva de San Agustín, pero no se hicieron descubrimientos importantes. El segundo mes lo pasaron en el cañón del río Santo Domingo, en las resurgencias de los sistemas Cheve y Huautla. En la primera, los espeleobuzos exploraron las porciones sumergidas, mientras los demás escalaron algunos domos. Mediante el empleo de respiradores de circuito cerrado, la resurgencia de Huautla fue buceada por una distancia de 1059 metros a una profundidad máxima de 65 metros. Los buzos salieron a la base de un domo, y pudieron observar una gran continuación en la parte alta, pero les fue imposible salir del agua. Debido a la descompresión, el viaje redondo hasta este punto requiere cinco y media horas de buceo. El tercer mes fue dedicado a bucear los sifones en la porción de Infiernillo del Sistema Purificación, en Tamaulipas, y a continuar la exploración del Sótano de Caracol, cerca de Revilla, en la parte alta de las montañas.

CAVING IN SISTEMA CHEVE, OAXACA

R. D. Milhollin

Sistema Cheve is the deepest cave in North America. It is located at the low end of a huge sink in the mountains of the Mexican state of Oaxaca. This cave has been explored for many years, most recently in the spring of 2003. The expedition was organized by veteran caver Bill Stone, perhaps best known for his efforts in the Mexican cave Sistema Huautla and his projects at Florida's Wakulla Springs. I had met Bill on a caving trip to the Purificación project region of Mexico and was asked to participate at Cheve.

My traveling companions for the long drive down were Melanie Alspaugh and Philippe Sénécal, who journeyed from France to attend, and Paula Grgich, who had just earned her masters degree in geology. Paula flew into Dallas from Pittsburgh, and we picked up Melanie and Philippe in San Antonio. The drive down was a little cramped, but we managed well. A couple of adventures along the way included finding a Mexican hardware store in downtown Monterrey that carries nut-grade carbide and traffic hassles when we unwisely entered the federal district that surrounds Mexico City. In the first case I drove right through the traffic to the store, following my memories of Monterrey from when I was last there at age twelve. That place has changed! After staying overnight in Ciudad Victoria and a fine light breakfast in the city market, we proceeded south past the Aquismón region and into the mountains of the Sierra Madre beyond Tamazunchale. Bill had advised taking the coastal route all the way to Veracruz and then turning inland through Tehuacán to Oaxaca, but we decided the route through the capital looked faster and would be more scenic and interesting. We assumed the traffic would be horrible, and we were willing to just look out the windows at the sights of the great city. But we were completely unaware of the restriction on automobiles entering into the defined urban limits. Each day only vehicles with certain ending digits on their license plates may enter. On the day we were there, my plates did not meet the mark. The traffic police wanted to issue a ticket and told us to follow them to the station, but persistent and tactful refusal by Melanie resulted in our freedom after about thirty minutes of negotiation involving at times four officers. As we skirted the city, we enjoyed spectacular views of the great volcanoes of the Valley of Mexico, Popocatepetl, which was erupting steam as we passed by, and Itzaccihuatl. A few navigation snafus ensued, but nothing that could not be corrected by backtracking for a few minutes. We did get stopped outside of Puebla by the army checking for explosives. The back of the truck was packed tight with all manner of equipment, and there was some tenseness when the friendly troops uncovered several small canisters of Coleman propane fuel. We were able to assure them the gas was essentially harmless and could not be reasonably used for terrorist purposes. They never asked to see inside the ten-gallon metal can filled with calcium carbide.

We had pretty good directions to Llano Cheve and had been forewarned that the road up into the mountains was narrow and very exposed. We did not arrive at Cuicatlan, the town at the base of the range, until about midnight, so we elected to sleep there before proceeding. Cuicatlan is a nice town with a fine market, so we stocked up on things we thought we might need or want while we were at camp for two weeks. The road on up lived up to its reputation, and we carefully made our way to the top, where the village of Concepción Pápalo balances precariously, and followed the graded road on to where the track to Cheve turns off. It took a few minutes to realize that the large valley we were descending into was in fact a huge doline. After about fifteen minutes of driving in it, we found where the trucks of the other cavers were parked. From there, it is about fifteen minutes of hiking downhill to where the base camp for the expedition was located. The "field house" was a series of tarps suspended by polypropylene ropes, with the back wall being the rock wall of the

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Adapted from a series of articles that appeared in the *Maverick Bull*, publication of the Maverick Grotto, volume 15, numbers 9–12, 2003. The reader may want to follow along on the map of Sistema Cheve that appears on page 51 of *AMCS Activities Newsletter* 23.

doline itself. The shelter was complete with other walls and a series of work tables. A generator nearby supplied AC power for the light bulbs and charging power-tool battery packs. Drinking water was collected in five-gallon containers from the stream flowing over a waterfall 10 meters away. Colloidal silver drops assured water cleanliness. Large propane canisters supplied two Coleman-style cook stoves, and cookware and food stashes consumed the rest of the large space. Groups of tents were situated along both sides of the *llano*. When we arrived, there were around twenty tents belonging to cavers from several European countries and all over the U.S. A rebelay course on a fifty-foot-high rock wall had been set up at one end of the *llano*. We were supposed to be able to pass a knot and three rebelays up and down in a set amount of time before venturing into the cave. The course looked pretty easy, but was more difficult than I thought when it came time to try it. We spent a couple of days acclimating to the elevation by hiking around and working on the rebelay course, and then we decided we were ready as a team to venture in.

Two days before, a large team had departed into the mouth of Cheve, planning to stay underground for seven to ten days. The cave had been rigged a month or so before by a different team, as few participants save Bill could stay the entire duration of the project. During the initial phases, a parallel effort was being made at the neighboring cave of Charco, and another cave up the side of the *llano* from Cheve was rigged and explored for several days as well. We were late arriving, and would leave before the expedition began to pull up the mile of rope rigged below us.

As we began to make day trips into the cave, the first trip I made was solo, and I slowly made my way down four short rope drops of about 6 to 10 meters each. The cave follows a small stream in the initial section. The ropes were rigged for each of the first drops in a very straightforward fashion, with only one rebelay at most. The second trip I took was with a small group, and we passed where I had turned back before and crossed a two-rope tyrolian affair. I personally didn't think the two ropes, one rigged taut and the other tied back at an angle and rigged more loosely, were necessary there, but it proved to be good practice for what would come later, when such a configuration was the only way to cross canyons. To cross, the long cow's tail is clipped onto the taut rope, while descender and ascender are used to first lower oneself to the bottom of the rope arc and then to climb back up to the opposite side.

The stream we had been following disappears into the wall, and from this point we crossed through a narrow vertical slot, aided by a handline, and entered what was prosaically referred to as the Birthday Passage. This is a huge room, probably 50 meters across and 75 meters high, that slants downward at a steep angle to, at this time for us, parts unknown.

My next venture, with the same group, took us downward through the Birthday Passage, past several more rope drops, to where the huge breakdown floor gives way to smooth bedrock and a stream emerges to flow along the passage once more. A couple more short drops led us down to the first major pitch of this cave, Elephant Shaft. From where the rope was rigged it dropped off into darkness, but there were three rebelays located along the 50-meter drop. A short distance from the bottom, a large stream roars down a series of pitches known as Angel's Falls. On the next trip we passed through this area, which is inherently wet and has three drops and a climb-up. The last pitch had a tricky redirect and a rebelay right next to the rushing water. It is a very good idea to be sure to make that maneuver quickly and correctly. At the bottom of Angel's Falls, a narrow, wet passage opens up into a large, boulder-floored room that leads immediately downward to the Camel's Hump, where the last vertical work for awhile, a simple downclimb, is encountered. The cave changes personality here. The way on is over and through house-sized boulders that slope upward for as far as we could see. The gurgling stream filters away through the breakdown, and the ceiling looms massive, 30 meters above. Off to one side of the cave passage is a small sandy beach that had been designated Camp 1 by early expeditions into Cheve and had been used for that purpose early in the 2003 effort. This first camp had since been abandoned, and most of the equipment from that camp had been taken down to Camp 2. From the crest of the mountain of breakdown, the floor begins to plunge downward, and one has to carefully pick one's way through the jumble to avoid setting rocks crashing down the steep slope. This area is called the Giant's Staircase, and it took us about an hour to descend the first time. We knew that on a real trip, carrying heavy gear packs, this would be one of the most exhausting areas of the cave on the way back to the surface. At the bottom of the stairs, the ceiling plunges down and nearly meets the floor. Here we carefully picked our way along the now steeper gradient, holding onto whatever handholds we could, because we knew that somewhere ahead lay the principal vertical obstacle in this extremely deep cave, a drop known playfully as Sacnussem's Well. Just for fun, and to be sure we knew what we were getting into, a couple of our team made the drop to the bottom of the 130-meter pit, passing thirteen rebelays along the way. The top of the pit was dry but cool, but the bottom was like a hurricane, with high winds whipping atomized water from a falls of the stream, which reappears from the cave wall about halfway down the drop. Our total time to the bottom of the well and back to the surface was around nine hours.

We returned to the camp and took a day off from caving, exploring the sinkhole-pocked *llanos* in the hills high above the Cheve entrance. The in-cave teams began to wander back to the surface during this interval. The Dutch team came out, followed by some of the Poles. As Pauline Berendse and Jan Matthesius walked through camp, their comrades prepared cool bottles of Dutch beer to celebrate their return. Jan responded by ceremonially removing his caving harness and solemnly placing it in the raging campfire. When asked what this meant, Jan, an experienced caver with lots of time in Mexican caves, replied that he was retiring, that "once you have caved Cheve, there is nothing else." The following morning he retrieved the metal buckles from the ashes of the fire. Early the next morning Bill and the British cave divers came marching out of the cave. They had made the trip in a single effort, bypassing all three camps along the way. The divers carried with them their homemade rebreathers. These "closed-circuit" scuba kits allow divers to use very small gas cylinders. Bill had designed computerized, multiple gas-mix, triple redundant, high-tech Cis-Lunar rebreathers many years before for the Huautla and Wakulla projects. But these divers had their own simple, small, but completely non-redundant units they had built themselves and were comfortable using. This was their decision, and Bill helped them carry their gear down past Camp 3 to the sump, where they would have to depend on them. At least one Cis-Lunar Mark V sat unused in the back seat of Bill's truck the duration of the expedition.

The next day reality struck, and bit. We had of course arrived just a little too late to be part of the main push that had just ended. The main exploration crew was not planning on going back down for several days. Life on the surface is very pleasant, more appreciated than usual after eight or nine days underground. Little things like sunlight on your back, a regulated and obvious difference between day and night, and stars at night make one just a little reluctant to go back down for a while. The next serious push would not be over until past the time that a couple of us needed to be heading back to responsibilities in Texas. I had taken off two weeks work to participate, and Paula was scheduled to interview with the dean of the geology department at UT Austin for admission into the PhD program in geology. We needed to make a move, and knowing that we had only a short window of time to make a long cave trip before we had to be back on the surface to prepare for the trip back to Texas, we began to feel around for a project we could do as a small group, Philippe, Melanie, Lewis Carroll from Washington D.C., and me. Bill Stone agreed that we could proceed down to Camp 3 and pick up dive cylinders left over from the 1995 expedition and some climbing rope and other gear at that deepest camp that would no longer be needed during the remainder of the expedition. Unfortunately, since we were all new to the cave, there would be no opportunity for original exploration or survey.

We took all morning to pack. I took a close look, then a second look, at everything I put in the cave pack. How much did it weigh, was there an absolute need for that item, could another item do double duty so only one was needed, could a lighter one be substituted, how many meals would be eaten, how much for each meal, what would we need to be completely filled, without being wasteful or gluttonous? All these questions flashed by over and over again as we packed and repacked in the morning shade. Each camp had treated water and a stove with limited fuel. We needed a light pot to boil water, and each team member needed a bowl and a spoon and a cup. We packed soup and dehydrated meals, a variety so we could trade around and not get too bored with the same thing over and over. Bill showed how he put his dehydrated food through a Salad Shooter food processor to further reduce the needed number of half-gallon Nalgene wide-mouth containers we used to transport food. Nalgene was one of the expedition sponsors, and a small mountain of used containers had been sitting around the cooking tent since the last team had dumped out their packs. A few of the experienced members pulled me aside and advised not crunching the food, since what little texture there was in the food would be destroyed, and hence one of the few small enjoyments of camp. Bill advised that each team member choose one small luxury to take along. I chose Earl Grey tea bags, because they were light and would be easy to carry, and if I left them in the food stash the Brits might use them all before I returned to the surface. By around noon all of us were beginning to look as though we were ready to make the trek down into what Bill already realized was going to be the deepest cave in the hemisphere once the numbers from the first push were entered in the survey database. One of the last decisions was what to wear into the cave. The pre-expedition notes indicated a need for expedition-weight polypropylene and PVC-coated caving suits, especially because we would be passing through or very near high waterfalls on the way to Camp 1. But we had seen Bill and a few others venturing downward in reinforced shorts over medium-weight underwear. I opted for a compromise: medium weight with the oversuit. For the first several hours of steep downward climbing things were hot, but I did not regret the cumbersome PVC suit later that night.

We made our way down through the Birthday Passage and the Elephant Shaft, familiar from my warm-up trips. Three hours had passed when we began negotiating through the Angel's Falls series, not a major thing, but tricky and a little time-consuming unless you had done it a lot. Then Camp 1 and an hour and a half down the Giant's Staircase to the top of Sacnussem's Well, where it took a couple of hours for all cavers and all gear to descend, even though we could all be on the rope at the same time. At the bottom, the cave turns wet, and it stayed wet for hours. Here is where the PVC suits were most appreciated. We waded down a short way until the passage narrowed to a point where the route goes up into an aven. There was a small supply depot here, and one of the lightweight fiber-wrapped scuba tanks we would be transporting to the surface was here. Onward, we rappelled down into the racing river, and we were in and out of that stream for several hours. At the approach to the Salmon Ladders, the cave walls are smooth and black, polished by running water. You could look up into the ceiling and see that seasonal floods would completely fill the large canyons we were traveling through. We passed the Turbines and continued to drop in elevation, though because we were so busy with rope-work, it was hard to tell how much depth we were actually gaining. The water roared so loudly that communication between team members was impossible, and it was here that I first felt the immense sense of loneliness or isolation that can come from deep cave exploration. On this portion of the trip you could not reasonably depend on anyone else; we were each on our own. At the Piston, we dropped down into more level passage, although upper passages, some of which are fossil stream passages, some active, abound. At the Sumplands, a critical junction, a trail was marked through a dry, upper-level passage known as the Wind Tunnel, which presumably saves lots of time in the water. We passed along precariously perched sand dunes far above the stream barely audible somewhere below, and at one point we entered a chamber that is highly decorated, for no apparent reason. Most of the passage we had been traversing for the past eight hours is active streamway with little depositional decoration. But in one area of the bypass we encountered soda straws yards long, lots of them, and the ceiling was brightly decorated with multi-colored flowstone. The beauty was serene, and we stopped to admire this curious and strangely beautiful display of nature.

Almost as soon as we began moving again, we were jarred back into the reality of the dangerous nature of deep cave exploration. To the right of the path and up a small slope is a fantastic collection of stalactites and intricate flowstone. We climbed up and looked into an empty grave. We were in the Avalon Connection Room, where another cave that descends from the surface intersects the Cheve System. In 1991, nineteen-year-old Chris Yeager died as the result of a fall at the next drop, the prosaically-named 23-Meter Drop. His body was brought up the drop ten days later and buried in the alcove we were looking into, where it remained for a year, until an international group of cavers removed it from the cave. The temporary headstone was still in place. It contained his name, dates of birth and death, and his expedition nickname, The Kid.

This grim discovery put somewhat of a damper on our fun, and we realized we were tired and hungry and needed to get to the shelter of Camp 2. There was some steep hiking left in the Connection Room, and then a tricky climb-down to the 23-Meter Drop. Everything was rigged, but we stopped to inspect all anchors we could find and get to. One by one we dropped the three pitches of the drop, and one by one we descended into the East Gorge. Suddenly we went from a quiet, dry, sandy floor to a slick, wet, screaming rock world. The walls of the canyon are marbleized by black and white stripes, a very distinctive look. Philippe was eager to get on, and Melanie was compelled to follow ahead quickly, while Lewis and I used a slower, more controlled pace. We trudged on through the knee-deep water, looking up for an obvious way to the camp we knew had to be in the vicinity. We were feeling exhausted, and after what seemed too long we found some indication that others had made what looked like a tricky crawl up some flowstone on the right. In our tired state it took some time to find the correct route, but after climbing up a rope out of the East Gorge, we passed through a small tunnel into an alcove about 20 feet high and 40 feet across, about eleven hours after we left the surface. Melanie and Philippe were already set up in a comfortable spot next to the supplies, and showed us where the stove, water, and latrine were located.

The twenty-four hours we spent at Camp 2 were somewhat weird. There is of course no way to tell time using any kind of natural reference; daylight is just an empty concept that deep underground. In the center of the camp there is an open area with a big flat rock that served well as a table of sorts. Along the corridor leading deeper into the cave is an area with little alcoves just the right size for personal spots consisting of a sleeping space and a little room to stack and organize gear. Slumberjack was an expedition sponsor, and their light-duty polyester sleeping bag stuffed right into a gallon wide-mouth Nalgene bottle, so they had been pretty easy for the initial crews to pack down to the camp. Large trash bags were in the camp to store the bags in so they would stay fluffed but reasonably dry in the damp atmosphere. The camp being thus equipped with bags, stove, and fuel, all we had to pack down was personal gear and a bag liner so the shared bags would stay clean. We all seemed overly concerned about conserving battery power and carbide fuel, so much of the time we just sat in darkness. Exceptions were when someone would fire up the stove to heat some water or when someone would leave a sleeping bag to trek to the latrine. I had no idea what time I woke up, but it was late in the day, and I had slept more than eleven hours. Others had been up, ate, and gone back to sleep, but some time in the late afternoon we all decided that we needed to set a schedule and keep to it. Melanie insisted rightly that in order to be at our optimum we needed to stick to a surface schedule, sleeping at "night" no more than eight hours and traveling during "daylight" hours. We compared notes and agreed that sitting still and doing nothing was having negative effects on us. I was hearing all kind of sounds of things that were not there and seeing flashes of light, and Melanie said that her over-active imagination was making skulls out of the dim shadows cast by a carbide lamp onto the ceiling. When moving through the cave we had no time to be so distracted. We stayed in camp the rest of the day and night, and by 8:00 AM the following morning we were up, had breakfast together, and were soon departing the camp for parts unknown to us.

At Camp 2 the East Gorge stream thunders on down below to a sump and disappears. Years ago, cavers had discovered the perched beach and upper-level cave passage that led onward. The way is dry and fairly level, for Cheve, that is. We were still climbing up and over rock piles, but no rope work was required for a couple of hours. We climbed up a precarious slope into the Low Rider Parkway, a wide passage with a flat, monolithic ceiling. After another couple of hours the ceiling was lowering and the floor was becoming more uneven, and finally we came to the edge of a precipice. This is the Widow-Maker Shaft, and it seemed fairly straightforward at the top, but the lower pitch is tricky. At the bottom the route intersects the resurged cave stream, crashing along with what seems renewed vigor. We could move along, but carefully, from boulder to foothold to scramble up. This quickly degenerates into one of the more entertaining passages in the cave, the Swim Gym. Contortion and balance are the name of the game here. It is possible to keep out of the water by carefully choosing handholds, but getting wet actually helps cool one off at times. Here communication is very difficult, even with nearby team members, due to the roar of the water churning through the convoluted streambed and the need to be constantly climbing up or down, over and through holes in the rock wall. Just as I was getting tired of this, things changed suddenly. A rope led straight up a flowstone wall and through a space between large boulders wedged in the 10-meter-high ceiling. The rigging was tricky, and concentration was needed to make the right move while soaking wet and carrying a bag half-filled with water. All around us a fine finish of tiny crystals on the wall shone in our headlights. A two-story formation blocks the canyon passage, and we had to climb over and around, carefully trying not to damage the huge stalagmite. On the other side we slowly climbed down into a large chamber that seemed to emit its own soft glow. Along the left wall are huge columns and tall stalagmites all lined up, running the length of the room and seeming to flow from a continuous crack high above. The floor is littered with broken stalactites fallen from the ceiling, and we noticed that most of the formations are cracked and broken, as if by the action of an earthquake. We were obviously in the Hall of the Restless Giants. This is more like New Mexico caving than anything else we had seen in the cave. The spray of the crashing waters is far below; occasionally we could hear a faint roar from holes in the floor somewhere down under the breakdown. There was a calm serenity here, and at the end of the passage we stopped on a high point to have lunch.

We all thought from what we had gathered by talking to other cavers that we were near the halfway point to Camp 3, but the hardest parts of the trip lay ahead. We chilled rapidly in the large room, for right behind us was a dark hole that was blowing cold air like an industrial air conditioner. Lunch over, we began to inspect the next descent. The drop was rigged from a precarious point high up a slippery flowstone slope. The rope dropped away to a redirect visible about 10 meters down. From there, it was hard to tell, but it looked as though the rest of the drop was uninterrupted for 20 meters to the bottom. We were right, the redirect was a little tricky, but the rest of the drop was straightforward. Toward the bottom the passage narrows down, and we descended into a maze of cemented breakdown and water-carved channels, now dry. After several hundred feet of stoop walking, short ropework, and squeezing through tight passages, we found the "keyhole" we had been briefed on. This is a body-sized tube that you have to climb up to, and it drops downward into darkness. The recommended technique is to drop through feet-first, feeling for footholds blindly while holding onto the rim of the hole and lowering one's weight slowly. It was a little unnerving, but took only a very short time. From there we entered a short but very confusing breakdown maze that forces the caver to dash under small waterfalls and slither through wet crawlways. At the top of a short climb up, we popped out into a huge, quiet void our lights could barely illuminate. We had reached the Black Borehole.

The echoes were eerie. The dark walls somehow absorbed our lights. The continuing passage appeared ghost-like off in the distance, and the proportions were unclear. The hall is about 20 to 30 meters wide and up to 50 meters high in places, I think. It was hard to judge distances in this vast chamber, because there are no reliable references. We felt like small insects climbing slowly along over huge pieces of the ceiling that had fallen in some long ago geologic age. Even though we were working hard, our travel pace seemed infuriatingly sluggish. At times we had to climb up ropes rigged somewhere high above us on a piece of the wall that appeared to be suspended in space. The image that kept appearing to me was something out of some old movie, possibly *Land of the Lost*, but no dinosaur ever stuck its head out of a hole just as we were slithering along one of the many precarious ledges along the route. The blackness of the cave walls and the breakdown composing the floor were overwhelming and probably added to the feeling of physical insignificance we felt as we negotiated our way through this massive room. After a couple hours of this, the breakdown seemed to be filling the chamber more fully, and in fact at one point the boulders piled up in front of us all the way to the ceiling, completely blocking the way onward. But the wind was apparent. You can hear the wind surging through this huge rock pile, and it seems to be more powerful on the left side, and of course this is the side most difficult to get to. It took about thirty minutes to climb down onto what appeared to be a floor, then over to the left wall where the wind was blowing out. Marks on the wall indicated we had chosen the correct path; this is the beginning of a passage that leads nearly straight up through the breakdown mountain. The route was pretty well marked, but we occasionally had to backtrack, because the body-sized squeezes limited seeing what your feet were doing at several points. Pulling the packs in Through the Looking Glass, as this section is called, was the hardest part. The body can bend and contort, and you can alternatively pull and push with arms and legs, but the bag is just dead weight and has to be powered through. Here a little teamwork went a long way.

At the top of Through the Looking Glass, the sensation was akin to popping out of a manhole cover onto a huge city street. Only in this instance the street is a cave passage even larger than the Black Borehole. The walls and ceiling here are light-colored and reflect light well, so there was a lot more to see. I didn't try, but it might be a ten-minute hike from one side of the passage to the other. This conduit is of Carlsbad dimensions, slopes steeply downward, and also continues back upward past where we had popped up into it. Just to be sure, we added another rock cairn at the inconspicuous hole we would need to spot on the way out, and we began to descend toward the faint sound of crashing water somewhere below us. This is the A. S. Borehole, named as a second tribute to Jules Verne's fictional explorer. Upslope is another large room descriptively but unimaginatively dubbed the Mud-Floored Borehole. The way we were heading was down, though, and we were all growing noticeably tired from the long, hard day. It was now around 6:00 or 7:00 PM, and fatigue and hunger were becoming factors we would need to deal with soon. The A. S. Borehole continues downward with a slight twist to the left, and within thirty minutes we were peering down to where a massive torrent of water spills from a conduit coming up from the breakdown floor. Here the directions we received called for a sharp climb up, but the trail was not well marked, and we ended up high above where we needed to be. Philippe and Melanie had gone ahead of Lewis and me, and we saw their lights off in the distance along the right wall high above the stream. They had located Camp 3, and we were able to join them there within a few minutes.

Like Camp 2, this camp is also a sand beach perched high above the moving waters, but there the similarities to that camp end. The room we were in is a huge tunnel sloping downward, and the camp is perched at the top of a steeply sloping wall facing across the river to a massive, vertical rock wall. The ceiling is similarly of gargantuan proportions, and the sound of the water slamming the rocks far below is absorbed or muted by the tremendous volume of the chamber. Our plan for the day, formulated with the benefit of a full day of rest and a renewed optimistic outlook early that morning, called for us to reach Camp 3, drop off unneeded weight, and make a quick dash down the river passage to the first sump, 1362 meters beneath the highest Cheve entrance. Reality at Camp 3 in the early evening was that we were all exhausted and hungry, and that trip to the sump was not going to happen. This would be the end of our downward progress in Cheve this expedition.

Dinner was rehydrated something or another, and we tried each other's cups for variety. Hot Earl Gray was a treat, along with a candy bar or granola bar squirreled away for this occasion. The latrine was a mess, as we expected, but the air was being sucked downstream, or so it seemed, and up in the sleeping area we were not bothered by the smell. Sleep came easy that night. I wrote a little in my journal, but a feeling of intense isolation returned after everyone quieted down. Living in an American city in the twenty-first century, one seldom finds himself so completely separated from society and from the comforts and gadgets we are accustomed to. The knowledge that this was perhaps the farthest away from the world I knew was overwhelming, and I wondered when I would ever have the chance to experience this stark reality again. I turned off the light, sat back, and savored that rare sensation.

The night passed peacefully. In the morning we made coffee and ate rehydrated something for breakfast, packed up our own gear, and then began gathering up the trash and excess gear we were supposed to bring back to the surface. The biggest items were a 50-meter climbing rope that was no longer needed that deep and a steel and fiberglass high-pressure diving cylinder that had been left full at the sump for several years following a previous expedition. The air inside had remained good and at usable pressure and had been used on the diving efforts the previous week. We had traveled down light, and now we would be loaded down climbing back up. We would need to carry this weight back up about 1200 vertical meters to the cave entrance.

The trip out went well. We traveled continually, stopping only to rest for no more than fifteen minutes at a time. While one of our team was climbing on rope, the others got a little reprieve from work. We made it past the big rooms and into the water passage by early afternoon, and we had to slog through the Swim Gym already tired. The last of the day's travel was up into the Low Rider Parkway, where we got disoriented and lost about a half hour trying different leads up to Camp 2. Eventually olfactory hints from the latrine led us into the proper passage, and we collapsed into sound sleep after quick nourishment.

The next morning we split up. Philippe and Melanie decided to go out at a faster pace than we had been traveling the day before, while Lewis and I were concerned about overexerting ourselves with no camp or supplies between us and the surface. This leg of the trip would require the lion's share of the climbing, with the water Olympics at the beginning of the day when we were strong. Lewis and I kept to what we thought was a measured pace, and before noon we had climbed up to the wet part of the cave below Sacnussem's Well. This was the hardest part of the trip, for we were pushing continually upward, at times almost completely immersed in the rushing stream. Both of us lost body heat here, and I credit the PVC oversuit with allowing me to be as comfortable as I managed to be. As we dropped into the aerosol canyon leading up to the Sacnussem's Well, we knew the most difficult part of the trip was over and that the way on was primarily dry.

The problem we faced at the top of the pit was time; it was well into evening, and we knew there were many hours to go before we would see the sun or stars, as the case might be. Steadily we pushed upward, but I finally had to drop the diving tank I was carrying at Camp 1, where it would easily be found by the other teams that would be down in a few days. Besides the tank, between us we had been carrying personal gear, camp trash, and a 50-meter wet rope. I felt bad dropping the tank, but we really needed to get out of the cave, and losing the excess weight and bulk helped immensely. All night we climbed at what seemed a snail's pace, but we were conscious of our exhaustion and were determined not to take any risks that could result in an accident. The last few hours were painful, knowing that the sun would be rising shortly, and we were beginning to make small mistakes. We began to snap at one another, as communication narrowed to only the essentials. Among the last few pitches, I accidentally tossed an ascender into a pool far below the trail, and realized I had been asleep while climbing. We made it out as the sun was rising over the camp.

Philippe and Melanie had gotten out during the night and had gotten some sleep while we were climbing out. The camp was just beginning to wake up, so we grabbed coffee and some real food before giving a debriefing on our trip. The next day we enjoyed sleeping late and stayed out in the sunshine. It had been raining for all of the time we had been underground, and the camp had been soggy. Many of the people on the surface we had left four days before had departed for their own corners of the world. Those cavers remaining were ready to get back underground.

We drove out of camp with a truckload of cavers for a meal in Concepción Pálapo, the village we had driven through coming up into the mountains. The simple food served in a rustic setting was appreciated as much as if we had stumbled upon a three-star restaurant. Well . . . , maybe not. But we enjoyed it immensely. In the village we were supposed to pick up a container of diesel fuel Bill had ordered some days before. Through some miscommunication, the local police had picked up the container and had driven away with it just as we were beginning to inquire about it. We had to chase the police truck all over the side of the mountain to get the fuel back, and it was a good thing for them we did, because their truck ran on gasoline, not diesel.

Back at Llano Cheve, we had one more day of caving before we needed to pack up and head home. I spent it on a trip back in to recover my lost ascender. At the pool where it had landed, I elected to strip off my clothes and swim naked, rather than risk being too chilled in wet clothes by the brisk breezes blowing against me on the way out.

The next day, the last exploration crew left the surface for a complex set of tasks down below Camp 3. Paula Grgich and I packed up to leave, since she had an appointment and I had to get back to work. Melanie and Philippe decided to take their time going back, spending a day in Ciudad Oaxaca and then taking a bus back to the border and onward to San Antonio. Paula and I would take the bulk of their equipment and deliver it to Melanie's mother's house there. We made our appointments Monday morning on time and adjusted back to life after the Cheve Expedition.

Notas de Cheve

El autor participó por dos semanas en la expedición 2003 al Sistema Cheve en Oaxaca. Describe el viaje al Campamento 3 en la cueva.

CHEVE 2003

Bill Stone, Yvonne Droms, and Nancy Pistole

A team led by Bill Stone descended into Cueva Cheve, Oaxaca, Mexico, for ten weeks in the spring of 2003 in an effort to extend exploration at the bottom of the system beyond the underwater tunnel that had stopped progress since 1990. A water-trace using colored dye had previously demonstrated a link to a resurgence spring located 2547 meters lower than the highest entrance of the cave and 17 kilometers to the north. If an exploration team can make the same trip, Cheve will become the deepest cave in the world by a substantial margin—possibly forever. There was significant motivation to return to the underwater tunnel, since explorations in the intervening decade had failed to discover a route forward in other parts of the cave. The exploration plan had two components. A team of divers would use closed-circuit rebreathers to explore the sump 1228 meters below and 8 kilometers distant from the Cheve entrance and to search for passage beyond, while simultaneously a team of climbers would attempt to bypass the sump by climbing their way up into high tunnels in the final canyon leading to the sump. The first contingent of a forty-five-member team assembled at Llano Cheve base camp on March 9, 2003, ready to start an assault on the cave after a six-year hiatus. Nearly simultaneously, a different team, led by Nancy Pistole and Matt Oliphant and consisting of twelve individuals, continued exploration of Cueva Charco. Cueva Charco is located approximately 8 kilometers north of Cueva Cheve and 1000 meters lower in elevation. It has been correctly viewed as a potential back door to Sistema Cheve. But because of its incredibly constricted nature, its exploration has been a struggle legendary in the cave-exploration community. The two teams comprised cavers from Mexico, Poland, England, the Netherlands, Germany, Switzerland, France, and the United States.

The text is a version of a report prepared in December 2003 for Mexican government agencies. All photographs are from the Cueva Cheve part of the expedition. See also a nice description by R. D. Milhollin of a trip into Cueva Cheve and an article by Rick Stanton on the sump dives; both appear in *AMCS Activities Newsletter* 27.

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At Cueva Cheve, the first sixteen days were spent rigging nearly three kilometers of rope and transporting many loads of equipment downward. This equipment included sleeping bags, pads, stoves, calcium carbide for lights, rope, rock bolts, drills, batteries, and diving apparatus. Three underground camps were established: Camp 1, an emergency bivouac site at –385 meters, Camp 2, a spacious and comfortable but windy camp at –787 meters, and Camp 3, a series of terraces constructed on a talus slope on one side of the massive AS Borehole, at –1010 meters. Diving apparatus was then transported from Camp 3 to the sump, and the stage was prepared for the first dive.

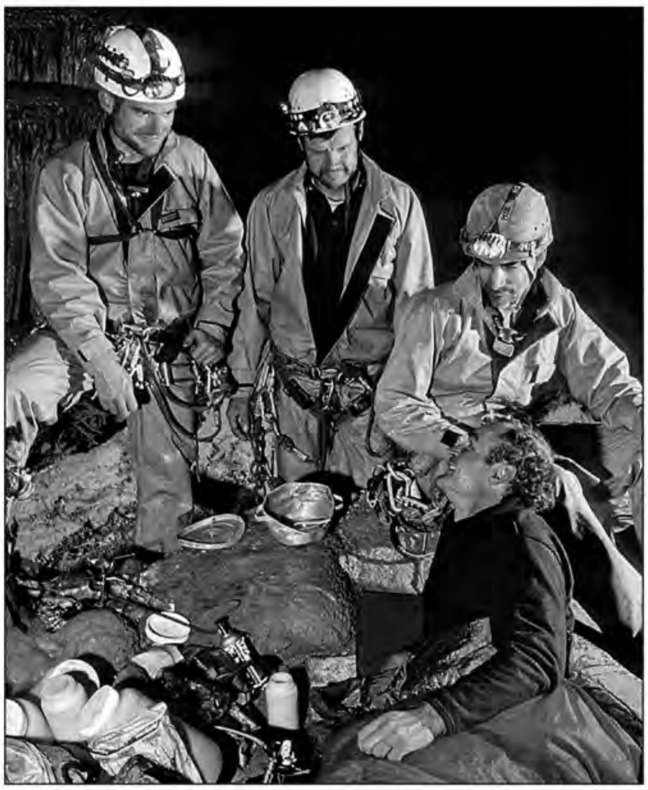
On March 26, Rick Stanton and Jason Mallinson, two of the world's foremost cave divers, made the first effort. The Cheve sump was first dived in 1991 by John Schweyen to a distance of 100 meters penetration and a depth of 24 meters. Schweyen reported that all of the tunnels he investigated were too small to continue. In preparation for the 2003 effort, we studied the data from 1991 and concluded that a fracture in the limestone had diverted the water into a different course. The main trend of Cueva Cheve is 330 degrees, that is, to the northwest. However, in certain sections of the cave, shear fractures cause the cave to divert to the east for short distances. We concluded that this is what must be occurring at the Cheve sump and hence decided to immediately look to the east for a new passage, rather than follow the old guideline. This hypothesis proved to be correct. Stanton and Mallinson successfully navigated a path through the sump and emerged, following a fifteen-minute dive, into an air-filled passage. The underwater tunnel that had stopped exploration for thirteen years was only 140 meters long and 12 meters deep. What lay beyond was a narrow, steeply descending canyon that carried the white-water river. (See the Sistema Cheve 2003 map.)

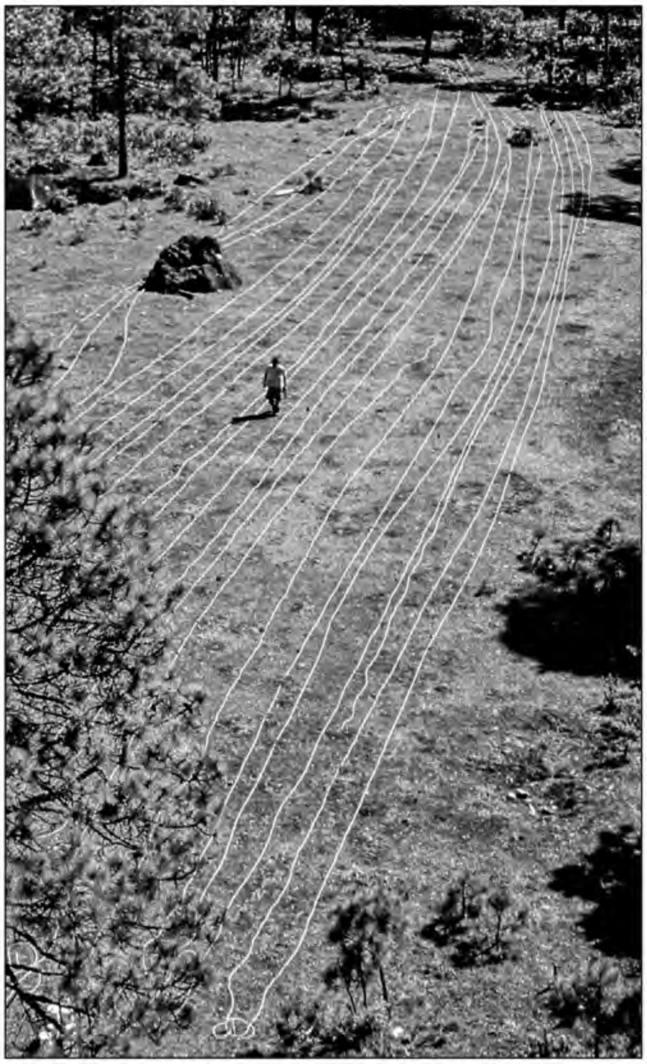
On this initial reconnaissance, the two divers did not have any rope for rigging vertical drops. Thus, the

Upper left:Bill Mixon and Kasia Okuszko load gear in Mixon's barn in Austin, Texas. Freezing rain covered the truck with ice outside the night before. *Bill Stone.*

Lower left: Mark Stover, Robert Moncza, and Peter Penczer (left to right) deliver supplies to the bivouac in the Hall of the Restless Giants, awakening Mike Frazier. *Bill Stone.*

Below:More than 2 kilometers of new rope laid out to dry at Llano Cheve base camp. It was soaked to tighten the sheath. *Pete Penczer*.





Upper Right: The beginning of the dive-gear transport job. From left, Kasia Biernacka, Marcin Gala, Kasia Okuszko, and Tomek Fiedorowicz load up for a supply run to Camp 3. *Bill Stone*.

Middle right:The Poles in Camp 2 at –805 meters. From left, Tomek Fiedorowicz, Kasia Okuszko, Marcin Gala, and Kasia Biernacka. *Bill Stone*.

Bottom right: From left, Paul Medhurst, Pauline Berendese, Jan Matthesius, and Andi Hunter celebrate a return to the surface.

Below: Richie Hudson gives a final check to one of the compact rebreathers going to the Cheve sump. *Pavo Skoworodko*.

Campfire dinner at Cheve base camp. *Bill Stone.*

descent through the canyon involved innumerable tricky, dangerous climbs through waterfalls. Furthermore, exploration beyond the underwater tunnel was complicated by the fact that this was done in diving dry suits. This had been one of the difficult decisions of the expedition. We did not know how long the underwater tunnel would be. Therefore the four divers, Stanton, Mallinson, Richie Hudson, and Bill Stone, decided to use dry suits rather than the more flexible wet suits used by most divers. These dry suits worked well in the underwater tunnel. But they led to significant overheating in the air-filled passages beyond. Fortunately, there were many deep lakes there, and these served to help reduce the heat accumulation.

On this first reconnaissance beyond the sump, Stanton and Mallinson discovered 800 meters of additional tunnel before they encountered another sump. At that point they had added 940 meters in length and 103 meters in depth to the cave. But the equipment used for diving through the first sump was insufficient to continue any farther. The diving team returned to the surface after nine days underground. We began to organize an assault on the second underwater tunnel, with more equipment and additional divers to help transport gear beyond the first sump.

Facing page, clockwise from upper left:

Mariano Fuentes Silva on the lake traverse at the bottom of the Salmon Ladder, –600 meters. *Gustavo Vela.*

Bart Hogan traversing the lake at the beginning of Wet Dreams, –1200 meters. *Bill Stone.*

Tomek Fiedorowicz begins his descent of the last cascade in the Salmon Ladder, while behind him Marcin Gala negotiates a traverse over a pool. *Bill Stone.*

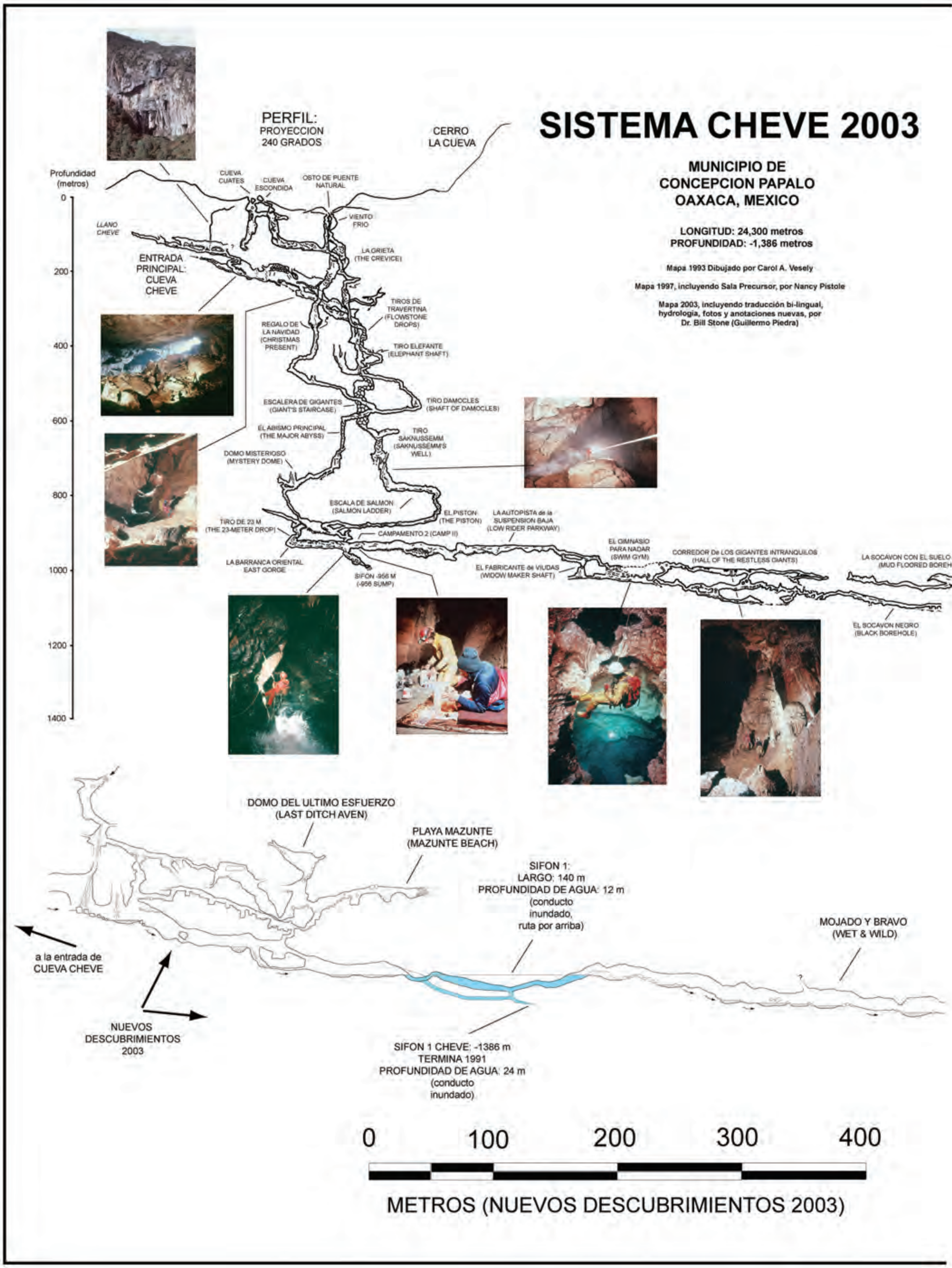
Jason Mallinson (left) and Rick Stanton prepare for their first dive into the Cheve sump. *Bill Stone.*

Meanwhile, a team of climbers searched for high passages in the roof of the final kilometer leading into Sump 1. On March 26, Tomek Fiedorowicz led a climb 10 meters up into a new tunnel that ended after only a few meters. Another climb, led by Marcin Gala, went up into a narrow chimney with loose rock and mud and was equally unsuccessful. Gala, Fiedorowicz, and Pawel Skoworodko later found a horizontal tunnel, but after 200 meters it split into four directions, all either leading back to known passage or becoming too narrow to follow. On March 29, the climbing team returned to the surface for a few days of rest.

On April 4, the diving team, now expanded to include Richie Hudson and Bill Stone, arrived at Camp 3, ready to explore the second sump. Diving equipment was carried beyond Sump 1, and ropes were tied at the waterfalls to make them safer to negotiate while carrying the diving gear. On April 6 and 7, the team spent twenty hours beyond the first sump, exploring and mapping the new territory. After helping transport equipment to Sump 2, Hudson and Stone surveyed from there back to Sump 1. Mallinson and Stanton dived the second sump. They followed a sloping fissure passage for 280 meters, reaching a maximum depth of 12 meters underwater, and they reached an air-filled chamber with a wall of boulders just ahead. Although they could hear water through the pile of rocks, they found no way onward despite nearly shredding their dry suits in their efforts to squeeze through tiny openings in the breakdown. This point is now the most remote point reached in Cueva Cheve.

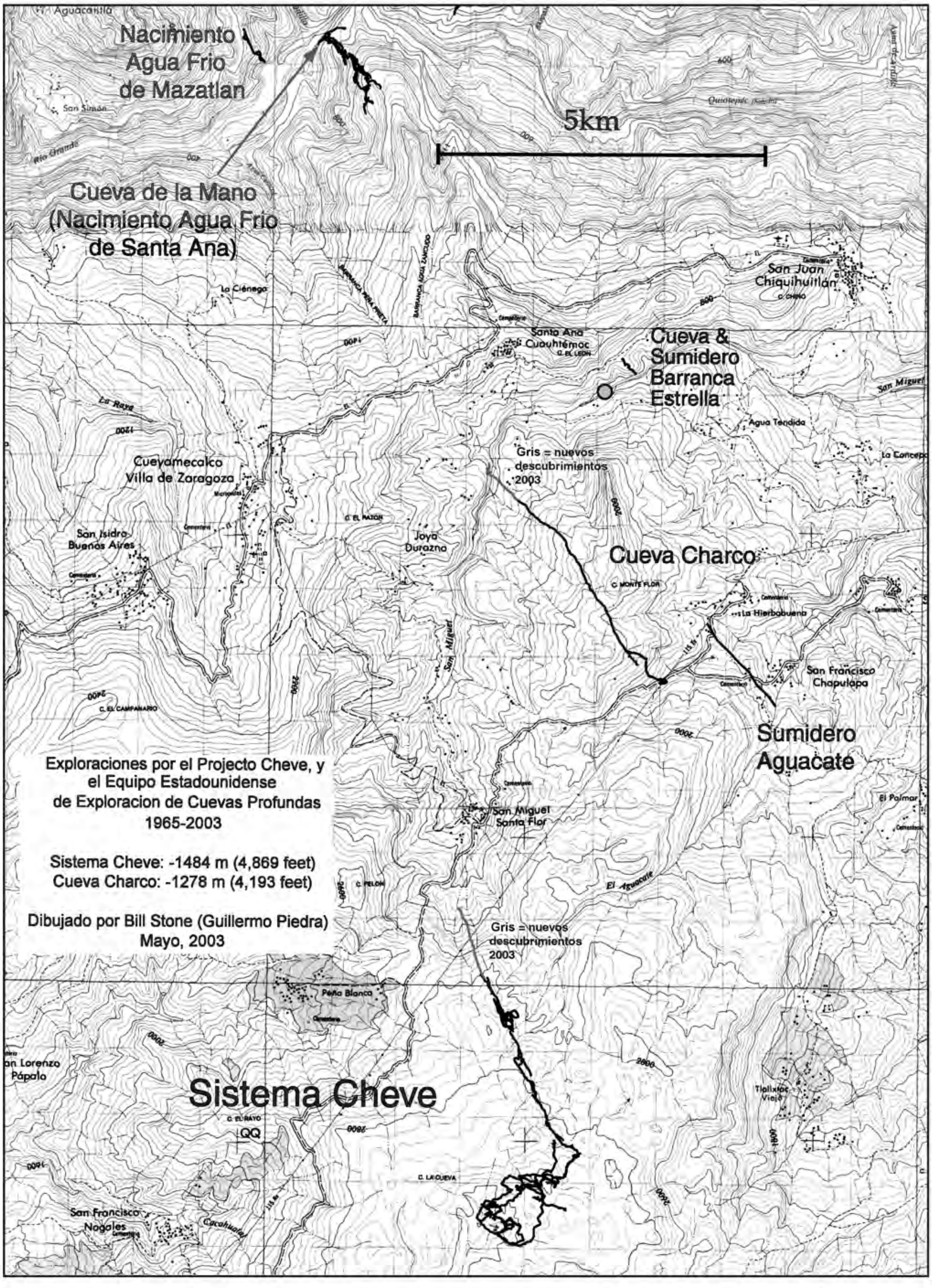
Also on April 4, the climbing team descended to Camp 3 for another attempt to find a high passage to bypass the sump. This time, after a difficult ascent up a waterfall, they found a high lead that had been reported by Mike Frazier, who had partially explored it in 1997. About 40 meters above the level of the active stream, the 2003 climbing team intersected new passage. A few climbs up and down to the north brought them back, after 200 meters, to known passage at a point near Sump 1. However, there were high-level continuations to the north. The northernmost tunnel, named Mazunte Beach, extended well out over the mid-point of Sump 1, some 60 meters above it, before terminating in a collapse. On April 9, the climbing team returned to the surface, helping bring out diving gear.

On April 14, a small team composed of Robbie Warke, John Kerr, Marcus Preissner, Bart Hogan, and Bill Stone began a final, ten-day push, checking high leads, completing surveys, and derigging the cave. In a final effort to bypass Sump 1, Stone, Kerr, and Preissner bolted 35


SISTEMA CHEVE 2003
MUNICIPIO DE
CONCEPCION PAPALO
OAXACA, MEXICO
LONGITUD: 24,300 metros
PROFUNDIDAD: -1,386 metros
Mapa 1993 Dibujado por Carol A. Vesely
Mapa 1997, incluyendo Sala Precursor, por Nancy Pistole
Mapa 2003, incluyendo traducción bi-lingual, hydrologia, fotos y anotaciones nuevas, por Dr. Bill Stone (Guillermo Piedra)
PERFIL:
PROYECCION
240 GRADOS
CERRO
LA CUEVA
Profundidad
(metros)
0
200
400
600
800
1000
1200
1400
LLANO
CHEVE
CUEVA
CUATES
CUEVA
ESCONDIDA
OSTO DE PUENTE
NATURAL
VIENTO
FRIO
ENTRADA
PRINCIPAL:
CUEVA
CHEVE
LA GRIETA
(THE CREVICE)
TIROS DE
TRAVERTINA
(FLOWSTONE
DROPS)
REGALO DE
LA NAVIDAD
(CHRISTMAS
PRESENT)
TIRO ELEFANTE
(ELEPHANT SHAFT)
ESCALERA DE GIGANTES
(GIANT'S STAIRCASE)
TIRO DAMOCLES
(SHAFT OF DAMOCLES)
EL ABISMO PRINCIPAL
(THE MAJOR ABYSS)
TIRO
SAKNUSSEMM
(SAKNUSSEMM'S
WELL)
DOMO MISTERIOSO
(MYSTERY DOME)
ESCALA DE SALMON
(SALMON LADDER)
EL PISTON
(THE PISTON)
LA AUTOPISTA de la
SUSPENSION BAJA
(LOW RIDER PARKWAY)
TIRO DE 23 M
(THE 23-METER DROP)
CAMPAMENTO 2 (CAMP II)
EL GIMNASIO
PARA NADAR
(SWIM GYM)
CORREDOR De LOS GIGANTES INTRANQUILOS
(HALL OF THE RESTLESS GIANTS)
LA SOCAVON CON EL SUELO del BARRO
(MUD FLOORED BOREHOLE)
LA BARRANCA ORIENTAL
EAST GORGE
SIFON -956 M
(-956 SUMP)
EL FABRICANTE de VIUDAS
(WIDOW MAKER SHAFT)
EL SOCAVON NEGRO
(BLACK BOREHOLE)
DOMO DEL ULTIMO ESFUERZO
(LAST DITCH AVEN)
PLAYA MAZUNTE
(MAZUNTE BEACH)
SIFON 1:
LARGO: 140 m
PROFUNDIDAD DE AGUA: 12 m
(conducto
inundado,
ruta por arriba)
MOJADO Y BRAVO
(WET & WILD)
a la entrada de
CUEVA CHEVE
NUEVOS
DESCUBRIMIENTOS
2003
SIFON 1 CHEVE: -1386 m
TERMINA 1991
PROFUNDIDAD DE AGUA: 24 m
(conducto
inundado)
0
100
200
300
400
METROS (NUEVOS DESCUBRIMIENTOS 2003)

Topografia Diciembre 1986 - Marzo 1997
por los miembros del Proyecto Cheve:

Rolf Adams	Mike Frazier	Herb Laeger	John Schweyen
Stan Allison	Ernie Garza	Susie Lasko	Tina Shirk
Bob Benedict	Andy Grubbs	Jason Mallinson	Jim Smith
Carl Bern	Peter Haberland	Lance Mattson	Peter Sprouse
Jeb Blakeley	Ed Halladay	Paul Medhurst	Rick Stanton
Peter Bosted	Louise Hose	Gary Mele	Bill Steele
Don Broussard	Bart Hogan	Karlin Meyers	Brian Steele
Harry Burgess	Richie Hudson	Tom Miller	Janet Steele
Laura Campbell	Andi Hunter	Mark Minton	John "Rocco" Stembel
Don Coons	Joe Ivy	Matt Oliphant	Bill Stone
Alan Cressler	Becky Jones	Lee Perry	Georg Tetzlaff
Ken Davis	Pat Kambesis	Nancy Pistole	Taco Vanleperen
Michael Denneborg	Peter Keller	Steve Porter	Carol Vesely
Ruthie Diamante	John Kerr	Marcus Preissner	Robbie Warke
Ramon Espinasa	Michael King	Peter Quick	Todd Warren
Mason Estes	Steve Knutson	Bitsy Ray	Nancy Weaver
Bill Farr	Matt Kramar	Susan Sanders	Steve Zeman


Nacimiento Agua Frio de Mazatlan
Cueva de la Mano (Nacimiento Agua Frio de Santa Ana)
5km
San Simón
Río Grande
Quiotepec
San Juan Chiquihuitlán
La Ciénega
Santa Ana Cuauhtémoc
Cueva & Sumidero Barranca Estrella
San Miguel
La Raya
Agua Tendida
Gris = nuevos descubrimientos 2003
Cueyamecalco Villa de Zaragoza
San Isidro Buenos Aires
Joya Durazno
Cueva Charco
La Hierbabuena
San Francisco Chapulapa
Sumidero Aguacate
Exploraciones por el Projecto Cheve, y el Equipo Estadounidense de Exploracion de Cuevas Profundas 1965-2003
Sistema Cheve: -1484 m (4,869 feet)
Cueva Charco: -1278 m (4,193 feet)
Dibujado por Bill Stone (Guillermo Piedra) Mayo, 2003
San Miguel Santa Flor
El Aguacate
El Palmar
Gris = nuevos descubrimientos 2003
Peña Blanca
an Lorenzo Pápalo
Sistema Cheve
QQ
Tlalixtac Viejo
San Francisco Nogales
Cacahuatal

Robbie Warke hangs from the traverse line, while Marcus Preissner rappels into the East Gorge. *Bill Stone.*

meters up a dome near the Mazunte Beach tunnel, but this ended in a boulder-filled rift nearly 70 meters above river level. The derigging effort that followed continued for nearly a week, with support arriving at Camp 2 in the form of Andy Zellner and Ashley Chan. Bivouac sites were established between Camp 2 and Camp 3 during the moving derig in order to investigate side tunnels. The most promising of these, a waterfall dome at the beginning of the Black Borehole, was scaled for 50 meters to where it joined a rarely visited extension of the Hall of Restless Giants.

In all, the team spent thirty-three days operating from Camps 2 and 3. The cave was extended to a distance of 9.3 kilometers from the nearest entrance, at the breakdown pile blocking the tunnel beyond Sump 2. More than 700 meters of high-level tunnels were mapped above the Wet Dreams canyon area immediately before Sump 1. In addition, a small team of cavers explored Cueva Palomitas, a nearby cave whose entrance lies above the Cheve entrance, to a depth of 500 meters, where they came close to making a connection with passage in Cheve. If connected, Cueva Palomitas will be the highest entrance to Cueva Cheve.

By early May 2003, Llano Cheve was once again quiet and deserted. The additional 1.9 kilometers of passage mapped at the bottom of Cueva Cheve brought its length to 26,194 meters and its depth below the highest entrance to 1484 meters, making it the deepest cave in the Western Hemisphere and presently the ninth deepest in the world. At 9.3 kilometers from the nearest entrance, the breakdown collapse beyond Sump 2 presently represents one of the most remote point inside the earth reached by humans.

Bart Hogan on the main trail, 100 meters inside the Cheve entrance. *Frank Abbato.*

Cueva Charco is located between the main Cueva Cheve entrance and the resurgence spring. Geologically, it is in an ideal position to connect into the Cheve system, and the cave has a strong flow of air and collects water. In 1989, a small group of cave explorers investigated the entrance. Over the next fourteen years, various groups of cavers from many countries pushed deeper and deeper into the cave. In 2003, a final group of explorers reached a sump at the bottom of the cave. A dye-trace confirmed that Charco is connected to the Cheve system hydrologically, but without specialized dive equipment, further exploration is impossible. Cueva Charco is 1278 meters deep and 6.71 kilometers long.

The entrance to Cueva Charco is large and picturesque. However, after a series of short pitches, the passage quickly constricts to a very tight crawl in an area that is prone to flooding. For the next thousand meters, the cave has a series of descending ramps, tight canyon passages, low crawlways, and various short rope pitches. Small incoming tunnels add to the volume in the stream. Some low crawlways are mostly filled with water. At first the cave spirals down on itself, then it heads approximately northwest with few meanders.

One large incoming stream, entering from the only significant side passage in the cave, greatly increases the volume of flow in the stream. While most caves tend to get bigger as they get deeper, the passage in Charco remains narrow. It is best described as a cheese grater, with tight squeezes even below –1000 meters. Just before the sump the stream passage intersects a borehole. The upstream section of the borehole is blocked by flowstone, and the downstream section leads to the sump. The sump was not investigated, although it is certainly large enough for divers to enter it. Carrying diving equipment to this incredibly remote, difficult spot is almost unimaginable.

At first, explorers were able to enter Cueva Charco on one-day trips. But soon a day-trip took longer than twenty-four hours just to get to the current end of the cave and back. In 2000, a camp was established 2.5 kilometers from the entrance at a depth of 600 meters. During the 2000 and 2001 expeditions, explorers typically worked from Camp 1 for periods of up to one week underground. It was not a pleasant place. The camp was located near the roof of the narrow fissure, where there were small ledges just wide enough to sleep on. If you rolled in your sleep there was the distinct possibility of plunging 12 meters down to the stream below. In 2003, a second camp was established at the –1000-meter level for the push to the end. Since there are no flat spots for a camp near the end of the cave, the explorers in 2003 slept in hammocks suspended from the walls using rock bolts. The present end of Cueva Charco remains one of the most remote, hostile places known on this planet.

A total of fifty-five team members from eight nations put in thousands of hours of work rigging, transporting equipment, and derigging. The expedition's success was the result of their work, together with the generosity of our sponsors and the numerous Mexican state, regional, and local governments who helped our efforts. To all of these people and organizations who made this expedition possible we offer our most sincere thanks.

Marcin Gala rappelling the slack line on the Turbine 1 traverse. *Bill Stone.*

Marcus Preissner (foreground) and Robbie Warke at the end of a traverse in the Black Borehole. *Bill Stone.*

Cheve 2003

Buceos en los sifones del Sistema Cheve en la primavera del 2003 incrementaron su profundidad a 1484 metros, convirtiéndola en la más profunda de México. El pasaje explorado buceando y otros pasajes cortos encontrados al escalar en cañones cerca del fondo conocido de la cueva incrementaron la longitud en 1.9 kilómetros, a 26 194 metros. (Otros artículos sobre la exploración de Cheve aparecen en el número 27 de la *AMCS Activities Newsletter*). Dentro del mismo proyecto, la Cueva Charco fue explorada hasta el final, un pasaje amplio que termina en un sifón. Charco tiene ahora 1278 metros de profundidad y 6.71 kilómetros de longitud. Llevar equipo de buceo al sifón sería muy difícil.

CHEVE 2004

by members of the expedition

This story of the Cheve 2004 expedition has been prepared by the editor from daily reports sent back from the field by satellite phone to the National Geographic Society. NGS editors condensed the material much more than I have, to about 350 words per week, and posted weekly summaries of the expedition while it was going on. These summaries can still be found at http://magma.nationalgeographic.com/ngm/caverace.

Introduction, Bill Stone, December 2004: Following the 2003 diving project at the bottom of Cueva Cheve, it was not particularly obvious how one might go about getting deeper there, or even how we might go about looking for an alternate way to reach the large unknown section that lies between the end of Cheve and the resurgence. The resurgence, Cueva de la Mano, had been pushed thoroughly in 2001 (see *AMCS Activities Newsletter* 25, page 53). And Cueva Charco, the great hope of the late 1990s in the middle karst had been bottomed at a zero-visibility sump in 2003 without connecting to the Cheve main trunk. No one had any illusions about the possibility of transporting diving equipment to the end of Charco, or at least no one was that desperate yet. I spent the summer of 2003 studying the topographic maps, reading old expedition reports, and staring at computer images of the patchwork of 3D lines that represented our knowledge of what lay inside the mountain. I kept coming back to Star Gorge, the Barranca Estrella, an area between Charco and the resurgence that we had first checked out in 2001. The largest surface river on the mountain, the Río San Miguel, disappears there at a point less than a half kilometer above the end of Charco. The leads there were all digs, but nonetheless it seemed worth a serious reinvestigation. That became the first item on the recon list for 2004. Southeast from Charco is the Sumidero Aguacate, which swallows up the second largest surface stream in the Cheve karst. Following our discovery of this entrance in 1989, only one exploration trip, in 1994, had been fielded to this cave, and the map generated as a result showed that it ended in a sump just under a kilometer from the entrance. Since this sump had not yet been dived, a return to the Sumidero Aguacate became the second item on our target list. Farther south, beyond the Aguacate canyon, begins the no-man's-land of death karst that runs for several rambling kilometers until one encounters Cerro la Cueva, now renamed on the new topographic maps Cerro Cueva Cheve, and the northernmost entrances to Sistema Cheve: Viento Frío, Osto de Puente Natural, Cuates, and Escondida. Taking into account the farthest recon hikes made to date into the karst north of Cheve, there still remained a 3-by-4-kilometer area completely unknown to cavers. It was into that area that we would direct our remaining recon efforts during the planned seven-week effort in 2004, all with the hopes of locating a back door to Sistema Cheve. [See the area map in the article on Cheve 2003 elsewhere in this issue.]

February 14, Bill Stone: Having only managed to crawl into our sleeping bags at 3 A.M. after two days of driving down from Bill Mixon's house in Austin, Texas, to the Tehuacan valley, we slept in until 8:30, when the hot sun began to rise above the cactus and the noise of unmuffled semis made further repose unproductive. In the distance we could see smoke rising from the stack at the sugar mill at Coxcatlán. The smell of molasses permeated the valley. Within two hours we arrived in Cuicatlán. It holds the district authority for the Cuicatec indigenous area that extends some 50 kilometers to the east and overlies the known extent of Sistema Cheve. Using our radios during the drive up the steep concrete track to the *zócalo*, we arranged to split up our chores: renting a pair of large propane tanks, securing permission from the district office for the expedition to be on the mountain, and shopping for durable vegetables for base camp. John Kerr and Jim Brown went after the propane. Andi Hunter and I met with the officials and described our progress during the 2003 expedition and our plans for this year. They wished us well. They, like most people on the mountain, knew that Sistema Cheve is something special that is well known beyond the confines of their district.

John and Jim reported that propane was out of stock, but that a delivery was expected in a few hours. Rather than all waiting around (Cuicatlán is very hot in mid-afternoon), Andi, Ryan Tietz, and I drove on up the mountain to

Concepción Pápalo, the *municipio* seat that controls the entry into the main entrance to Cheve. There we met with the proprietor of the local dry-goods store, Elfido Méndez, and picked up a thirty-kilogram drum of carbide left over from 2003. While most of the cavers on the expedition had switched to LED lights, some of the Europeans still planned to use carbide. From Concepción Pápalo we drove over the top of the mountain and down toward the village of San Miguel Santa Flor. The current end of Cheve lies less than a kilometer from the center of this village, at a great depth beneath it, of course. In the distance, across the beginning of the Barranca Estrella (Star Gorge), we could make out the terraced village of Santa Ana Cuauhtemoc. A wispy tongue of mist was moving rapidly up the valley from the east and would soon consume both valley and town.

We continued on through the fog to Santa Ana. While Andi and Ryan played soccer with the local children, stakes being a few handfuls of Jolly Rancher hard candies, I went off seeking Inmer Martínez Playas, a member of the municipal authority. Santa Ana was our second to last stop on the diplomatic chain. The *presidente*, Prospero Pérez Mariscal, was off at a meeting of the coffee-growers' association across the Santo Domingo Canyon in Huautla de Jiménez, so Inmer, the *tesorero* for the town, presided over a review of the caving progress on the mountain over the past few years. Inmer kindly offered us access to an unused house a few blocks from the municipal offices, and soon Andi, Ryan, and I were unloading the truck, mainly for the purpose of locating the Jolly Rancher candies to pay off the insistent young winners of the impromptu soccer match. About this time we began picking up radio messages from James Brown, John Kerr, David Kohuth, and Gregg Clemmer, who had come up the mountain a different way after getting the propane, but were making slow progress through the fog. Tentative plans were made with Inmer to have ten mules show up at noon the next day.

February 15, Andi Hunter: Awoken by the obnoxious cries of a donkey, we faced a huge pile of gear that needed to be sorted out. Stone left over mud-soaked roads at 7:30 A.M. for Chiquihuitlán to get permission for the east end of Star Gorge. After the mules were heavily loaded with plastic tubs and duffel bags, we headed for our base-camp location, two hours away over trails with boot-sucking mud. The evening was occupied by pruning vegetation for personal tents, clearing a group area, and setting up group tarps for the cooking area. By dark, the generator was up and running, lights were on, and we were cooking a hearty meal.

February 16, Bill Stone: With base camp established, be began our investigation of Barranca Estrella. In Santa Ana we had received a report from Inmer that a local rancher who worked the valley floor, Pedro Pérez, had, the previous October, heard a roar in the canyon and gone to investigate. He discovered that a 25-meter-diameter sinkhole more than 12 meters deep had suddenly appeared in the floor of the canyon and was swallowing the river. Truck-size boulders had fallen into an underground void. Gregg Clemmer, Ryan Tietz, and David Kohuth went to locate this shortly after breakfast.

Pauline Berendese and Jan Matthesius from the Netherlands hiked into camp through the mist, having bivouacked on the hillside. Both had been members of the Cheve 2003 expedition and were back for more. On the way to the entrance to Cueva Barranca Estrella, I met the team returning from the new sink. Gregg related that it is a clean collapse, with the river falling through large boulders. There are voids below, and Gregg had carefully negotiated his way some 5 meters down before deciding that the boulders were too precariously balanced. It did appear that the collapse was triggered by the collapse of the roof of a large cave passage below. It will be an engineering challenge to pick out the boulders one by one.

John Kerr, James Brown, Andi Hunter, and I removed logs blocking the entrance to Cueva Barranca Estrella, the first target of the expedition. This cave had been shown to Bev Shade, José Antonio Soriano, Charles Brickey, and me in March 2001. It is on the northern rim of the gorge near Santa Ana, and it is the oldest of what is now a chain of three places where the Río San Miguel in the gorge found its way underground. Its present entrance is 10 meters above the floor of the gorge. The cave is blocked by fill a half-kilometer in from the entrance. Hunters from Santa Ana had tried to close the cave entrance to prevent game, mainly *tepeizquintle* (paca) and *temasate* (a small deer) from hiding in the cave. The plug at the end makes the air in the cave foul with CO_2. Our goal for the day was to enlarge a flat-out crawlway about 100 meters in so that a crew could easily pass with large loads of equipment. After turning the crawl into a duckwalk, we proceeded another hundred meters to the first drop, a 5-meter pothole made by the river that once flowed through the cave, and then returned to camp. (A map of Cueva Barranca Estrella is on page 60 of *AMCS Activities Newsletter* 25.)

February 17, Andi Hunter: The morning was spent sorting ropes, practicing on the rebelay course set up in a tree, and gathering parts for the rebreather that would be taken into Cueva Barranca Estrella to deal with the bad air in the dig. A first team, consisting of John Kerr, Jan Matthesius, Pauline Berendese, and David Kohuth, headed for the cave around noon. A second team, Bill Stone, Ryan Tietz, James Brown, and I, headed down soon after at a slower pace, with Brown carrying the heavy rebreather equipment. Two new arrivals, Nathan Noble and Mike Frazier, caught up with us on their way to visit the cave. They had already been in the area for weeks, they hadn't showered in a while, their clothes were ragged and torn, and their vertical gear was nearly shredded. Our team would look the same after a few weeks. They went on into the cave while we sorted specialized equipment at the entrance. Finally we headed into the cave, to be greeted once again by the long black, tarry streaks of vampire-bat guano that ran down the formations and puddled on the floor. After all the drops were rigged, Nathan, Mike, and I started digging out restrictions to try to improve airflow to the end of the cave. Everyone else went on to the dig at the end of the cave to start hauling out bucket after bucket of sand and gravel. Eventually Mike, Nathan, and I joined them. A hauling team remained out of the tight area, where others filled the buckets. A 12-foot hose with a blower was attached to a diver's rebreather so that stale air could be circulated though its CO_2 absorber and oxygen could be added. Fingers worn and joints aching, we headed out of the cave for dinner at 10:30 P.M.

February 18, Pauline Berendese: Yesterday, a team of five Polish cavers arrived, Paweł "Pavo" Skoworodko, Artur Nowak, Katarzyna "Kasia" Okuszko, Tomek Fiedorowicz, and Małgorzata "Gosia" Barcz, very welcome help for the dig. Today we said goodbye to Frazier and Noble. Starting today, we are going to have more normal working hours, two hours hiking and caving to the dig, seven hours digging, and two hours back. Gregg Clemmer, David Kohuth, Jan Matthesius, and I headed out first. Finally after the foggy days we saw some blue sky and could feel the warmth of the sun. More importantly, the trail started to firm up; there are some really steep parts. Soon after we started digging we were joined by John Kerr and the five Poles.

Bill Stone: James Brown, Ryan Tietz, Andi Hunter, and I stayed in base camp today, mainly catching up on gear preparation and doing laundry in the river. Ryan spent most of the day unraveling a kilometer-long length of dive line, some of which would be used as haul lines in the Cueva Barranca Estrella dig, but most of which would be spooled for possible use in the Sumidero Aguacate sump later, if we failed to make a breakthrough in the Star Gorge. I spent much of the day charging a pair of Ovonic nickel-metal-hydride batteries that will be used to power our Warn winches. We now have fourteen in camp and can begin working two objectives at once. The winches could be used to tackle the new collapse upstream.

Meanwhile, news of our presence had spread, and the number of visitors has increased. Three hunters from Santa Ana told us they knew of a cave some fifteen minutes up the valley that they would be willing to show us tomorrow. An entrance farther up the river would be particularly interesting, since it would be near the contact between the volcanic rock and the limestone and if a cave there went deep, it would be a great find, nearly on top of the limit of exploration in Cueva Charco, which would only be about 500 meters down from the canyon floor.

The Polish team, from left: Artur Nowak, Małgorzata "Gosia" Barcz, Tomek Fiedorowicz, Paweł "Pavo" Skoworodko, and Katarzyna "Kasia" Okuszko. *Bill Stone.*

February 19–21, Gregg Clemmer: After days of digging in the low, bottom passages of Cueva Barranca Estrella, we focused our efforts on the river sink, Sumidero Barranca Estrella, 500 meters upstream. The dramatic stream collapse still farther upstream proved too unstable to dig. But because of it, our dig at the old *sumidero* was now dry. The limestone strata dipped to the north-northwest. Previous visitors had watched water spiraling into a number of swallow holes under huge limestone blocks. A solid limestone headwall on the north side of the dry creek bed hinted of cave where the stream had disappeared. Broken bamboo lay piled against one corner of the headwall, indicating the water's swirling path. Soft, deep sand was banked underneath. Digging would be easy initially, or so we thought.

David Kohuth, John Kerr, James Brown, and I began the dig by clearing the bamboo and removing four feet of sand against the headwall. A solution crack opened on our right, a joint that had been filled with sand, rotting leaves, sticks, and assorted trash. Ryan Tietz joined the crew in midafternoon. About dark, I pushed my crowbar through into a void, which caused excitement that gave way to more hard work. An opening was cleared to reveal a clean-washed cave passage that was far too tight to enter. But when we peeked beyond, it appeared to open up.

The next day we went at the dig again, taking out rock in chunks with drills and chisels. Andi Hunter wormed her way into the tightest section, head down, and handed back rock after rock, sand, and muck, lowering the floor and widening the passage for the rest of the crew. We also began a second dig about 4 meters to the left of the first one. This, according to Stone, was where the water had been seen sinking the previous year. Large, ominous boulders the size of concrete trucks stood poised above this point. Safety being paramount, we lowered the floor against the headwall and kept an eye on the rocks wedged above us. I crawled into the small space, finding hundreds of daddy longlegs pulsating on the ceiling. I noted a very definite cool breeze.

On Sunday, February 21, Kohuth, Tietz, Kerr, Jan Matthesius, Pauline Berendese, and I went at both digs with a vengeance. More digging in the left-hand dig increased the airflow, but the right-hand dig offered ample evidence of limestone solution. After several hours, I had cleared a small space on the left, 4 meters deep and an irregular 1 meter in diameter, angling down into more broken rock. Fortunately the arachnid occupants had vanished. Numerous blowing holes chilled all who worked this dig. Having winched a number of boulders, one estimated at three to four tons, we pushed the dig deeper. After eight hours of backbreaking work, we closed down the operation for the night. Even the right-hand dig was now showing signs of airflow.

February 21–23, Bill Stone: On the twentieth, Tomek Fiedorowicz and Pavo Skoworodko had hiked for some two hours on the high trail toward the village of San Juan Chiquihuitlán, about 200 meters above the gorge, on the north side. There they had been shown a deep pit by local farmer Salvador Zuniga. According to their GPS location, it was relatively close to the dirt road on the north side of the ridge between Chiquihuitlán and Cuicatlán. Today seven of us, Tomek Fiedorowicz, Pavo Skoworodko, Andi Hunter, Artur Nowak, Gosia Barcz, Kasia Okuszko, and I, hiked up the mountain to Santa Ana at dawn. We picked up one of the trucks and drove east for a half hour before pulling onto a muddy, deeply rutted trail southwest over the ridge and down to the cave. Tomek rigged down the entrance shaft, trailing, with some measure of hope, a duffel bag filled with 200 meters of rope. Pavo, Andi, and I followed. It was an impressive drop, with rays of light penetrating down into the gloom and illuminating sinuous fissures extending off in three directions. When I touched down, Tomek informed me that he and Pavo had explored a deeper chamber, where the cave ended. While he ascended, the rest of us began the survey. There was some apprehension among the surveyors when Pavo pointed out some very large spiders. The lower chamber was 20 meters in diameter, with a floor of dried, cracked mud. A small stream issued from a hole on one side, crossed the width of the room, and sank into an equally small hole. Andi and I climbed tandem to measure the entrance drop, which was free for 60.7 meters up to a rebelay, and then another 20 meters to the lip. The total depth of the cave, Osto de Palo Elite, is 92 meters.

On our way back to Santa Ana on the mountain road, we met a bus

Pavo Skoworodko hiking down the arroyo to Cueva Barranca Estrella. *Tomek Fiedorowicz*.

Andi Hunter and James Brown shopping at the weekly market in Cueyamecalco. (Note the supermarket PLU sticker on the apple at bottom.) *Ryan Tietz*.

Maarten Poot, Bill Stone, and Paulina Berendese discussing cave surveying techniques at Sumidero Barranca Estrella. *James Brown*.

that held three new expedition members from the Netherlands, Tjerk Dalhuisen, Maarten Poot, and Martijn Boonman. Adding them and their gear to our truckload, we went on to Santa Ana, where we spent the night, since local Marti Gras festivities had begun and it was too late to arrange burros to haul our second winch down to the gorge base camp.

Sunday was market day in Cueyamecalco, and we drove there to buy fresh fruits and vegetables for base camp. Then we backpacked from Santa Ana down to base camp, where the Sumidero Barranca Estrella dig was still going strong. We pitched in there.

On the twenty-third, Skoworodko, Barcz, Nowak, Poot, Boonman, and I went in for one last look at the dig in Cueva Barranca Estrella, which Fiedorowicz had strongly argued was not worth further effort on our part. Substantial progress had been made since I had last seen it a week before. It was obvious I was not going to fit all the way to the end of the dig, so Pavo went in feet-first and disappeared for a long time. He had dug out a scoop full of sand, and the hole he left was slowly filling with water. There was no airflow to encourage us. Reluctantly, we decided to end our efforts there, having excavated 46 meters, and we pulled out all our equipment. We now had a week to make the digs in the *sumidero* go. If they did not, we would pull out of Barranca Estrella to pursue other tasks.

February 23, John Kerr: A team of five, James Brown, Andi Hunter, Ryan Tietz, Tjerk Dalhuisen, and I, headed to the *sumidero* dig after assembling equipment and eating a hearty breakfast. In the left-hand dig, we decided to continue down into a tight, sand-filled opening where we could squeeze into a rock-filled chamber. We had to constantly avoid touching a collection of tenuously balanced loose rocks. From the small chamber, a steady procession of rocks was passed up through the maze and out onto the ever-growing mound of debris on the surface. Several large rocks, either too heavy or oddly shaped, were just repositioned in the growing chamber. As the sandy floor was probed, a small void became apparent, and loose pebbles could be heard falling into a room below. Finally we were able to enter this bedroom-size area through a 30-centimeter high squeeze at its ceiling. The ceiling of the room seemed to be composed of solid rock, which provided a sense of security.

The right-hand dig has an entirely different character. It is a narrow crack in seemingly solid rock that is plugged with debris, sand, and mud. The redeeming quality is that stability is not an issue. We hope that we can reach a main passage via the left-hand dig and then dig from inside to reach the right-hand entrance, which would become the preferred route into the cave. Each day's digging progressed either downward or inward as the rock dictated. The tight quarters required some real contortions. Today we continued this work, removing what at this point was predominantly gravelly mud.

February 24, Jan Matthesius: Today started as a routine day like the days before. Still, something was in the air. Indeed, it turned out to be an exciting day. Maarten Poot, Tjerk Dalhuisen, Pauline Berendese, James Brown, and Martijn Boonman went to the left-hand dig and started to remove some big boulders in a narrow, horizontal passage. Slowly they worked their way to the first real pit in the dig, a 3-meter downclimb into a small chamber in big, round boulders. From that point, the cave really started to go. A small downclimb went to a black, gloomy rift off into the darkness. The floor of the rift dropped steeply, but it was possible to continue horizontally. The walls consist of heavily eroded, sharp limestone, and there was something at the end of the rift that seemed to be a 20-meter pit, but the bottom was not visible. No rope being at hand, they went out for lunch and a group meeting, where it was decided that the cave should be surveyed to that point before exploration continued. Maarten, Martijn, and I went to do that job.

In the meantime, rapid progress was made in the right-hand dig, where Bill Stone and Andi Hunter worked their way down in the clay and mud. After both digs were surveyed and plotted in the computer, it turned out that the passages are close to each other, so breaking into the safer right-hand dig might be fairly easy.

February 25, Andi Hunter: We woke to light drizzle and a dense fog after a restless night's sleep, but the exciting lead drew us from our sleeping bags. No one wanted to act as base-camp guard, so straws were drawn. The first push and survey team comprised Martijn Boonman, Maarten Poot, and Pauline Berendese. At 2 P.M., Jan Matthesius replaced Maarten. Since the secure right-hand dig had not been connected, the only access was still through the unstable boulders of the other dig, where only those who enjoyed tight squeezes, had experience in unstable surroundings, and whose physiques were compatible with narrow fissures could go. The team descended the water-washed pit walls, surveying as they went, then finagled their way through abrasive black passages and narrow, descending cracks where handling a day pack was an arduous task. They had some frustrating moments trying to get used to sketching to scale, but ended up turning out a fine product by the end of the day. A hole across the top of the pit was seen, but it would take an aid climb to reach it.

A second team, consisting of Bill Stone, Ryan Tietz, John Kerr, James Brown, and me, made slow progress hauling one bucket of wet, sticky mud after another up the tight right-hand dig. A rebreather was installed in the crack to refresh the air, just as it had been used in Cueva Barranca Estrella. The current focus there was to dig straight down, hoping to connect with upper leads in the pit room in the left-hand dig.

February 26, Jan Matthesius: Yesterday the cave ended at station 24, a small hole going off to the left. Today we enlarged it and dug away the floor. Pauline Berendese passed through to a narrow continuation, beyond which she could stand up. After a few meters, it dropped again and became larger. There were bits of flowstone throughout this area. It became narrow again, and after about 40 meters came to a sudden stop. There was a small hole almost filled in that appeared to be the only way on. A bit of work with a hammer gave some results, but we will have to go back.

Martijn Boonman: From the bottom of the pit, a large window can be seen approximately 6 meters up. The climb went well. After four or five bolts, the window was reached; the drill battery was holding out, and a lot of solid rock was found for the anchors. Unfortunately, the window led only to an upward shaft.

Andi Hunter: We continued the gnarly mud-filled dig in the right-hand cave. The width was no more than 9 inches, so we were able to retrieve only one handful of dirt at a time. The digging was long, wet, and grim, but we continued despite the heavy rain coming down outside, which created a small stream in our digging area. Only 6 more meters to go, according to the map, to connect with the other cave. It's hard to stay motivated when you wake to rain and mud, put on your wet and muddy cave suit, and scoop up one muddy handful of dirt after another.

Bill Stone: As you can see, three days of rain and tough going underground have led to a lowering of morale. We'll hope for sunshine to dry out our clothes and invigorate the airflow in the cave, which seems to have stalled when the bad weather arrived. It was the air that kept everyone focused. Without that to guide us, the work underground is guesswork.

February 27, Jan Matthesius: The dig site at the end of the left-hand cave was attacked by Martijn Boonman, Pauline Berendese, and me. Slowly the hole became deeper and wider. All three diggers turned into muddy brown puppets. All material that was removed ended up on the floor in the small room. Little airflow was felt. Later, Artur Nowak joined us. After 1 meter, the front of the dig turned from sand into flowstone with a lot of solution holes. John Kerr, Maarten Poot, and Tjerk Dalhuisen worked later in the day, and some big rocks were removed.

Andi Hunter: Another gloomy, cloud-covered sky and a late start, but nevertheless we gathered our gear and tramped through the mud and rain down to the cave entrance. James Brown, Bill Stone, and I were headed in to do a lead climb in the dome in the left cave, a change from the usual scooping routine in the other entrance. I was still a bit leery of the unstable entrance, so we proceeded cautiously with large packs of climbing gear. Bill pushed and squeezed, but he could not fit through the small boulder restrictions to reach the climb, and James's specialty is diving, not climbing, so I did the climb. The drill performed exquisitely, but my blow tube was too short, and I had trouble reaching the hole to blow out the dust. One bolt after another, I could feel my shoulders starting to fatigue from the drilling over my head. Finally I was able to wedge myself into a crack near the top of the dome and sit on a small ledge in order to place the last two bolts. We heard a voice coming, and to our surprise it was Bill, who had used various cave-widening techniques to reach us. I rigged a static rope from the top of the dome, and Bill climbed up to help me survey the tight fissures leading off in various directions. In all, our efforts had gotten us 10 meters up into the dome, but all of the passages leading off were too tight to pass.

February 28, Andi Hunter: Everyone slept late, and the sun finally fought its way through the clouds, so some of us declared it a day for laundry and washing dishes. Matthesius, Berendese, and Dalhuisen worked some more on the dig face in the left-hand cave, and Kerr worked on the right-hand dig, which had only 4 meters to go before connecting, according to the map.

February 28–March 3, Pawel Skoworodko: During the last few days of the Barranca Estrella camp, Osto de Cerro Voludo #2 was explored. Stone told us about this pit on the south side of the valley. He gave us the GPS location of Osto de Cerro Voludo #1, a nearby 106-meter pit that had first drawn cavers' attention to the area. Artur Nowak, Ryan Tietz, and I first went up there on February 28. Fortunately we encountered a local boy on the trail who showed us the entrance, which would otherwise have been hard to find in the karst. We had no bolt kit, so I just tied off to a boulder. Artur went down the pit, where Stone had previously dangled at the end of a 50-meter rope, first and also ran out of rope, but he had good news: unlike most of the pits in this area, this one continued down. He saw big tarantulas down there, but they are not that scary anymore. The next day, Artur, Martijn Boonman, and I returned with more rope, bolts, hammer drill, and survey gear. While Artur rigged the second drop, Martijn and I began the survey. The second pit was also about 50 meters deep, and most of it was covered in clean flowstone. At the bottom, there was a little room, with an easy 5-meter climb to a window into another pit, which contained beautiful white formations. The bottom of that pit, about 10 meters below the window, seemed to be the end of the big cave. We entered into European-style alpine-karst meander, a jagged, narrow, twisting canyon, which took us to a small pit with ankle-deep (if you're lucky) mud at the bottom. There was a small window about 8 by 16 centimeters in size through which a continuation could be seen. A rock hammer didn't accomplish much, so we decided to return with better tools. No strong airflow was noticed.

The next day John Kerr, Boonman, and I went in with drills and chisels. We finally passed the hole, and John and Martijn got into a beautiful flowstone chamber with a chimney going up and a couple of pits going down. In the deepest pit, Martijn reached a sump.

The following day, Artur and I went back to the cave to survey the new discoveries and derig. I noticed there was a tight squeeze by the sump that might be passable after a bit of hammering, and there was a chamber on the other side of it, so we decided to leave the cave rigged. We checked several leads on the way out. One of them, a tight crack out of the second pit, has the strongest airflow I noticed in the cave, but is too tight to enter. Stone and I reduced the survey data, and Osto Cerro Voludo #2 is presently 167 meters deep and 245 meters long, pretty much a succession of pits connected by some short horizontal passages.

February 29, Bill Stone: There are no supermarkets in the Sierra Juárez. But there are markets that roam from town to town on a weekly basis. On Sunday, the colorful affair is in Cueyamecalco, about 5 kilometers west of Santa Ana Cuauhtemoc. A fairly large contingent of those suffering from the mud, rain, and bugs down in the Barranca Estrella base camp made the trek up the mountain in search of culinary treats, while a few diehards remained on site to continue

Spanish, Australian, and Mexican members of the team, from left: Marta Candel Ureña, Alan Warild, Greg Tunnock, Enrique "Zape" Ogando Lastra, Estibaliz "Esti" Orella Campo, Luis Miguel Casabona Sevillano, Ignacio "Nacho" Orella Campo, and José Antonio Soriano. *James Brown*.

the exploration of Osto de Cerro Voludo #2 (see message by Skoworodko above) and the dig in Sumidero Barranca Estrella. We also zeroed in on the hardware in the market, since there were now several caves in the project competing for equipment. John Kerr bought a rather well made two-pound sledge that was destined for the bottom of the dig in the *sumidero*, now 60 meters deep and 200 meters long, heading at 330 degrees into the mountain.

Most of the crew returned to Santa Ana and base camp. Four of us, Tjerk Dalhuisen, Maarten Poot, Andi Hunter, and I, continued south on a little-used four-wheel-drive road to the town of San Miguel Santa Flor and made our way to the municipal building, where we explained the purpose of our mission. After a half-hour of friendly banter and inspection of maps showing the known caves in the area, the *presidente* read a letter of introduction from officials in Oaxaca City, signed it, and ceremoniously stamped it with the town seal. This was our permission to scout the mountain to the south, where the high karst plateau loomed in the distance.

March 1, Bill Stone: The previous evening at the *presidencia*, the town registrar had mentioned that just above town the Río San Miguel, the stream in the Barranca Estrella, splits into two parts. Half purportedly disappeared into a hole in the side of the canyon about a half-kilometer upstream from town. This morning we set out to investigate. We soon found ourselves chopping along animal paths through thick tropical foliage and into a narrow rift in limestone in a sea of metamorphic rock. Contacts between others rocks and limestone are good places to find cave entrances. Our focus was on the streambed, and shortly we found what we were looking for, a 1-meter-diameter solution hole in the side of the canyon at floor level. It was more obvious that it might have been because the locals had built a small dam of mud and rock around it to keep water in the main stream. Tjerk dropped in, and out came several tens of thousands of gnats in a black cloud. The hole was filled with boulders, either thrown in to stem the flow or washed in naturally. As an experiment, we broke the dam and diverted a fair portion of the flow into the hole. We did not see it reappear anywhere nearby downstream, so it looks like a good bet as a water entry into Cueva Cheve. But the hole soon filled up and overflowed. It drained slowly when we rebuilt the dam. An interesting prospect, but not the open shaft we had hoped to find.

We then continued down the road to San Francisco Chapulapa, at the head of the deep Aguacate canyon that leads southwest toward the Cheve plateau. In 1989 we had located another river sink, the Sumidero Aguacate, in the area above town during the same recon trip that discovered Cueva Charco. During the 1994 expedition to the Cheve area, this cave was subsequently explored to what appeared to be a terminal sump at a depth of 174 meters, about a kilometer from the entrance. Its dimensions are generous, with a large tunnel leading to a sump. It takes the entire drainage of the huge Aguacate canyon, it is in the limestone contact zone that extends all the way from Cheve to the springs in the depth of the Río Santo Domingo canyon, and it trends 330 degrees. This all makes it likely to be a significant part of the overall system of caves in the area. The Aguacate canyon also provides a point from which to search the high plateau for pit entrances that might connect to Cheve.

In Chapulapa, a few men were hanging around the municipal building chatting. Since no cavers had been there in the past ten years, we had to explain the importance of the exploration work. Eventually, one of the men, Celso Iglesius, the *registrador de hacienda* for the *municipio*, took an interest, because the expedition was willing to rent part of the mostly unused municipal building as a base for working in Sumidero Aguacate. He promptly signed a copy of the letter of permission from Oaxaca City and affixed the town seal.

With that in hand, we drove back up the mountain to an intersection I had noticed on the way into town. It had not been there in 1989 or in fact even in 2003. When I mentioned this in town, I was told that it led 5 kilometers farther up the mountain to the village of El Ocotal, exactly the direction we wanted to go to reach the high karst, saving 500 meters of elevation gain on foot trails. It also passed within a few minutes' hike of Sumidero Aguacate, as we verified in the afternoon, when we drove up to El Ocotal, passing through several canyons with black holes in their walls. Some local field workers offered to serve as guides to take us up into the area the following morning. Although we could have gone on our own, with the GPS to ensure we could find our way back in the fog, it is good to have a local guide who knows of every *osto* (pit in Cuicatec) and sinkhole. We slept in the municipal building in Chapulapa that night.

March 2, Andi Hunter: The lights came on automatically at 5 A.M., which gave us an early start at packing for the adventure in the highlands into the death karst, which gets its name among cavers from the jagged, heavily weathered limestone that can break off and send you plummeting into cactus. There is no water and only scrub vegetation, and a day up there frequently leads to sunburn, dehydration, and wounds beckoning for stitches. Dalhuisen, Poot, Stone, and I struggled to keep up with a fit local guide as we headed south of the Aguacate canyon toward the tall cliffs south above the village of Tlalixtac Viejo. At almost every turn, our guide would point out obscure *ostos*. As soon as we would top one sinkhole, we'd enter another. We had been looking for water all day when our guide pointed to a *ciénega* (swamp) of muddy, rust-colored water full of algae and cow droppings and declared it to be "sweet" water. It was the only source of water in the highlands. We recorded GPS coordinates of over twenty-five pits and potential digs that afternoon. Because of its inaccessibility, the area had never seen a caver's headlamp, and we were determined to change that by establishing a camp in the highlands. Given the state of the local water, we would have water transported by mule. Three mules were available in El Ocotal, so each delivery could bring 120 liters of water every other day, enough for a six-person camp. Conditions would be primitive, terrain rough, and showers nonexistent.

March 3, Andi Hunter: Dalhuisen, Poot, Stone, and I slept in the cold at 2800 meters near the Cueva Cheve entrance, where we had driven to get a GPS location for it. We plotted up several of the GPS locations taken yesterday and found that one cave in particular, Cueva Jabalí, which we had briefly checked and continues on a 330-degree bearing, needed revisiting. It took us three hours on the narrow roads to get from Cheve back to Santa Ana, where we found energetic new cavers awaiting our arrival. They were Alan Warild and Greg Tunnock from Australia, Enrique "Zape" Ogando Lastra, Marta Candel Ureña, Luis Miguel Casabona Sevillano, Estibaliz "Esti" Orella Campo, and Ignacio "Nacho" Rafael Ramos from Spain, and Mexican caver José Antonio Soriano. We sent the new team over to set up a base camp at Sumidero Aguacate, and Stone and I hiked down to the Estrella base camp by moonlight. Late that night, a discussion among everyone there decided to give both Osto Cerro Voludo #2 and Sumidero Barranca Estrella one more push day and then pack up and move up the mountain to work in the Aguacate region.

March 4, Maarten Poot: By the time Tjerk Dalhuisen, Ryan Tietz, John Kerr, and I were ready to go to work in the dig in Sumidero Barranca Estrella, two other teams had already taken all of the battery-operated drills, so we decided to haul the base camp generator to the front and use the Milwaukee drill to loosen some boulders blocking the way forward. Since there was hardly any draft in the cave, the air got really bad after a few minutes of drilling. Tjerk had to be escorted out. The generator had left so much fog at the front that digging was impossible for a while, so to kill time we started to explore the main fissure upstream of the dig, where Matthesius and Berendese has previously started a climb. John dug open a hole in the floor of a small chamber, and I crawled through. Below were a couple of small chambers connected by squeezes, all in solid bedrock. Holes in the roof were plugged with boulders. The drain for the area was plugged with mud. The hole into this area was still unstable, and a big boulder needs to be removed to make it more comfortable.

Then we returned to the front, cleared out some loosened boulders, and removed all the equipment. It looks like the fissure could break out into going tunnel, but it is impossible to see ahead more than a meter. The crack, a half meter wide by 3 to 5 meters high, is full of boulders wedged there when the Río San Miguel ran through it, making progress exceedingly arduous. We finished Jan and Pauline's bolt climb, which dead-ended at the top, removed all the hangers, which were getting to be in short supply, derigged the main pit, and hauled all the gear back to base camp. I can't believe we got the generator into and out of there. Total survey in Sumidero Barranca Estrella was 205 meters, to a depth of 59 meters.

March 6, Bill Stone: The evening of March 5 we packed up the main base camp tent at Barranca Estrella, and it was a strange, exposed feeling eating dinner that night. The full moon was rising, and some local cows had decided to return to their pasture and were roaming through our tent city. Pavo Skoworodko, Marcin Gala, Artur Nowak, and Kasia Okuszko were still off on a last push in Cerro Voludo #2. The rest of us were wondering whether Brandon Kowallis had been successful in his solo mission to Santa Ana to arrange mules.

It took two rounds of eight mule loads each to get all our equipment up to Santa Ana. Then we had to get all of it and eight people into one truck. We were fortunate to locate the last fifty liters of diesel fuel in town, and, loaded down, we four-wheeled it across the mountain to San Miguel Santa Flor and on to San Francisco Chapulapa. Various parts of the team had already passed through town. Martijn Boonman, Tjerk Dalhuisen, Maarten Poot, Peter Hartley, Jon Jasper, and Brandon Kowallis had their hired truck driver take them straight to El Ocotal, from which the following morning they had hiked up the mountain to the limit of the previous week's recon to establish a high camp. Alan Warild, Greg Tunnock, and the Spanish contingent had done the same a day later and were now holed up in the *presidencia* in Chapulapa. They had been keen on getting started in Sumidero Aguacate and had just returned from a second day of rigging and exploration there. Warild had concluded that the sump would not go, but many side leads remained to be looked at, and there were a number of domes that could be climbed. Hunter, Kerr, Tietz, Skoworodko, Nowak, Gala, Kasia Biernacka, and I found unoccupied spaces in the building and crashed for the night. It rained hard.

March 7, Bill Stone: The Poles were eager to ascend the mountain and get their fair share of rain in the cloud forest above El Ocotal, so after breakfast we transported them and some 180 liters of water in twenty jugs up to the basketball court in the village, where we wished them luck in arranging burros. If the rain continued, the arrangement for water-supply by burro would be unnecessary, but the usual weather in March in the high karst is hot and dry. John Kerr and Ryan Tietz decided to join them at the last minute.

On the way back to Chapulapa, Andi Hunter and I met James Brown above the entrance to Sumidero Aguacate for a recon trip to the bottom. Warild and crew had left the cave rigged at our request, and this was our chance to finally see the cave that was one of the main targets of our expedition. In a somewhat futile attempt to remain dry, Warild had rigged the cave through a second entrance, guarded over by a 10-meter *mala mujer* tree. When I reached the bottom, I was watching for the coral snake Warild had seen, but saw only black rock. Soon Andi and James arrived, and we headed into the main cave. Almost immediately we were crawling flat-out in the stream—so much for staying dry. The crawl opened into the first of four main pitches leading down to the –110-meter level. There was no staying out of the water on the pitches, which are separated by a few meters of walking in the stream. Finally we were in the main low-level corridor, a tunnel three-quarters of a kilometer long and averaging 10 to 20 meters wide and 5 to 10 meters high. At the base of the last large pitch, we turned into a crawl up a different stream and slithered along at a good clip for a few minutes. In the distance we could hear a rumbling sound, and soon we could feel the mist and wind from a large waterfall. The crawl abruptly enlarged into a high, arched chamber, where the water was coming down one side of a giant dome leading up some 30 meters into darkness. The flow coming down the falls did not seem to be related to the water coming in the cave entrance, since it had at least twice the volume. The water could be being pirated out of the same surface stream farther upstream, or it could be coming from cave higher up the mountain. (There is a map of Sumidero Aguacate in *AMCS Activities Newsletter* 23, page 52.)

Downstream in the main passage was fast walking over a streambed littered with Volkswagen-size boulders, polished smooth over the eons. As we neared the sump, steep walls of organic-rich mud began to ascend the walls of the widening tunnel. The stream had cut its way down on the west side, and we followed it directly to the sump. Jim maneuvered into the sump feet-first until nothing but his head was out of the froth that was brown with the mud we'd stirred up in the passage. He kicked around but found nothing passable to divers.

During our retreat, we took time to investigate the northeast wall of the final room, looking for anything that might have been overlooked to provide a bypass to the sump. We ascended a tremendous mud bank until it crested 40 meters east of the sump and 20 meters above it. Back down the other side, it soon hit the descending wall. But Andi located a narrow horizontal crack in the floor and was soon tossing out rocks and saying she could see farther down. I joined in, and within a few minutes enough loose rock had been removed to reveal blackness below to the east. Andi dropped in and said, "You're not going to believe this, but I'm in a room as large as the one we just left." Together we explored the large chamber. Like the other room, it was mud-floored, and to the northeast was a large funnel, where we carefully cut steps to look at the drain. A hole about a meter in diameter led vertically down into the gloom. It was too steep to attempt without a rope.

At camp that night, we decided there was merit in awakening fresh at the front, without having daily gone through the deluges in the

Below: Overloading the poor truck when leaving Santa Ana for Chapulapa. *Bill Stone*.

Right: Andi Hunter on the wet second pitch in Sumidero Aguacate. *James Brown.*

entrance pitches, so Bart Hogan, who had just arrived from Maryland, Andi, and I began planning a camp in the room leading to the sump.

March 8, Bill Stone: Early in the morning we heard from John Kerr by radio. It turned out that there were few mules or horses in the Ocotal area, and only one horse and part of the crew had ascended the mountain on the seventh. Most of the new crew descended today to go back up carrying what they could. James Brown drove up to Ocotal around noon to drop the Australians and Spaniards off for a recon descent through the towering canyons to the southwest of Chapulapa. With Spanish-speakers on hand, it was determined that there was only one horse available and one person, our previous guide Atanacio, game to haul gear up to the high karst. So they returned to Chapulapa and arranged for eight mules there with Vicente Navarrete, the rancher whose land contains the Sumidero Aguacate.

Andi Hunter, Bart Hogan, James Brown, José Soriano, and I packed gear for the underground camp in Aguacate. As the overall team was scattered, some tools were again in short supply. Andi sorted food and rope, and Bart modified a power supply to charge our drill batteries. (The grid power in Chapulapa was dropping down to 70 volts and our usual chargers were shutting down.) I sorted climbing gear for an ascent up the waterfall dome we'd seen the day before. James and Soriano agreed to help us haul in gear.

March 9, Bill Stone: A glorious sunny day broke over Chapulapa, and we could see blue sky extending up over the high karst as well, a welcome sight, I'm sure, to those camping above. Today the Aussies and Spanish will meet a burro train from Chapulapa to take water and equipment to the high camp. Then there will be nineteen in the high karst and only five remaining in Chapulapa. Andi Hunter, Bart Hogan, and I will disappear for the next three days into Sumidero Aguacate, while José Soriano and James Brown will, after helping us set up the underground camp, man base camp and maintain radio contact with the high camp. News yesterday was that the Dutch had returned to Cueva Jabalí, the horizontal crawlway that Tjerk Dalhuisen had entered a week ago, and come to a five-second pit, but that Maarten Poot had hurt his hand while clearing an entrance to the pit and would be out of action for a few days. Pete Hartley and crew had established a camp higher up on the ridge and were moving on into the killer karst.

The five of us left the surface at about noon. We dropped off most of the equipment at the site of the underground camp and proceeded directly to the dig in the bottom of the mud funnel in the new room. Andi and Bart did most of the digging. By the time James and I took our turn, maybe fifteen 5-gallon buckets later, it was apparent that we were not just pulling out mud, but were in breakdown. We retreated to camp and made a list of things for James and Soriano to bring in tomorrow. We dug a flat, drip-free shelf above the river, hung a clothes line, and finally dug a latrine downwind from camp.

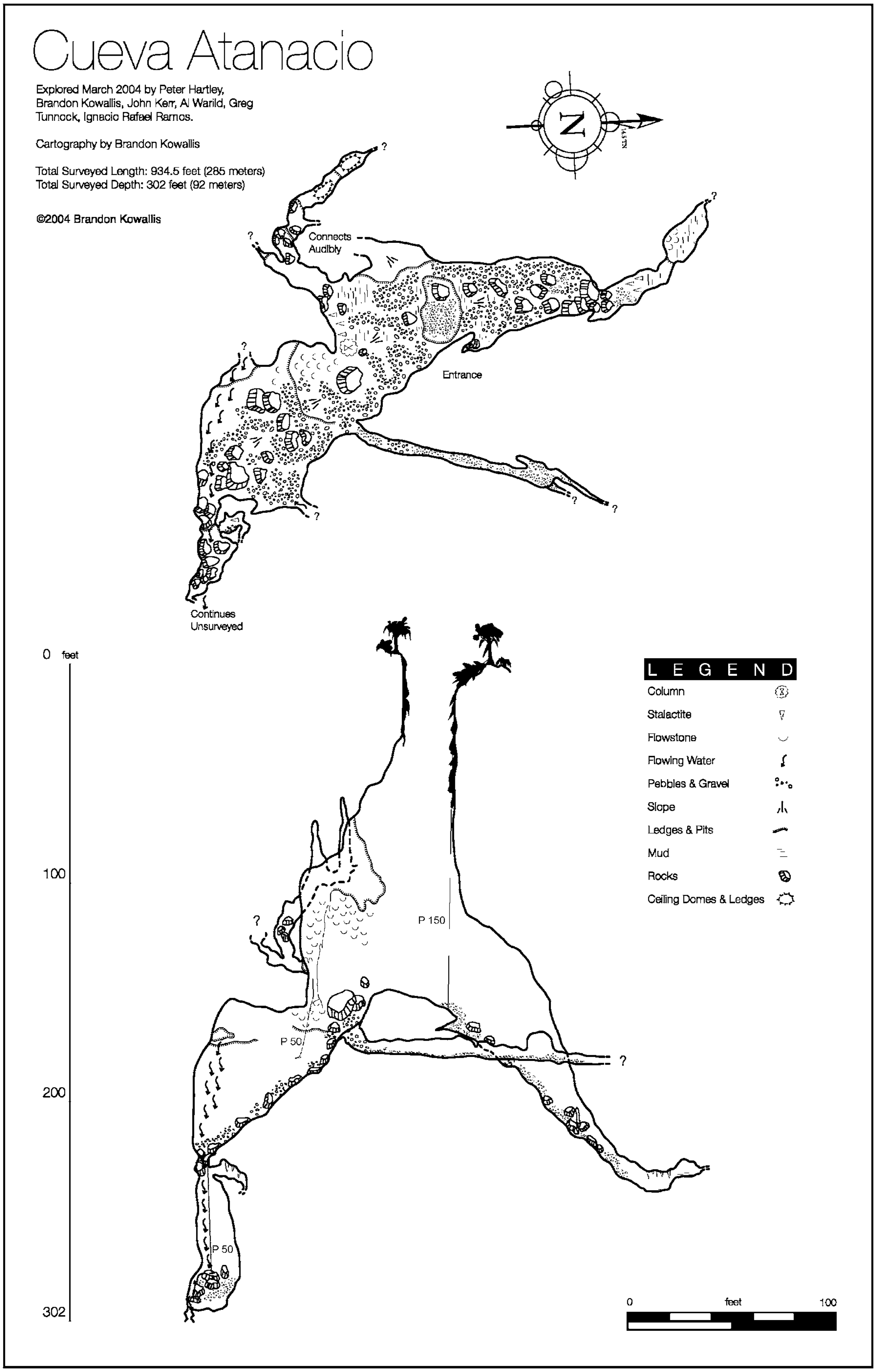
March 10, Bill Stone and Andi Hunter: Everyone recalls hearing a loud noise last night and thinking it was a flood, but water levels have not changed. It might have been a loose rock that had been disturbed by a caver and finally fell.

We are back in camp after eight and a half hours of digging. Bart and Andi did all the digging. The rest of us, including James and Soriano, who had come back in with supplies and to help, did the hauling. Digging is not a glamorous sport, but the sound of rocks dropping below us was enough incentive. The excavation is now about 5 meters deep, and pebbles seem to drop through the breakdown about as far again. Toward the end of the day, Bart drilled five holes, and then Stone went in and hammered until some key cobbles gave way—work for tomorrow.

March 11, Bill Stone and Andi Hunter: Being camped underground has some definite advantages: no rain and no locals to distract you. Yesterday's hammer work had been very successful, and we pulled out fifteen more buckets of debris, plus a dozen large rocks, two of which required a 2-to-1 pulley system to yank out of the hole. Then we decided to take a break and do something different. Andi suggested that we go climbing. We gathered back in the main tunnel and looked for cracks in the roof. Stone had spotted something during our first trip in on March 7 that appeared to lead into blackness, another possible sump bypass. Andi did the climb. The first four bolts were exposed and went diagonally across the overhanging roof, making it difficult to gain more than a meter per bolt. The fifth bolt put her in a vertical crack that led to a chamber 6 meters wide and 10 meters long, with several leads. The climb took about nine bolts in all. An additional drill battery was sent up, along with webbing and rope. Hogan went up to help set up a traverse line over fissures in the floor.

March 12, Bill Stone and Andi Hunter: Our efforts in the high lead netted a few crawlways. It was like Swiss cheese up there, with holes going in all directions. Bart Hogan and Andi Hunter pushed and squeezed though many of the holes, but they tapered into even smaller holes, though one that Hogan found still went. So finally we pulled out the drill and the rope across the fissures and returned to the dig. José Soriano, James Brown, and John Kerr showed up at 2:30 in the afternoon. John's arrival was a surprise, a welcome one because he is a master with a hammer and had brought in a ten-pounder, with which he promptly created more hauling work in the dig for tomorrow. He filled us in on the high karst. The trails there were grossly muddy, but they'd found some deep caves, one of which was down to –180 meters. Cueva Atanacio had been mapped to a depth of 92 meters. The Dutch and the Utah cavers, Peter Hartley and Brandon Kowallis, had left the mountain this morning. With Kerr and Ryan Tietz now back in Chapulapa, the Poles, Spanish, and Aussies rule the upper camp.

Brown had come prepared to


Cueva Atanacio
Explored March 2004 by Peter Hartley, Brandon Kowallis, John Kerr, Al Warild, Greg Tunnock, Ignacio Rafael Ramos.
Cartography by Brandon Kowallis
Total Surveyed Length: 934.5 feet (285 meters)
Total Surveyed Depth: 302 feet (92 meters)
©2004 Brandon Kowallis
Z
Connects Audibly
Entrance
Continues Unsurveyed
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0 feet
100
200
302
P 150
P 50
P 50
LEGEND
Column
Stalactite
Flowstone
Flowing Water
Pebbles & Gravel
Slope
Ledges & Pits
Mud
Rocks
Ceiling Domes & Ledges
0 feet 100

Greg Tunnock sketches the map of the floor of Cueva Atanacio. *Brandon Kowallis.*

camp for two days. Soriano and Kerr left for the surface.

March 13, Bill Stone and Andi Hunter: Today was survey day. Is the dig at the bottom of Andi's mud room deeper than the sump? We surveyed up from the bottom of the dig and down to the sump. Sketching the survey in camp, Stone found that the sump was only a half-meter below the dig. The sump was now running clear, and we could see the hole was about 1 by 0.5 meters, headed down. We pounded in the dig some more. Then James Brown and Bart Hogan went up to push Bart's lead in the maze of tubes off the high room Hunter had climbed to two days before, while the two of us struggled to complete the survey of that area, now called the Arterial Neurosis. James continued digging, and Bart prepared for a lead climb. There is some air there, and it appears to lead to an upper level, but we haven't figured out how to get there yet.

Kerr and Tietz arrived late that evening, after having hiked up to the Ocotal camp and back that day. They joined the camp crew. We have pushed all the leads near the sump and will soon have to work back toward the entrance if none of these pans out.

March 14, Bill Stone: John Kerr, James Brown, and I pulled out buckets of gravel from the dig for an hour. Bart Hogan went up to whang at the top of his climbing lead, which he topped out with four bolts, with Kerr's ten-pound hammer—no go. Hunter, Brown, and Tietz went scouting upstream, where Andi found a fissure leading east about 50 meters upstream from camp. It has a boulder blocking the way in.

March 15, Andi Hunter: I headed down to the dig again, with Hogan and Kerr, where we proceeded to haul out at least fifteen buckets of rock and mud. The "point" is currently blocked with debris from our digging efforts, but we are slowly hammering away at a large boulder blocking the passage.

After lunch, I headed for the big waterfall dome that was through the water crawl upstream from the bottom of the last large rope pitch, at about –110 meters, where Ryan Tietz and James Brown were learning how to do a lead climb, belayed by Stone. They had progressed about 15 meters up the dome, which was 40 or more meters tall. Just as the drill batteries died, the hammer drill became detached from Brown's seat harness and fell, narrowly missing Stone. Ryan and James returned to camp.

Stone and I headed for the surface on a resupply run, meeting Soriano at the entrance. We took with us trash and dead batteries. As I cleared the lip and was surrounded by vibrantly green leaves and other lush vegetation, my eyes went into overload, even though it was an overcast day.

March 16, Bill Stone: This was a day of regrouping on the surface. Kasia Biernacka radioed that she and three other members of the Polish contingent were coming down the mountain for supplies and

The first descent of Cueva Atanacio. Only when over the lip does one appreciate the size of the pit. *Ryan Tietz.*

needed to be picked up at El Ocotal. Soriano went to fetch them, and soon there was a reunion with team members we had not seen for over a week. Pit #25, the great hope of the high camp that had begun with a spectacular moss-covered 50-meter entrance shaft, had bottomed out at 200 meters depth in a narrow fissure filled with boulders and no wind. But they were discovering new entrances daily and had a hot new lead northwest of camp that was taking a substantial stream and had a strong wind blowing out. They were down 80 meters vertically and at the top of a deep pit. We discussed logistics and made plans to regroup in a week, at which point either we would head up high or they would come down to Aguacate, depending on who had the best leads. Around midday today, Yvonne Droms and Mark Minton arrived from Texas bearing much-needed supplies of equipment.

Andi Hunter and I entered Sumidero Aguacate this evening with very heavy packs of equipment and food, including four liters of pancakes Andi had prepared and a half-liter of real maple syrup, which we will keep secret until breakfast tomorrow.

March 17, Bill Stone: While Hunter and I had been on the surface getting supplies, Kerr, Hogan, Tietz, and Brown had been busy. They had removed the boulder from the fissure passage 50 meters upstream from camp that had been noticed on March 14 and had climbed up more than 25 meters into an old, fossil upper-level complex of rooms and crawlways that led off in many directions. After the surprise pancake breakfast, all six of us in camp went up the new lead to survey it and push a low crawl where Kerr had stopped the previous day. John Kerr and Bart Hogan took digging tools along, but nobody expected a long day. After two hours of surveying, we heard voices below. Mark Minton, Yvonne Droms, and José Soriano had come in on a day trip. They had checked the dig below the mud funnel, and Minton said, "I wouldn't waste another cent on it." I suggested that they go join John and Bart looking for the way on, while James Brown, Andi Hunter, Ryan Tietz, and I continued the laborious survey, with shots averaging 2 to 4 meters. When we came to John's crawl, there was much complaining from Jim, who was lead tape, and much giggling coming from the other side, where Bart and John had returned from their scouting. It certainly looked low and uninviting and appeared to just lead to a small muddy chamber, so I suggested I just throw the book and instruments though and let them do the last shot of the survey. But John said, "No, you *really* have to come through and see this." Suspecting a suck-in but being a good sport, I forced my way through the last meter of the crawl. "All right, good joke, now let's wrap this up and get back to the dig." But it turned out that they had found a half kilometer of new passage that contained the stream beyond the sump. John agreed to guide us through the complicated maze, continuing the survey, while Bart volunteered to stay and dig more to

The village of San Francisco Chapulapa, taken from the road to Sumidero Aguacate. *Ryan Tietz*.

Andi Hunter begins her climb in the sump chamber of Sumidero Aguacate. *Bill Stone*.

Pancake breakfast in camp in Sumidero Aguacate. From left, James Brown, John Kerr, Bart Hogan,Ryan Tietz, and Andi Hunter. *Bill Stone.*

improve the low crawl. We didn't get back to camp until 9 P.M., although we had not planned to be away long enough to miss lunch.

March 18, Bill Stone: We had agreed last night to return to the new passage with rigging gear, so I made a solo run to the high dome where we had been climbing on the fifteenth to fetch some things we needed. John Kerr, Bart Hogan, Andi Hunter, Ryan Tietz, and I left camp at 12:30 P.M. and reached the new river at around 2:30. Following a Huautla tradition, I started the "30-minute run" clock, the amount of time we would scoop before turning around to survey. We went swiftly some 400 meters downstream to where the stream was pirated into an impassable rift. But the canyon we'd been following continued, still 2 to 3 meters wide and 3 to 10 meters high. It was floored generally with small, flat cobbles that made for easy walking. About 100 meters farther, the ceiling dropped to about 1.5 meters, and we were crawling or duck-walking. At this point we sent Ryan back to the river for water, while the rest of us continued in the dry passage, which opened back up. There was one stretch of 30 meters of narrow canyon, but it was mostly open walking passage with no vertical pitches. The fact that there had been little elevation loss in what was probably 1 kilometer or more of passage beyond the sump mystified me. Finally we got to the end of the tunnel we had been running down. Shortly after a nearly right-angle bend, we came to a sand crawl. I'd seen this many times before in the region—a dramatic change in direction followed by a blockage. The passage was jogging to the east, a bit uphill, toward a new tunnel down-dip toward the resurgences, and this had provided a place for the stream to drop its load of sediment.

Kerr whipped out his titanium crowbar, the only tool we had with us there, and began to dig. He eventually got some 50 meters ahead of Bart, who was following him. Meanwhile, Andi and I started surveying back, starting with arbitrarily named station 500. Soon Ryan joined us. We had progressed about fifteen stations when Bart and John caught up with us. John had had an alarming time with sand slumping down on him as he dug upward, but he thought the upward trend was a good sign, and he wanted to go back and push it some more. To speed up the survey, Ryan and John handled the tape, Bart read instruments, and Andi and I shared the sketching chores, since fortunately we had two pencils. By 12:30 A.M., after 810 meters of survey, we were all tired and making mistakes, so I had Ryan find a final station, number 587, to flag. This happened to be in the only large room along the way, about 25 meters high with an open lead at the roof.

March 19, Bill Stone: This was mainly an R&R day. Around 1:30 in the afternoon, Yvonne Droms and Mark Minton showed up. We had been expecting them to camp, but they were doing another day trip. James Brown, fresh from a rest day in camp yesterday, volunteered to help them survey in from station 110 in the Soda Straw Room, a small chamber with some of the only formations in the cave, located about 150 meters before the beginning of the new streamway. The weather had been sunny when Vonny and Mark entered the cave, and they had heard by radio that the Spaniards would be coming down the mountain on the twentieth; their time was up. So we decided to have one more push in the new territory on the twentieth and then head out for a meeting on the twenty-second and an opportunity to wash camp clothes. Bart will have spent twelve days continuously in our underground camp. The surveyors got to station 151, about 50 meters into the new river passage.

March 20, Bill Stone: Last night's chili con carne dinner, made with black beans Hunter had been soaking for several days, had a devastating effect on everyone. We rationed toilet paper and had Pepto-Bismol tablets for breakfast. All except Ryan Tietz felt well enough by noon to carry on with the planned push. John Kerr, Anti Hunter, Bart Hogan, and I left camp about 2 P.M. and reached station 151 about four o'clock. We tied that survey into station 587 in the big room by 6:30, and we ate lunch. We continued on to the sandy dig, where Andi and John disappeared to extend the lead, while Bart and I checked high leads back toward the point where the stream disappeared, hoping for an easier way to cross over to a new canyon. We free-climbed 15 to 20 meters at a dozen or more places, but none of these went.

When we returned to the dig, I was concerned that Andi and John had been gone so long in what I presumed was a 50-meter-long body-tight tube. Bart volunteered to go check up on them. About thirty minutes later I head scuffling. John reported that there was about 180 meters of cave in there, with walking beyond the crawl. Bart, John, and I surveyed through the crawl and on to an end at another place where John was digging out sand. We reached camp at 6 A.M.

March 21, Bill Stone: Another rest day for the underground camp crew. Yvonne Droms and Mark Stover, Robert Monczka, and Matt Covington, three new arrivals the day before, came in, and we briefed them about leads this side of the stream piracy in the new section. They returned about midnight, having surveyed some 50 meters in a passage to the east with an incoming stream.

March 22: Bill Stone: Everyone else in camp headed out loaded down with trash, laundry, and survey notes. I had to go back into the new section to recover a camera box inadvertently left near the stream piracy. It had the memory cards with the photographs for the past week, some of which we would need to send to National Geographic along with our exploration narratives while we were on the surface. Lightly loaded, I caught up with the rest on the way out.

In base camp in Chapulapa, we found that important progress had been made in high camp at Ocotal. Marcin Gala reported that they now had two new going caves, one down to –250 meters and the other to –320 and carrying a stream and wind. Marcin, Kasia Biernacka, Al Warild, and Greg Tunnock were out of time and would be coming down on the twenty-third to return home, leaving only Pavo Skoworodko and Artur Nowak at high camp. And they were out of rope. We had brought 1500 meters of rope, but with rope rigged in Aguacate and several deep caves above Ocotal, it was all being used. We decided that all who remained would go up to high camp to carry on there for the coming week, likely derigging one of the deep caves to get rope for the –320-meter cave. Suddenly, six weeks into the expedition, breakthroughs have come.

March 23: Bill Stone: Shortly before noon, Pavo Skoworodko, Marcin Gala, and Kasia Biernacka arrived with details of high camp's three new caves. J1 is a large entrance that drains a large area near the bottom of a deep canyon. J2, a multi-pitch vertical cave, is presently 320 meters deep. And Tetris is a very tight vertical cave where the first 60 meters is down through a pile of loose breakdown. John Kerr, Mark Minton, Yvonne Droms, Ryan Tietz, and Matt Covington went up today with supplies. Pavo, Andi Hunter, Mark Stover, Robert Monczka, Bart Hogan, and I will follow tomorrow with six mules.

March 24, Andi Hunter: The trails leading up to high camp above Ocotal were slick with calf-deep mud. Seven mules, donkeys, and horses followed us carrying colorful cans of water or fuel and pack after pack of heavy vertical caving gear. The high camp has a water-collection system of tarps, but it is still necessary to have water brought up every few days. We were thankful for the sunny day, because most of our days so far have been cloudy and filled with mist, making it difficult to dry out wet caving gear. However, this also made our hike up to 2450 meters a hot task. Matt Covington, John Kerr, and Artur Nowak went into Tetris Cave today to derig, so that we would have rope to push the deepest cave, J2, otherwise known as Osto Faustino. That evening, we huddled around a campfire in the fog.

Survey party at the entrance to J2. From left, Bart Hogan, Matt Covington, Andi Hunter, and Ryan Tietz. *Bill Stone.*

John Kerr views formations in the Soda Straw Room in the sump bypass in Aguacate. *Bart Hogan.*

March 25, Andi Hunter: We awoke to another sunny day. Bill Stone and John Kerr climbed a tree 40-plus meters high that extended high above the canopy. This resulted in a grand view of the karst areas we had been unable to see due to misty days and thick vegetation. The high point also would allow us a clear satellite connection to upload our daily logs to National Geographic.

Yvonne Droms and Mark Minton went into J2 to do some additional widening with hammer and sledge. Pavo Skoworodko and Artur Nowak also went into J2, carrying three bags of rope, to continue rigging as far as they could get. They returned at 3:30 A.M., having run out of rope.

Mark Stover: After helping haul gear from camp to J2, Robert Monczka, Matt Covington, and I headed down the mountain to Chapulapa with a list of supplies to be procured. When we broke out of the cloud forest into the very steep, newly cleared fields, local workers showed us a new hole. It was a 1-meter-wide hole that dropped straight down 6 meters to a rocky floor that sloped down into darkness. After thanking our new friends, we recorded the location with GPS and continued down into town.

March 26, Andi Hunter: Five of us headed down the trail to J2 with a mission to survey. Bill Stone could not fit through the gnarly squeeze above the second drop, so only four of us, Matt Covington, Bart Hogan, Ryan Tietz, and I, continued onward. The cave got wetter and muddier the farther down we went, but we were determined to complete our survey chore. Fifteen drops down, I noticed that the gritty ropes had eaten a hole into the hollow middle of my stainless-steel top bar and, fearing that the exposed sharp edge would cut the rope, I got into a stable position on a sandy platform, where Bart and I rearranged the bars on my rack. The survey was difficult, given its completely vertical nature, and we were in waterfall spray the entire way. We had to try to sketch or read instruments on rope while warding off hypothermia. The bottom came quickly—not the bottom of the cave, but the bottom of the last rope that Skoworodko and Nowak had rigged.

Bill Stone: Pavo had warned me that the cave was very tight and "you aren't going to like it." I had been braced by this warning not to expect much here. I had been in tight caves before, and they are not my forte. Although I make a point of staying trim, it is the bone structure that ultimately determines whether you get through the cave or not. When we reached Pavo's tight spot at the top of the second pitch, everyone else forced their way through. Bart Hogan was heading on down the rope when I slipped my way in, feet first. My feet were dangling over 20 meters of space, but I had a safety line attached with a locking carabiner to the rope leading out over the drop. Slowly I realized that I was slipping farther and farther into a vise through which I wasn't going to fit. I could hear

Kasia Biernacka surveys in Tetris, which was pushed to 300 meters deep and continues. *Marcin Gala.*

Andi on the rebelay below, offering tips and encouragement, but it was no use. I found a good handhold and did a series of pull-ups and was out.

I told the others that they'd have to go on without me. For the first time in memory, I'd been left behind. I hoped the others would be careful, for a rescue here would be most difficult. I turned and headed back toward the entrance in search of hammer and chisel. Caving is team work. Those below would bring back the data. I and those coming in to enlarge the crack would make the cave safer.

Yvonne Droms: Mark Minton, John Kerr, James Brown, and I set out along the very steep, muddy path toward the headwall above the cave entrance. Jim was carrying the camp generator, which we'd be using to power a large hammer drill to try to enlarge the tight squeeze leading to the second drop in J2. Once at the entrance, James settled in to tend the generator, which had a way of turning itself off way too easily. John, Mark, and I slithered down the tight fissure, pressing against both walls to control our slides. We rappelled down the first drop, then negotiated various constrictions leading to the second pit. We found Bill waiting near the top of the drop swatting the large, annoying flies that pestered us in the upper part of the cave. John went through the tight spot and pulled up the rope in the pit so that rocks we loosened would not cut it when they fell. We spent the day drilling, chiseling, and hammering rock away, and we were successful in enlarging the passage enough to be somewhat more comfortable. John reinstalled the rope, and we all headed out and back to camp.

March 27, Andi Hunter: At midnight, the beginning of the new day, Matt Covington, Bart Hogan, Ryan Tietz, and I were standing on a breakdown pile 300 meters vertically below the entrance, looking down into a dark abyss below. The water and wind whirled down into the vertical shaft. The cave was going down fast, and the wind meant it was going to go a lot farther. The survey was done, and it was time to head out. Skoworodko, who had rigged this part of the cave, had warned us of a large, unstable rock near the end. We had all passed over it without realizing it on the way down, but we were more cautious on the way up. We finally made it out of the cave and back to camp at 7:30 A.M.; a nineteen-hour day trip had come to an end.

Mark Stover: Artur Nowak, Pavo Skoworodko, and I headed into J2 for what was sure to be a long trip to continue rigging and surveying down the dramatic fissure. It took several hours of squeezing and rappelling through tight spots and water spray to reach the end of the previous survey at approximately –350 meters. Artur went ahead rigging, while Pavo and I began the survey. After 45 meters of nearly vertical shots taken while hanging from bolts, we reached the bottom of the fissure at nearly –400 meters. Our final rappel landed in a small room with a light but steady waterfall and a 1-meter-wide fissure heading downstream. We continued downstream for several hundred meters at a fairly steady direction of 320 to 360 degrees through narrow canyons, tight climbdowns, breakdown piles, and a thin meander that required stemming over small potholes full of water. Loose rocks were often underfoot, and handholds were often suspect, so Pavo made judicious use of a bolting hammer to test them. We reached a point where the stream becomes a waterfall dropping approximately 10 meters into a room at least 12 meters in diameter. From the top of the waterfall, we could not see the full extent of the room or where the water left it. The batteries in our drill were dead, and we were many hours from the surface. During our trip out, we still needed to stagederig the ropes in the cave to protect them from the flood waters of the next rainy season. Rather than attempt to survey the complexities of the stream passage, we headed to the surface, satisfied that at least we had reached a new level of the cave.

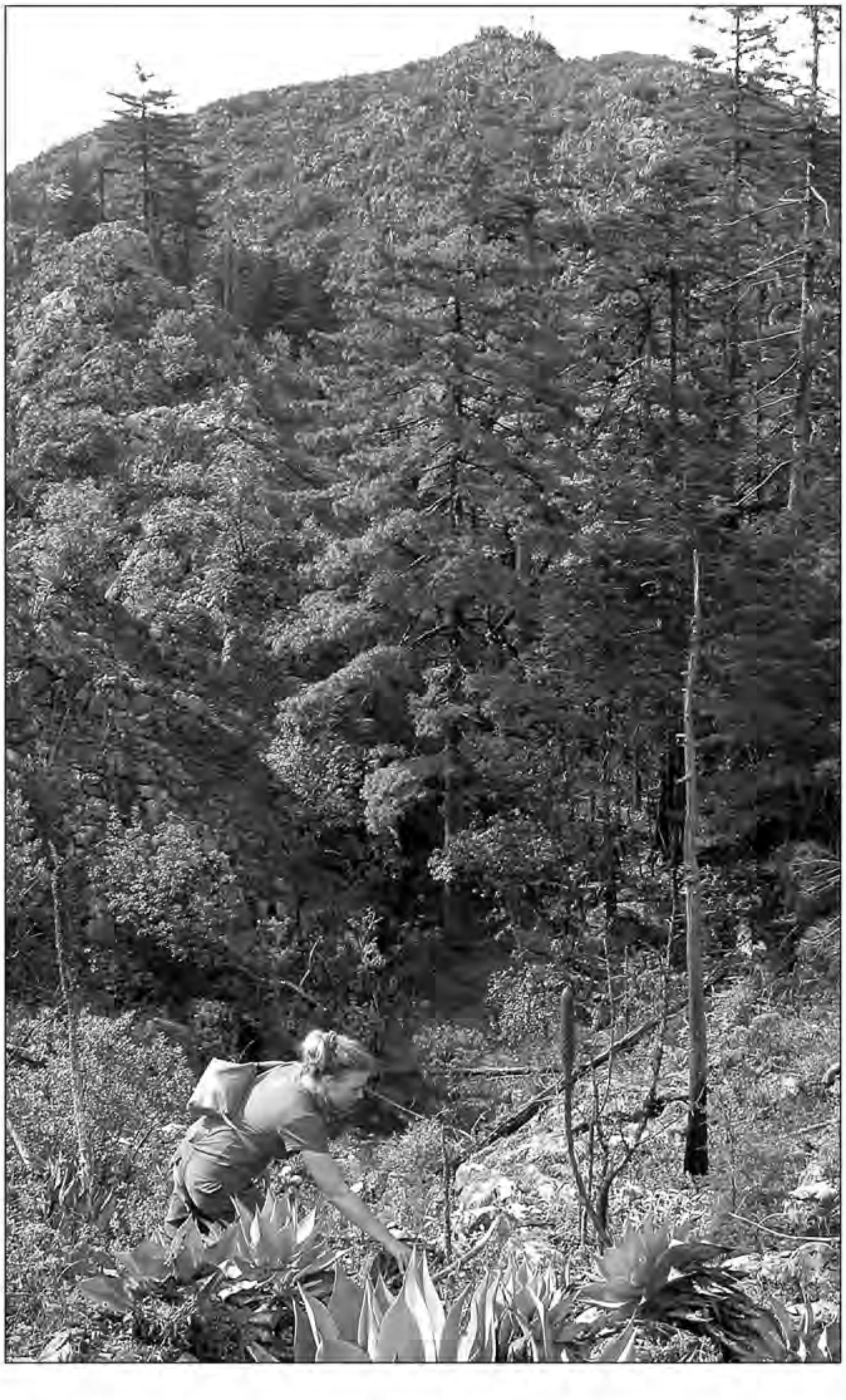
March 28, Bill Stone: We awoke to find the final push team from J2 sitting around the campfire. They had just returned from an 18-hour trip in which they had reached the bottom of the shaft series at a depth of 391 meters by using a 50-meter dynamic rope, the last piece of rope in camp. Beyond, they had forced their way through 400 meters of stream tunnel, encountering a junction with a major stream that tripled the flow in the passage. They came to a wet pitch where the water arched out into the blackness of a large chamber. They were unable to survey the part of the cave below the shafts, but estimated that they had dropped another 50 meters.

With the entire expedition rope supply rigged, we had no choice but to pull back, leaving J2 as the target for a future trip. We decided to arrange for mules for the following day and to return to Sumidero Aguacate for the final week of the expedition.

Before leaving high camp, we still needed to check out a sinkhole in the death karst at very high elevation, near 2800 meters, some 3.5 kilometers northeast of Cueva Cheve. So Bart Hogan, Andi Hunter, and I set out on a marathon recon into this mysterious area. It took two hours to climb up through wet trails of the cloud forest and break out into the barren area of death karst, jagged, heavily eroded limestone ridges and pinnacles separated by cactus-filled sinks, fissures, and pits. The tips of the ridges frequently break off underfoot, and our pace slowed dramatically. Three hours of thrashing later, we reached the peak, 2875 meters according to the GPS, from which we were able to get a grand view of the entire Cheve high karst. In the distance to the south was the mystery sink we were aiming for, along with dozens of others not shown on the topo map. We bushwhacked into all of these, unfortunately finding no cave entrances. The main sink was, amazingly, floored with grass that looked like a golf course, rolling with sub-sinks all about. Most of the latter are also grass-floored; one that Andi and Bart investigated takes water but is blocked by a constriction. By 6:15, thick clouds had rolled in, visibility had dropped to 5 meters, and it had begun to rain.

Fortunately, we had a string of GPS waypoints, taken to record the location of karst features, to follow back home.

March 29, Bill Stone: Pavo Skoworodko had gone down the mountain to arrange for mules for 9:00 A.M. No one in camp believed this schedule, however. Time in the mountains is usually plus or minus five hours. I was still sacked out at 9, when I heard the unmistakable whistling of burro drivers coming up the trail. I rushed to meet them at the campfire, where Mark Minton and Yvonne Droms were already busy packing group equipment. The locals seemed quite content to sit around the fire drinking coffee and watching the circus as gringos scurried about. Within two hours we had reduced the camp to around thirty duffel bags. By 3:00 in the afternoon we had reached the trailhead at El Ocotal, and by 4:00 we were at our municipal-building headquarters in Chapulapa, where we emptied the packs, cleaned and sorted gear, and prepared for a final four-day underground camp in Aguacate.



Andi Hunter checks a sinkhole in the "death karst" below the 2875-meter peak. *Bill Stone*.

March 30, Yvonne Droms: While most of the team was getting ready for a second underground camp in Sumidero Aguacate, Mark Minton and I prepared for a day trip into the cave to check some leads that had been noticed during earlier surveying. Since we had to leave for home the following day, we unfortunately could not participate in the cave camp. When we got to the entrance, a nasty surprise awaited us: the entrance rope was gone. Rope is a very coveted commodity in these rural mountains. We returned to Chapulapa to get more rope and discuss the situation with the team. It could turn into a crisis if the rope was removed while the team was in the cave.

Having rerigged the entrance pit, Mark and I rappelled down the series of ropes leading to the main passage. It must have been raining hard for a while higher up on the mountain, because the waterfalls were very forceful. We were mostly at the edge of them, since the ropes were rigged to avoid the full force of the water, but sometimes I'd swing into it.

We were carrying a number of large batteries for the team, and we dropped them off near the passage where they would be used for a dome climb. We then located our lead, a narrow side tunnel off the main trunk heading southwest about halfway between the final rope pitch and camp, and started into virgin territory. That particular area of the cave is extremely muddy, which made crawling very difficult; we sank deeply into the oozy mud. But the cave continued ahead, and it lured us onward.

We took turns climbing or squeezing into any possible lead we found. Some minor, unimportant-looking holes netted large, echoing chambers or pretty domes glistening with water droplets. One waterfall came in handy to wash off some of the heavy muck that coated our coveralls and packs. After a couple of hours, we had found a network of interconnected routes where water once flowed, as well as an active passage that held promise of continuing. We were stopped at an exposed traverse over a pit. It was late, and we needed to turn around and leave. It was the end of the expedition for us, alas.

Bill Stone: There was a flurry of activity at our base camp in San Francisco Chapulapa. We had only four days to push Sumidero Aguacate, and we wanted to make the most of them. Ryan Tietz, Andi Hunter, John Kerr, Bart Hogan, James Brown, and I planned on a three-day push from camp at –170 meters. Our last act before loading up the trucks was to upload the week's reports to National Geographic and get e-mail. We received an e-mail from Bill Mixon in Texas:

> Don't know whether you've heard anything about the fuss over an "accident" and "rescue" in Cuetzalan. Some Brits, many of whom happened to be members of UK military, got trapped by high water. They were prepared for that and had arranged backup from some Brit cave divers who came over and got them out. But the Mexican press created all sorts of nonsense—like the Brits were military spies looking for uranium in the cave. This led to politicians doing stupid and hasty things. Result is that the Brits were cleared of all charges but expelled from the country (after being detained and questioned for a few days) for doing research on tourist visas. Officials are now claiming, hopefully temporarily, that all caving in the country needs research visas. And Ramón Espinasa reports that one of the Mexican TV networks is encouraging viewers to report all foreign cavers to the authorities.

I immediately called a meeting to discuss this. We had permits for our project and were well known on the mountain. But we had recently had some unusual conversations with the locals. At high camp, one of the mule drivers asked us about our permission and was shown our letters. The *presidente* in Chapulapa asked for a list of team members and their nationalities. These were pointed questions from someone high up in the mountains, where life tends to be casual to an extreme. The e-mail perhaps explained this, and also some vandalism to the trucks that we discovered when leaving town at the end of the trip. But the unanimous team vote was to proceed with our original plan of a camp in Aguacate.

Andi Hunter: We awoke to the squeal of a pig being slaughtered at first light, followed by howling dogs and hungry donkeys. The early arrival of the mules at high camp yesterday had caught us off guard, and the gear piles were highly disorganized. It was hard to get motivated to go back underground, given the current political situation, the increased scowls of the locals, and the possibility of our rope being taken again from the entrance. But finally we mustered all our gear by early evening and headed underground.

March 31, Bill Stone: Last night we arrived in camp worried about what might greet us when we surfaced. At least we were secure in the knowledge that no one was going to pester us at camp. Wednesday morning, though, everyone was excited about having another go at Aguacate. John Kerr rounded up Matt Covington, James Brown, and Bart Hogan and headed for the sand-crawl dig at the northern end of the cave, now 300 meters below the village of La Hierbabuena northwest of Chapulapa. A second crew, Ryan Tietz, Andi Hunter, and I, headed back to the base of the shaft series 110 meters below the entrance, where an upstream passage carrying more than twice the flow of the surface Aguacate stream entered the system. This tunnel ended in a high dome, where a climb had been begun during the first camp. This was far enough west of the entrance that it might just continue on southward toward El Ocotal and perhaps, we thought, be a potential route for the J2 underground river. I took the first lead and managed to extend our line another 15 meters upward, to where the static line I was trailing ran out. There was no ledge there, so the next leg of the climb would have to be belayed from bolts on the wall.

American cavers near the end of the expedition. From left, Bart Hogan, James Brown, Andi Hunter, Bill Stone, Mark Minton, Yvonne Droms, Matt Covington, Ryan Tietz, and John Kerr. *James Brown.*

Andi Hunter: Stone came down after four hours, and we had a break for an hour drinking hot chicken bouillon and splitting a can of tuna. I agreed to lead the next climb, while Tietz and Stone would hang from harnesses for four or five hours and belay me. Attached to two dynamic ropes and trailing a static one, I slowly bolted my way up an overhung diagonal crack. The sound of the waterfall was so loud that communication was impossible. I followed the waterfall, and after several necessary deviations, continued up a dry route, not expecting it to go anywhere. After several more bolts, I was out of gear and battery power. Ryan and Bill were wet from spray and very cold from waiting for me at the belay station.

April 1, Bill Stone: Predictably, no one was up until around 11 A.M. There was some early talk of the entire team going out to the dig, given that this point was farthest in the direction of a potential connection to the Cheve system. But both leads were of considerable interest, so we decided to send a four-person crew to the dig and two to the climb. Matt Covington had to leave today to catch a bus to Mexico City and his flight back to California, and he headed out shortly after Andi Hunter and I went off to finish the climb.

When I reached the end of Andi's route, I hung far out in the shaft and saw, around a corner, that there appeared to be a higher level that she had missed. The small fissure above the belay stance looked like it might provide a dry bypass around the direct route up through the waterfall. Sure enough, three bolts later I was into the fissure and found that it spiraled around and led up some 20 meters higher into a 7-meter-diameter chamber with a ledge leading out over the shaft and up onto a still higher platform. By the time we had fixed lines rigged and Andi had joined me, we were 70 meters above the floor of the pit and looking up a giant shaft full of fog and spray. After lunch, Andi took the next lead, but she found she did not feel confident this day, so I was soon back at the point. Unlike some of our previous pitches, this one had ample foot- and handholds, all covered with a gritty layer of flowstone, which made for good free climbing. They also made niches to stow the heavy drill and battery pack while I did more traditional free climbing, with 5 meters or so between bolts. But at one point I dislodged the battery pack, and it fell 15 meters onto rock. Incredibly, when I hoisted it back up, it still worked, although the outer shell was crushed. I continued confidently up, and with two more bolts discovered to my surprise that there was a horizontal tunnel leading off toward the sound of a waterfall. I rigged a fixed line, and Andi came up. We soon found ourselves at the base of yet another cascade, this one 12 meters high, coming into a flowstone-coated chamber. By climbing the walls, we were able to gain another 10 meters into a stalactite-festooned room and a dead end. The waterfall was the way on, and we were out of static line, so this was the end for this expedition, a lead heading south into the mountain. We surveyed out and made it back to camp by 3:30 A.M. Less than forty-five minutes later, the other four returned from the dig. They had progressed only another 5 meters. Bart still believed the dig would go, but it was more work than they had bargained for and would require a few days' effort, something that wasn't going to happen this year. The known length of Sumidero Aguacate had grown by 2171 meters to a total of 3225 meters

April 2, Bill Stone: As I was groggily awakening at 10 A.M., a bright light appeared in the distance. It was Pavo Skoworodko returning from a brief trip to Mexico City to change his flight schedule. He had met there with Ramón Espinasa and had much more news about the Cuetzalan affair, which he filled us in on.

Andi Hunter: We were full of energy this morning, and at breakfast we decided to work as a team and move our gear in stages. The arduous task of derigging camp and carrying out the large loads did not seem as difficult as it would have seven weeks earlier. I guess our bodies had acclimated. I was actually looking forward to hauling the heavy loads and viewed it more as a challenge to see how many separate loads I could haul through the tight spots. We staged the ten duffels of equipment every couple of rebelays and spread out the team so that each person was focusing on specific sections of rope. Several of us found it amusing to attempt to haul two heavy camp packs at once on the more open drops. Ryan Tietz and John Kerr pulled the ropes behind us. Back in Chapulapa we started dropping like flies. We'd had another successful push, and now we could sleep.

April 3, Bill Stone: Base camp was packed by midmorning, and by 11 A.M. the trucks were being loaded for the long trek north. The *presidente* walked up at the scheduled time for our briefing, almost to the minute. We walked up to his office, laptop in hand, and over the next hour I stepped through the progress of the preceding seven weeks for him. The results of the project have been all that we had hoped for in what was basically a reconnaissance expedition. We left the mountain having more than tripled the length of Sumidero Aguacate, where several promising leads remain. We had a major going cave, J2, at high elevation and surveys of dozens of smaller caves and pits. In total the expedition discovered and mapped more than 5 kilometers of new cave, including nearly 2 kilometers of vertical extent.

Cheve 2004

Durante la primavera del 2004 una gran expedición visitó el área del Sistema Cheve, Oaxaca, buscando nuevas rutas hacia la cueva que estén entre la cueva conocida y su resurgencia en el Río Santo Domingo. En la Barranca Estrella, la excavación al fondo de la Cueva Barranca Estrella tuvo que ser abandonada después de varios días de trabajo al comenzar a llenarse de agua. Dos rutas a través de rocas de derrumbe en el Sumidero Barranca Estrella, donde el río se disipaba antes de que una nueva dolina apareciera río arriba, llevó a cuevas pequeñas y difíciles, pero sin progreso real a través de ellas. En el Sumidero Aguacate, campamentos subterraneos llevaron al descubrimiento de un pasaje alterno al sifón que había marcado el final de la cueva. El pasaje más allá del sifón y otros pasajes pequeños explorados al escalar domos, incrementaron la longitud de la cueva en 2171 metros, a 3225 metros. Los miembros de la expedición fueron guiados a varias cuevas verticales en el karst arriba de El Ocotal. La cueva más prometedora ahí, J2, fue explorada hasta aproximadamente 440 metros de profundidad, a un tiro en un pasaje amplio con agua. En total la expedición exploró y registró más de 5 kilómetros de nuevos pasajes, con un total de casi 2 kilómetros de desarrollo vertical.

PUSHING THE LIMITS FOR MORE THAN A CENTURY

THE EXPLORERS JOURNAL

SPRING 2005

EXTREME EARTH:
Descent into One of the World's Deepest Caves

Expedition Kenya: Life Among the Desert Gabbra

EXTREME

A descent into what may be the world's deepest cave in the hills of northeastern Oaxaca.

EARTH

By Andrea Hunter Photos by Bill Stone

The spring 2004 dry season in southern Mexico was wetter than most could recall in years. Water levels had been high that day in late March when we began our descent into the Sumidero Aguacate, one of several places where whole rivers disappear into the high mountainous region of the Sierra Juarez. A particularly intense thunderstorm that morning had dumped tons of water into the gorge that emptied into the cave. Now, a day later, it was still coming down hard. A chill crept up my spine as frigid water ricocheted off a deformed stalactite and trickled down my jumpsuit. The wind whipped spray into the air. Three of us were suspended like spiders 30 meters above the floor of a tall dome shaft. I was in the lead with a hammer drill, setting a string of rock bolts that had allowed us to scale the sheer walls of the abyss. Below me, Ryan Tietz, 23, of Austin, TX, and Bill Stone, a 33-year veteran of Mexican cave exploration and our expedition leader, patiently shivered in the mist on a hanging belay. Ahead and above us was a dark, unexplored opening that led to…God knows where, but hopefully to Sistema Cheve, still nearly two kilometers below our present location, but tantalizingly close in terms of favorable geology. One climb into the right corridor could open up several kilometers of cave in a day's work. And that, after all, was why we were here—to find a back door into Sistema Cheve, perhaps the deepest cave on Earth.

As a participant in the expedition, I had spent the past two weeks camped 200 meters underground in the Sumidero Aguacate, near the village of San Francisco Chapulapa, nestled high in the limestone ranges of northeastern Oaxaca.

Above ground, children carried stacks of wood, donkeys and mules hauled materials and market supplies, and bare-footed women balanced large water barrels on their heads. Men were in the corn fields clearing the previous year's crop and planting new seed. Fields lined the mountains around small villages like a patchwork quilt only seen from afar with occasional sun rays finding their way through clouds frequently dominating Chapulapa. Below ground, the Chapulapa hustle came to a halt. Silence dominated and 24 hour's of eternal darkness prevailed.

This was my second season exploring Cheve. In Spring 2003, I had been invited to be a "sherpa" for Stone's expedition to Cueva Cheve,


THREE

then the second deepest known cave in the Western Hemisphere. Located at an elevation of nearly 3,000 meters Cheve had been dye-traced to a spring 2,547 meters lower on the mountain.

Being an ardent enthusiast of vertical rope work and expedition-type adventures, I flew down to Mexico from my home in Fairbanks, AK, to offer hauling services to the Cheve mission. Precisely, the sherpa's job that year was to repeatedly haul 20-kg packs loaded with diving equipment, weights, climbing and camping gear, and food down into Cheve an average of 20 hours a day over a two-day period, then return to the last check point and shuttle more gear either up or down, depending on what was needed.

Awaiting the supplies were two British cave divers, Rick Stanton and Jason Mallinson, and Bill Stone—who were pushing the limit of exploration in an attempt to break a world depth record of 2,080 meters, which was held in Krubera Cave in the Abkhasia region of the Republic of Georgia.

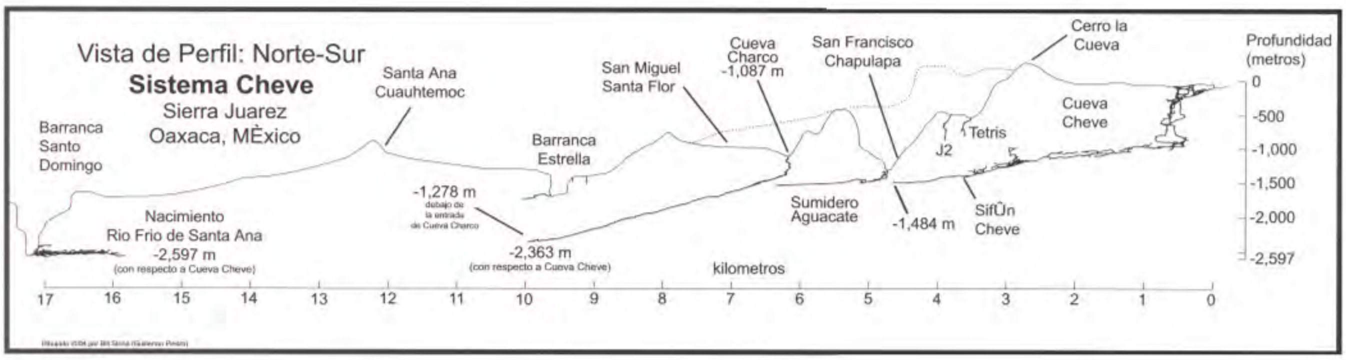
The exploration lead in Cheve was a sump dive that was attempted in 1991 but required further advancement in life-support systems before its numerous flooded chambers could be investigated. Now that those systems were available, it was time to scope out the diving leads at the Cheve sump,1,364 meters below the surface.

I had been on several other caving expeditions prior to Cheve, but none quite as intense or mentally and physically as draining. There is no communication with the surface and numerous physical obstacles—complicated free-hanging rope gymnastics and traverses through waterfalls, mountainous debris piles to circumnavigate, "leaps of faith" over open gorges, and probing large black boreholes extending as far as the eye can see, requiring delicate foot placements on the water-slick rocks.

As one of only three women to make it to camp 3, located 1,100 meters vertically below the surface and a two-days' climb from the cave entrance, I felt very proud, yet the remoteness could be overwhelming. During our final two-day exit, I had underestimated the amount of food I would need given the incredible energy expenditure. I ended up with only one power bar halfway to camp 2 that I split four ways with the group. My energy levels were completely drained that day and I had trouble focusing on the rope work that I attempted in between dizzy spells. I have run a marathon before, but it was nothing in comparison. I was too stubborn to burden a teammate with my heavy pack and at one point, I remember hanging on a rope—one of many rigged over more than a hundred shafts—above a deep, black pit during one traverse and musing that if I fell down the hole and died instantly from the impact that it would be easier than trying to get myself out of the cave alive.

Cheve was definitely not a cave for a pessimist, the weak at heart, those deficient in spirit, or those lacking physical endurance. Our efforts on the 2003 expedition were halted when the lead diving crew discovered a breakdown collapse beyond a second underwater

The four-person lead team had managed to extend the cave by 1,400 meters—more than 400 of which was underwater.



Slowly we descended the twisted maze of vertical obstacles, pushing the grit-saturated rope through our rappel devices one handful at a time.

tunnel. The four-person lead team had managed to extend the cave by 1,400 meters, more than 400 of which was underwater.

A significant push beyond that point required more time and resources than were available. We had not broken the depth record, but the effort had been highly successful having reached a depth of 1,484 meters at a point 9.3 km from the entrance—the most remote point reached by humans inside the Earth. Given the ceiling collapse blocking the river route forward, a return to the bottom of Cheve would not be an immediate undertaking, at least, not by the route we used.

During the Summer of 2003, we began planning for the Spring 2004 expedition. It was decided that the season would be used to find another surface entrance into the same system—an attempt to bypass the Cheve sump. Our 2004 mission became clear after reviewing topo maps and cave profiles. Two primary independent sites would be investigated; all predicted to be potential entry points into the Cheve System that would connect beyond the second sump in the main cave.

The first objective was the river sink of Sumidero Aguacate, a major stream sink on the contact zone between cave-bearing limestone and overlying volcanic rock to the west, which contains relatively large tunnels.

Initial exploration there was stopped at a sump in 1994. No one had returned since, yet a renewed study of the post-2003 maps suggested a dive was now in order. Similarly, significant advances in climbing technology had taken place since then and there were likely to be opportunities for a climbing bypass to the sump as well.

As a hedge against failure at Aguacate, we planned to split up, sending one group to conduct high-elevation overland reconnaissance missions between Cheve and the Aguacate sink. Portions of this area were completely unknown for good reason. The majority of the 100-square-kilometer zone is a no-man's land of razor-sharp limestone pinnacles, unstable ridges, barbed plants, and agave cactus covering thousands of depressions and pits, euphemistically known by cavers as the death karst. One of those inconspicuous holes was sure to go deep.

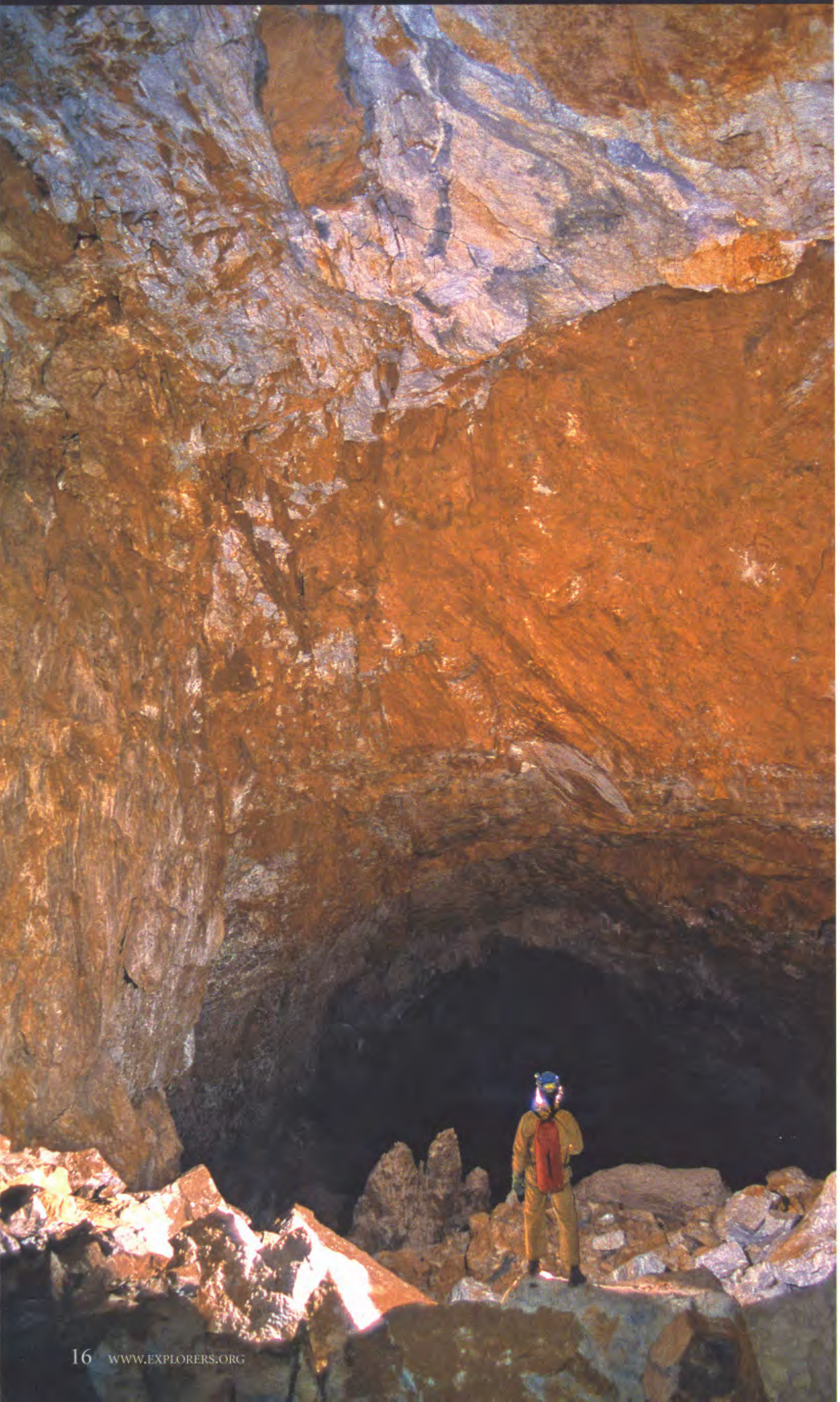
The crew that assembled on the mountain in early February 2004 was a star-studded cast of 40 people from eight countries.

During our fortnight underground in Aguacate, Mexican biologist José Antonio Soriano had made numerous day trips to camp 1 from the surface, replenishing our food and gas for our stove. As it turned out, Aguacate yielded the second best scoop of the expedition. After discovering the sump to be undiveable we had spent seven days backtracking slowly toward the entrance, investigating every crack, fissure, and black opening in the ceiling.

It was John Kerr, a 2003 expedition veteran and one of Indiana's best "diggers," not unexpectedly, who dug open the dirt crawlway that led to the breakthrough. Kerr had been so focused on the digging mission that his fingers and hands were completely chaffed, his knee and elbow pads were shredded and hanging by threads of elastic, and his hair was so permanently saturated with three weeks of silt and sweat that it could be shaped into any formation like a gooey blob of putty. "It goes," he explained. "That narrow fissure climbing lead from yesterday…it goes. We've bypassed the sump." During a cave dig, if you can feel air movement at the point you are digging, it is a good bet that there are significant voids beyond. The dirt crawlway that Kerr had just widened had opened into something significant.

I remembered what Stone had told me about reconnaissance trips—they are "90 percent boredom followed by 10 percent uncontrolled adrenaline." This was definitely a moment of uncontrolled adrenaline. Despite my aching fingers, mud-coated face, and sore back

We reached massive, virgin chambers with pristine white and red flowstone.



from remaining in hunched over, awkward digging positions for hours on end, we took turns being first to run down virgin passage. We literally ran at one point, realizing we still had to survey all of it on the way back. When it was finally my turn at point I could hear my heart beating in spite of the hollow splashing noises my boots made. As I maneuvered left and right, following the stream into unknown darkness, excitement pumped through me to all my extremities. And then, the river turned and wound its way in the direction needed for the break through we had been waiting for. We were sure this was the connection to the Cheve System.

Kerr took a turn in the lead, the rest of us running just meters behind through vast expanses of dark virgin tunnel. After two kilometers of running, the tunnel funneled into tall fissure cracks and finally small "A"-shaped belly crawls. Soon, our momentum stopped, heavy breathing could be heard in the silence, and we found ourselves confronting the first of three consecutive sand digs. Kerr, team rookie Ryan Tietz, sump diver Jim Brown, and Maryland teammate Bart Hogan continued doggedly digging for the next three days through the debris with no end in sight. We were not going to break through the blockage this season.

Our concentration diverted toward climbing a 100-meter-high dome we had discovered upstream. We knew what to do. The staccato drone of the hammer-drill was completely lost in the roar from the falls coming down the shaft as we bolted our way upward. I was hanging out in space, attached to the highest bolt.

Stone and I rotated leads finally reaching massive, virgin chambers with pristine white and red flowstone and delicate white soda-straw calcite formations overhead. We surveyed the place, leaving the continuing waterfall shaft leading onward as a lead for the next expedition.

And so with the Aguacate finished for this season, up we went. We had now been in the cave many times and had the route wired. Leaving camp 1 to hike a kilometer upstream brought us to three big shafts dripping with cold water.

Not too much further, we emerged in the lush vegetation and enhanced iridescent green colors of the outdoors grabbed my attention after seeing shades of gray underground for weeks on end. Smells of wet grass and a field of bright blue flowers lured my senses as I ascended the last entrance rope—three 15-kg camp duffels hung below me.

Several weeks prior, veteran Huautla caver Mark Minton and West Virginia caver Yvonne Droms, had discovered the entrance rope had been chopped with a machete and the bolts, hangers, and webbing had all been stolen. I prayed the rope was intact.

Several meters from the surface, an unexpected resident, a spider, caught my attention. Its beady multifaceted eyes were staring at me as it clung to the walls of the half-meter-wide shaft. As big as my hand, with black, wooly, long, barbed legs, it was the Aguacate gatekeeper. Please don't jump on me, I thought as I slithered vertically over the creature with only a few centimeters of clearance. I looked back down the narrows of the shaft and saw the spider was gone. I hoped it had crawled in a hole and was not clinging to the back of my yellow cave suit, as I squirmed out of the darkness onto the pasture above.

Meanwhile, several weeks of machete bush-whacking in the highland cloudforest yielded several deep systems named with a "J" prefix by Marcin Gala and Pavo Skoworodko, two of Poland's top explorers. *Jaskinie* is Polish for "cave."

J2, the most promising, had an entrance surrounded by trees, shrubs, and vines covered with a skin of chartreuse moss. The drooping furry branches and standing water ponds laden with small swarms of mosquitoes nearby gave the place an eerie feeling. Underground, barely passable constrictions were abundant in J2's tall narrow fissures. Drips from popcorn ceiling rock formations maintained wet walls and a damp and humid atmosphere, and there was a cold, inwardly drawing, relentless wind. The speed of that wind, nearly 50 kilometers per hour at certain times of the day, left no doubt that this one was going deep.

A great deal of rope had already been carried into the cave. Al Warild and his Aussie mate Greg Tunnock had rigged the last of it, ultimately reaching a depth of 225 meters on a rock platform bridging a great abyss. The fissure canyon continued straight down as far as the eye could see.

"Squeeze Stone, squeeze," I pleaded as we attempted the first serious constriction in J2. All of the smaller members of the team had already gotten through and descended the 20-meter shaft immediately below the squeeze. Unfortunately, Stone's tall figure would not allow him past.

Sometimes all the experience in the world makes no difference underground. This squeeze was not the last of the small stuff either. In fact, much of the cave was meant for a thin hobbit. But the scent of depth drew us onward nonetheless.

Slowly we descended the twisted maze of vertical obstacles, pushing the grit-saturated rope through our rappel devices one handful at a time. I stood on a small ledge between drops and prepared my rappel device for the next pitch, soon realizing the muddy ropes had worn a hole straight through my top friction bar, leaving a razor-sharp edge where it encountered the rope. I had no choice but to continue given my precarious stance on a small ledge. I carefully worked my way down the rope using a safety ascender, trying not to create friction or excess rope tension. Luckily, one teammate had a wrench to fix the problem on the next ledge.

Cold mist hung in the air, leaving my suit damp and my face dripping with a combination of sweat and an occasional spray of water from some unseen waterfall high overhead. I kept my light focused on the survey book, making sure not to drop the mechanical pencil.

We spent most of the evening like that with the team strung down the great rift, each occupying a deeper bolt in succession.

We came to the end of our rope at 391 meters below the surface. The following day, the final survey team into J2 rigged the last few meters of rope left in basecamp, including our dynamic ropes, which were not normally used for static line cave rigging. But that didn't matter now. Rope was rope. The final three-person crew of Pavo Skoworodko, Artur Nowak, and Mark Stover ran out of line at a depth of more than 450 meters where they were left staring down into a gaping black chamber at the confluence of two subterranean rivers. The wind whipped spray into the air and sucked it deep into the abyss below. Whatever the expedition had come to represent, its essence was right there. We had found what we had sought.

The 2004 Cheve expedition was a solid success. After months of toughing it out on unrewarding digs, hacking through jungle, and negotiating jagged karst pinnacles, we had finally broken through and discovered nearly six kilometers of previously unknown tunnels. The high camp lead, J2, in all probability is the "back door" we have been seeking to Sistema Cheve.

Despite diplomatic setbacks resulting from the British 2004 Cuetzalan expedition, which threatened to end expedition caving in Mexico, a ten-month effort on the part of both U.S. and Mexican members of the Cheve team, and some extraordinary help from the U.S. State Department, the Cuicatlan Foundation, the ex-governor of Oaxaca Diodoro Carasco Altamir-ano, and the Mexican Ministry of Tourism finally led to granting us a permit for the 2005 J2 Expedition, which we are now on as of this writing, having headed to the field on March 19. This Spring, our 45-member team is using the J2 route, hoping to bypass the sumps and prove Cheve's hard-earned dye-traced world depth record exists for human passage. ■

Andrea Hunter, a veteran climber and cave diver, lives in Fairbanks, AK.

THE RETURN TO J2

Marcin Gala, Paweł Skoworodko, and Kasia Kędracka

This article gives reports from the Polish team in the 2005 J2 Expedition in the Sierra Juárez, Oaxaca. It does not attempt to report about the whole expedition and all its participants.

This is our fourth expedition with the US Deep Caving Team, all to the area of Cueva Cheve, the deepest cave in the Western Hemisphere. Slowly we are learning about the underground waters of the region. The leader is, as always, Bill Stone. In 2001, we explored the resurgence cave, Cueva de la Mano; in 2003, Cueva Cheve itself. In 2004, we started to work in a new sector, the mountain over the village of El Ocotal. We live in a tropical forest under a sky of leaves at an elevation of 2000 meters. There is no water here; we depend on what falls from the sky or is brought up by mules.

In 2004, we focused on surface exploration. We found eleven interesting entrances. One of them is J2. Initially it was very tight, so we called it Barbie. We thought it would end around every corner. But a succession of drops led us to a large 140-meter shaft. At its bottom, at –391 meters, a canyon began. Paweł Skoworodko and Artur Nowak, the last ones in the cave, ran for 200 meters and were stopped by a drop.

Paweł: *The incredible thing is, the passages there are bigger than in Cheve, 20 meters wide, with waterfalls pouring in from every direction. And the airflow is so strong it rips your head off.*

Their euphoria about the lead is enough of a motivation for us to return to J2 again in 2005. The expedition begins with rerigging the upper part of the cave and surveying the last section.

Marcin: *Are these the passages like in Cheve? You could at least have surveyed that. . . .*

We begin exploration. Despite the fact that the euphoric stories from the year before had been hard to believe, the passage is in fact getting bigger and bigger. Trips from the surface make rapid progress. Below the large shaft, the cave is almost horizontal, but since there are no serious obstacles, we gained depth at a significant rate. After a week, we reach –735 meters and decide to install a camp.

Enrique Ogando, who is suffering from a knee injury and a can't join us in the underground camp: *I am very envious. I'm quite sure you will surpass a thousand. Just take enough ropes, so that you won't have to come out too soon.*

We set up camp in a large hall. A huge waterfall 15 meters wide would disturb our sleep, if we were not exhausted from the hauling. Tomorrow we will have another day of fairy-tale exploration.

In the morning, Greg Tunnock starts rigging, and Kasia Biernacka, John Kerr, and I survey. After three shots, Greg returns. That's it, a sump. The end. The rest of the shift is spent mooning around the Great Hall, searching for a bypass. The next day we search the canyon above. Nothing. Where are those fairy-tale discoveries? Where is this thousand? Those on the surface do not know yet. Just a week of exploration has passed, and we have already finished the cave. Some people have not yet arrived. We leave the cave in grim moods. It is time to go back to surface work.

Bill Stone: *I have made my decision. We will have the diving equipment delivered from the States. Can you lend me the satellite phone?*

In only five days the diving equipment travels over 2000 kilometers. Our team is newly energized. We believe the cave will continue beyond the sump. The divers who will take the sump by storm are Alan Warild from Australia and Bill Stone. We organize a large team to take all the equipment down. Two people will remain at the sump to assist the divers. Kasia Biernacka and I will wait for news in the camp at –552 meters. Then we will organize a party from the surface for either hauling out the gear or exploration.

The preparations for the dive take about two hours. Bill will dive first; if the cave lets him through, Alan will follow. Bill submerges, but only for about three minutes.

Bill: *I traveled about 7 meters. Shallow, 4 meters. But a squeeze is ahead, and we will not fit through it.*

Meantime hours pass in the camp. Finally, we hear someone coming up from below.

This article originally appeared in Polish in *Jaskinie* 4(41), 2005.

All photos by Katarzyna Biernacka and Marcin Gala, speleo.pl.

Gala: kasia.marcin@speleo.pl

Alan: *Good news! It does continue.*

Alan had taken all his diving equipment off underwater in order to pass the squeeze. He immediately emerged from the sump on the other side and ran down 200 meters of passage. So the cave definitely continues.

At the surface, the news raises hopes only briefly. What to do next? We are not prepared for long-distance exploration beyond a sump. But there was still a lot of time left. Alan proposes a solution.

Alan: *I think the water in the sump is blocked by some kind of dam. If we manage to disassemble it, we could lower the water level so that it would be possible to pass the sump with your head above water.*

Bill is at the camp by the sump, and we send John Kerr, our specialist at widening tight passages, to him. The only problem is that he is not a cave diver. Disappointment and silence rule the surface camp. Not really believing in the success of the work underground, we return to surface exploration. Meanwhile, Greg Tunnock and Alan Warild help John go through the sump. John spends twenty hours on the other side, working on the dam. At the same time, the Australians continue exploration beyond it. On the return, Alan free-dives the sump, holding his breath. So then progress could become faster. The following day, Kasia Biernacka and I reach the underground camp.

John: *I see almost no chance of opening up the sump this year. I am tired; I think I need to take a day off.*

But when the next morning I ask John to come with me to work on the sump, he happily reconsiders. The next three days are spent working together to lower the water level. Every morning and evening we go through the underwater squeeze, sometimes multiple times to transport equipment, though neither of us is a diver. Our insurance is Kasia and Bill waiting at the camp. We have radio contact with them. From the exit to the sump to the passage beyond is about 7 meters. This is the distance we needed to dig the mud and stones out of. Working sixteen hours a day in water up to our knees, we crush the blocks of stone and transport them farther into the cave. On the third day we are joined by Franco Attolini. At 9 p.m., I return to camp, finding Bill lying in his hammock.

Marcin: *We have opened the sump! Don't believe me? Look, my hair is dry.*

We had managed to lower the water level 2.5 meters, and we needed to widen the upper part of the squeeze. This does not mean that it can be walked through dry. In the narrow spot your helmet has to be taken off, and only your nose remains above the water.

Kasia Biernacka in the underground camp.

It is worth mentioning here an innovative solution to charging the batteries for the drills. We did that using military lithium batteries. Such batteries are easily and cheaply acquired in the States, and they are high in capacity and light in weight. Alas, they cannot supply a high current, so they are useless for direct connection to the drills. So we are using a special charger to transfer charge from these to the drill batteries. One battery was sufficient to charge three drills, and charging took about three hours.

More cavers join us in the underground camp, and we all go into action. John and I take care of the rigging. Bart Hogan, Tommy Shifflett, Bill, Kasia, and Franco survey. We pass huge waterfalls, beautiful, clean canyons, and huge lakes, deep and 30 meters wide. After twelve hours we finally and with a sigh of relief look at the bottoms of our rope bags.

For most of us, this is the end of the expedition. Bill and Franco stay at the camp, and the rest of us leave the cave. Fortunately, Matt Covington, Jonathan Lillestolen, Kasia Kędracka, Paweł, and Artur remain in the surface camp, all of them full of energy and enthusiasm for exploration. Eventually, the cave reached a depth of 1101 meters. Its

John Kerr, Marcin Gala, and Bart Hogan charging drill batteries in the underground camp.

Kasia Biernacka and Paweł Skoworodko.

length is 5,944 meters. I am happy our crazy trip in 2001 has led to such a result. We have spent many wonderful moments in Mexico. We are like a family now. Other expeditions are still before us.—*Marcin Gala*

Artur, smiling, "Paweł, what now?" Paweł, his face expressionless, "What do you mean, what now? Let's get packing." The next day five of us, Kasia Kędracka, Artur Nowak, Jon Lillestolen, Matt Covington, and I, go into the cave. We take most of the remaining camp food and ropes with us. Only José Antonio Soriano stays above as a camp guard. Bill Stone and Franco Attolini are very happy to see us. They have both been underground for a week. Having prepared everything for the next day, we go off to sleep. We arranged with Bill that Artur and I will do the rigging, while the rest will take care of surveying the new passages. Kasia, after a few kilometers of surveying with Bill, says she doesn't want to go to a surveying class once she's back in Poland.

In the morning, squeaking, we put on wet wetsuits and go down to the sump that we have heard so much about from Marcin Gala. Eyes wide with fright, we descend into the dark waters. The stories seem to have been a little exaggerated. It is, though, a fact that the wind blows as if we were in a turbine. After some further crawling, we descend into a canyon with a river. I have never gone canyoning, but this is how I have always imagined it: rappelling down waterfalls, swimming, and tyroleans. My breaststroke proves to be very effective. We reach the limit of exploration and start to rig a large waterfall into a lake disappearing around a turn in the passage. Another two waterfalls lead us to a dry section. Now it is just like Cheve. Artur has gone over the edge. He has thrown away his rope bag and run on ahead. I could hear only his distant cries. Next time I see him, an hour has passed. His face is smiling, with eyes of a madman. We continue on together. I don't think the survey party is going to reach us very soon. We leave cairns for them along the way.

Having walked for over twenty hours through dry sections in a wetsuit, all I can think about is talc. Fortunately we have it in camp. Next time we should take clothes to change into.

Summing up, we went on three long trips beyond the sump, starting from the camp just above it. The smell of the sump in the morning is even better than an early start with coffee. But I think next year we should move our camp to the dry sections above the wet canyon. During this last camp the cave went on large but mainly horizontal. For me it was undoubtedly the most spectacular exploration in my life. We were discovering one huge section after another, separated by complicated breakdowns. We thought the last one would stop us for good. But the cave continues, and it does not seem likely to close down very soon. The farther you go, the bigger it gets.

We also encountered a peculiar formation that Kasia called black lace. It looks as if 90 percent of the rock corroded away and the remnants formed a black, lace-like structure resembling nerve tissue. Artur and I rappelled inside such a thing for the first time. You can't walk on it, because it breaks. You leg falls inside. You can't aid-climb on it. Our experience from the jungle comes in handy—you have to cut a path through it.—*Paweł Skoworodko*

Marcin Gala in the sump.

I told my parents and friends just before leaving for Mexico that I would always stay with a fellow Pole, since it was my first caving expedition. But when we joined the expedition, the camp was boiling with uncertainty, diving equipment was on the way from the States, and some people were getting impatient or even bored. And then Marcin Gala said, "Kasia, Mike will take care of you."

Mike Frazier, an American caver whom I had met three months earlier in Poland, told me to pack my things, take my sleeping bag, and leave the camp in the forest behind—Goodbye Poles! I was not about to keep my promise. With Mike, Mark Wilson from Australia, Peter Hartley from Britain, Tjerk Dalhuisen from the Netherlands, and Tommy Dwyer from Ireland, I went down to the village of San Francisco Chapulapa. We called our team the US Shallow Caving Team, as opposed to the US Deep Caving Team. We explored a cave the entrance to which had been shown to us by the inhabitants of Santa Maria. We called it Ken, as a companion for Barbie, the unofficial nickname of J2. The entrance to Ken is situated at the bottom of a gigantic sinkhole, the sides of which are home to exotic plants. Inside, it was really hot, especially as I was caving in a yellow "oil-cloth overall." The mud stuck to our heads and toes, each puddle almost moved because of all the creatures dwelling in it, and white worms were met almost everywhere. The prizes for all this were dozens of beautiful formations and the fact that I have just gone down my first, if small, virgin shaft. Ken is a sequence of shallow pits, slopes, horizontal passages, and two large halls.

The exploration of Ken took us five days and concluded at a depth of 266 meters in a big hall the walls of which were covered with fantastic sculptures of mud.

While the diving was going on in J2, Mike, Mark, and I surveyed small Cueva Campana, 85 meters deep, which was discovered a few years ago by English cavers, but not surveyed. Killer bees in a hive 2 meters high hanging over the entrance had attacked the English and stopped their attempts to survey. We were luckier.

Tony Dwyer hauling gear through J2.

After a week, I returned to camp, the Polish language, and even greater excitement the source of which was, of course, J2.—*Kasia Kędracka*

Retorno a J2.

Algunos espeleólogos polacos de la expedición 2005 a J2 en Oaxaca describen sus experiencias personales, incluyendo el bombear agua del sifón y explorar y topografiar la Cueva Ken.

THE SAGA OF CUEVA CHARCO, THIRD-DEEPEST CAVE IN MEXICO

Nancy Pistole

I can't believe this is the underground camp—it's so small. My idea of an underground camp is lots of room, big flat floor, nice stream off to one side. If it weren't for the fact that it took me twelve hours to get here and I'm utterly exhausted, I'd turn around right now and leave. And the minor detail that it was a grueling trip to get here. I had been familiar with the first part of the cave: the 33-Meter Drop, the belly crawls, the Ivy Filter. It always amazes me that no matter how much gravel I push out of the way in those belly crawls, it all falls back in for my next trip through. But the rest of the trip to camp was new to me. Charley Savvas said the passage opened up. I'll have to ask him to define his idea of "open." Yeah, I guess you could call a cheese grater "open." The passage stayed small almost the whole way. And it seemed to just go on and on, with very few memorable landmarks. There were long stretches where I could only measure my progress by the occasional survey station. For a brief time the passage did get bigger, but I was wallowing in mud. Now I'm in this camp, and every time I move I hit my head on the ceiling and dirt falls down the back of my neck; my legs are so bruised they look like they belong to a Dalmatian. Time to get some rest, but what a choice of sleeping spots. I guess I'll take the one with the big boulder pushing into my hip.

After some sleep and a hot meal, I feel better. I asked Mike Ficco about some of his worst underground camps, and he had some stories to tell of wet, cold, windy places. At least this camp is dry, and the temperature is quite pleasant. And there is virgin cave just waiting around the corner. Okay, maybe this camp isn't so bad after all. . . .

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Cueva Charco, located in the state of Oaxaca, Mexico, was first found by Mark Minton, Noel Sloan, Pam Smith, and Bill Stone in 1989. The entrance is inviting, a 5-by-5-meter opening at the bottom of a sinkhole, with several short drops leading into darkness. The passage makes a hairpin turn to the left, and then the scene changes. Within several meters, the passage shrinks down to a belly crawl. The first group stopped shortly beyond this point at a water-filled passage with very little air space.

The cave was revisited in 1993 by Peter Bosted, Carol Vesely, and James Wells. When they looked at the entrance, they noticed airflow. They got to the same point as the previous group and found that the crawl through the water was short; it was just a puddle, hence the name of the cave (charco means puddle in Spanish). The air seemed to whistle through a mishmash of fractures and fissures, and sometimes it wasn't obvious which route was humanly passable. As the cave goes deeper, the passage becomes better defined, but not significantly larger. There are still plenty of chimneys and squeezes to negotiate. Several more survey trips were made that year, and with the help of Don Coons, Patty Kambesis, and Ed Sevcik, the survey reached 734 meters long and 267 meters deep. During the last survey trip, a shaft was discovered that was 33 meters deep. There were high hopes that this signaled the beginning of bigger passage.

Charco is located in an area referred to as the "middle karst." It is an area of limestone located between the main entrance to the Cheve system and the Cheve resurgence. The Cheve system must have infeeders, because the volume of water at the resurgence is greater than the river in Cueva Cheve. Geologically, the middle karst is the ideal place to look for these infeeders. [See the area map in *AMCS Activities Newsletter* 29, page 28.]

In 1994, twenty-four cavers rented an old schoolhouse for two weeks in the small village of La Hierbabuena for a systematic assault on the middle karst. Many cave entrances were located, and the ones with the most potential for a connection into the missing middle part of Cheve were explored and mapped. Charco was not high on the list for exploration, not because of its lack of potential for a connection, but because of its reputation for being tight, wet, and relatively cold. Charco hardly fit the idea of Mexican borehole. On the only significant trip into Charco that year, Harry Burgess, Nancy Pistole, "Long Bob" Riley, and Taco van Ieperen went down the 33-meter pit (imaginatively dubbed the 33-Meter Drop) and continued to the end of the survey. Disappointingly, the passage did not get any bigger. In fact, within a few meters, Nancy was squirming on her belly through a small stream, digging out gravel so she could get through the passage. Taco was cold, so he left the cave. When he returned to the base camp, he told such horror stories of the cave that no one else wanted to check it out. The passage did open up a bit, but still had plenty of tight spots. Only about 200 meters were surveyed, adding less than 50 meters to the depth.

No one returned to the cave for five years. There are several major cave systems nearby, the main Cheve system, Huautla, and the caves of Cerro Rabón, all of which are much more inviting. Even in the close vicinity of Charco, there are many other cave entrances. However, during those five years cavers checked many of the surrounding caves, and the promising leads in the middle karst dwindled. Several attempts were made to get through the big pile of breakdown at the end of the main passage in Cueva Cheve, with no real success, so serious attention turned back to Charco.

In March 1999, Joe Ivy, Becky Jones, and José Soriano rented two small houses just above the Charco sinkhole. The accommodations were pleasant enough. There was enough room in one house to store gear, and the other building was turned into a kitchen. Both houses even had basic electricity. The primary mission was to explore Charco and determine if the cave had enough potential for a bigger expedition. This was supposed to be a small, informal trip, but over the course of two weeks, a total of sixteen cavers showed up, from the US, Mexico, Switzerland, Great Britain, and Italy.

Every day at least one survey team plunged into Charco, adding data to the survey. Sometimes another team would go in to rearrange rocks and widen parts of the passage to make the route less difficult. Progress was slow. Typically, a team would cave for one long day, then take two or three days to recover. Joe did a good job of "Ivy-sizing" the tight parts, but was finally stopped at the Ivy Filter, a tight, awkward squeeze over a calcite dam into a cold pool of water that inevitably forced a head-dunk. Yvo Weidmann, Catherine Perret, and Mike Frazier found several very small and sinuous side leads, one of which makes a loop connecting the top of the 33-Meter Drop to its bottom. Charley Savvas went on a survey trip with two Italian cavers, Luca Tanfoglio and Giacomo Rossetti. Even though they did not speak a common language, they had a successful survey trip. On the last survey trip, Matt Oliphant and Charley told Mark Folsom to be prepared for a twenty-four-plus–hour trip, but Mark thought they were kidding. The trip lasted twenty-nine hours, and Mark ran out of food. When they got to the surface, they ate a hot meal, and then Mark went to his tent. Becky checked on him a while later; he was lying there sound asleep, fully clothed, with his feet sticking out of his tent and his boots still on.

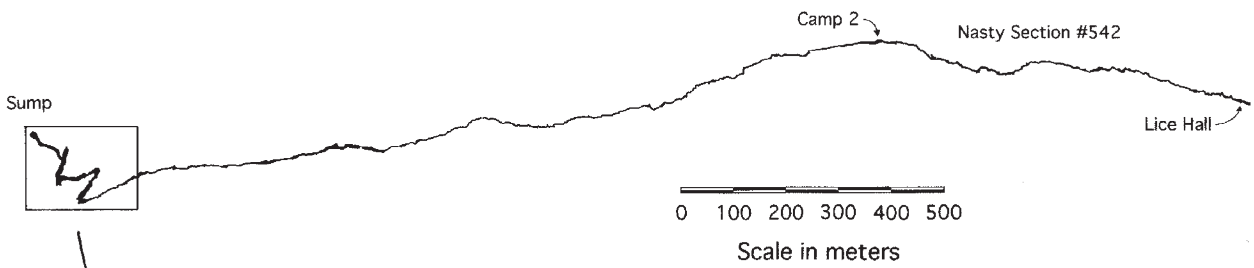
Upper left: The surface base camp. *Nancy Pistole*. Lower left: Inside the gear house. *Tommy Shifflett*. Below: Cleaning up after a cave trip. *Nancy Pistole*.

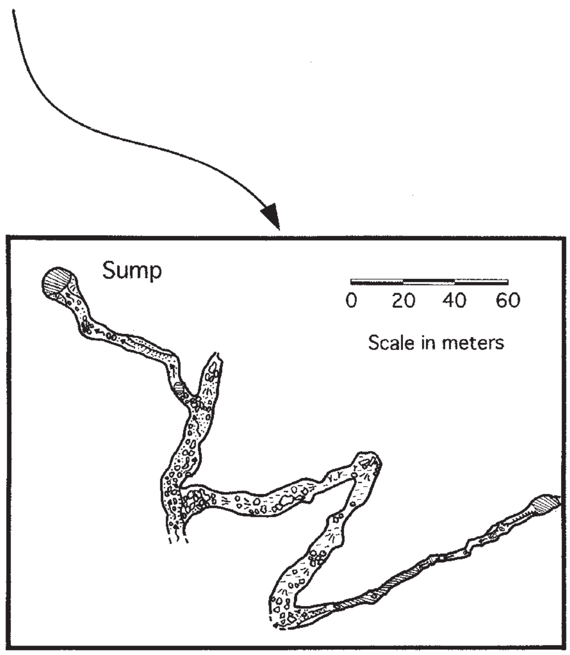
CUEVA CHARCO

SAN MIGUEL SANTA FLOR, OAXACA, MEXICO

Total surveyed length: 6.71 kilometers

Total depth: -1,278 meters





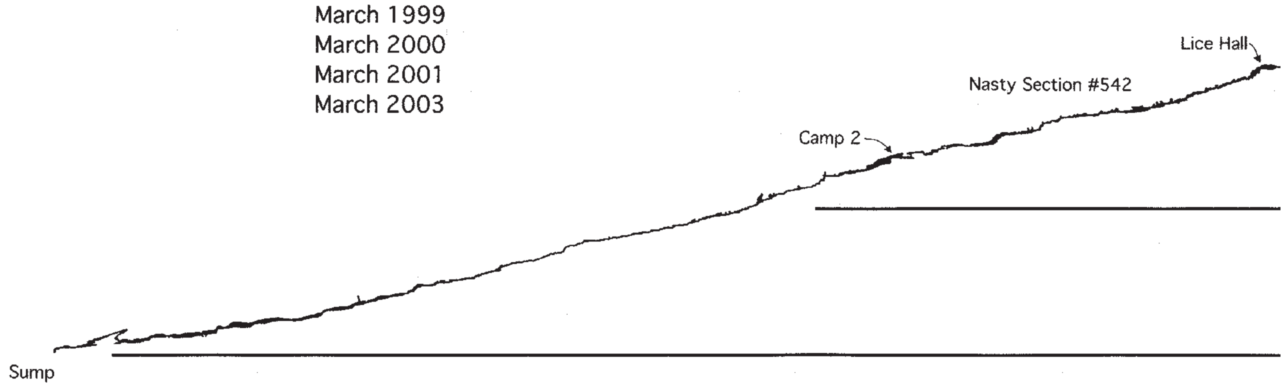
Surveyed by:

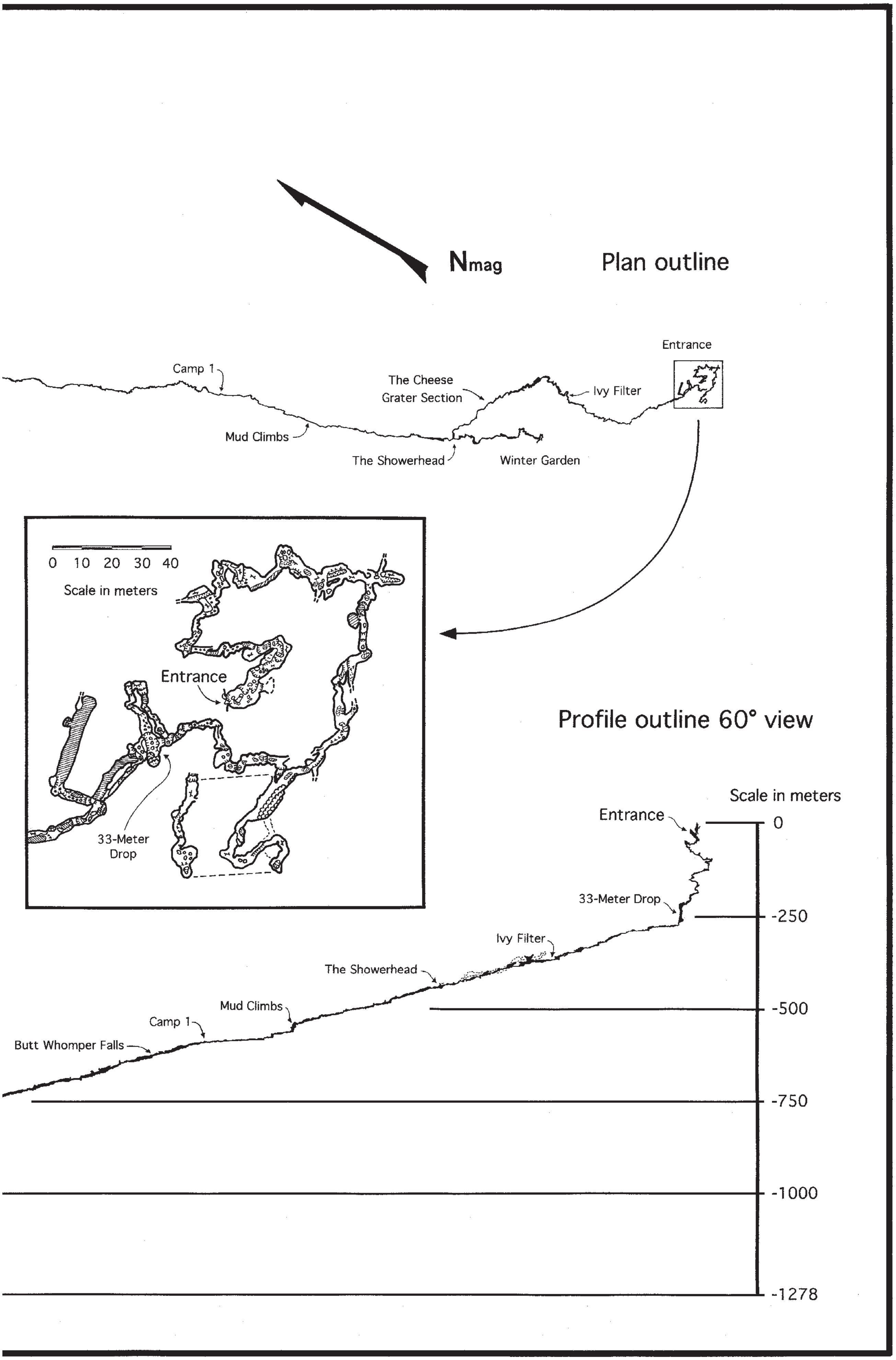
Peter Bosted
Harry Burgess
Andy Capel
Don Coons
Luís "Wicho" Diaz
Tony Dwyer
Jerry Fant
Mike Ficco
Mark Folsom
Mike Frazier
Mariano Fuentes
Chris Gibson
Peter Haberland
Pete Hartley
Patty Kambesis
Paul Medhurst
Nathan Noble
Matt Oliphant
Catherine Perret
Nancy Pistole
Bob Riley
Matteo Rivadossi
Giacomo Rossetti
Charley Savvas
Tony Seddon
Ed Sevcik
Tommy Shifflett
Jason Siemion
José Antonio Soriano
Bill Stone
Luca Tanfoglio
Taco vanleperen
Gustavo Vela
Carol Vesely
Yvo Weidmann
James Wells

Cartography by Nancy Pistole and Charley Savvas

Suunto and tape surveys:

February 1993
March 1994
March 1999
March 2000
March 2001
March 2003





Nmag
Plan outline
Entrance
Camp 1
The Cheese Grater Section
Ivy Filter
Mud Climbs
The Showerhead
Winter Garden
0 10 20 30 40
Scale in meters
Entrance
33-Meter Drop
Profile outline 60° view
Scale in meters
Entrance
0
33-Meter Drop
-250
Ivy Filter
The Showerhead
Mud Climbs
Camp 1
Butt Whomper Falls
-500
-750
-1000
-1278

Cozy in Camp 1. *Tommy Shifflett.*

From the line plot, the nature of the cave was becoming apparent. After a few spirals near the entrance, there is one passage that heads in a straight line north-northwest, towards the Cheve resurgence, with very few side leads. The profile shows a consistent gradient, also towards the resurgence. The cave was now 2.6 kilometers long and 588 meters deep and had good airflow and running water. Even though the passage continued to be a series of crawls, chimneys, squeezes, and short drops through loose, nasty, brittle chert layers, we decided the lead was worth pursuing.

The following year, in March 2000, twenty-one cavers returned, determined to find the connection between Charco and the Cheve system. The most efficient way to continue exploration was to set an underground camp, but where? Although the average passage near the bottom of the cave had become a bit bigger (roughly 1.5 meters wide by 1 to 3 meters tall), there was now a stream running along the floor, and the walls were covered with sharp, loose protrusions. The year before, Charley Savvas had noticed a small alcove above the stream when he was sketching. With a year to dim his memory, Charley, always the optimist, was sure that this alcove would make a great camp. After setting up the rental houses and making a few trips into the cave to rig and shuttle supplies, the first camp group was ready to go. Mike Frazier, Nathan Noble, and David Cole headed in with enough provisions for an overnight stay. However, they never found the alcove and ended up setting up a temporary camp. They came out of the cave the next day, very tired and beat-up. That was enough for David; the following day he left on a bus going down the mountain. Matt Oliphant, Gustavo Vela, Paul Medhurst, and Charley were the next ones in. Since they knew where the alcove was, they planned on a long rerig and gear-hauling trip. They found the alcove without any problem, but it wasn't exactly the great camp Charley had described. After several hours of hard digging and rock rearranging, three sleeping spots were excavated.

These were not luxury accommodations. One of the "bunks" was in a slot less than half a meter high. Another bunk was long and narrow, with a big rock jutting in from the side. The crew slept for a few hours, then headed out.

After reevaluating the underground camping situation, a new plan was formulated. With some more digging, it would be possible to carve out another three sleeping spots, for a total of six. But there were more than six cavers who were getting psyched for the misery (and potential virgin cave). The plan was to send more than six cavers in to camp, and they would "hot-bed," using the camp in 12-hour shifts.

Ten cavers headed into camp over a two-day period. The bare minimum of camp gear was taken down to set up the camp, and even that had to be shuttled through the tight spots, since a normal-size camp duff would not fit. The first group, Mike Ficco, Nancy Pistole, and José Soriano, had the chore of carving out three more bunks. The entire camp space was so small that there was barely enough room for six people to be standing at the same time. Globs of mud kept falling from the ceiling. There was no place to dig a latrine without contaminating the stream, so garbage bags were rigged in a small rock alcove to make a porta-potty.

Peter Haberland, Pete Hartley, and Tony Seddon came down next. Because the end of the survey started close to the camp, the survey trips were quite efficient, with two survey teams leapfrogging. Then when Charley Savvas, Mike Frazier, Nathan Noble, and Gustavo Vela arrived in camp, the team divided into shifts. The way the plan was supposed to work, one shift would leave camp as the other shift arrived. That rarely happened, so at most of the shift changes, all ten cavers were in the tiny camp at once. It looked a lot like the old how-many-people-will-fit-into-a-VW-Beetle contests. Luckily, the cavers were in good spirits and tolerated each other well.

About a week later, some of the first cavers returned to the surface, and Matt Oliphant, Paul Medhurst, and Bill Stone joined the camp crew to continue surveying. Bill brought in some 7-millimeter heavy-duty dive line. The push team was short on rope, so they used the dive line to rig the many short nuisance drops.

On their last survey trip, the team broke the 1000-meter-depth mark, but the passage was still just as miserable. In one place, the passage was 8 meters high, but too narrow to continue. After drilling and hammering the bedrock wall and taking off their vertical gear, they were finally able to squeeze through. At that spot on the way back out, Charley tried to get through the squeeze with his vertical gear on. He wedged himself in the passage, but he formed a human dam, and the water in the stream started backing up and threatened to submerge his head. He backed out and reconsidered his tactics.

The underground camp was used for ten days, although no caver stayed for the entire time; five or six days was enough to get sufficiently trashed. The trip was very productive, and Charco was now 4.6 kilometers long and 1,019 meters deep. The line plot still looked the same, an almost straight line heading north-northwest toward the resurgence. And the passage continued to be tight, nasty, and loose.

The lure of a connection into the Cheve system overpowered the memories of the small passage and cramped camp. A smaller group returned in April 2001. The survey trips from the underground camp had become too long to be done in 12-hour shifts, so now there would only be room for one group of six cavers to stay in camp. At first, the surface crew was plagued by injuries. Pete Hartley was recovering from knee surgery, Tommy Shifflett showed up with a horrendous toothache that turned out to be an infection, and Gustavo Vela tripped in the middle of the night and badly bruised his foot while chasing a dog that was stealing food from the kitchen. Rest and medication cleared up most of the problems. After a few days of setting up the surface camp, organizing gear, and making some initial gear hauls into the cave, an underground group was ready to go. Tony Seddon, Charley Savvas, and José Soriano, all veterans of the underground camp, headed in first. Their job was to continue the gear shuttles and set up the underground camp. Matt Oliphant, Tommy, and Gustavo left for camp the next day. This was Tommy's first camp in Charco, but Tommy, with years of experience in some of West Virginia's most difficult caves, seemed to enjoy Charco's obstacles.

The cavers stayed underground for a week. Unfortunately, the end of the survey was so far away from the underground camp that most of the caving time was spent in transit, and not a lot of time was left for surveying. By the end of the week, they had managed three long survey trips, netting 661 meters of passage and adding 124 meters to the depth. The cave continued as it had been, narrow, straight passage, heading roughly north-northwest.

When the cavers headed out of the cave, they were in for a big surprise. The weather hadn't been great during the week they were underground, and it had been raining steadily for two days before they left for the surface. The stream level in the cave wasn't affected much, although they did notice a little more flow on the way out. But the tight belly-crawl in the entrance area was now filled with cold water. (Recall that when the cave was first discovered, this area had been sumped.) Soriano and Gustavo reached the sumped area first. They thought they had made a wrong turn and retraced their steps, but after searching the very few alternate crevices near the entrance, they reluctantly realized what had happened. After a grueling 12-hour trip from camp, now they had to start bailing. Charley soon joined them, but it still took about four hours to get through. It turned out there were three sumps at dips in the passage, and since the passage was a tube with no side leads, the only place to move the water was into the next lower dip. That meant when Tony, Matt, and Tommy came out, the sumps had been refilled, and they also had to bail them out. Tony had less patience than the rest and ended up free-diving one of the sumps.

Besides the disappointment of being so close to the surface and having this obstacle in the way, they had another adversity to contend with. Early in the year, a cow had died in the entrance. By the time we arrived in April, the cow was quite ripe and supported a thriving colony of maggots. Most of these maggots had been washed into the sumps. Matt and Tommy were the last ones through, and Matt recognized what all the white "floaters" were. In one spot, when Tommy was squeezing through one of the tight places with his head halfway submerged, Matt pointed out all of the maggots floating in front of his face. This gave Tommy an extra incentive to get through the spot and out of the water quickly. All six cavers gathered in the kitchen afterward to eat a warm meal, recount their adventures, and pick little flesh-eating beasties out of one another's hair.

Surveying the sump. *Tommy Shifflett.*

Matt and Tommy were not satisfied with the relatively small amount of depth that had been added to the survey and figured the other possibility for adding depth to Charco was to go up. With help from Nancy Pistole and Jerry Fant, they pushed every crack and crevice near the entrance. The payoff was small; they managed to gain about 27 meters above the datum at the entrance.

The other goal for this trip was to confirm the link between Charco and the Cheve system with a dye trace. The underground team carried fluorescein to the farthest point they reached and released it into the small stream. Meanwhile, Bev Shade was in the resurgence area, and she placed some dye bugs in several places in the water at the resurgence and along the Río Santo Domingo. After everyone left Charco, a handful of cavers went to the resurgence to collect the dye bugs. The hike down to the river is hideous from the south side, but is relatively easy from the north. The group drove through Huautla and on to San Simón. From there it is an afternoon jaunt to the resurgence, although it requires a river crossing that can be tricky if the river level isn't low. Dr. Nick Crawford at the Center for Cave and Karst Studies at Western Kentucky University generously offered to analyze the dye bugs, since very sensitive equipment was needed for detecting the highly diluted dye. Not surprisingly, the dye trace was positive, so the Charco-Cheve link was confirmed.

Two years later, in March 2003, many of the same people reconvened in Mexico for another push in Charco. After the initial gear shuttles and lots of planning, the first group went in for a seven-day stay. This hardy bunch consisted of Tony Dwyer, Mike Ficco, and Tony Seddon. They used the original underground camp, now called Camp 1, for one night, but Camp 1 was too far away from the end of the survey to use as a base. The next day they continued farther into the cave. At one point they had to climb up and traverse above the stream because the passage below was too narrow. Before they dropped back down into the streamway, they set up Camp 2. It was just wide enough that they could hang hammocks across the passage, although the hammock anchors were a bit shaky in the loose rock walls. The breakdown floor was made up of sharp rocks, so they cleared a flat spot for cooking. This was hardly an ideal camp spot. There were many holes in the floor, so if anything got dropped, it fell down into an inaccessible part of

Charley Savvas negotiating one of the many nuisance drops. *Tommy Shifflett.*

the stream below.

In two long push trips they surveyed over a kilometer of passage, to a sump. About 300 meters before a sump, the nature of the cave changes. While most caves tend to get bigger as they get deeper, the main stream passage in Charco remains straight, small, and narrow, best described as a cheese grater, with tight squeezes even below –1,000 meters. But just before the sump, the stream passage intersects a borehole almost 10 meters wide by 10 meters high in some places. The upstream section of the borehole is blocked by flowstone, and the downstream section leads to the sump.

The group briefly tried to find a bypass, but they were on a schedule and needed to leave to make room for the second team coming in. This group was Matt Oliphant, Charley Savvas, and Tommy Shifflett. The hammocks were not set up for a tall person like Matt, so he spent several hours rearranging rocks to make a bed. They spent five days underground and, in one very long push trip, checked every possible nook and cranny, but could not find a way around the sump. Matt swam around the sump pool looking for a way on. Finally, they packed up the camps and made the long and tortuous trip out of the cave for the last time. At each climb, squeeze, or generally hideous place Charley and Matt celebrated. "This is the last time we are ever doing THAT again!"

While the end of the cave was being explored, the cavers on the surface reviewed the map of the cave. There were almost no side leads, but there was one major infeeder a little way before Camp 1. Because the spray of water coming into the main passage couldn't be avoided, it was called The Showerhead. The surface crew figured that this might be the last chance to explore Charco, and this infeeder really needed to be checked out. Luis "Wicho" Díaz, Mariano Fuentes, Jason Siemion, and Nancy Pistole timed their trip so they could make one long push trip into the infeeder, spending two nights at Camp 1 when the deep teams weren't using it. After a rather hairy climb up a chimney to avoid the flow of water from the lead, they squeezed into a very low passage. This opened up, and the passage trended upward, varying between tight belly crawls and fair-sized rooms with high ceilings, for 350 meters. While most of Charco has no formations to speak of, this passage has alcoves choked with formations. The water cascades over pretty flowstone shelves and white, bulbous calcite. The team ran out of time and turned around at a nasty tight spot.

Tony Seddon, who had been out of the cave with the rest of the first camp team for less than 12 hours and had heard about the unfinished Showerhead lead, convinced Mariano and Nancy that it could be checked out on a long day-trip from the surface. So the three of them went back to the nasty tight spot at the end of the survey there and continued pushing. They managed to map another 52 meters before they came to a place where the water poured out of small holes that were definitely too tight. They checked out a short, dead-end side lead and admired some of the very pretty formations in the stream passage. This area was named the Winter Garden. Altogether, the Showerhead passage added over 400 meters to the length of Charco. The survey climbed almost 100 meters of elevation, but its end is still well below the surface, over 300 meters deep.

With all the data tallied, Cueva Charco is 1,278 meters deep and 6.71 kilometers long. This makes Charco the third-deepest cave in Mexico, behind Sistema Cheve (1,484 meters) and Sistema Huautla (1,475 meters). There are some features of this cave that make it quite different than the other deep systems in Mexico. Charco has one entrance and very few side passages. The length of the passage that must be traversed to get from the entrance to the sump pool is 6.08 kilometers, and the depth from the entrance to the sump pool is 1,243 meters, so the main route covers over 90 percent of the entire cave. The longest rope drop in the cave is 33 meters. There are dozens of short nuisance pitches, but most of the depth is obtained by climbing and scrambling. Most of the shorter drops were rigged with 7- or 8-millimeter rope; the longer drops and the ones nearer the entrance were rigged with 9- or 10-millimeter rope.

The line plot of Charco adds an important piece to the Sistema Cheve puzzle. The hope was that Charco would cut over toward Cueva Cheve and a connection would allow access to the lower part of Cheve, beyond the boulder choke that is currently preventing further exploration. But Charco, like other caves in the area, points in the direction of the resurgence. Charco drops to a sump kilometers away from the resurgence, so the conclusion is that there is a labyrinth of passages below the water table that eventually drain out to the resurgence. This knowledge significantly reduces the area of the middle karst that needs to be searched for caves that will connect into the Cheve system below the boulder choke and above this underwater labyrinth.

During the years that crews were working deep in Charco, groups on the surface were searching for other cave entrances nearby. Several pits were found, the deepest being 65 meters, but they all ended. Cueva Palomora was the most promising of the bunch. After squeezing through a very narrow crack, cavers found a slightly wider passage

Peter Haberland is glad to be out of the cave. *Monte Paulsen*.

for a short distance, but then it pinched back down and was too tight to follow. The depth of Palomora is 142 meters, and the length is 262 meters.

We want to thank several sponsors who continued to support us throughout this endeavor: Cancord Inc., who generously made us nylon rope specifically for the trip, Richmond Area Speleological Society, Dogwood City Grotto, National Speleological Society, Gonzo Guano Gear, and Huntsville Grotto. We would also like to thank all the cavers involved for not getting injured in the cave, as any kind of serious rescue beyond the first kilometer would have been impossible.

La Epopeya de la Cueva Charco

La Cueva Charco está en el carst intermedio entre la Cueva Cheve y su resurgencia en la Cueva de la Mano en Oaxaca. Fue descubierta en 1989. El primer kilómetro de cueva fue topografiado hacia 1994. En 1999 comenzó la exploración en forma para buscar una posible conexión con la sección hasta ahora inaccesible de la Cueva Cheve más allá del límite explorado actual. La mayor parte de la cueva es lineal y sus 1243 metros de profundidad se alcanzan después de una serie interminable de pequeños tiros y desescaladas. Casi todos sus 6.7 kilómetros de longitud están en el pasaje principal, que es pequeño y frecuentemente apretado, aunque cerca del final de la cueva, hacia el sifón terminal, es más grande. Se utilizaron dos campamentos subterraneos bastante incómodos durante la exploración.

SISTEMA J2–LAST BASH: THE 2010 J2 EXPEDITION

Matt Covington

My story begins in May 2006. That year's J2 expedition started with a mad rush into the unknown, in pursuit of a wide open lead at –1000 meters. However, at –1200 meters, exploration came to a screeching halt when the team encountered El Sifón de Los Piratas. For several weeks, teams mapped and explored side leads in hopes of finding a bypass to the sump. During one of these trips Tommy Shifflett, Jon Lillestolen, Bart Hogan, and I explored an infeeder near Camp 2a. We continued up two free-climbs, following strong airflow, and stopping at the base of a 15-meter waterfall. The airflow was intriguing, but the passage seemed to be headed upstream, not a likely place to find a sump bypass. In any case, we had no aid-climbing gear with us that day and could not continue.

Several days later, back on the surface, Jon convinced me to go with him to check out a pit that he and several Polish cavers had discovered in 2005. After searching around for a couple of hours and checking a bunch of dead-end holes, we relocated the pit, which had been dubbed La Cueva Hija Puta by Pavo Skoworodko. The entrance was tight, thus inspiring the name, but man, was it sucking in some air. We were both excited by the air, and Jon went in through the entrance squeeze and set the first rebelay. From there the cave dropped through two more squeezes and opened into an echoing pit around 30 meters deep that clearly took water in wet times. Out of rope, we retreated to the surface, stoked about having going cave. On the way back to camp, for some reason we decided to try a new route. The route down the valley bottom had been pretty grim, and we knew there was an established trail somewhere above us, if only we could get there. After about thirty minutes of bushwhacking up the treacherously steep hillside in the dark, we still had not found the trail. Going was slow, and we opted to traverse back into the valley bottom and retrace our earlier path. Inspired by this small adventure and the fact that the expedition was nearing its end, we settled on a new, more politically correct name for the cave—Last Bash. Upon returning to camp and adding the Last Bash survey to the database, we could see that the cave entrance was nearly directly over J2, and only about 500 meters horizontally from the blowing infeeder at Camp 2a. It seemed like a stretch at this point, but could these two passages possibly connect?

In a last-ditch effort to find a bypass to the J2 sump, the next day Bill Stone, Jan Matthesius, Pauline Barendse, and I headed for the bottom of J2 to push bolt-climbing leads, the final exploration trip for the year. We spent two long days beyond Camp 3 knocking off climbing leads one by one, with Bill and me trading off the lead. None of these climbs yielded any significant passage, and we decided to retreat to Camp 2a and spend our final exploration day climbing up the infeeder passage. It seemed unlikely to lead to more depth, but at least it was going passage.

The waterfall that had stopped us before is broken into two steps, with a large alcove about 5 meters up. I free-climbed the first pitch, which was easy, but very wet. Once at the top, I rigged a rope and the rest of the team followed. I then bolted up the remainder of the waterfall and squeezed into a tight passage above. The cave continued, and up around the corner I found a better place to rig a permanent line, which dropped back into the alcove below, out of the waterfall's spray.

Upstream, the passage enlarged to mostly walking size. We encountered two more free climbs and scooped about 200 meters of passage before finding another big waterfall. We went back for the climbing gear, and I began the climb while Bill and Pauline started surveying the passage below. The waterfall created a

San Francisco Chapulapa. *Kasia Biernacka and Marcin Gala.*

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Team Mexipole (Wicho Díaz, Omar Hernández, Mirek Kopertowski, and Oliwia Rysnik) and their "racing spoons" in Camp 2. *Kasia Biernacka and Marcin Gala.*

tremendous amount of spray, and the chamber below it was swirling with mist. Jan, who was belaying me, managed to crouch in an alcove to escape the brunt of the wet and wind, but he certainly had a couple of cold, grim hours ahead. I bolted my way up the side wall and across an overhanging traverse, until I could swing myself around into the slot from which the water was rushing. Then I chimneyed up the wet chute for about 5 meters until it opened into a chamber. I placed one bolt, and got halfway through the next drill hole before running out of power. In that hole I placed a second, shallow bolt, which also happened to be my last. The chamber ended at yet another waterfall, with what appeared to be a narrow canyon passage emerging at the top. The cave continued, but we would not go there today. We completed a final survey shot, and I left a note on the station with the station number, our names, and the date. As I had a final look up the falls before descending, I wondered whether anyone would ever find that note from above, maybe years from now, if it could survive the high flows of the wet season.

In 2009, we returned to J2 for a major diving expedition. Amid the chaos that is a major diving expedition, the team also managed to conduct a number of forays into Last Bash. Early in the expedition, Jon, Jim Castelaz, and I returned with 50 more meters of rope. We rigged down three pitches into a roomy chamber that led to the top of a deep, sloping fissure. Some rocks we dropped seemed to go on out of earshot. It would turn out that this fissure was even deeper and more vertical than it sounded. In a series of trips later in the expedition, team members continued the push down this fissure. The ramp gradually grew steeper for about 100 meters before reaching a free-hanging drop of 150 meters. After several more steep drops, the cave reached base level at around –400 meters, becoming much more horizontal. A final exploration and survey push, by Wicho Díaz, Will Heltsley, Jon Lillestolen, Mike Pugliese, Yuri Schwartz, and Sergey Tkachenko, led to about –500 meters, where the team ran out of rope. Now the gap between Last Bash and J2 had greatly decreased. Given the amounts of air and water, it seemed likely that the two caves would connect, probably in the vicinity of Camp 2a, but there were many infeeders near there, so where exactly it would come in was anyone's guess.

After 2009, the team was pretty worn out with J2, and we needed a break from hauling loads of diving gear. Furthermore, Bill Stone, who had led most of the previous

Center: *Kasia Biernacka and Marcin Gala.* Others: *Omar Hernández.*

J2 2010 photos by Kasia Biernacka and Marcin Gala, clockwise from upper left: Oliwia Rysnik climbs rope at the start of the route up from Camp 2. The main shelter in base camp. Omar Herández at the drying rack in Camp 2. Oliwia Rysnik in a dry bypass route. Oliwia Rysnik squeezes through one of the many tight spots in the Moment of Doubt in Last Bash.

J2 expeditions, would be spending several months in Antarctica with the Endurance project and didn't have time to plan another expedition for 2010. Given this, we knew that another big diving push in 2010 was out of the question. However, Jon Lillestolen, Marcin Gala, and I decided to put together a smaller expedition, with the main goal of trying to connect Last Bash into J2. Not only might this create an easier route to the bottom of J2, but it also would bypass the Surprise Sump at –750 meters, which had flooded several times in 2009, trapping cavers beyond. If we succeeded, we would head to Camp 3 to push an intriguing lead that Yuri Schwartz and Sergey Tkachenko, two Russian cavers, had discovered near the end of the 2009 expedition. While Bill and José Morales had been diving in Sump 4, Yuri and Sergey were bolt climbing near Camp 3. They had reached an ascending passage with a large amount of airflow being sucked into it. This air was heading to a lower entrance somewhere, and just might bypass the sump and head downstream.

Jon and I arrived in San Francisco Chapulapa late in the afternoon on February 27, 2010, after driving straight through from the border. Shortly thereafter, Marcin, Kasia Biernacka, their daughter Zuzia, and Wicho Díaz arrived, having driven up from Oaxaca City that day. We settled in for the night at Rancho Faustino, the home of our good friends in Chapulapa, and the next day began negotiations with the *presidente* and *bienes comunales* to obtain permission to go up the mountain to Last Bash. Negotiations with the *bienes comunales* dragged on as one day became two days became two weeks. Two unfortunate cavers, Mike Young and Brendan Nappier, came and went in the time that it took to gain permission. Luckily, during that time we were at least able to do some caving in Ken Cave near Santa Maria Tlalixtac, where we easily obtained permission. The true heroes of this expedition were Kasia Biernacka, our best Spanish-speaker, who spent countless hours in the hot seat during negotiations, and Wicho Díaz, who made two trips up from Oaxaca City to help us get permission. Without the hard work of these two, we would not have had a 2010 J2 expedition.

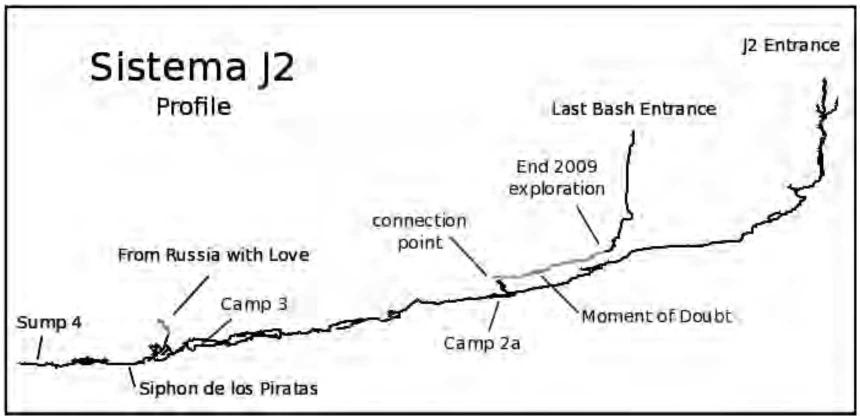
Señor Faustino Navarete Rubio (right) and his adopted son Jonas, our hosts on the mountain. *Omar Hernández*.

With permission obtained, on March 14 we finally started up the mountain with our gear, establishing a new base camp in the fields below Last Bash. It certainly had a different feel than our previous camp in the remote cloud forest. The new camp was exposed to the sun and frequented by cattle, pigs, and dogs, and every day dozens of locals would walk by on their way up to work in the fields. After splicing a T-junction into a nearby hose, we at least had running water, which we never had in the cloud forest. On March 15, Marcin Gala, Will Moffat, and Joke Vansweevelt set off on the first trip into Last Bash. Their main goal was to survey about 300 meters of passage that had been explored in 2009 but not surveyed. If they had time, they would continue beyond. Around 9 a.m. the next morning the crew staggered back from the cave. They had extended the survey to about –570 meters, but had no time to continue into unexplored passage. This was quite a "warm-up" trip to start off the expedition. Clearly, pushing Last Bash from the surface was going to require some long, difficult trips. Later that day Jon, Kasia, and I headed into the cave. We started rigging and surveying, and after only 100 meters of narrow passage we reached a tight crack that was taking all the air and water. I climbed down into the crack and crawled along the stream for a few meters before encountering a short flowstone constriction that was too tight. We had brought 150 meters

From left: Jon Lillestolen, Omar Hernández, Joke Vansweevelt, Will Moffat, Kasia Biernacka, Marcin Gala, Bill Stone, Oliwia Rysnik and Zuzia Gala, Mirek Kopertowski, Kelly Mathis, Wicho Díaz, Matt Covington. *Omar Hernández*.

of rope, several drill batteries, and countless bolts and hangers, but we didn't have anything for enlarging passage. Stymied, we headed for the surface, emerging around 2 a.m. after fourteen hours underground.

The next morning we discussed our options, all of us now being a little uncertain about whether we would succeed in a connection. Given the difficulty of the trips, each team needed two recovery days before returning to the cave, so we all relaxed around camp for the day. The following day, Marcin, Will, and Joke returned to the cave, prepared to work on the constriction. After the hour-long hike to the cave, Will realized, to his dismay, that he had left his vertical gear in camp. While he ran back for it, Joke waited at the entrance, and Marcin decided to descend ahead of the others to start the work. Marcin arrived at the constriction and started a long two hours of hammering, half lying in the water with a shower trickling in from above. Finally, it was large enough to pass through, so he went for it. However, up ahead there was a horn that jutted out, creating a narrow spot in the air-filled portion of the passage. He had to completely submerge his body and ease under the horn in order to reach the other side. Soaking wet, and tired from the hammering, he was unhappy to find another constriction around the corner. His opinion was that this one was too tight for too long. It couldn't be passed without serious use of chemical persuasion. About this time Will and Joke showed up. Marcin was hypothermic, so he headed for the surface. Will and Joke also passed the first constriction and spent some time hammering, removing the horn and reducing the water level in the squeeze by lowering the lip of the dam that was holding back the water. They took a quick look at the next constriction, but then also headed for the surface because they were getting too cold.



Two days later, Jon and I returned, afraid of the grim lead that lay ahead, but prepared to push hard. The others had significantly improved the passage, and we only got wet up to our waists going through the first squeeze. Once beyond, Jon started working on lowering the water level more, while I scoped out the terminal constriction. Without the fog of hypothermia to bias my judgment, I could see two possible routes. Up high, it looked almost passable, and it was out of the water. Down low I thought was a little bigger, but also very wet. I would try high first. I removed all of the vertical gear from my harness and squeezed my way up into the opening, but that level quickly pinched out. From there, I thought I might be able to get back into the lower level past the wettest part. I worked my way into the widest spot, but soon my hips jammed. I wasn't going any farther. I had started to climb back out when my harness snagged on a projection. After a couple of minutes of fruitless struggle, I was beginning to wonder about my predicament. I slid back down to a spot where I could barely reach my harness carabiner and started working it open. Soon I had my harness unfastened and was making better progress slithering out of the crack. About that time Jon showed up to say, "Man. Your harness is falling off."

"Yeah, I know."

After a breather, I decided that down in the water might be the way on. I squeezed in feet first and gradually eased my way through. Awkward, but passable. Jon followed, hammer in hand, removing the most offensive projections. Next came another ascending squeeze, followed by a sharp turn into a tight chimney back down. Finally things started to look better. We got out into walking passage. For nearly thirty minutes we scooped forward through fairly easy passage, with a few short down-climbs but no rope drops. We ultimately named this passage The Bazooka Attack in memory of the shootout reportedly including "grenades, artillery, and bazookas" that Jon and I had narrowly missed on our drive across the Mexican border. As we continued on, we were starting to wonder whether we had overshot the Camp 2a infeeder. There had only been about 200 meters of horizontal distance separating the new surveys in Last Bash from J2, and we had gone much farther than that. Then the cave turned hard right, back on itself. Soon we were looking down a 10-meter drop that we could not free-climb. I turned my headlamp up and scanned the room

Zuzia. *Omar Hernández*.

below. There it was, a rope rigged to the far right wall. This was the waterfall that I had looked up in 2006, wondering if someone would ever discover it from above. We had made the connection. Sistema J2 was established.

We had left all of the survey and rigging gear back before the series of squeezes, which we later named the Moment of Doubt. Our plan was to try to survey the passage and then return to the surface. However, the only set of instruments was totally fogged. Since we had rigging gear, we decided that Jon would work his way back to the connection point, rigging all of the short drops for travel with a camp duffel. In the meantime, I would work on the Moment of Doubt with the sledge. Two and a half hours later, Jon returned, and we headed out of the cave.

The first goal of the expedition was accomplished, but time was running out fast, and we still wanted to push leads out of Camp 3. Marcin, Will, and Joke headed in for a five-day camp. Their plan was to spend some time surveying the connection route on the way down, and then to head for a day of exploration out of Camp 3. Travel was slow with the camp packs on the way in, and they didn't have time to survey. Jon, Omar Hernández, and I followed the next day. We planned on spending two nights at Camp 2a working on improving the Moment of Doubt, familiarizing Omar with the cave, and installing a data logger in the Jungle Series above Camp 2a. The Camp 3 team had a tough but successful exploration day and found a route through the tight, loose, breezy breakdown maze that had stopped Yuri and Sergey in 2009. They stopped at the bottom of a 7-meter climb that needed bolts. After a fast trip back to Camp 2a, they spent the second half of the day surveying in the connection route, and then they connected the surveys through the Moment of Doubt on the day they left the cave, a strong effort at a miserable task. Somehow this team always seemed to end up with the hardest pushes and long surveys of scooped passage.

The next trip into the cave was a six-day camp with Kasia, Omar, Wicho, Mirek Kopertowski, and Olivia Rysnik. They would spend two days exploring in the bottom. On the first day, they pushed leads in the lower passage near the sump. They also discovered that the water level in the sump had risen about 10 meters during the wet season, leaving dive gear floating in the water and one dive tank stranded near the ceiling. The next day Kasia, Omar, and Wicho started out of the cave, while Mirek and Olivia went to bolt up the climb that had stopped the previous team. They reached the top, crawled through more breakdown, and emerged into a sizable chamber, with passage going both directions. Downstream quickly pinched with flowstone, but there was an ascending stream passage that had the air.

As the others left the cave, Jon, Bill Stone, Marcin, Kelly Mathis, and I descended for a final trip to the bottom. We first went to map Mirek and Olivia's discovery and look for a way on. The ascending passage quickly deteriorated into a large breakdown maze. We spent a few hours pushing around in it, without finding a continuation. Though the air flow was enticing, the passage otherwise was pretty nasty. We had lost the air in the breakdown, and were becoming doubtful that we could find a way through. After mapping several routes through the breakdown we called it a day, not sure whether we would even return. Given the grim nature of Yuri and Sergey's lead, we named it From Russia with Love.

The next day Bill and I stayed near Camp 3, collecting data and installing a data logger. Marcin and Kelly went to bolt climb up to the best remaining lead in the bottom part of the cave, and Jon returned once more to From Russia with Love to see if he could find a way through the breakdown. Marcin completed the climb, but the lead went nowhere. Whether it was good luck or bad might be debated, but Jon found a way through the breakdown and emerged at the bottom of a 30-meter dome, which he called Perestroika Well. The passage continued, but now, nearly 200 meters above the main stream level of J2, it seemed to be heading toward the surface. We learned after the expedition that a nearby cave, Palomora, which ends in a too-tight squeeze, has a strong outward draft. The two caves are only separated by about 350 meters vertically and less than a kilometer horizontally. Will there some day be another connection to J2 through From Russia with Love? I don't know. The team that explored Charco were the last folks to push Palomora. They report that it is horrible, tight, and nasty. . . . Maybe not.

Sistema J2—Last Bash
La Expedición 2010 a J2

La cueva Last Bash fue ubicada inicialmente como una entrada angosta en 2005. Durante la expedición de mayo de 2006 a J2, la cueva fue explorada hasta la base del primer tiro. En la misma expedición se exploró río arriba una fuente de agua cerca del Campamento 2A en J2, hasta la base de una cascada. Durante la expedición de 2009 a J2, Last Bash se exploró a 500 m de profundidad, y la topografía indicaba que no estaba muy lejos del campamento 2A en J2. En 2010 una pequeña expedición conectó Last Bash con la cascada no escalada en J2. Hay varios pasos estrechos y con agua que tuvieron que ser pasados. Dos grupos acamparon en el Campamento 2A usando la ruta por Last Bash y exploraron pasajes cerca del final de J2, pero no se encontraron vías alternas a los sifones de J2.

J2 2009

Kasia Biernacka and Bill Stone

No one wrote an article for the AMCS on this major expedition. The NSS News *issues for January and February 2010 contain long articles by Jon Lillestolen, Matt Covington, and Jose Morales. The material that follows has been assembled by the editor, with photos selected from over three thousand taken during the expedition—the curse of digital cameras. The first part reprints an article by Kasia Biernacka in* Polish Caving 2005–2009, *published 2009 by the Komisja Taternictwa Jaskiniowego Polskiego Zwiazku Alpinizmu (Caving Commission of the Polish Mountaineering Association) for the 15th International Congress of Speleology, pages 19–21.*

Two months in the cloud forest, a couple of weeks underground, diving at –1200 . . . exploration of a deep cave system is underway.

The first wave of team members, including Dr. Bill Stone, the leader of the 2009 J2 Expedition, left on the fourteenth of March from Bill's ranch in Texas. The rest of the team joined them in Mexico, and two days later sixteen members of the expedition set up tents in El Ocotal, a village at the foot of a mountain in the Sierra Juárez, Oaxaca. We needed four more days to pack all the gear and to get permission for caving from the local government. Finally we were ready to go to the mountain. The base camp was set up in the same place as in 2004, 2005, and 2006, a twenty-minute walk from the J2 entrance.

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Stone: bill.stone@stoneaerospace.com

The entrance had been found five years before during a reconnaissance trip to this area. That year the cave was explored and surveyed to –391 meters. The next year a depth of 1101 meters was reached, despite finding a sump at –762. Sump 1 (aka the Ex-Sump) was passed first by a scuba diver, but eventually we were able to pass it without diving gear, with our heads partially submerged.

In 2006, exploration in J2 reached a second sump, Sifón de Los Piratas (Sump 2), at a depth of 1209 meters, and the cave had reached a length of about 10 kilometers. During exploratory diving through Sifón de Los Piratas, another sump, Sump 3, was found beyond. Passing Sumps 2 and 3 and continuing exploration of the air-filled passages beyond were the goals of this year's expedition.

We hoped that the passages beyond the sumps would lead toward the conjectured extension of Cueva Cheve, which is less than a kilometer away. A connection of J2 and Cheve would be a step toward a connection of Cheve and its resurgence, Cueva de la Mano, which would result in a depth of 2540 meters. The 2009 expedition to J2 was a part of Proyecto Cheve, led by Dr. Bill Stone and the US Deep Caving Team.

Marcin Gala and I met Bill Stone in Mexico in 2001, and since then we have participated is many of his expeditions to Mexico. This year we also invited Magda Aksman, Lucyna Cieślik, Marcin Derlatka, and Paulina Olinkiewicz to go with us to the cave hidden in a cloud forest.

Once the base camp was made, we started to check the ropes in the cave and improve the rigging in some of the shafts and passages. Then we started to transport the camp gear, the food, and the dive gear from the entrance to the Sifón de Los Piratas. This mission required complicated logistics and a coordinated effort of all the thirty members of the team. J2 is wet, 10 kilometers long and difficult. Its beginning is tight. At –762 meters we had to swim through Sump 1, which was so narrow that we had to take off our helmets. Before we arrived at Camp 2A, we had had to swim through a couple

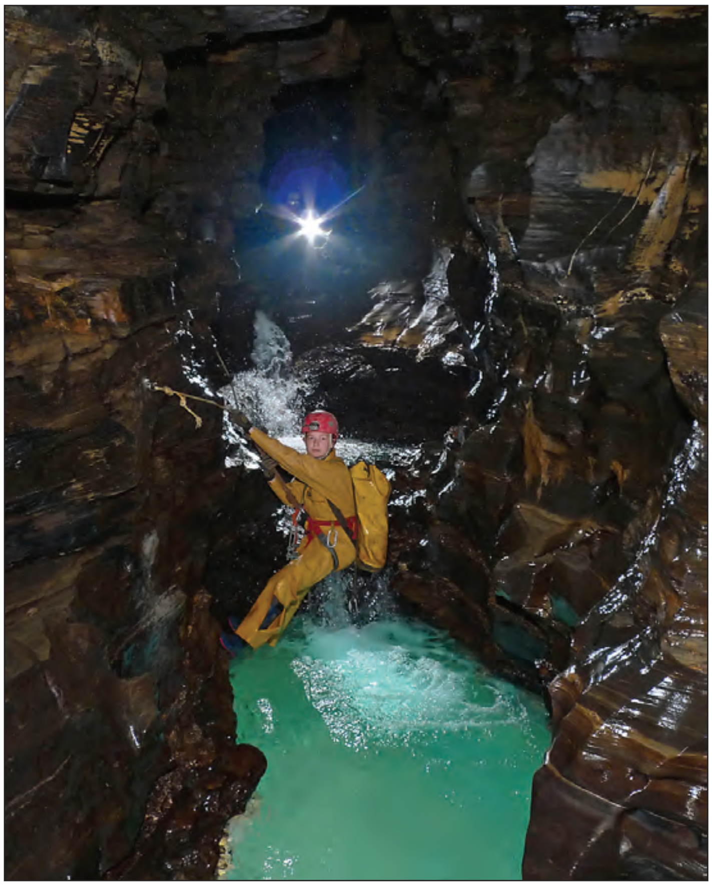
James Brown and José Morales preparing for the initial 2009 dives in Sump 2. *Bill Stone.*

Above: A trail thought the jungle. *Will Heltsley*.

Above left: José Morales talks on a Michie phone to the cave from base camp. *Mike Pugliese*.

Below left: Matt Covington passing rebelays in the Jungle Series. *Marcin Gala*.

Below: Kasia Biernacka, Yvonne Droms, and Mark Minton at the kitchen table in base camp. *Bill Ston*e.



Nikki Green traverses a rope above one of the beautiful pools in the Jungle Series. *David Ochel*.

Jon Lillestolen and José Morales prepare rebreathers near Sump 2. *Bill Stone.*

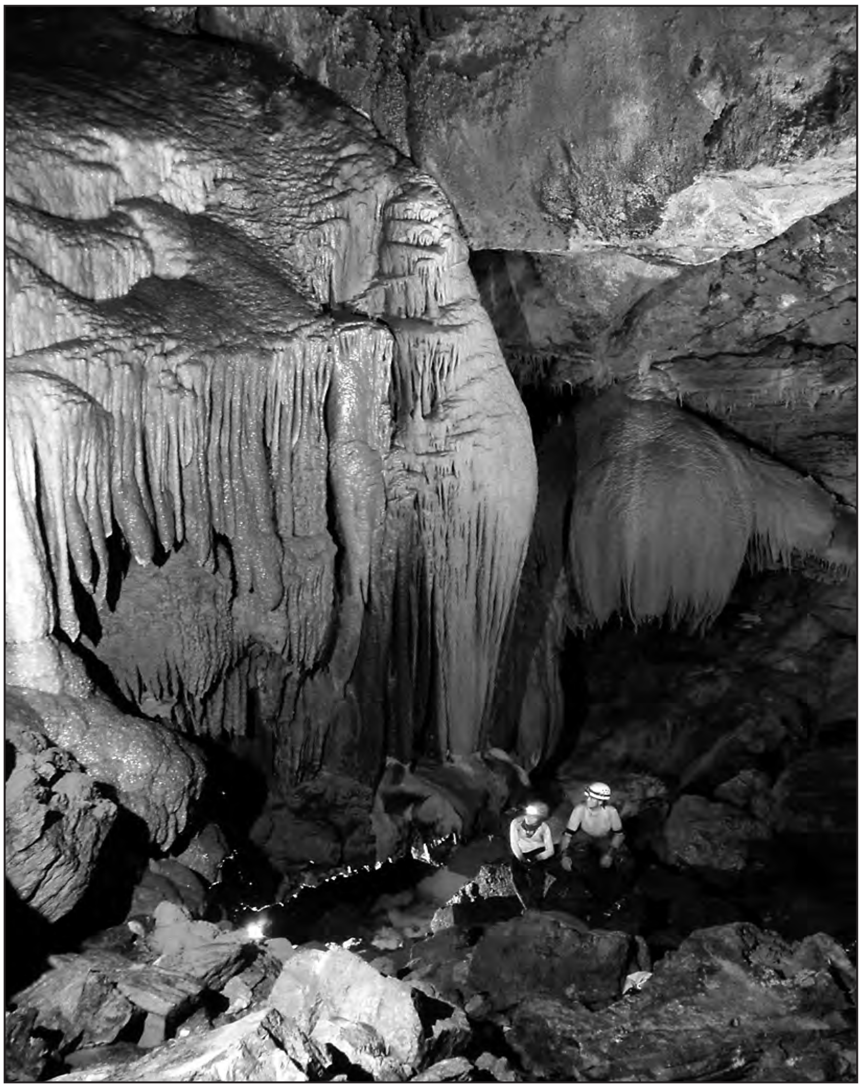
Dive platform at the Sifón de Los Piratas. *Bill Stone.*

A haul team rests in the comforts of Camp 2. *Bill Stone.*

of lakes. To reach Camp 3 from the surface, an experienced caver carrying a heavy duffel bag needs two days. From the camp it takes another two hours to get to the Sifón de Los Piratas. The rock around Sump 2 is very shattered, and therefore there is a danger of falling down and getting a piece of stone in your hand. The hauling trips into J2 took from six to more than ten days, because sometimes we shuttled the gear between the underground camps. We had to interrupt the haul trips two times because of Surprise Sump, a lake just beyond the Ex-Sump that after a heavy rain can cut off the way to the lower parts of the cave. One team had to spend two additional days imprisoned beyond the Surprise Sump.

The Polish cavers were mainly transporting gear. Marcin Gala was also responsible for the rope-work tests that all the participants had to pass before entering the cave. He also checked out the proper rigging of the cave.

The main sponsor of the 2009 J2 Expedition was Poseidon Diving Systems, which supplied us with six brand-new briefcase-size Mk6 rebreathers. The Mk6, at less than 15 kilograms, allows the diver to work underwater for over three hours at 60 meters depth. Pre-expedition training on the rebreathers took place in Texas in October 2008 and March 2009. The divers used another innovative piece of equipment, composite tanks made by Structural Composites Industries. As they weigh not much more than a bottle of mineral water, the 3-liter "plastic" tanks were a big advantage during the hauling.



La Boca del Bigoton. *Bill Stone*.

After one month of the expedition, all the diving gear had been transported to the Sifón de Los Piratas. Then the lead divers could start their job. They set the dive line and a rope to transport the camp gear through the sump, 200 meters long with a maximum depth of about 10 meters. On the downstream side of the sump they discovered a fissure that hadn't been seen in 2006 and looked like a possible way to bypass Sump 3.

Marcin Gala and Matt Covington

John Lillestolen squeezes through a tight spot in Last Bash near the 2009 limit of exploration. *Mike Pugliese*.

spent five days beyond Sump 2. They explored 830 meters of new passages, mostly looping, sponge-like, and muddy. The most promising passage was a borehole heading north-northwest. At the end they were stopped by a flowstone wall. Matt free-climbed it, but it seemed to be choked. Then they went back to the lower level, where they swam through a 40-meter-long lake (Lake 41). At the end of the lake they found another sump, with stalactites hanging underwater. As they were short on oxygen, they could not use the rebreathers. So Marcin dived the sump beyond Lake 41 with open-circuit gear. It's very short (25 meters) and shallow (7 meters). At the end of the sump he found an underwater sand dune with ripples, showing a potential flow route. On the other side, Marcin explored another 40-meter-long lake, choked at the end. He thought that there was a continuation of this lead underwater, but due to a shortage of compressed air, he was notable to continue the exploration. When we left the expedition at the beginning of May, another diving team was entering the cave. They wanted to check the underwater tunnels around Lake 41.

In Last Bash, a cave found in April 2005 in the lower part of the J2 valley, close to the junction with the Aguacate Canyon, the depth of 511 meters was surveyed. Travel in it is mostly smooth and vertical, but it has some tight and wet spots as well. It needs another 200 meters vertically and about 600 meters horizontally to connect with J2 near Camp 2A.—*Kasia Biernacka*

The following has been revised from a message e-mailed by Bill Stone to expedition members at the end of the trip. The short first paragraph is from an earlier e-mail from Marcin Gala.

As of May 5 during the 2009 J2 expedition, Matt Covington and Marcin Gala had spent five days in new Camp 4, beyond Sump 2, which had been lined with 9-millimeter rope and a telephone wire. They surveyed 830 meters of new passage, mostly looping, sponge-like, and muddy. They were pretty sure they had bypassed Sump 3, seen but not dove in 2006 [see *AMCS Activities Newsletter* 31, pages 49–51]. A borehole ended at a flowstone wall, which was climbed and appeared to be choked. At a lower level, a 40-meter-long lake ended at another sump that had stalactites underwater. This short, 25-meter sump led to another 40-meter lake that appeared to continue underwater.

Members of the expedition also pushed Last Bash, found in April 2005 in the lower part of the J2 valley, close to its junction with Aguacate Canyon. It is currently 511 meters deep and going. It might connect to J2 around Camp 2A.

The final push was nineteen days underground, beginning on May 5. José Morales and Bill Stone spent seven and a half days of that time in Camp 4. Sump 3 was explored for 170 meters and definitely connects to the head of Sump 4, carrying flow into it. Sump 4 saw three exploratory dives. The first surfaced at 170 meters penetration in an infeeder that was not passable. The second dive searched the north and west walls of the tunnel for possible continuations. The main tunnel was 8 to 12 meters wide and up to 12 meters tall. The continuation was discovered by José in a 5-by-5-meter tunnel on the north wall of the sump about 105 meters in. On the third dive, this was pushed to 350 meters penetration in borehole 8 to 10 meters wide and 5 to 8 meters high. José surfaced in an air-bell, but the tunnel continued shallow below and appears to be rising. Another very large air-bell was discovered at about 200 meters penetration. It appears to have dry borehole heading east and west about 5 meters above the surface of the water. At this point they ran out of diving consumables, and with the team down to only eight and no backup crew on the surface, resupply was not possible. The most striking thing about the final diving push from Camp 4 and the reason it took so long to figure out what was going on is that the cave took a totally unexpected turn to a predominantly 240-degree heading, almost perpendicular to the trend of Cheve. Altogether they mapped about 600 meters of underwater tunnels to add to the dry cave surveyed by Matt Covington and Marcin Gala.

Meanwhile, Yuri Schwartz and Sergey Tkachenko worked on climbing leads from Camp 3. They climbed all of the major dome leads that had remained from 2006. All either connected back into the main passage or ended in breakdown.

While Yuri and Sergey were completing the final climb, Morales and and Stone met with David Ochel, Vickie Siegel, and Nikki Green and

Matt Covington and Marcin Gala in Camp 4, the loneliest spot on the planet. *Marcin Gala*.

José Morales and Bill Stone in Camp 4. *Bill Stone*.

began to derig upwards to Camp 2A. After two days of hauling they reached Surprise Sump and found it closed. Rains had persisted for four days and abated to heavy mists. By this time, Yuri and Sergey had packed Camp 3 and arrived at Camp 2A. They and David Ochel graciously volunteered to return to Sump 2 and retrieve two of the side-mount carbon tanks and hoods and masks to allow for an exit through Surprise Sump. Stone did the first dive and set a phone link. Then Morales and Stone shuttled people through along a 9-millimeter safety rope they had installed, and most of the party moved up to Camp 1. David Ochel and Nikki Green, who cannot dive, remained at the bivouac while we sent a team to the surface for a full-helmet dive system and food. Thanks to the new Michie phones, everyone was able to keep in contact on an hourly basis. Just before the surface team entered the cave with the emergency gear, the Surprise Sump broke, with 10 centimeters of airspace. David then pulled nine duffels of gear through the sump, in addition to the four José had hauled through earlier. It took two more days to derig to the surface.

Final calculation of the surveys gives J2 a depth of 1222 meters and a length of 11,017 meters. Last Bash is 511 meters deep and 795 meters long.—*Bill Stone*

J2 2009

La expedición al Sistema J2 en Oaxaca usó equipos autónomos de circuito cerrado y otros sistemas avanzados de buceo para extender J2 en más de 1400 metros de pasaje más allá del Sifón 2, incluyendo 600 metros de topografía subacuática en los sifones 3 y 4. Se escalaron muchos domos buscando una ruta alternativa al Sifón 2, pero ninguno tuvo éxito. Después de intensas lluvias, algunos grupos estuvieron atrapados por debajo del Surprise Sump (“Sifón Sorpresa”), que no había existido en expediciones anteriores. La longitud de J2 al final de la expedición fue de 11,017 metros, con una profundidad de 1222 metros. Durante este proyecto algunos espeleólogos exploraron una cueva nueva, Last Bash, hasta una profundidad de 511 metros. Se está acercando a la zona del Campamento 2A en J2.

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Misbehaving Sumps and Lost Tadpoles
A Tale of the US Deep Caving Team's 2009 J2 Expedition

Jon Lillestolen

The 2009 J2 expedition is the latest endeavor in the Aguacate Valley area of the Cheve Karst in Mexico's southern state of Oaxaca. A three year blitz of activity ending in 2006 yielded Mexico a new 1200m deep cave, only to be stopped by a shallow 200m long sump and not enough time or equipment to continue exploration that year. In the three years which followed, dreams abounded about kilometers of virgin borehole. Plans for this expedition were to continue to push the dry passage beyond the bottom of the cave at El Sifon de Los Piratas (Sump 2). The expedition developed new technology and brought with them the determination to meet the cave on its own terms to accomplish the goal of discovering what could be the deepest cave in the world.

History

During the 1970s and early 1980s, most American expedition cavers, who focused on world-class deep caving, spent their efforts on the caves of the Huautla plateau. Discovered in the 1960s, Sistema Huautla was a proving ground for cavers of the era. It was in this place and time that many American-style expedition caving techniques were born and established. With the connection of Li Nita to Sotano San Agustin the Huautla System broke the elusive 1000m depth mark, becoming the deepest cave in the Western Hemisphere and the first 1000m deep cave outside of Europe. (1) It remained the deepest Mexican cave until 2003, when it was surpassed by Sistema Cheve.

The discovery of Cueva Cheve in 1986 by Carol Vesely and Bill Farr led to the formation of a new Mexico deep caving effort, Proyecto Cheve. This discovery and subsequent exploration would ultimately shift focus from the Huautla Plateau southward across the Santo Domingo canyon to the Cheve area as Mexico's premier deep caving project. By 1993, cavers had pushed the Cheve system to world-class depths along with the world's deepest proven potential. Belief in a major trunk hidden deep in the mountain has kept cavers coming back year after year to fulfill the promise of deeper cave despite minimal depth gains since the early 1990s (4).

The Cheve karst lies within the Sierra Juárez, part of the greater Sierra Madre Oriental de Oaxaca, in the northern part of the state of Oaxaca. The highest elevation entrances in the Cheve karst are located near the town of Concepción Pápalo at approximately 2850m above sea level. This highest segment of Sistema Cheve includes Cueva Cheve, the main entrance, and Cueva Escondida, the highest known entrance to the Sistema, in addition to several other nice caves in the general area referred to as the Cheve upper karst. The upper karst swallows the surface drainage from the highlands and discharges it with all its infeeders into the Santo Domingo canyon 19 kilometers to the north. The resurgence karst including all the entrances near and in the Santo Domingo canyon have been explored since before the discovery of Cueva Cheve and include 12 kilometers of dry passages and more than a kilometer of submerged cave to date. Everything in between the upper and resurgence karsts is considered the "middle karst". This includes an area of over 60 square kilometers between the southern edge of the highland plateau and the village of Santa Ana Cuauhtémoc, twelve kilometers to the north. Surface water in the middle karst tends to disappear into stream gravel far from any obvious entrances, making it somewhat difficult to find caves. However, with approximately fifteen linear kilometers of unknown passage between the upper karst and resurgence karst explorations, the middle karst may hold the backdoor to the booming conduit hidden somewhere in the mountain.

In 2003, two major expeditions were undertaken in the Cheve karst. One would push the last of the leads in the bottom of Sistema Cheve and the other would push onward in the confined canyons of Cueva Charco. Before the expeditions, Cheve was the second deepest cave in the Western Hemisphere. Charco, the best lead in the middle karst, was hoped to continue towards a connection with the elusive subterranean conduit that connects Cheve with its resurgence. Unfortunately, both expeditions were stopped by serious obstacles. The limit of exploration in Charco is marked by a small sump at the end of a very long and miserable cave – essentially a 6 kilometer long crawl in water. Cheve currently ends in an impassible rock pile on the other side of two sumps (the current deepest point in a cave in the Western Hemisphere is located mid-way through Sump 2). To push even further would require months of preparation and significant risks just to return to the limit of exploration at either location (5).

After Charco, Proyecto Cheve cavers went back to the proverbial drawing board to begin searching anew for areas to find new cave. The effort in 2004 focused on untapped areas in the middle Cheve Karst. It was this year that produced Mexico's newest deep cave, J2. After 10 weeks of effort by a multi-national team from 9 nations organized

Kasia Biernacka & Marcin Gala

Michael Denneborg helps reload the basecamp propane cylinder back onto a mule

Michael Pugliese

The kitchen in its full glory as dusk approaches

by the USDCT in a miserable, unending rain storm on the mountain, the team cataloged a long list of potential caves by grid-searching the area around what would become the J2 basecamp. Most never proved to be worth pushing, but J2 eventually swallowed every piece of unused rope that the expedition brought that year. A return the following year would leave J2 at -1101m and a gaping borehole that would beckon a third expedition in 2006. The 2006 expedition led to the discovery of the Sifon de Los Piratas (Sump 2). Sump 2 was found to be 200m long. It surfaced into dry60 meter diameter chamber that ended in Sump 3. The dive through the SLP established J2 at a depth of -1209m (3).

The Expedition Objectives

The 2009 expedition set off with the objective of diving the Sump 2 to the dry passage on the other side and exploring Sump 3. The dive team would consist of several experienced exploration divers and a handful of logistical divers that would transport equipment through the sump for deeper camps. Logistical divers would be experienced expedition cavers given a crash course in the overhead diving environment, giving them the ability to dive with redundant air supplies and follow a dive line through Sump 2. The plan was for logistical divers to swap leads with the exploration divers to put the best team at the leading edge. This would push the exploration forward at a reasonable pace and provide the safest way to map the cave.

Additional goals would include pushing "Last Bash" – a 30m deep fissure discovered in 2005 in the floor of the Aguacate canyon that blows enough air to be a decent-sized cave as well as concentrating on reconnaissance of areas slightly further from basecamp and into unknown territory in the El Ocotal Cloud Forest.

Preparing for the Expedition

To prepare for the diving push at the end of J2, a core team of experienced J2 cavers assembled at Bill Stone's compound in Austin, TX for a week in October of 2008 to train and plan for the expedition. Poseidon Diving Systems had graciously sponsored the expedition with eight of their soon-to-be released Mk-6 rebreathers as they had been designed to be capable of being carried into a cave such as J2. The compact size and range of the closed circuit rebreather would allow for more diving than with an equal amount of weight in open-circuit diving gear. This training would allow both the more experienced exploration divers and the logistical divers enough underwater experience to feel comfortable using the Mk-6 under highly controlled conditions in a cave. The training additionally allowed the divers, experienced and inexperienced, to become familiar with the redundant diving setup that would be used in the sumps of J2.

Over the course of the week in Texas, the team learned to work with each other more closely while learning the intricacies of diving with a closed-circuit diving system. The setting was a comfortable one, dive training started in the 8-foot deep test tank that Stone had built for his NASA projects. From there, we moved to a local caver's backyard pool, complete with hot-tub, 15-foot deep end, and a duck-under to a man-made cave complete with skylight. The week rounded out with dive trips to a SCUBA park on Lake Austin, which featured a plethora of dive obstacles including a metal profile of a shark that swallowed our dive line more than once.

With the week of intense diving and expedition planning complete, the team was working like a fine-tuned machine. Everyone left for their respective homes to continue dive training until it was time to leave for the expedition.

Southward Bound

As with most American-led caving expeditions to Mexico, the 2009 J2 Expedition started in Austin, Texas. Austin is a town with a sizable grotto that has no equal in it's support network for expedition cavers traveling south. With local Texans and the small gathering of J2 participants, heaps of expedition gear were loaded into the caravan of trucks for the long trip to Oaxaca.

The first wave of J2 cavers departed Austin with their caravan of trucks on March 12th. Three long days of travel across the rugged Mexican highways landed them in the small town of San Francisco Chapulapa ready to start negotiations with the local politicians for permission to visit and continue exploration in the area. Since the 2006 expedition, Chapulapa had elected a new presidente and had elected a new board of members for the bienes comunales. This presented some challenges because although we came bearing permission directly from the state of Oaxaca to be there, the locals were always eager to demonstrate their power (particularly so following the teacher strike in 2005). In an attempt to gain friends and convince the locals that we were there for our stated aims, we arranged to share a slide show on cave exploration along with some basic information on karst geology. The slide show was followed by a question and answer session to allow the locals to air any concerns.

Thanks to the assistance of several expedition members that were fluent in Spanish and had a thorough understanding of the culture, the locals, although not fully convinced, left the slide show with an improved impression of the cavers. The negotiations with the local politicians dragged on as they tended to be both stubborn and disorganized. While waiting for the presidente and the "comisariado" de bienes comunales (representing the two independent power structures in this little mountain town), the expedition set up camp in the field behind the house of our dear friend Faustino Navarete Rubio, who had been helping with J2 expeditions since the very beginning in 2004.

The Fun Begins

After a week of tedious discussions, negotiations and politics, permission was

Bill Stone

James "Jaime Hot Tub" Brown organizes dive gear at the *Sifon de Los Piratas* in preparation for establishing Camp 4 beyond the sump.

Kasia Biernacka & Marcin Gala

Marcin Gala and Matt Covington use the cave board to keep track of gear in the cave.

finally granted and the expedition proceeded. Gear, food and personal equipment was organized on Señor Faustino's field to be arranged into packs for the long trek up the mountain. Mule trains then hauled these packs up the mountain in order of importance. The process took several days as the locals had only a finite number of mules and the five-hour round trip limited them to two trips per day.

With gear steadily arriving, basecamp was assembled in short order. Massive tarps were set up first to cover the kitchen and expedition gear areas. Makeshift tables were built to keep dive equipment, Michie phones and the expedition log out of the dirt. The kitchen would have its own large table with two sets of double-burner propane stoves. The stove-top table was surrounded by hanging pots and pans and group food was strewn across the ground behind it. The bulk of the expedition food was neatly packed in large grocery bags on the ground behind the stoves with dates to indicate when each was to be available for use. The bags had to be labeled by week in this way to make sure that the food would last the entire expedition.

The camp fire ring from previous expeditions was once again surrounded with sitting logs to become a natural collector for cavers. Across the campfire ring from the kitchen was the climbing tree. This 30 meter tall tree served as the site of the rebelay course. Before long, the proctor of the rebelay couse completed rigging the challenging course for expeditioners to prove that they could competently travel through the complex ropework in the cave. J2 is no easy cave, and this test would assure that we were not allowing cavers to put themselves in danger through lack of skills or over-confidence.

The group area/kitchen was wedged between the edge of the ridge as it dropped off into the J2 valley and a large steep-walled sinkhole giving the appearance to the camp of being nestled around the rim of a volcano. Tents filled in around the remainder of the volcano crater, with the trail down to Señor Faustino's being on the side of the crater opposite the kitchen.

Once all the toil of setting up basecamp had settled, the focus started towards J2. A three year gap in expeditions to the area made it necessary to check the rigging that had been left in the cave. The cable ladders, used in the first hundred meters of the entrance section, were brought back to ease travel through the hardest and tightest section of the cave. Large sections of rope in the vertical shaft series at around -250m were replaced with

new 9mm rope, getting rid of the much abused ropes that had been left hanging since 2004. In addition to the ropes, the phone line that allowed easy communications between basecamp and the underground camps was checked and any badly worn sections replaced. The expedition had commissioned a dozen new Michie phones for 2009 along with a base station from David Larson who had kindly worked on a compressed schedule to ready these for the project. The expedition quickly reached Camp 1 at -555m, where supplies were restocked (we used standardized 35 liter food bags, good for about 8 person-days). The lead team, checked the condition of staged gear at Camp 1 from 2006 and spent the night before their quest onward.

Sumped!

Waking up from Camp 1, the ex-sump and the former Camp 2, are only an easy two-hour trip deeper into the cave. Camp 2 is in a large chamber with a nice set of short rebelays taking you down the far side of a 20m high cascade. Near the bottom of the cascade is a flat spot, where a small tent can be set up to keep the spray off the camp's sleeping bags and cook gear. Going deeper in this chamber and down several more sets of short cascades, the room starts to taper down into a 1.5m wide canyon with a deep pool of water in the bottom of it. This steadily-narrowing canyon is what is referred to as the eEx-Sump . This ex-sump is the part of the cave that temporarily stopped exploration in 2005, when the water was 2 meters higher because of a breakdown dam on the downstream end of the canyon. What required dive-gear and the guts to pass an underwater body-tight squeeze in 2005, now requires a neck-deep bath in what remains of the sump-pool.

To pass the ex-sump now requires sliding down a short Tyrolean line that drops into the sump-pool. After a short swim with the aid of the Tyrolean line, the canyon tapers down into a body-tight squeeze that requires helmet removal to pass through. Fortunately, the squeeze is short and adrenaline helps with the exciting climb out of the 11 F water. Wind rips through the same canyon passage as it heads for the larger passages beyond and quickly cools anyone foolish enough to wait here for too long.

As the first team in 2009 passed the ex-sump, they prepared themselves to pass a wider, but deeper pool of water just beyond. A small hill of breakdown separates this pool from the ex-sump and as they reached the top of this hill, they were surprised to see that the pool was now reaching all the way to the ceiling where there had previously been at least two meters of airspace in 2005 and 2006. They had just discovered what would become known as the Surprise Sump. Expecting an easy trip to Camp 2A, the cavers were amazed that once again J2 would require a short sump dive to continue. Apparently the large pile of clean washed breakdown on the far side of the pool had shifted since 2006 holding back more of the water than in previous years.

With a delay in the plans to continue onward into the cave, the expedition reestablished the old Camp 2 in the large chamber before the ex-sump. Dive gear was prepared and Surprise Sump was dived to see if the feat performed at the ex-sump in 2005 could repeated on this new challenge. After diving the sump, it was determined that whatever was holding back the water could not easily be reached and the sump would have to drain at its own slow pace. Although it drained slowly, the sump did eventually lower to the point where, some 3 days later, brave crews could pass through with several centimeters of airspace.

During the two months of the 2006 expedition, Surprise Sump had never given any indication that it would rise during rain events and so it was never thought of as a threat. To prevent any further problems, a set of dive gear was staged on the far side in the event that heavy rains would require the cavers to dive to exit the cave.

Moving Equipment

With the problem of Surprise Sump temporarily solved (though disconcertingly not by our accord), teams pushed deeper in the cave, re-establishing camps 2A and 3 and repairing the phone line on the way to the Sifon de Los Piratas. As if there hadn't already been enough trouble with sumps and politics, an influenza mini-epidemicstarted to spread across the basecamp. It hit some of the cavers harder than others, making some unable to work for up to 3 weeks. Due to the combination of complications that came out of politics, the Surprise Sump and now the flu outbreak, the expedition was way behind schedule and still had a huge pile of dive gear destined for El Sifon de Los Piratas that had not left basecamp.

Finally, fresh cavers began to arrive in basecamp, and teams of cavers were able to begin moving bag after bag of dive gear into the cave. Several dedicated cavers offered to make surface runs, carrying bags into the cave to the bottom of the vertical shaft series and exiting in the same day, experiencing the worst that J2 had to offer twice in the same day.

The cave starts out in a beautiful heavily-vegetated steep sinkhole. It can be hard to see the sun from the entrance during most of the day due to the big depression and the tall trees that seem to flourish in the vicinity. Just above the main part of the entrance is a classic Mexican cave headwall of smooth limestone, only on a smaller scale than the big well-known Mexican caves. Just inside the entrance, the cave quickly descends into down-climb after down-climb into a body-tight meander canyon. Several of these down-climbs are permanently rigged with both cable ladders and ropes, because of their tight nature, it is easier to descend on rope and ascend on cable ladders where it can be very difficult to use ascenders. After about 200m of body-tight canyon, the cave opens up into its first small chamber. The relief of unrestricted passage only lasts a short while as cavers are then forced into a super tight pitch-head that required many days of rock-shaving to allow passage for everyone when the cave was first being explored in 2004.

Beyond that first rebelay pitch, the passage becomes more manageable and steeper as the cave begins dropping short pit after short pit. Finally, the water from the entrance series disappears into a small crack in the floor at the bottom of a nice cascade. From here a short rope traverse through a narrow canyon leads to the top of the vertical shaft series. One hundred and fifty meters of depth and a never-ending series of rebelays leaves teams at the bottom of the vertical shaft series which still has the bolt placed in the floor marking the end of the final survey of 2004, the year the cave was found.

This is where the surface crews deposited their bags before returning through the misery of the entrance series. The bags were later picked up by crews basing themselves out of Camp 1. From the shaft series it is a kilometer-long, mostly-horizontal trip to Camp 1 sloshing through the ever-growing stream, as J2 picks up new infeeders along the way.

From there, the Camp 1 teams carried bags into the next short stream section to leave their bags at the near-side of the ex-sump at the site of the old Camp 2, about 2 kilometers beyond Camp 1. They would then return to Camp 1 to sleep that night and would repeat the process as long as bags were being hauled in from the surface. Once enough bags were hauled into the staging area at Camp 2, a massive effort was put underway to move the approximately 20 bags (averaging 50 lb) through the Ex-Sump, Surprise Sump and Jungle Series to arrive at Camp 2A and into the dry borehole of the Wonderland at the -800 meter level.

Camp 4

With enough of the gear bags close to the sump, and food supplies dwindling for the large contingent operating out of Camp 3, the decision was made to prune the bottom-crew to only four. Two divers would remain and begin their move to a bivouac at the Sifon, while another two support cavers would move the remaining bags, rig the diving platform at the sump, and assist the divers with any needs they might have. After two long days of setting up hammocks, arranging the dive platform, rigging a taught-line-slack-line Tyrolean to access the platform at the sump, and building rebreathers, the divers were finally ready to get into the water. Thanks to the Mk-6 rebreathers, graciously provided by Poseidon Diving Systems, the divers were off on their mission to prepare the sump for a push beyond. Although rebreathers are arguably more complex and moody than open-circuit dive gear, they provided us with an opportunity to explore beyond the sump that was safer, but more importantly requiring far less equipment overall due to their

Kasia Biernacka & Marcin Gala

Bill Stone, Jose Morales, Jim Castelaz, and Matt Covington cooking in Camp 2

Kasia Biernacka & Marcin Gala

Matt Covington at the spacious and comfortable Camp 1

Bill Stone

Jon Lillestolen assists Jose Morales into the new Poseidon Mk6 rebreather at the *Sifon de Los Piratas* in preparation to dive the sump.

high efficiency in the use of the compressed gas that was brought down. We used standardized carbon-epoxy tanks this year – 2.9 liter oxygen tanks weighing only 2 lb and 4.7 liter side-mount compressed air bailout tanks.

To explore through the sump into what we were hoping would be large section of dry cave, it had been decided that the best guideline would be a 9mm caving rope. This would allow divers to pull themselves through the 200 meter long sump instead of finning which would ultimately save energy and our precious dive gas. The push divers rigged this guideline and a telephone line then carried the camp gear for Camp 4. They deposited it all on the far shore of the dry chamber, which had only been visited by a single diver (James Brown) in 2006. After a quick reconnaissance of the massive dry chamber on the far side of El Sifon de Los Piratas the divers (Jim Brown and Jose Morales) returned through the sump and back to the safety of Camp 3.

On their way out of the cave, the bottom-crew swapped places with a fresh set of divers (Matt Covington and Marcin Gala) that would establish Camp 4 and begin the exploration into the unknown territory beyond. The six cavers swapped stories and advice alike. On their way into one of the most remote reaches of the planet, jokes were lightly tossed around about what to do in case of illness or injury. Everyone involved knew that there was no reasonable rescue beyond the sump platform, not even the world's best cave rescue resources could manage to pull someone out of the bottom of J2 alive. It would be a toss-up whether it could be done from somewhere as high in the cave as Camp 2A.

The two lonely souls destined for Camp 4 pushed onward and in short time were phoning the surface from their new home. Because of their remoteness, the new bottom-crew phoned in twice daily to give progress reports on their exploration and to check in with family and friends. They surveyed from the far end of El Sifon de Los Piratas downward into the tunnel that runs past Sump 3, into a diminishing passage beyond Camp 4, and then diving into Lake 41, also referred to as Sump 4. Marcin Gala performed a 40 meter solo recon dive into Sump 4 that confirmed the sump continued on the same general trend as the rest of the cave as a lake with a slowly descending ceiling and the only dry passages shot northeast and away from the known trend of Sistema Cheve. These dry passages were short, narrow, miserable canyons that led nowhere.

In four days based out of Camp 4, the first push team had mapped about a 600 meters of passage eliminating all possibility of a dry continuation in this far section of the cave. A heroic effort, no doubt, but it would have to come to an unfortunate end because the team was out of both leads and supplies. While this crew planned their exit, the surface crew made plans for a second crew to make Camp 4 a home, but this time with a crew of seasoned cave divers.

Last Bash

J2 is an interesting cave and had a habit of consuming every last resource on the mountain, but there are many other great leads to pursue. Short ridgewalks from basecamp would consistently yield new caves and more surveyed passage.

One of the better leads to pursue outside of J2 in 2009 was the 30m deep "Last Bash" (LB) cave. Last Bash blows as much air as J2 in the entrance pitches and seems destined to connect as it lays directly on top of the line plot of J2. Steering a crew away from J2 to explore LB only required re-targeting rope earmarked for the main cave. Through the persistence of a handful of the J2 cavers, the expedition assembled three separate pushes on the cave, each discovering more new cave than the last. In the end of the pushes, only a half kilometer of passage separates the end of Last Bash at it's current depth of -500m and the most likely connection spot near Camp 2A. Another good solid push could possibly have linked the caves together, assuming that stream passage in LB continues along its current trend of easy walking passage.

Final Push

The spirit of the expedition diminished slightly with the news of a fourth sump blocking the long-sought connection to Sistema Cheve. All the dreams of running down kilometers of Papua-sized borehole trailing a 100m tape instantly vanished and the effort concentrated on sending more equipment to the sump for a second Camp 4 crew. Time was running out, and the team remaining in basecamp was getting smaller, as cavers started returning to real-life in droves to attend to family and career needs.

Fresh dive tanks and rebreather parts filtered into the cave as trash and personal gear were carried outwards. The sump-diver crew swam through the second sump with a week's worth of equipment to lay seige to the fourth sump, and try to salvage what was left of the dream of a 2009 Cheve connection.

Bill Stone

La Boca Del Bigoton in the borehole beyond Camp 2A

Michael Pugliese

Luis "Wicho" Gabriel Diaz traversing a handline in Last Bash

While the divers toiled away at the diving leads at the end of the cave, a team of aid climbers began working on high leads near Camp 3 in the hope of rediscovering the lost airflow. With lightweight lithium batteries, a small hammer drill and the ability to recharge batteries at the base of the climb, the Camp 3 team made short work of the high leads, while not giving support to the dive crew.

Meanwhile, the Camp 4 crew dove every possible underwater lead that they could find, pushing any going lead in either sumps 3 or 4. Despite a few gear failures, the team persisted and found a likely connection tunnel leading westward toward the Cheve trunk. Sump 3 was physically connected to the main dry passage just before Sump 4 via a 170 meter dive. Sump 4 was pushed on 4 sepearate dives to a penetration of 400 meters with the 12 meter wide x 8 meter tall tunnel rising and at a ceiling depth of less than 2 meters. Dwindling gas supplies and a lack of time before the advent of the rainy season, however, turned the team around as soon as they had found the likely path to success. The maximum depth of the cave (-1222 meters) is also the deepest point in Sump 4. With the surveys returned by the second dive team a total of 1400 meters of new tunnels were discovered and mapped in 2009, almost half of which were underwater.

Bill Stone

Jose Morales dives the new Poseidon Mk6 rebreather in the sump

Derig and Leaving Mexico

The sump-diver crew returned through the Sifon de Los Piratas for the last time to rejoin the rest of the deep team at Camp 3. Notes were compared and plans were made to start the long haul of gear out of the cave. Moving from Camp 3 back to Camp 2A, the crew spent a night and loaded up for the trek through the wettest part of the cave, including the exciting swim through the ex-sump. The team made good progress through the Jungles Series and then into the paleo tubes above the stream passage and into the sump-pool at the surprise sump. The rainy season had appeared to have arrived early on the surface as it had rained non-stop for about a week. Unaware of all the rain, the derigging cavers were surprised to find Surprise Sump once again filled to the ceiling with water. This time the water level was even higher than the first time it had happened this year.

The dive bottles that had originally been left at this sump for safety had long since been moved deeper into the cave to serve as bailout bottles for the push divers in Camp 4. The safety bottles were one of many pieces of gear that hadn't made the list of gear destined for the surface. The weather on the surface didn't appear to be getting any better, so with no other options, the team decided to return to Camp 3 and retrieve the dive gear from deeper in the cave.

Kasia Biernacka & Marcin Gala

Will Heltsley sketches in Last Bash

At this time seven crew were trapped below Surprise Sump. Using the tanks, two drysuit-equipped divers assisted three divers with no diving suits through the 20 meter sump. One member of the team was a non-diver and was unable to get through; thus one member of the team remained to keep a 2-person bivouck on the downstream side of Surprise Sump while the remainder of the team went on to Camp 1 to sort out an emergency recovery plan while hoping for the rain to temporarily abate. Two of the team going to Camp 1 continued on to the surface to bring in an EXO-26 full-face commercial diving helmet to assist the non-diver out. Fortunately, 36 hours after reaching Camp 1, and with constant phone contact with the bivouack crew, the sump opened with 10 cm of air space and the two were able to pass through. By this time the Camp 1 crew was already on the upstream side (coordinated by phone) to bring the remaining equipment bags up.

Following this final 19 day underground push, and with everyone on the surface at last, basecamp was slowly broken down and gear loaded onto the mules to be sent down the mountain.

Kasia Biernacka & Marcin Gala

Matt Covington traverses a pool in the wet canyons between the ex-sump and Camp 2A

Tony Dwyer, Tony Castro, Marcin Gala and Michael Denneborg prepare to leave basecamp for a short trip into J2.

Paulina Olinkiewicz climbs a pitch in the entrance series of Last Bash.

Through the gracious help of Señor Faustino and his family, the cavers made their way down the mountain along with all their gear. Trucks were loaded, everyone said their goodbyes and another successful expedition was completed to the El Ocotal cloud forest.

J2 2010 Expedition – Return to the Deep

Although the cave hadn't done exactly what had been hoped, plans were laid late in the expedition for a return to the J2 area in 2010. The Cheve Karst doesn't give up its secrets easily and although intensive sump diving expeditions could certainly do a lot more to crack the secrets that lie below, there is a growing crew of us that believe there is plenty to be explored in the Cheve area that does not involve difficult tank hauls followed by grim diving.

In 2010, the expedition objectives will involve entirely non-diving leads. The main goal will be to create Sistema J2 by connecting in "Last Bash." Although it was pushed somewhat on this expedition, the connection remains only a long day's push from tying the survey lines together assuming that the cave Gods are smiling upon us. From this entrance the lower reaches of J2, and the borehole beyond Camp 2A, will be easier to access and the few remaining leads in this section of the cave will get a good final look. Using the "Last Bash" entrance to the system will make it possible for us to use a basecamp lower on the mountain and much closer to a water source. Our friends in the village of El Ocotal have graciously offered the use of their ranch high in the Aguacate Canyon. This will put us within a half hour's casual hike of the entrance of Last Bash instead of the hour-long jungle bash down steep slopes from the traditional J2 basecamp.

The second objective will be to give a good final push to all the remaining side leads in the bottom of J2. Although the most promising leads have all been pushed, there remains several infeeders and other interesting leads that could be the way to discovering the route of the elusive gale-force airflow that is lost at the -700m level in J2.

The final objective is to ridgewalk the remote upper reaches of the Aguacate Canyon. The Aguacate canyon has been walked on several occasions, but with a basecamp established directly in the canyon it will be possible to focus a more intense effort to find the less obvious caves that could become Mexico's next 1000m deep cave or the secret to finding the massive Cheve Conduit that lies somewhere below.

Expedition Members and Sponsors:

Kasia Biernacka, Zusia Biernacka, James Brown, Petr Čáslavský, Jim Castelaz, Anthony Castro, Lucyna Cieslik, Elizabeth Covington, Matt Covington, Michael Denneborg, Marcin Derlatka, Luis Gabriel Díaz (Wicho), Yvonne Droms, Tony Dwyer, Marcin Gala, Nikki Green, Will Heltsley, Heather Levy, Jon Lillestolen, Mark Minton, José Morales, Nina Muller, David Ochel, Paulina Olinkiewicz, Michael Pugliese, Yuri Schwartz, Vickie Siegel, Marion Smith, Seth Spoelman, Bill Stone, John Swartz, Sergey Tkachenko,

Members of the expedition would like to thank the sponsors and many willing cavers who made this another successful USDCT expedition. First and foremost is Poseidon Diving Systems, which without their assistance with equipment and development of the Mk6 rebreather, this expedition could not have happened. Nalge Nunc Products, Direct Fastner Systems and CanCord Rope again made gracious donations to the USDCT. Stenlight again provided excellent lights, chargers and underwater batteries for the diving effort. Expedition Sponsors also include Analytical Industries, the Association for Mexican Cave Studies, Caves of Tabasco, Deep Outdoors, DSS Deep Sea Supply, Dive Rite, Google, Molecular Products, Niterider, Patagonia, PMI, Puerto Rico Technical Diving Center, Santi, Science Art and Magic, Sea Pearls, Stone Aerospace, Structural Composites, Thermo Valves, Underwater Kinetics, Whole Earth Provision Co., Windy Point Park, and XS Scuba. Special thanks go to Bill Stone, Jose Morales, James "Jaime Hottub" Brown, Mark Minton, Yvonne Droms, Luis "Wicho" Gabriel Diaz, Jose Antonio Soriano, Fofo Gonzales and the many others who spent countless hours organizing the expedition. We are also grateful for the continued assistance of Proteccion Civil Oaxaca, The Distrito de Cuicatlan, and the Municipio de Chapulapa over the past 20 years.

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J2: The Journey to Camp 4—Beyond the Sump

Matt Covington

On April 23, 2009, a dozen cavers sat in the cloud forest atop a remote mountain in Mexico, entranced by the constant crackling of the cave phone. At 4:07 pm Jose Morales and James Brown had entered the sump at the bottom of J2. It had taken a full month between the arrival of the team and the first dive, a month that was fraught with setbacks – political problems, destroyed rigging, a surprise sump, swine flu, and many heavy loads. Today, we finally had divers in the water, and we anxiously awaited news.

In 2006, J2 exploration was halted by the discovery of a sump at -1200 meters. We had enough time and gear for a single exploratory dive. James Brown dove into the sump and emerged from the water after a 150 meter-long dive that never reached more than 10 meters of depth. He climbed up a breakdown slope and into a large chamber. The route then descended down to another sump that seemed to be the main continuation. We knew at this point that any return would require a major diving expedition.

During the next three years, we took a rest from J2 while Bill Stone worked with Poseidon to develop a lighter, more compact, and more foolproof rebreather. He also began to assemble a team of cavers interested in working beyond the sump. Finding cave divers who are interested in negotiating a serious deep cave has long troubled dive efforts in deep caves. Bill's typical approach has been to train expedition cavers to dive.

For the 2009 J2 expedition, Bill assembled a dive team made up of two types of cavers. There were the exploration divers, who were experienced cave divers and also capable of negotiating the rest of the cave. The secondary dive team was composed of expedition cavers who had trained specifically for diving the rebreathers in J2. They were experienced in rigging and other skills needed for above-water exploration but had limited cave diving experience. The exploration divers would complete all underwater exploration and rig 9-mm static ropes through the sumps. The secondary divers would pull along on the static lines, hauling camp and rigging gear to push the cave beyond. The 9-mm ropes would greatly increase travel speed and safety for those 'commuting' through the sumps. James and Jose were the primary exploration dive team. If they were successful, then Marcin Gala, a Polish caver, and I were slated to follow with the first dry caving push on the far side of the sump. We were on edge.

At 10 pm Bill's voice brought the cave phone alive, "Basecamp, basecamp, this is the sump. Do you copy?"

"Yes, Bill. We copy. What is the news?" Marcin replied.

"James and Jose have returned from the sump. Let me give the phone to Jose to relay what they found."

Jose recounted the news. After emerging from the sump, Jose had climbed up to the high side of the large chamber and discovered a going dry passage. For two hours, he and James explored a maze of passages that seemed to bypass the next sump. It was clearly time to send in the next team to establish Camp 4 and continue exploration. Jose and James would spend the next day rigging the 9-mm rope and the phone line through the sump, and hauling some of the camp gear to the far side. Marcin and I were to enter the cave the next day.

The next morning we piled up the gear required for our trip. As the morning progressed, the pile grew. We wanted to have enough food and rigging gear for nearly a week of exploration on the far side, but it was clear that a heavy load was accumulating. Packs bursting at the seams, we set off to the cave. During the expedition, Marcin and I had ended up caving as a team on almost every trip. As a result, the two of us had grown close through long hours toiling together and talking about everything on the earth (and under the earth)—the sort of friendship that is often forged in expedition caving. As we paused at the entrance, we mused about the trip we were about to undertake. After all of the hard work and long wait we were primed for what might be one of the greatest adventures of our lives. This thrilled us, but we also couldn't ignore our heavy packs and the difficult trip that lay between us and the prize.

Eight hours later, we were at Camp 2a, tired, but not trashed. Our nearly week-long rest on the surface had paid off. News came via the cave phone that the 9-mm rope was in place, and the initial camp loads had been hauled through the sump. The next day, we met Bill, Jose, James, and Jon Lillestolen on their way out, between Camp 2a and Camp 3. We stopped for a long chat about the dive

Lake 41

Marcin Gala

Kasia Biernacka & Marcin Gala

Climbing through the skeleton rock near -1000m

Kasia Biernacka & Marcin Gala

Fretting over the pile of dive gear at Camp 2A


Marcin Gala

Matt Covington and his flooding mask on the return dive from Camp 4

logistics. Initially, we had planned on diving that day, but after a late start, and our long chat, we decided that it would be better to get a good night's rest at Camp 3 and dive on the following day. We arrived for an early evening at Camp 3. Need I say that it's hard to sleep the night before a sump dive at -1200 meters in one of the deepest known karst hydrological systems in the world? I have slept better.

Early the next morning we arose and headed to the sump. Upon arrival, Marcin rappelled to the dive platform and began readying the rigs for the dive. Once the rebreathers were ready, Marcin got into his dry suit and into the water, making room for me on the platform. I loaded my pack with gear and weights to counter its buoyancy. Then I struggled into the rebreather on the awkward platform. We needed three bags to fit all of the gear, so Marcin took two bags and one bailout tank, while I took one bag and the other two bailout tanks. By this time, Marcin had been in the water a while and was already becoming hypothermic. He clearly wanted to get going. I slid into the water, and we headed down. However, my bag was still too buoyant, and poorly balanced. It dangled upside down from its tether like a balloon on a string. Right as I signaled to Marcin that it was too buoyant, some of the lead fell out and it became even more buoyant. I slid back up the rope to the surface and repacked the bag. Marcin was not having a good time.

"Matt, *please* hurry. I'm very cold."

Marcin retrieved the weights. I repacked the bag, adding more weight and jettisoning a nalgene full of cashews that really didn't fit. We descended again, and after a moment to check everything, we started pulling ourselves along the line. Since Marcin was so cold, he rocketed out in front. I kept up for a few of minutes, but then began to fall behind. For the most part, the line ran quite close to the floor, which was largely composed of sharp and jagged horns of rock. Every minute or so I would feel a sharp tug backward and realize that my pack had snagged one of the horns. It became automatic to reach back and scoop it free with my hand. In many cave dives, dragging along the bottom like this would be the worst thing you could do. However, the only sediment on the floor was large-grained sand that quickly settled after being stirred up. Visibility was hardly affected by our passing.

About seven minutes into the dive, I was becoming out of breath from racing along the line. I paused for a moment to see if I could slow my breathing. After 10 or 15 seconds I started moving again at a slower pace, but I was still not catching my breath.

"Something doesn't feel right. Is something wrong with the rebreather?" I wondered.

In a moment of doubt and panic, I reached for my bailout gas, where I knew I could get good air. I tried to take a big breath only to feel the resistance build half-way through until I could draw no more air. Then I remembered. The valve was turned off to avoid loss of air in the case of slow leaks. I groped through the tangle of gear and rotated the valve, relieved to feel air flow. I paused again for a few seconds, to slow my breathing.

"Okay. I need to get out of here."

The rest of the dive was a continuous struggle between keeping a calm and measured pace and just wanting to get through, knowing that I was using up precious bailout gas. Luckily, two minutes later I saw the surface of the water, with Marcin's light refracting down from above. I was glad to have that over with.

The dive was only 10 minutes long. Not much, really, but long enough.

We discussed the dive for a few minutes. I didn't know whether I was having a genuine problem with the rig, or if it was just overexertion combined with psychological stress. I did know one thing though; the dive back would require a concerted effort at staying calm. We climbed out of the water and stashed the dive gear up in the boulders. Marcin was still cold. My dry suit had leaked like a sieve (I'm just too skinny for a standard size), and I found myself knee-deep in water inside, and also cooling down fast. We fired up the stove to make a hot drink.


Matt Covington

Elizabeth Covington on one of the ladder pitches in the entrance series

After hot tea and dry camp clothes, the world started to seem a bit better. After all, we were beyond the sump and about to explore one of the most remote places yet reached underground. Our first task was to find a good location for Camp 4. Following a quick recon, we found a flat sandy spot that Jose had mentioned, about 5 minutes away from the sump. Returning to the sump, we grabbed the camp gear, surveyed our way back to camp, and laid the phone line. We reached camp, with 170 meters of survey, and called it a night.

That night we wondered aloud what we might find the next day. I could feel the weight of the expedition on our shoulders. Many people had worked very hard for us to be here, and many had trained with us for the opportunity we now had. There were many others who could have been in my place. I had been at the right place at the right time,


Bill Stone

Vickie Siegel passing a pack through the Donde Homek Breakdown at -1000 m

and because of that, I was the one here. It was the ultimate privilege. As Marcin put it, “It now seems as if the whole expedition has been working just for us.” We would make it count.

The next morning, we continued our survey down the passage from camp. After a short distance, we entered the maze that Jose had explored. A number of passages diverged to the right, but a few hours of surveying later, we could tell they were not headed the right direction. As our mapping progressed, we decided to push a good-looking lead to the left that led quickly to a free climb up to a ledge overlooking a large borehole. Finally, it seemed we had something.

We rigged a rope and rappelled to a ledge. From there we could traverse out into the borehole. The vast passage was floored with giant breakdown blocks. We picked our way along the boulders, surveying as we went. About an hour later, we stood staring at a flowstone ramp ascending ahead. We had only gone about 150 meters, but this already looked like the end. After a couple of attempts, I managed to climb up the ramp, using tiny edges in the flowstone for footholds. The slope eased, and I scampered to the top, only to confirm a total flowstone blockage. After rigging a double-rope rappel, I descended back to Marcin. We would have to try low. A short way back, we were able to climb down through the boulders to a lower level. However, this passage was immediately blocked by a lake. Enthusiasm waning, we returned to camp earlier than we had anticipated.

Marcin had a Palm pilot with Auriga, and each night we entered the survey data, in order to get an idea of where we had gone. We also phoned up the survey data to the surface, so that they could track our progress as well. That day we came in with 380 m of survey, but not quite the easy booty we had hoped for. While talking to base camp, we learned of the swine flu outbreak in Mexico. This explained the bad sickness that had gone through the expedition weeks before, but now we wondered whether the reinforcements that we were expecting in the next days would actually arrive. Would they be allowed to travel? Would they decide it was unwise to come to Mexico? Among those expected to arrive soon to basecamp were Will Heltsley and my wife, Elizabeth, who were travelling together from California, as well as Yuri Schwartz, Sergey Tkachenko, and David Ochel, all strong cavers whose help we could use. I had been looking forward to seeing Elizabeth when I got out of the cave, but now all that was uncertain. In honor of the news, we dubbed our new borehole passage the “Pigs Flew Passage.”

Bill Stone

Left to right, Vickie Siegel, Jose Morales, Nikki Green, and James Brown during the final haul of dive gear to the sump

The next morning we arose and retrieved our drysuits from the sump, in order to check out “Lake 41,” named after the survey station at its edge. We swam out into the lake and around the corner. Actually, it looked pretty good; we could see about 30 meters ahead. After a constriction the lake opened up into several small chambers, all heavily decorated. However, the lake ultimately sumped. Although the water was so deep we couldn’t see the bottom, the ceiling below water was still covered in stalactites, suggesting that the passage was once air-filled. Somewhat dejected, we returned to camp to drop off our dry suits and have a hot drink. Marcin thought that the sump would be the way on and wondered whether there was any point in continuing survey in the maze. I maintained some shred of hope of finding a bypass, but mostly I was just enjoying the survey and dreading the return dive. A couple more days of pushing leads didn’t sound that bad. For the rest of the day we mapped a passage that gradually became tight and muddy, dubbing it “What Tiggers do the Best.” After 65 meters of small passage it hit a T-junction with larger passage. However, one direction quickly looped back to known cave, and the other terminated in grim leads headed up-cave.

Back at Camp 4, we learned that Elizabeth, Will, and Wicho Diaz had arrived in base camp. They had decided to brave the swine flu. “Someone wants to talk to you, Matt,” they told me. It is strange indeed to talk with one’s wife, whom one hasn’t seen in a month, while camping beyond a sump three days into a cave. She had just finished her Ph.D. in California and was coming to Mexico to spend a couple of weeks relaxing

Marcin Gala

Marcin Gala and Matt Covington at Camp 4. Two lonely souls at one of the most remote reaches of our planet.

Marcin Gala

Surveying in the Undertaker

Marcin Gala

The intersection between the Pigs Flew Passage and the Grim Reaper Loop, near the water source for Camp 4

Marcin Gala

Looking out into the Pigs Flew Passage

and generally enjoying life. How else could one begin such a conversation than with, "Dr. Covington, I presume?"

The next day we were resigned to pushing more maze leads. First, we headed into a lead that we had seen the previous day near the Pigs Flew Passage. It quickly forked and led to two different lakes. On one side it continued and went into a sharp, mud-coated, small passage. Somehow we had gotten on a Monty Python kick. I was quoting every skit I could remember, while Marcin laughed. He had seen a lot of Monty Python in Polish, but was amused to hear the lines in their original language. Finally, he asked, "What is the name of death? The guy with the black coat and blade."

"Oh, we call him the Grim Reaper," I replied.

"That is what we should call this passage," Marcin exclaimed. Thus was born the "Grim Reaper Loop." The macabre theme continued, and later we surveyed "The Undertaker." We then spent a couple of hours combing the breakdown and walls in the Pigs Flew Passage but came up empty. Finally, Marcin photo documented the passages we had explored, and we called it a day. That day we surveyed 200 meters of passage, bringing the total new survey to 837 meters. After dinner, we talked with Bill on the phone. He asked whether we would consider a reconnaissance dive in Lake 41. Marcin perked up. That was what he really wanted to do. We carefully considered the amount of remaining gas and decided that there was enough bailout gas for Marcin to do a quick and shallow open circuit recon dive.

Kasia Biernacka & Marcin Gala

Matt climbing through the sharp rock near Camp 3

The next morning we hauled three bags of dive gear from the sump to Lake 41. We only had a gap reel, so we knew Marcin wouldn't be able to go far. He entered the water at 1 pm. I turned off my light and sat in the dark, pondering where I was and wondering what he was finding. No one else was in the cave but the two of us, and Marcin was now doing an exploration dive. Fifteen minutes later he returned,wanting more line. He could see an air surface just 10 meters ahead, but couldn't quite reach it. I ran back to camp and loaded a bunch of phone line onto the dive reel. He returned to the water at 2:45 pm. This time the wait was longer. Maybe he had found something. Forty-five minutes later he returned to tell his story. After a 25-meter dive he had emerged in another lake, thinking that he had cracked the sump. However, a 25-meter surface swim revealed that he was in a pocket blocked by flowstone. There were some high leads but nowhere to get out of the water. However, on the way in, he had seen some ripples on the sand dunes underwater, indicating strong flow. The way on was probably there, deeper underwater.

After hauling the dive gear back, we returned to Camp 4 to phone an inventory up to basecamp and pack up our personal gear. We were headed out, but after a few more days of rest, Bill and Jose would return to push the new sump. Marcin and I had learned some lessons from the previous dive. Upon arriving at the sump, I took plenty of time to fiddle with my gear, make sure I knew where everything was, and test that the rebreather was working correctly. I got in the water first, and Marcin followed a few minutes after. The relaxed preparation paid off, even though conditions during the dive were quite unpleasant. The team dive masks fit my narrow face poorly, and on this dive my mask leaked terribly. It completely filled about every 15 seconds. I resigned myself to do most of the dive blind, only clearing the mask when I needed to check my partial pressure of oxygen. Despite these difficulties, I managed to remain cool-headed this time, and soon I was ascending up the rope to the platform. A few minutes later, Marcin arrived. We dropped our bags on the platform and went back under so that Marcin could get some photos and video underwater. Surfacing again, and returning to Camp 3, we found our mood had significantly lightened. While at Camp 4, the return dive had hung over us like a dark pall in the back of our minds. Having returned through the sump, we were still three days from the surface... but we could smell it.

Next month

The J2 story continues with a gripping personal account by Jose Morales on the final push of Sump 4. Team members were pushed to heroic limits after being trapped by rising waters and running out of food. Read it next month in our February issue.

Kasia Biernacka & Marcin Gala

Matt Covington descends into the Jungle Series of J2.

Kasia Biernacka & Marcin Gala

Kasia Biernacka descends a pit in the entrance series of J2.

Bill Stone

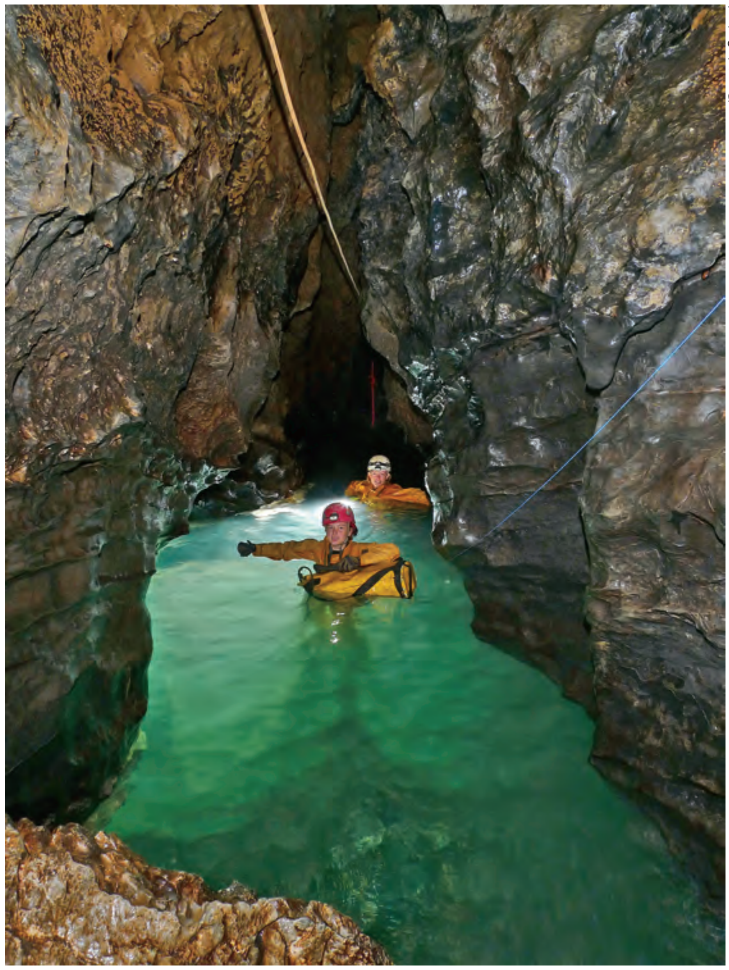
Nikki Green traverses a handline in the Wonderland Borehole, J2.

Kasia Biernacka & Marcin Gala

Paulina Olinkiewicz skirts a pool in the wet section between Camp 1 and Camp 2A.


Marcin Gala

Matt Covington climbs through the cascades of the Jungle Series


David Ochel

Vickie Siegel and Nikki Green swim in the frigid J2 waters at the start of the Jungle Series.


Kasia Biernacka & Marcin Gala

Left: John Swartz descends a pit high in the entrance series of J2

Left: Marcin Gala prepares to dive in Lake 41. Photo by Matt Covington


Kasia Biernacka & Marcin Gala

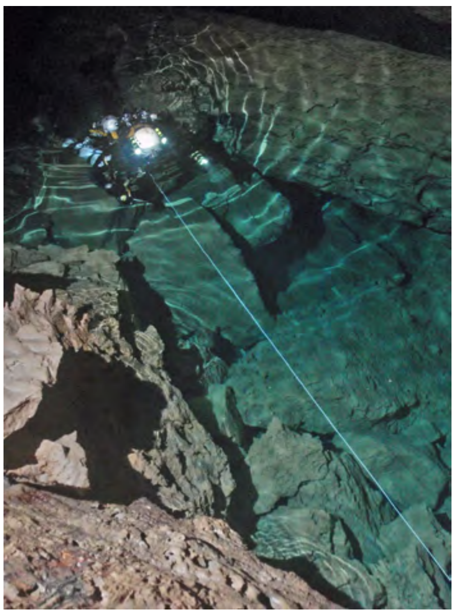
Right: Magda Aksman traverses one of the many Tyroleans just upstream of Camp 2A in J2

J2 2009: The Final Push

Jose Morales

[*Ed. note: This story continues coverage of the Mexico J2 expedition from the January issue*].

We left J2 base camp on April 28th, 2009 and began a long 4wd descent down the eastern flank of the Sierra Juarez. Bill Stone and I discussed the situation at the cave as we drove down through the maze of rugged dirt roads for the next 4 hours. We were on our way for an expedition food resupply to the big city of Tuxtepec in the eastern coastal lowlands of Mexico. Even though the scenery was stunning—the road precipitously skirted the 1600 m deep Santo Domingo gorge—there was a much more powerful thought process going on inside our heads: what was the status of the crew that was now headed to Camp 4 in J2? What had they discovered? How were they feeling? When would we get a chance to go back? Our crew of James Brown, Jon Lilestolen, Bill Stone and me had just exited the cave the previous day following a 14-1/2 day push to rig a 9mm rope and telephone line through the 200-meter-long Sump 2 at the -1209 m level of J2. We had achieved that, and, as well, transported most of the food and supplies needed to establish Camp 4 to the downstream side of the sump, thus preparing the cave for a significant assault on the most remote, deepest reaches. We had met the team headed in for the first push from Camp 4—Marcin Gala and Matt Covington—at the -1000m level and briefed them on the situation at Sump 2 for almost an hour. They headed down and we headed out. Those two would be alone in the cave from then onward, pushing the exploration limit. Even though we were supposed to be recovering from that long Sherpa trip—and we were enroute to a place full of good food—we were preoccupied with the cave. In our collective minds, we were missing out on the action. We decided to give the locals in Tuxtepec part of the U.S. Stimulus Plan by buying as many tacos as we had money for. The expression on their faces told us that they were happy as well, or maybe they couldn't believe how much a few gringos could eat! It is still debatable and unclear who ate the most.



Bill Stone

Jose reels in the dive line while surveying on the second passage of Sump 3. Although the cave is muddy in places, the sumps were clean with large breakdown and white, coarse sand on the floor. Average dimensions were 10 to 12 m wide by 6 to 8 m tall.

Back at base camp two days later I could not wait for news on the status of Marcin and Matt's exploration of the "Land between the Lakes," which lies between Sumps 2 and 3. Before putting our packs down, the inhabitants at camp told us that the push crew had racked up a significant dry cave survey total during our absence. The bad news was that they had also found what appeared to be another sump. Unbelievable! But nothing in this cave ever yields easily. We thought we had the key breakthrough on April 25th when James and I reconned the giant chamber at the head of Sump 3 and surprisingly found a gaping, air-filled tunnel heading northwest. Matt and Marcin had now mapped about 800 meters in that area, without gaining any depth. Somehow, we had landed in a fault zone that collected water and it was much more extensive than anyone had thought possible. It was the same fracture that expressed itself on the surface as the Cueva Charco valley. In fact, we were almost directly beneath the entrance of Cueva Palomora at the western limit of that valley—albeit some 1200 meters lower in elevation. The map showed J2 to be headed towards the San Miguel gorge, where the Charco valley spilled over into a 600 meter deep canyon. Our Holy Grail was to bust through into that air-filled, descending corridor. In base camp, sitting comfortably around the campfire in warm dry fleece, we hoped that this new, inconvenient Sump 4 would be short and easy. Naiveté is easy when you are comfortable.

Marcin and Matt continued to survey the tunnels in between the downstream side of Sump 2 and the upstream side of Sump 4. Their effort yielded no potential dry leads

and ended with a quick open-circuit reconnaissance of the beginning of Sump 4. On that dive Marcin was able to surface into an air bell about 25 meters into the sump along the righthand wall. But it was clearly not the way forward. On his way back he was able to see that there were other possibilities worth looking at which could potentially be the way forward. Puzzlingly, the only choices were heading west-southwest; Cheve system caves almost invariably trended north-northwest. After 5 days of survey Marcin and Matt started their long way back to the surface. We were able to track their progress upwards from the daily contacts on the Michie phone, which operated flawlessly all the way to Camp 4. Later, at basecamp, when I asked them how isolated it felt to be in Camp 4 for five days they responded that after they exited Sump 2 they could almost smell the entrance. They still had 3 days of travel ahead to reach daylight.

It was then May 5th and many changes were taking place with the team. We had originally planned to be where we were now some 3 weeks earlier, but the H1N1 flu had hit the crew hard and we operated at less than 30% power during much of the first month of the project. Now some of our strongest players—including Matt and Marcin and six others, were scheduled to leave the mountain. Ahead of us was serious cave diving exploration work. Of the eight that would remain on the mountain, only three were full cave divers. James had injured his knees on the last push, which left me and Stone to do the diving. Despite the small team and the impending rainy season, I couldn't be more excited. We prepared gear and food resupplies for what we felt would be a 10 day push. Amongst that was one carbon-epoxy 9 liter compressed air tank (at 6000 psi) and a spare oxygen bottle (2.7 liter at 3000 psi), also carbon-epoxy, to replace the gas supplies at the sump. Despite the equipment paring, we still had six 55 liter packs when we entered the cave, each in the neighborhood of 65 lbs.

It took us three days to reach the sump. With us was Yuri Schwartz and Sergey

David Ochel

Jose Morales serves as loadmaster at Camp 1, trying to compress the items going out into the fewest number of duffel bags. The expedition standard backpack was a 35-liter volume PVC pack made in Poland. Two of these shown here are 55-liters, which work well in open passage but frequently require unpacking in crawlways and squeezes.

Tkachenko, both from Siberia, Russia. Yuri is currently a full time post-doc resident in the U.S. working in microbiology and is a regular GVKS caver. Sergey was a co-founder of the Novosibirsk Diggers caving organization. Both are highly skilled expeditionary cavers and their support was crucial. In addition, Jon Lillestolen and Will Heltsley generously carried a load each to the sump before heading back to Camp 2A to check a few high level leads before leaving the mountain. On May 8th the four of us remaining reached Sump 2 at 2 pm and began a lengthy series of chores—changing out and re-calibrating an errant electronics module for one of the rebreathers; recharging the gas supplies for 8 tanks and, most tediously, packing two 55-liter duffels for underwater transport with our food, rigging, and diving supplies for Sump 4. Things went slowly and it was not until 2 am the next day that all systems were working and checked out, the big bags were neutrally weighted for transport underwater, and Bill and I were kitted up and in the water. Yuri and Sergey waved goodbye from the dive deck. They then began their long trip back to Camp 3 and we began our dive to Camp 4. They would spend the next week working on aid climbs near the sump in the hopes of discovering a dry bypass to the underwater maze.

Bill Stone

In-cave recharging of electrical gadgets. We used Mil-surplus lithium-SO4 primary batteries (the dark green blocks) to recharge helmet STEN lights, primary dive lights (black cylinder to the right, from NiteRider), Mk6 rebreather batteries (clear plastic cylinder), as well as Underwater Kinetics eQ-LED underwater lights. These two blocks provided all electrical power for the 7-1/2 days spent working from Camp 4 on the final push in 2009.

The dive proceeded flawlessly, despite our having been awake for almost 20 hours. It took around 20 minutes to get all the gear through to the downstream side of Sump 2. We had a lot of resources for what was going to be the push that was going to make it or break it for J2. We were determined to do anything within the limits of reasonable safety and the capabilities of our gear to find the way through.

We got to Camp 4 at almost 5 a.m. so we decided to sleep for a few hours and then use what remained of the day to transport the diving equipment from the beach on the downstream side of Sump 2 to the mouth of Sump 4. It looked like a pretty easy 500 meter stroll on the map back in base camp but it was not that comfortable in reality as the rebreathers had a lot of delicate parts on them that had to be protected during transport and we had to make the trip many times.

On the afternoon of May 9th we reconned the route to Lake 41 (the beginning of Sump 4) and found that we had to place a few bolts and a few more ropes to make it safe enough to transport the rebreathers—a damaged component out here would mean the end of our exploration efforts and a dangerous open-circuit exit to Camp 3. After the rigging improvements were completed we alternately carried the rebreathers one by one with the other guy acting as a guide when moving through breakdown to prevent any damage. Eventually we carried all the remaining dive gear to Sump 4, including the carbon-epoxy side-mount tanks containing our bailout gas as well as fins, masks, reels, lights, and drysuits. Once this task was completed, we went back to camp and started strategizing on how we were going to tackle the first dive. The preliminary plan was to scout the left wall looking for a way onward to the west, since Marcin said that his effort was concentrated on the more logical right wall (we had been expecting north-trending passage).

The next day right after breakfast we were on site kitting up for the dive. This is a tedious process that requires mental rehearsal and concentration to make sure that you don't forget or overlook anything. Cave diving is dangerous business so it is imperative to have a pilot-like attitude for pre-dive checks and execution. In this case it was not an issue since both of us were used to flying aircraft and had the same philosophy regarding discipline on a cave dive. Once in the water we started slowly making our way through the tunnel, tying off our guide line as we were figuring out the way forward. We previously decided that I was going to lead and that Bill was going to do the underwater survey on the way out. He always had this attitude of encouraging other people to do things out front while he picked up the less interesting tasks. Just as Marcin had warned us, about 30 meters into the dive the cave did something illogical and abruptly made a 90 degree turn underwater to the west, abandoning its usual northern course. The large hairpin-turn corner at the limit of Marcin's exploration gave the impression that the cave "wanted" to go forward (north) but for some reason it was not allowed and it turned west. Later on, on other dives, I continued to observe other large pockets or pseudo-tunnels like this one trying to go north but they all quickly ended in the same abrupt way.

We made the left turn and continued 8 meters vertically up a very large sand dune. There was a large air bell at the top of the dune and we surfaced there briefly. There were no obvious tunnels leading off from it,

unfortunately. The way on lay below, down the other side of the big dune. We stayed on the left side of the tunnel reaching a maximum depth of 20 meters at the bottom of the sand slope (this point later turned out to be the deepest point reached this year in J2 at -1222 meters). We continued the exploration for around 180 meters and eventually made another illogical turn to the south. We surfaced then in what looked to be the end of a very tight fissure infeeder tunnel. A small waterfall could be heard falling in the distance. The place was not pleasant. We surfaced in waist-deep mud. A quick recon showed there was nothing more we could do here. Somewhere we had missed the main underwater tunnel. Bill surveyed everything on our way back while I did what I could to search for alternative routes out of the underwater canyon. Back at Camp 4 the data revealed that the tunnel did in fact turn to the south at the end, with no physical chance of it being the continuation. We concluded that we must have missed it somewhere before this dead end point and would have to return.

The next morning we were back at Sump 4. As we were going through the pre-dive checklist we discovered that Bill's head-up display (HUD) had somehow leaked on the last dive. The rebreathers had seen amazing abuse in the 11 kilometers of transport to get here. Now the automated pre-dive code on the Mk6 was sensing the short and failing the test series. The problem was that as the main computer was seeing this problem it was not allowing the rest of the pre-dive systems check to be completed and would therefore not enable diving. Unlike the Mk5 predecessor, the Mk6 was designed primarily for the sport diving market and it was fully automated (it allowed no user intervention nor overrides). We had the mk6 along because of its very small size. But we now found its limitations. It was correctly indicating that something was broken, that service was required, and as designed it was preventing unsafe use. Our problem was that there was no way to service it here. There were emergency procedures that could be used to operate the rig without the electronics, but not on an exploratory dive. After discussing many different alternatives Bill graciously let me continue the exploration of Sump 4 by myself. We still had the issue of having to get back through 200 meters of underwater passages at Sump 2 as the first step to get out of this cave. We were going to have to employ a contingency plan to do this, but for now the important thing was to not use all the open circuit gas so we could have some for our way out from both the exploratory dives in Sump 4 as well as the return through Sump 2. All of these things conspired to reduce our well-planned push to requiring solo exploration diving.

Bill Stone

Jose preparing to depart on the downstream exploratory push on Sump 3. This shows the full diving rig from the rear. The rebreather is the small black cylinder in the center. The top tanks were 2.7 liter x 1.6 kg carbon-epoxy tanks containing air (left) and pure oxygen (right). The two bottom tanks were also carbon-epoxy (4.7 liter x 3.5 kg). By using a larger (9 liter) tank at much higher pressure (400 bar) we were able to re-load the air tanks beyond Sump 2 for each exploratory mission by trans-filling through the first stage regulator ports using a flexible high pressure hose.

I found absolutely nothing on my very detailed reconn of the right wall up to the top of the sand dune. Every time I turned back Bill would be patiently waiting on me and playing through strategies to enact if something was to go wrong while I was diving. This is a very uncomfortable position to be in and I'm very grateful of the way he did this and the so many other things and sacrifices he made over the coming days so I could keep diving.

We did a few more methodical dives in the hopes of discovering a continuation but found nothing. Our life support supplies were now starting to run low. We decided that I would make a last dive into Sump 4, concentrating on the right wall past the crest of the dune and going downhill. Later, as I was hovering over this crest I decided to lightly lay on top of it to get the million things hanging on me better organized before continuing downhill with my cave diving line. I barely put any weight on the sand when suddenly a 5 to 7 meter wide section of sand and mud started sliding violently downhill, making the kind of noise that you just don't easily forget. I quickly came back to a hover and stayed a good 5 to 10 minutes, analyzing the situation to figure out if it was safe enough to lay my line over this kind of terrain without running the risk of line traps or any other life-threatening situation. Barely any silt had come up from the bottom as a consequence of the slide and with no apparent current present, the silt was certainly staying static in the same place. So I decided to slowly continue over this area to a predetermined turnaround point that if reached without seeing a potential lead, would be the place to turn around, since going any further would mean getting more into the tunnel that eventually headed south into nothing. I reached this point right when I ran out of line.

I made one last tie off and moved laterally some 15 meters to the original line, placed by Bill and me on the initial dive. I tied my reel to it. Hovering in frustration, I realized that this was the end, no more leads, no more line, and no more gas. I turned around to face the exit but decided to pause for a second before leaving and think it through one more time. There was one stretch of wall, a bit further on towards the south, that I had not covered. I moved further into the cave in that direction, staying as far right from the fixed line as I could in order to give the last portion of the right wall a better look. At this point I was getting very cold—my drysuit was leaking—and was wondering if it made any sense to continue into an area that was too deep and in the wrong direction.

Suddenly I saw a shadow on the right wall. I tried to get a better look but I started to lose sight of the main line. I turned and headed back to safety taking care to not stir up any silt. Now on the main guide line I paused again in frustration, and unclipped my safety reel. It was the only dive line I had left. As I tied it off and began reeling into the new tunnel I was thinking what Lamar Hires, my cave diving instructor, would have to say about this: "*bad idea.*" I was as focused as someone could ever be as I was moving into the general direction were I thought I saw the tunnel. And soon, there it was, a tunnel that we completely missed on our initial dive, heading north. I made a left turn some 8 meters beyond the entrance and quickly ran out of line. It was not borehole, but it was interesting. I reeled back my safety line in case I needed it later, and quickly thereafter was making my way back along the main line to the exit when I found the empty reel that I had run over the dune on the way in. I decided to reel it in all the way in case we needed more line latter on. Little did I realize that doing so would almost be the end of me.

I was looking down, minding the reel

as I rolled in the line, when suddenly I went straight into a cloud of some of the worst visibility I have ever encountered on a sump dive. The kind of zero viz that gets you almost dizzy as the light mixes with the murky water and you lose physical references of things as you are swimming through the emptiness. So before I could ask myself what changed, the line in front of me started to make turns that I had not made when I placed it originally. A few minutes later the line suddenly went straight into a mud wall. Not good ! As I was feeling the mud obstacle in front of me I bumped my elbow against a rock on my right. As I pushed myself to the left, to get away from it, I bumped again but now with some sort of ceiling and with something else on the left wall, almost simultaneously. I had read about this kind of situation more than once—usually in accident reports—and I could not believe it was actually happening to me. I don't know how I got into that hole but it seemed that backing out a little was worth trying. The thing about it was that the side mount tanks were fish-hooking against the rocks to my sides and for some reason the banging of the electronics on the top was not making me feel that this was a good idea either. I was probably only stuck for about 2 minutes, but it felt like two hours. I had to calm down and remember that thank God I was using a rebreather and had about 4 hours of gas left to solve this problem. I decided that taking things off was going to be the last resort. I did not have much space anyways, so next step was going to be to dig the line and myself out of it.

Bill Stone asked me 6 months prior to this whether I thought regular cave diving line was OK for this project and I told him that there was room for improvement. So I went ahead and designed a custom, tough, abrasion-resistant 2mm cord with the help of the Cortland company from NY. They graciously sponsored the project with more than 2 kilometers of this line. A lot went into the creation of this line and it was paying off now as I was pulling the hell out of it from in-between rocks and mud. I continued to shuffle everything for around fifteen more minutes until I came out into crystal clear visibility. I was now able to realize that while I was gone there had been a second mud slide of much larger proportions that changed the face of the whole place. In doing so it grabbed my line and stuck it into a very nice line trap from hell.

After this incident we settled into doubt about Sump 4. It just did not have the feel of a going tunnel and it was clearly headed in the "wrong" direction. Perhaps all along we had been falsely led away from the true way on—Sump 3. Back in April, James Brown had entered Sump 3 for about 30 meters, and it was going large, with a crystal white sand floor, much like Sump 2. If anything, this place for sure had the current and should go the "right" way despite the fact that we thought we should have bypassed it by now. I picked up where James left off and continued placing new line for 175 meters. Then suddenly it ended in some sort of sand dune to the left and a small fissure to the right of it. After poking my head over the crest of this sand dune and seeing how steep it was, and taking into account that it looked like the bottom of the sand pile I had just fought my way out of the previous day, I chose to continue into the narrow fissure route. The thing about that one was that it was not big at all and it was making all sorts of sharp turns around big and questionable breakdown boulders. But there was no silt, the water was super clear, and I was feeling very curious about what was coming up. What appeared ahead was an air chamber with a wide open feel to it, albeit for an uncomfortably tight egress to shore. After getting all my gear off, making a complete systems check and leaving it in a stable place I started an exciting climb into the unknown, still in my drysuit. Two minutes later I was contemplating something that should have not existed in the "unknown," a flimsy-looking, pink thing that looked very much like flagging tape to me. It said MGMC for Marcin Gala and Matt Covington. Great! I came out of Sump 3 into the tunnel that leads into Lake 41, 30 meters prior to it at the bottom of a fissure that we did not see before. I left my gear there and walked back upstream to Sump 3 to meet Bill through the very familiar route that we used from Camp 4 to Sump 4. I could not resist getting close to Bill before loudly calling to him. The echoing voice coming from the upstream direction had the surprise effect I had been seeking. He quickly understood before I got to him what had happened and after a short discussion we went back to camp.

With Sump 3 now definitely explored and clearly carrying the river to the head of Sump 4 we concluded that our last chance was to go back to the tunnel that I found using my safety reel near the end of Sump 4. The thing was that we needed all the line that I just placed in Sump 3. That meant another dive and the consumption of precious diving resources. We had no choice, however. I was already using Bill's CO_2 canister. He had agreed to exchange his almost unused canister for my very used and almost depleted canister in order to allow exploration dives to continue. After making the long cold dive into Sump 3 to survey it and then to retrieve the line, we transported the equipment back to Lake 41 for the one final push.

Bill Stone inspects the water level at Surprise Sump on May 20th. The bolted rock had previously been installed by Heather Levy and Seth Spoelman more than a month earlier when they were similarly trapped beyond the sump. The top of the rock is exactly the point at which air begins to flow through the sump. Here it is half a meter underwater.

We slept restlessly that night. Right after breakfast we were back to Lake 41 through the now super-familiar route. We both knew this was the last chance to find the missing way forward but at least if we did, we now had two exploration reels full of the special cave diving line to do it. We gave each other the Roman *Virtus et Honor* salute and I headed in. I left feeling it was so much harder for Bill to stay back, but if anyone could deal with it the right way, it was him.

Back underwater I picked up where I left off with my safety reel a few days back and continued placing line to the end of the tunnel. I suddenly reached another dead end! I turned around and paused again at the entrance of a small tunnel going south. I had passed it on the way into this chamber, yet dismissed it at the time. I now followed the illogical route south thinking that it had better make a U turn pretty soon. And for once, the cave did something right and made the "U" turn and started heading northwest through a much different tunnel—spreading out to 12 meters in width and 10 meters high with large breakdown on the floor. Everything was covered in white sand. This tunnel had small "V" shaped sand ripples in the bottom pointing the way forward—a sure sign of the lost flow and its direction. It was also very consistent in size and heading and I was making very quick progress through it. Eventually I ran out of my first spool of line which was not that nice since it was getting to be very far from the entrance. I tied on the second and last Dive Rite exploration


Bill Stone

Jose in the "Land between the Lakes" – the giant chamber between Sumps 2 and 3 in J2. The dry bypass of Sump 3 is up and over this breakdown pile some 200 meters distant.

reel and continued on. I felt so humbled and fortunate to be enjoying this incredible opportunity of truly navigating deeper into the unknown. I felt a deep sense of unison and peace with the cave that is hard to put in words.

I was now past the point where my sidemount bailout bottles had enough open-circuit gas to get me out of there. I did not go much longer until my second reel ran out in the middle of the tunnel, still underwater. I paused in frustration only momentarily before deciding to use my safety reel again. I was going to use everything that I had at my disposal, and that was it. As I was tying the reel I was asking myself whether I was surrendering my reason to my passions in bad honor to the Greeks. The tunnel was giving indications of getting shallower and after only 20 meters I saw the unmistakable mirrored surface of air overhead! I surfaced and quickly tied the line off to a rock that was inside the airbell. I stowed away the safety reel with barely enough line to perform an emergency line recovery procedure. I swam through the air chamber with some excitement. I had a lot of light—an array of 5 UK Super Q e-LED lights and one Sten Light—and everything was sharply lit. I could not wait to see what was coming up. I made a couple of turns and realized that this was a large air bell just prior to what I now believe will be the main air-filled continuation of the cave. The bottom was coming up now—max depth 1.5 meters on the roof—and the flow was speeding up. All the prior morphological observations in that final stretch of 12 meter wide by 8 meter tall tunnel point to this conclusion. Going forward those last few meters underwater, unfortunately, was not in the cards. I was out of line, dangerously low on all consumables, and still had a 2 hour long survey dive back to Bill. There was no doubt in my mind then about whether the cave went. Before heading back I enjoyed a few minutes looking around at one of earth's most remote places. I have literally lived by the saying that there are no atheists in the war trenches, so I gave a humble prayer to the almighty and decided to enjoy the trip back through the most awesome cave I have ever seen, read, or heard about. Three hundred and seventy meters later it was over and I was back at Lake 41.

I was very happy to see Bill and quickly told him everything. We had a good night's sleep and began readying for a very tough derig ahead, following 7-1/2 days at Camp 4. Because of all the vagaries of the way the expedition had unfolded we were short on people and knew it. The main preoccupation now, however, was that before Bill and I could get to Camp 3 we had to dive through Sump 2 with 200 pounds of very negatively buoyant equipment and a dysfunctional rebreather. Bill and I had spent a lot of time in Camp 4 discussing how this would proceed. Amazingly, we had also discussed it with basecamp via the Michie phone and Vickie Siegel had taken the discussion notes down the mountain and was able to reach one of the Mk6 code developers by satellite phone. Based on her relay of the advice they gave we thought there may be a way to jump start the automated control system by submerging the rig (it had an auto-start safety feature meant to protect divers who accidentally fell off a boat with the rig on their backs but not turned on). Several hours later the two of us were in the water at the beach at Sump 2. Bill went out a few meters into the sump to a depth that should have triggered the auto-start procedure but the fault persisted. He returned with a resolute look on his face and said, "pull the battery." That left him with a dead rig. The normal abort mode for the Mk6 was to go to the surface during a dive. Fine for a novice diver in open water but not so good with 200 meters of underwater tunnel ahead. Neither did the Mk6 have a backup PO_2 monitoring system (again, a simplification for lightweight sport diving). It did, however, have a manual oxygen addition switch that we added just before leaving Texas. That decision now proved to be crucial. One of the final abort scenarios we had discussed at Camp 4 was to run the rig in "semi-closed" operation. In this mode the user can take a breath from the automated air addition system and recycle it a number of times—usually somewhere between 10 to 15 breaths for a calm person. The reason it works is because the CO_2 is being pulled out by the scrubber canister and because a normal person only consumes about 5% of the oxygen in a breath during normal breathing. With the CO_2 kept low, there is no autonomic insistence by the body to change the air, so one can calmly breathe this mix as it goes ever more hypoxic. The trick is to decide when to dump the hypoxic mix and reload. Bill was able to extend this concept much further with a second trick: by breathing in only half of a lung of air and then filling the remainder, manually, with pure oxygen, it was possible to extend that single "breath" to nearly 10 minutes underwater. At the end of that interval he dumped the entire breath and executed the procedure again. He only had to do this procedure three times to get through the sump—thus effectively diving a 200 meter sump on three breaths. It was this type of efficiency that had allowed us not to dwell on the exit from the cave for the past 4 days. But it was not something you would prudently use for exploration. Because no one on the team had ever tried this procedure, however, we agreed that I would carry the full load of gear (both 55 liter bags) while he went ahead and focused on getting out, hopefully without having to resort to his sidemount bailout gas.

Meanwhile, I had to inflate everything that I had to the maximum, including my drysuit, in order to make a much shallower trench in the bottom as I crawled to the exit. Thankfully, we had had the foresight to rig that 9mm rope through the sump and it was now possible to make rapid headway by pulling along on the rope—definitely non-standard cave diving practice, but highly effective for carrying big loads through a sump. I could not stop thinking about Bill's situation and after 30 long minutes I saw him peacefully waiting for me underwater at the head of Sump 2. Even though we had discussed the procedure at length it was still hard to believe: he had exited the cave through a 200 meter sump, more than 1200 meters below the surface, on manual mode on a rebreather that was not designed to do that, with all the computers and screens off, with a leaking drysuit and, at the end, he took time to pull out a camera and film my arrival for the sponsors before we got out of the water. Later on at the diving platform he told me how much he enjoyed the whole thing.

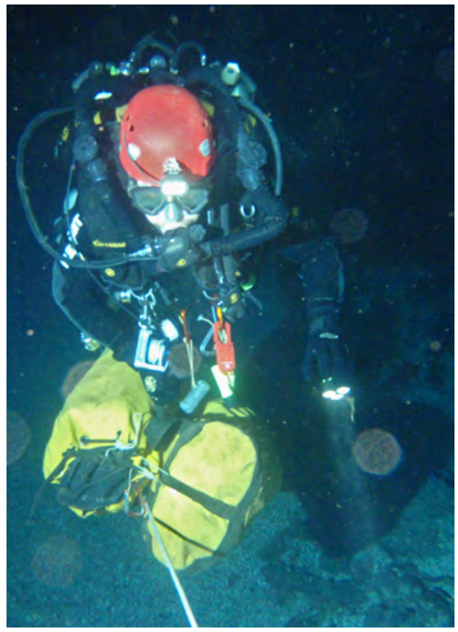
The horrible de-rig was a much longer and heavy procession than anyone wanted. The good thing was that we had a great crew. At this point we had seven in the cave: Vickie Sigel had guided Nikki Green and David Ochel down to Camp 2A. They were making shuttle runs down to the -1000m level to retrieve the gear we were moving upwards. Yuri Schwartz and Sergey Tachenko from Russia had persisted for more than a week at Camp 3 eating nothing but powdered potatoes—their drill batteries had long since given out and they had spent the time hauling equipment upwards. Bill and I completed the underground team following our return from Sump 4. James Brown manned base camp and the all-crucial Michie base phone to coordinate the asynchronous teams. And that was it: these were the last of the 46 person team to remain on the mountain on what surely had been a roller coaster of an expedition. We had a nice party when the entire team met at Camp 2A (-800 m). It was a cause for much merriment and one of the expedition's more memorable quotes: having been living on subsistence rations at Camp 3 for a week, Vickie had promised the meat-loving Russians that she would bring them an entire sausage to Camp 2A for them. But the timing had been bad and although they had brought the food to Camp 2A half of it was gone before Yuri and Sergey got there. With a hearty laugh Yuri then said, "*there have been **many** promises that have been broken on this expedition, but worst is that Sergei and I would have entire sausage to ourselves in Camp 2*." If anyone had a right to make the claim it was Yuri—he had spent considerable time training to go beyond Sump 2 and through happenstance (because he was not yet a full cave diver trained in exploration skills) had been unable to go. As a consolation, we kitted him up in my gear at Sump 2 after Bill and I surfaced on May 19th and he made two 50 meter penetrations down the 9mm line, just as we had rehearsed in controlled settings prior to the expedition. It was his first cave dive.

The following morning we began what we felt would be a routine exit from the cave. Everything proceeded well until we reached Surprise Sump. To our stunned dismay we discovered that a recent series of persistent showers on the surface had again flooded it shut, apparently just after the passage of Vickie's team descending to Camp 2A. After the initial frustration passed we went back through 500 meters of the highly technical Black Gorge section to Camp 2A (a 2 hour journey) and had another party to

James Brown tests the EXO-26 commercial diving mask that would have been used for a sump rescue at Surprise Sump.

boost the collective morale of the group. The next day Bill and I were the first ones to get to Surprise Sump and found it to be even worse than the previous day. Now the situation required us to start making some tough choices. We asked our Russian crew to go all the way back to the head of Sump 2 and retrieve some of the scuba gear that was left there for the next expedition. This was a highly non-trivial request but our disciplined friends started to get ready right away and left with David, who graciously decided to join them, on their 19 hour mission. Bill and I established a bivouac at Surprise Sump, along with a Michie phone and a plan to coordinate immediately with the others if the sump opened. The basic problem at this stage was that there was literally no more food left anywhere downstream of Surprise Sump. We all knew the cascade of consequences that could follow under such circumstances this far and this deep with the psychological chances of not making it out. Had the rainy season arrived early this year? If so, then the sump was not going back down and we had to come up with a proactive way of dealing with it—hence the trip to the sump to retrieve dive gear. Bill and I painfully constructed a bivouac in the rock pile downstream of the sump and used our drysuits and coveralls as "sleeping" mats. The plan was that as soon as the Sump 2 crew made it to Camp 2A, Nikki and Vickie were going to take that gear and bring it up through the Black Gorge to Bill and me. We in turn would dive Surprise Sump and then quickly go to the surface and bring supplies down. The only inhabitant at base camp at this point was James Brown, who was recovering from injuries sustained on earlier trips. It was felt imprudent by all for him to attempt a solo descent. It was far more important that he continue the indispensable job of monitoring the weather as well as arranging for special equipment to be brought up the mountain from the vehicles if needed.

Bill and I had one small Power bar which we had to split for three days. We did get very hungry and as a consequence very cold as well. But we kept good spirits as we were waiting for the gear. Eventually the sump crew made it back to Camp 2A and handed over the gear bags to the next team that was going to bring it to us. Fifteen minutes after they left the camp and began their ascent up the Black Gorge they were forced to turn around because of stomach problems related to the lack of nutrition and general fatigue. This meant that we were going to have to wait almost a day for the Sump 2 crew to recover from their push trip so they could bring us the gear while the other team recovered enough for next day's inevitable mission of getting out of there.



Jose arrives at the upstream side of Sump 2 on May 17th, bearing the two 55-liter x 50 kg gear bags coming back from Camp 4. The 9mm guide line is visible below the bags.

Finally we got the gear after an incredible effort from all of them and went quickly to work; they returned to Camp 2A to wait for our call. Bill went first and dived upstream for what proved to be 23 meters before surfacing. The route, unfortunately, was a little bit technical—it was not a straight shot to the other side as we had hoped. He took a look at the EX-Sump (beyond, towards the entrance) to confirm that it was passable without dive gear. Then he plugged in a Michie phone into the line and called me at the bivouac to give a report. It was very hard to hear him over the powerful background noise the water was making at his location but it became clear that the plan we had developed jointly to dive out with the entire team was doable. When he came back we decided that we did not have any indication that the situation was going to get any better. Further, it was not clear that we were going to have enough time to go out and back before the rainy season really got into full swing and the water rose even higher. As far as we could tell—and as Vickie had pointed out on more than one occasion—the rainy season appeared to have arrived very early this year. So we decided that everybody was going to have to dive their way out of this one. We did not have any time to waste, since every meter the sump came up, the dive got 10 meters longer. We called Camp 2A and told Vickie and Nikki to start making their way to Surprise Sump as soon as possible, with the mindset of making a short dive to get out. We told the rest to give the first team 2 hours and then to leave Camp 2A and head our way with the same mental preparation of

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having to dive out. We only had two of our 4.7 liter sidemount bailout tanks with us so we were not going to get too many tries at this. Complicating the matter was that there were seven of us and only three XL drysuits. Four people would have to do this in nothing but their cave suits. Vickie and Nikki arrived at the sump and were quickly met with a detailed brief on what to do. I was going to wait for them on the other end and Bill was going to coach them on this side. They did not have any weights so they were going to have to crawl inverted on the ceiling to get to me. Once I got to the other side I saw Vickie's lights quickly moving my way and before I could submerge myself to guide her to me she was already out of the water. I felt so happy and proud of her for the outstanding job she did under such pressure. The plan had been for her to get gear to the other side of the long swim through the Ex-Sump and then wait to help Nikki out the waterfall at the upstream end. She did this and waited for almost half an hour before hypothermia onset forced her to set off for Camp 1 at a slow pace, solo. Back on the downstream side of the sump we were having problems. Nikki had not shown up.

I eventually dived back to the downstream side to find out what was taking so long. As I surfaced I saw the scene that I was hoping not too see: Nikki was hyperventilating in a corner, overwhelmed with the situation. She had attempted repeatedly to submerge but each time could not get a full breath from the dive regulator. After one glance at Bill, who was patiently trying to assist, it became clear she was not going to be able to make it through. The reality was that the situation was asking her to do something super hard in a weakened condition. She had never dived before, much less in this kind of environment. The 11 °C water temperature without an exposure suit was not helping the cause. The more critical problem was that she had already consumed too much gas in her attempts to go under and we still had 4 more people to get out on that same tank. Partially hypothermic now, she was not in a good position to make a decision as to whether to continue trying or to stay behind for an uncertain rescue. It was also clear to Bill and me that she would likely drown trying to go through. I had to make the choice for her. It was not an easy thing to do but I had to ask her to give me her tank so I could use it to help the rest. She immediately agreed and went back to the bivouac site as the others got ready for their turn.

Everyone else (all with some level of prior dive training) was able to go through with no major setbacks. David Ochel decided to stay back at very high personal risk to help her out through the waiting period. He did this knowing that the river could continue rising to the point of making a rescue impossible. This was good and bad: good because she had someone else to talk to as Bill and I were racing to the surface to get emergency gear and more gas, and bad because if something happened we could lose two team members at once. Of course we were going to do everything we could to prevent that.

The four of us that subsequently went through—Sergei, Yuri, Bill and myself—pretty much raced to Camp 1 and met Vickie there. She knew something bad had happened when she counted crew members and came up two short. She almost waited too long in the waterfall zone above the ex-Sump, hoping to see Nikki at some point. She had a long cold trip alone back to Camp 1 thinking of what happened to the rest of the people all along. She was still shivering when we got there and quickly understood the seriousness of the situation. We decided that Yuri and Sergei would go to the surface to retrieve dive rescue equipment. We had already phoned James and requested he descend the mountain to get a special EXO-26 commercial diving band mask that could be used to transport an unconscious person through a sump. That and a spare 9 liter carbon-epoxy tank would be enough to get the remaining two through Surprise Sump if we wasted no time. On the surface, James frenetically assembled gear and food bags to go back down. Thank God that we never lost the ability to communicate through the Michie phones—with them we kept a half hour phone contact line with the bivouac team as well as with the surface. Bill, Vickie and I stayed at Camp 1, recovering with the very little food that was left there so we could be ready to jump into action as soon as the Russians were back. As Yuri and Sergei were getting closer to the surface the trapped crew started reporting that the sump appeared to be slowly going down. A weighted rock and rope had been tied to a roof pendant there more than 5 weeks earlier by Heather Levy and Seth Spoelman for the purpose of tracking the sump level. Our hope was that it might go down enough so as to allow them to get through without the emergency dive gear—and thus relieve Yuri and Sergei of having to bring down the heavy package.

Somehow the miracle happened—there was a 1-day breach in the now continuous rain—and the sump opened with just 10 cm of air space at 10 am May 23rd. David called Camp 1 and let us know their plans. Bill and I suited up immediately and met them several hours later as they were coming through the ex-Sump. Once Nikki was clear, David had gone back (he was wearing the third dry suit, which fit him well) and shuffled the remaining duffels of equipment through. Once they were out of the sump we were all able to breathe a little easier and continued the heavy process of the de-rig but with a renewed sense of accomplishment and unison. Bill and I had been underground for 19 days when we reached the entrance. It was the longest contiguous period either of us had spent in a cave. J2 was now 1222 m deep and more than 11 kilometers long. More than 600 meters of underwater tunnel had been explored, of the 1.5 kilometers discovered by the expedition beyond Sump 2.

The expedition concluded without any further incidents. It had been a memorable trip at every level. A week later we all had a wonderful expedition homecoming party at Stone's ranch in Austin and gradually departed our separate ways over the coming weeks. Even at the party talk had already begun of how we would come together once again to push forward in this magnificent system. The 2009 J2 expedition was one of the ultimate examples of the importance of cohesive and smooth team work; the amount of equipment transported underground was daunting, yet the entire team dealt with it in

Bill Stone

an upbeat manner. I cannot wait to be part of it again.

I heard before the expedition that some people in the past had categorically declared J2 to be finished. Suspended in the underwater borehole at the end of Sump 4, with the ground and ceiling rising, ripple marks on the clean, white sand floor, and the San Miguel gorge—with its possibility of another 600 meters in depth—now only a short distance away, I knew otherwise. The cave goes strong, and it is without a doubt one of the most formidable exploration challenges on Earth.


David Ochel

The team reviews the outcome of the 2009 expedition when the new passages are plotted up on the regional map. Left to right: James Brown, Sergey Tkachenko, Nikki Green, Jose Morales, and Bill Stone.

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