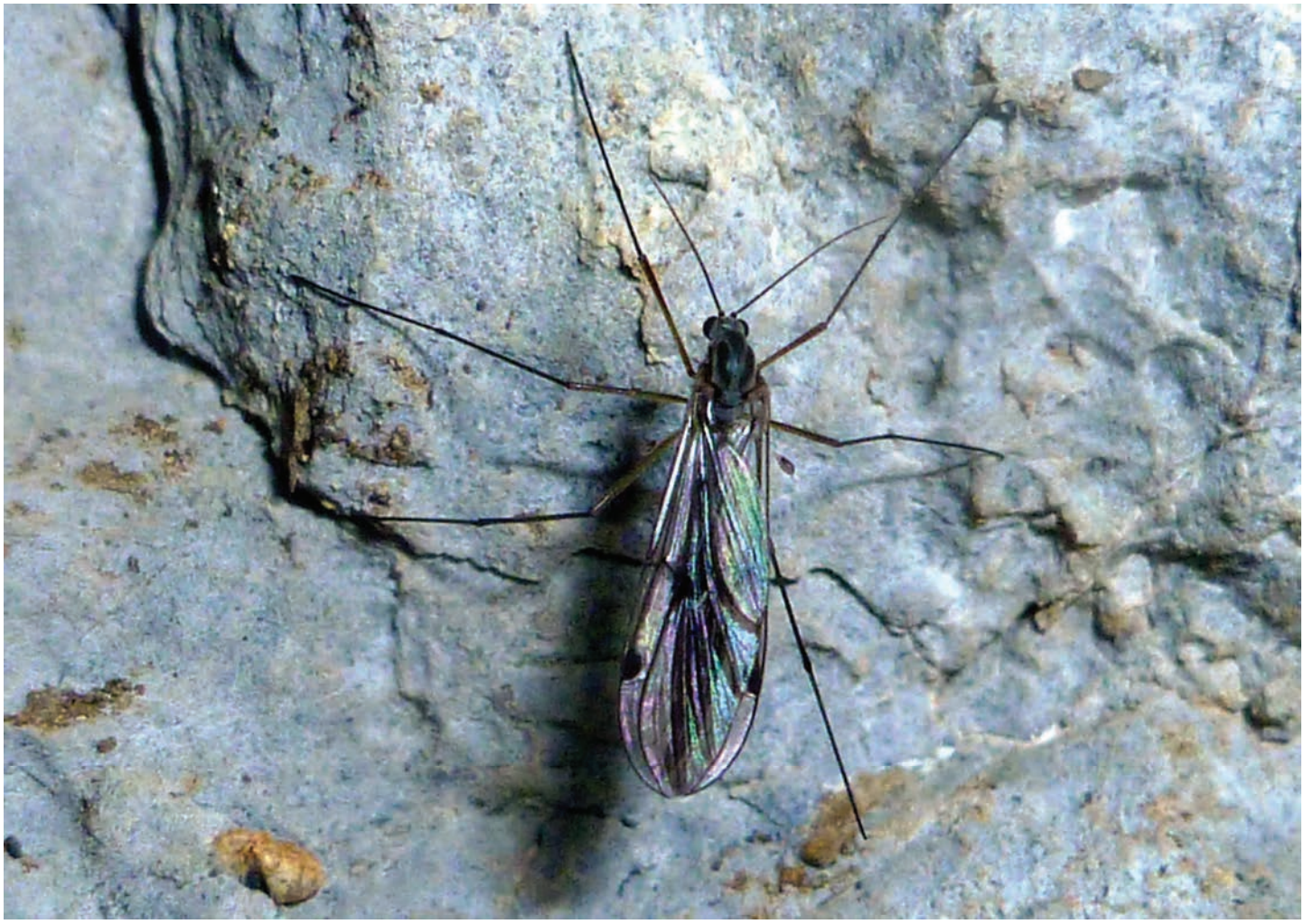
Cave and Karst Programs

National Park Service
U.S. Department of the Interior

Inside Earth



This beautiful photograph captures the iridescent wings of a Mycetophilidae fungus gnat found during a cave bioinventory at Great Basin National Park, Nevada. NPS Photo

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Calendar

December 2012
17th Deadline for paper submission for the 16th International Congress of Speleology in Brno, Czech Republic http://www.speleo2013.com/

January 2013
7-11th A Karst Waters Institute Symposium on Carbon and Boundaries in Karst, Carlsbad, New Mexico http://www.karstwaters.org/

March 2013
11-15th George Wright Society Conference in Denver, Colorado http://www.georgewright.org/gws2013

May 2013
6-10th 13th Sinkhole Conference in Carlsbad, New Mexico http://www.nckri.org/sinkholeconference2013

July 2013
21-28th 16th International Congress of Speleology in Brno, Czech Republic http://www.speleo2013.com/

August 2013
5-9th National Speleological Society National Convention in Shippensburg, Pennsylvania http://www.caves.org/region/mar/nss2013/
27-31st 8th IAG International Conference on Geomorphology http://www.geomorphology-iag-paris2013.com/

October 2013
27-30th Geological Society of America 125th Anniversary Meeting 7 Exposition in Denver, Colorado http://www.geosociety.org/meetings/2013/

November 2013
4-8th National Cave and Karst Management Symposia in Carlsbad, NM http://www.nckms.org/2013/index.shtml

Submit Entries for the Calendar to: andrea_croskrey@nps.gov

A Word from WASO

New Cave & Karst Program Coordinator Announced

In case you missed the announcement on the Inside NPS website, Dale Pate has been hired as the new Cave and Karst Program Coordinator. The text from the announcement was as follows:

Dale Pate, NPS Cave and Karst Program Coordinator.

"*The Geologic Resources Division is pleased to announce that Dale Pate has been selected as the new full-time national cave and karst program coordinator.*

Dale comes to this position having worked in cave and karst areas since 1970, where much of his early experience comes from volunteer efforts to discover and document caves mostly in central Texas and northern Mexico. In 1976, Dale joined the U.S. Geological Survey - Water Resources Division in Austin, Texas. For the next 15 years, he collected and analyzed surface water and groundwater quality, operated stream gauging stations on the Brazos River and other streams, operated urban base flow and storm runoff stations within the City of Austin, and operated a series of groundwater sites in the Edwards Aquifer in the Austin area, including Barton Springs.

Dale joined the National Park Service in 1991, spending 21 years as the cave specialist for Carlsbad Caverns National Park. Significant duties and accomplishments there included supervising a professional team of employees dedicated to documenting and conserving the park's world-class cave resources; setting standards and protocols for entering and working in park caves; managing Lechuguilla Cave, presently over 135 miles in length and the deepest limestone cave in the U.S.; being the guiding force for the Carlsbad Cavern protection plan and EA, which allowed the park to make major infrastructure improvements to protect Carlsbad Cavern; overseeing the placement of a stainless steel air-lock system and culvert at the entrance to Lechuguilla Cave; working with numerous researchers in various disciplines to better understand and manage the spectacular, yet very fragile, cave resources of the park; and working with numerous volunteer groups and individuals to accomplish exploration, survey, inventory, and restoration within the 117 known caves.

For the past five years, Dale has been serving in a half time role as GRD's national cave and karst program coordinator while also serving as a supervisory physical scientist at Carlsbad Caverns. Dale has spent a long career working in and protecting cave and karst resources and has discovered and documented numerous new caves, new cave passages, and unknown endemic cave species. Dale has developed a vast network of contacts within the cave and karst community, and he has earned a great deal of respect from that community for his experience and wisdom dealing with multitude cave and karst issues.

During the past several years, Dale has been managing a number of cave inventory projects and has directly helped parks develop cave management plans. Dale holds a BA degree in geography from Texas State University (1974)."

Program Update

Submitted by Dale Pate, Cave & Karst Program Coordinator

I was recently selected as the National Cave and Karst Program Coordinator within the Geologic Resources Division, Natural Resource Stewardship and Science. This is a tremendous opportunity and a great responsibility as we move the cave and karst program forward in the National Park Service. Please note the title as a coordinator. I have no park and no resources that I am directly responsible for. My position is to help all parks and regions that have cave and karst resources to identify, understand, and manage their resources in a manner that will conserve and protect them while providing quality education, interpretation, and recreational opportunities to the visiting public. With that said, notice that I also stated "as we move the cave and karst program forward". The success of the program depends on a high-level of communication, cooperation, and collaboration between everyone who has an interest and a stake in the cave and karst resources managed by the National Park Service (NPS).

Strategic planning for the program for FY2013 and for FY2014-1018 is now underway. One of the key items that will be focused on in the next few years will be park Foundation Documents that are to be prepared for all NPS units by the end of 2016. Upon initiation of this new planning process, a news release stated "The basic building block of the portfolio is the foundation document, which describes a park's purpose, significance, fundamental and important resources, and interpretive themes." We will be working at a national level to make sure that cave and karst and other geologic resources are included as "fundamental and important resources" into these documents.

Cover of the updated and printed, trifold "Discover National Park Caves" brochure. This brochure lists NPS units with cave tours and useful websites.

Part of the long-term planning for the program is to integrate karst more fully into the program. Initial efforts in cave and karst management in federal agencies over the last 35 years focused mostly on cave management with karst being added at a later date. Karst management and scientific studies have increased in recent years, but there is still a long ways to go. Karst is still an unknown term to many and there are many unknowns in NPS karst landscapes, particularly recharge areas and flow paths. And of course, there are still many, many miles of unexplored cave passages to explore and document, numerous ecosystems we know little to nothing about, and a host of other unknowns. And with civilization encroaching into many areas at a seemingly faster rate and in order to conserve and protect cave and karst resources, it becomes more and more critical to know more and more every day and to apply that knowledge in careful management of these resources.

DISCOVER NATIONAL PARK CAVES
This summer we had the opportunity to print 4,000 copies of this brochure first recommended by Bonny and Andy Armstrong and developed by Andrea Croskrey for the 2009 Congress of Speleology held in Kerrville, Texas. Half of these brochures have been sent out to 18 parks so far and early indications are that this will be a useful and successful brochure. Copies of this brochure are still available for interested parks and we will have the print files available soon for parks that may want to print larger amounts. We may also be able to collect money to have a group printing to reduce cost per copy. Please contact me if interested and "thanks" to Bonny, Andy, Andrea, and Jim Wood (Geologic Resources Division) for making this happen.

You can reach Dale at 303-969-2635, or dale_pate@nps.gov.

Sample of the map in the center of the "Discover National Park Caves" brochure.

Reports From the Field

New Species Found in Caves of Great Basin NP

Submitted By Gretchen Baker, Ecologist, Great Basin National Park

Researchers on a biota trip to Lehman Cave in Great Basin National Park in April 2009. NPS

Five new species of flies in Great Basin National Park have recently been identified and named. These flies were all found in caves and mines and are in the family Phoridae, or Phorid flies. These flies, when threatened, often run across a surface rather than fly away, hence the other common name: scuttle flies. About 4,000 species of scuttle flies are known in 230 genera. They are tiny, only 0.5 to 6 mm in length, and hump-backed.

Dr. Henry Disney from the United Kingdom, a specialist in Phoridae, was the lead taxonomist, and cave biologists Steven Taylor, Michael Slay, and Jean Krejca assisted with the publication in Subterranean Biology.

The five new species fall within two genera: Aenigmatias and Megaselia, with the latter composed of a huge number of species from around the world. The new species are Aenigmatias bakerae Disney, Megaselia excuniculus Disney, M. krejcae Disney, M. folliculorum Disney, M. necpleuralis Disney.

All of the flies were collected in the twilight or entrance zones of the caves or mines. These areas had humidity ranging from 52.5% to 82.6%, which is higher than the average annual relative humidity of 43.8% at the nearby Mather Overlook weather station. This suggests that the flies may be using the caves and mines as a refuge from the drier above ground conditions. Additional study is needed to learn more about the life history of these particular flies.

Surveyors visited some of the sites only once for this inventory effort. The large number of new species from the limited sampling makes it likely that additional species remain to be discovered with more sampling effort.

To read the complete paper, please visit: http://www.pensoft.net/journals/subtbiol/article/2511/new-species-of-scuttle-flies-diptera-phoridae-recorded-from-caves-in-nevada-usa

Rock Fall Hazards in Lava Tubes at Craters of the Moon NM & Preserve

Submitted By John Apel, Integrated Resource Program Manager, Craters of the Moon National Monument & Preserve

One of the more complicated cave management issues the NPS continues to try to resolve at Craters of the Moon National Monument & Preserve is identifying and mitigating rock fall hazards in lava tube caves visited by thousands of people each year. Since the early years of Craters of the Moon National Monument (CRMO), the lava tube caves have been of keen interest to visitors to the Monument. Some of the first trails in the Monument are now known as the "Caves Trail" and this trail remains one the most popular in the Monument. The maintained trails largely end at cave entrances. Currently only five of the 300+ inventoried caves in the Monument and Preserve are open to recreational use. Since 2011, pre-screening and permitting of visitors by NPS staff is required to reduce the risk of introducing White Nose Syndrome.

A trail side exhibit in the parks displays the brittle nature of rocks in Craters of the Moon National Monument & Preserve. Photo by John Apel

Little documentation of concern about rock fall hazards in the caves appear in park records prior to 2000. In that year the CRMO geologist noticed several potential rock fall hazards in areas of lava tubes with high public use. It was unclear

how long the potential hazards had been present. Several experts with backgrounds in cave management and mine safety were consulted. Recommendations varied, in part due to varying perceptions of what risks were acceptable in a natural cave environment. Management responses ranged from complete closure of one cave, signed closure of portions of other caves and removal of hazards in several cases. New signing at the trailhead and each cave entrance emphasized the safety hazards associated with what are described as "wild caves".

Additional rock fall hazards in the five most popular caves have been identified in recent years. The CRMO Safety Committee discussed the issue and in August of this year a team of experienced cavers were asked to evaluate rock stability in regards to public safety. The team led by David Kampwerth (the U.S. Fish and Wildlife Service's Cave/Karst Coordinator based in Pocatello, Idaho) included members of the Bear River Grotto of the National Speleological Society. Guided by CRMO geologist Doug Owen, this team examined each of the previously identified potential hazards and conducted assessments to identify any other visible hazards. The team provided a report on options for each hazard including possible methods to eliminate the hazard by forcing the rock from their current precarious perches to a stable position on the cave floor. An interdisciplinary team of CRMO staff has now examined each hazard and the recommendations of Kampwerth's group to finalize a plan to mitigate the risk. These actions include removing the rock hazards in some cases and improving signing and/or barricades to warn visitors from entering high risk areas in some caves. Safe methods of removing rock fall hazards are still being developed on a case-by-case basis. Guidance on identifying safety hazards in caves and criteria to determine when to act will be incorporated into CRMO's new cave management plan expected to be completed in 2013.

For more information, contact:
John Apel
P.O. Box 29
Arco, Idaho 83213
Phone (208) 527-1350
Fax (208) 527-3073

Nationwide I&M Cave Ecology Framework Presentation Planned for the George Wright Society Conference in 2013

The George Wright Society (GWS) Conference gathers every two years to provide an environment for professionals involved in the study and management of protected areas to network and share experiences and research on a broad array of topics and disciplines. In their own words "The GWS conferences are all about reflection, reconnection, and renewal — a week of stimulating discussion about leading-edge research, innovative practices, and foundational values". The 2013 George Wright Society Conference on Parks' Protected Areas, and Cultural Sites will be held March 11-15 in Denver, Colorado. As a lead on one of the cave and karst protocol development teams from the cave and karst managers gathering in 2008, Gretchen Baker will be presenting on the progress of the cave and karst ecology work group at the 2013 GWS Conference. This, and hopefully other protocols from the 2008 gathering, will be shared in this newsletter and the NPS Cave and Karst Program website. The Title, Value Proposition, and Abstract of the planned presentation are included below. For more information about GWS 2013, please visit their website:

http://www.georgewright.org/gws2013

Title of Paper: Developing a Nationwide Inventory and Monitoring Cave Ecology Framework

Presenter: Gretchen Baker, Ecologist, Great Basin National Park

Value Proposition: Learn about a framework to inventory and monitor caves throughout the National Park System in a variety of cave types.

Abstract: In 2008 a meeting was held in Lakewood, Colorado to discuss how national protocols could be written to address a variety of National Park Service (NPS) units containing caves. A number of focus groups were created, and our group concentrated on cave ecology. With NPS caves varying from the longest in the world to only a few belly lengths, from significant nutrient inputs to virtually none, it was decided that one set of protocols would not be practical or desirable. Instead, we developed a Cave Ecology Framework that contains a decision-making tool NPS units can use to determine local cave biology and ecology inventory and monitoring priorities and needs. In addition, the Framework contains information from experts in the field and references protocols currently being implemented in the NPS. This Framework is near completion and additional reviewers, particularly those that might use it, are being sought.

Implementing a New Cave Monitoring Protocol at Lava Beds and Oregon Caves National Monuments

Submitted By Katrina Smith and Shawn Thomas, Biological and Physical Science Technicians, Lava Beds NM

New to the Klamath Network Inventory and Monitoring Program this summer is the implementation of the Integrated Cave Entrance Community and Cave Environments Long-term Monitoring Protocol. These established vital signs have been selected for long-term monitoring at two parks within the network: Lava Beds National Monument (LABE) and Oregon Caves National Monument (ORCA). The goal of this protocol is to create a long-term dataset that enables the Klamath Network to monitor the status and analyze trends of several cave parameters to determine the health of its cave resources and support future management decisions.

To accomplish this effort, seven parameters were chosen for monitoring, including cave meteorology, ice and water levels, human visitation, entrance vegetation, bat populations, scat deposition (nutrient input), and cave invertebrates. Each of these parameters has its own standard operating procedure (SOP) and schedule for data collection. Every other year, during the summer, one seasonal technician will work with field leads at each park to conduct semi-annual surveys for scat, invertebrates, and entrance vegetation, in addition to collecting summer data on water levels, cave climate, and human visitation. Each respective park will be responsible for maintaining monitoring of parameters that are surveyed during the winter, including bat populations and ice levels, as well as collecting data on parameters that are monitored annually or continuously.

At LABE, 124 monitoring sites encompass 31 caves to emphasize spatial balance and randomization while also focusing on the significant bat and ice resources within the monument. At ORCA, 27 sites exist between Oregon Cave and another small cave.

Within each cave, entrance, middle, and deep zones were established for monitoring the gradients of climate, scat, and invertebrates with respect to light availability and surface connection. Climate is also measured on the surface above each entrance zone so that its variation may be linked to changes in cave climate. For caves that have multiple entrances, a single entrance was chosen as the "main entrance" and designated for both the entrance zone location and the entrance vegetation surveys. Visitation is measured in all caves, either by infrared trail counters or sign-in cave registers, while bat populations along with ice and water levels are only measured in caves where these parameters are present. Oregon Cave, a significant and extensive tour cave that dominates the cave resources of ORCA, is an exception to the three zone strategy and instead contains a heavy concentration of monitoring sites to provide coverage of the main and off-trail tour routes as well as wild sections that receive little to no visitation.

Though many of the SOPs were field tested as part of a 2010 pilot study, the invertebrate and vegetation parameters were not fully implemented at the time. Therefore, complications with these SOPs became apparent during the first field season, which led to some creative problem-solving opportunities for the field crew. For example, we discovered that the traditional ground-based point transects used for vegetation monitoring do not translate very well to the cave environment, where the majority of the vegetation is often established on the walls or ceiling near the dripline, instead of on the floor. Also, due to the spacing of the point drops, rarely did the transects incorporate ferns and other unique herbaceous plants growing in very small numbers within the entrance microclimate. As no established alternative sampling method could be found that would address these problems, we instead decided to focus on monitoring the moss, lichen, and algae that cover the floors and breakdown blocks within the entrance.

A dead banana slug was discovered during a scat survey in Oregon Cave. The array of fungus radiated out a foot in diameter from this huge nutrient input. NPS Photo by Emily Ring

During invertebrate survey trials, we battled with a hungry opponent at LABE. More often than not our efforts to set baited invertebrate plots were foiled by what we assumed to be rodents (based on the suspicious scat left on and near the traps) stealing the bait and leaving us to survey areas nearly devoid of invertebrate life. Even hardware cloth cages secured with heavy rocks did not deter these critters, so we were forced to come up with a new plan to bypass the ingenuity of these trogloxenic rodents. The next set of trials will employ wire mesh tea balls filled with bait and anchored to the ground; hopefully this method will produce more positive results while streamlining the ease of placing and removing bait stations.

Despite these challenges, the implementation of this protocol marks a major step in the development of one of the most comprehensive peer-reviewed cave monitoring protocols in the NPS. With the initial field season winding down, the protocol will continue to undergo some modifications in response to methodological successes and failures from this year. The startup of a new protocol is always a significant endeavor, and a great deal of work lies ahead in terms of refining procedures and completing extensive documentation of field sites. Within the next year, though, the Klamath Network's cave monitoring protocol should be complete and ready for a rotating set of field crews to keep running it in perpetuity. Many of us are excited to check back in 10 or 20 or 50 years to find out what the data can tell us about the health of our cave ecosystems at Lava Beds and Oregon Caves.

For information on the Klamath Network and the new cave monitoring protocol, please visit http://science.nature.nps.gov/im/units/klmn/index.cfm

Cave and Karst Related Websites

Complied By Andrea Croskrey

As emails and announcements have been sent since the last issue of *Inside Earth*, I've been saving interesting websites to share in this issue. Some are papers and newsletters, others are interesting news articles. All in all, some good cave and karst related reads. Enjoy!

Newsletters

The Appalachian Cave Conservancy provides cave stewardship in SW Virginia and Eastern Tennessee. Their May 2012 newsletter discusses the acquisition of Gilley Cave in Virginia. The provided link opens a 4 page PDF: http://www.acave.us/Newsletter2012.pdf

Publications

Summarizing 10 years of work in the Guadalupe Mountains, Peggy and Art Palmer published "Petrographic and isotopic evidence for late-stage processes in sulfuric acid caves of the Guadalupe Mountains, New Mexico, USA" in the International Journey of Speleology. The PDF is available online at: http://scholarcommons.usf.edu/ijs/vol41/iss2/10/

With the cooperation of the USFWS. the USGS prepared a literature synthesis and annotated bibliography of about bats and wind energy. Open-File Report 2012-1110 summarizes 36 article on the subject which were written between 1996-2011. http://pubs.usgs.gov/of/2012/1110/

The USGS worked in cooperation with the National Park Service to mist-net bats in El Malpais National Monument and surrounding area. The results of this effort are recorded in Open-File Report 2012-1097 "Surveillance for White-Nose Syndrome in the Bat Community at El Malpais National Monument, New Mexico, 2011" by Ernest W. Valdez. Download a PDF of the report at: http://pubs.usgs.gov/of/2012/1097/

Websites

The Edwards Aquifer Authority has created a website to provide information about and highlight the Edwards Aquifer Habitat Conservation Plan (EAHCP). The EAHCP is under review by the USFWS as a plan to safeguard the threatened and endangered species whose only known habitat is springs fed by the Edwards Aquifer http://www.eahcp.org/

Scientific American posted an article about a 2012 underground tsunami that was caught on video at Devils Hole, a collapsed cave, where the endemic pupfish live. http://www.scientificamerican.com/article.cfm?id=earthquake-at-devils-hole&WT.mc_id=SA_CAT_EVO_20120402

White-Nose Syndrome A coalition of the USFWS and it's partners created a website to consolidate efforts related to White-Nose Syndrome http://whitenosesyndrome.org/

Press Releases

New Family of Spider In August, the California Academy of Sciences had this news release: "New Spider Family Discovered from Cave in the Pacific Northwest" http://www.calacademy.org/newsroom/releases/2012/trogloraptor.php

Park Updates

Buffalo National River

Submitted by Chuck Bitting

With most of our caves closed to recreational caving because of the threat of WNS, there is nothing to report on that front.

We continue to support a very limited amount of scientific inquiry into karst resources.

Cave Research Foundation continues to do WNS detection surveys at a few caves, and is continuing to do mapping.

The Nature Conservancy and several nationally recognized cave biologists recently completed surveys in two caves for an endemic species of cave adapted harvestman of the genus *Crosbyella*. The surveys indicate numbers appear to be stable.

CRF recently discovered the gate to the Beauty Entrance of Fitton Cave had been breached. We did emergency repairs to the gate the following week.

We are working with USFWS to better understand torpor bouts of the Gray bat (*Myotis grisescens*) as part of the WNS research being sponsored by USFWS

One of the smaller sections of Munchkinland, a huge room discovered this May in Lechuguilla Cave. Note the caver on top of the large piece of breakdown for scale. Photo by John Lyles.

Carlsbad Caverns National Park

Submitted by Stan Allison

Park Staff Changes

Since the last issue of Inside Earth, Dale Pate, Cave Specialist, has moved on as the National Cave & Karst Program Coordinator for the National Park Service in the Geologic Resources Division based in Denver, Colorado. Dale worked at Carlsbad Caverns for over 20 years and was the driving force behind many activities that greatly improved cave & karst management at the Park and elsewhere. The early years of Dale's work at Carlsbad Caverns National Park were challenging times, but Dale was able to make many improvements. Dale was responsible for bringing modern cave survey standards to Carlsbad Caverns National Park. Dale was able to steer both Carlsbad Cavern and Lechuguilla Cave survey and exploration in a much more positive direction and greatly reduced the impact to both of these caves during his tenure.

Dale was very active in the development of the 1996 General Management Plan for Carlsbad Caverns National Park and the main driver for the 1996 and 2006 Cave & Karst Management Plans in addition to the Carlsbad Cavern Protection Plan. All of these plans were appropriately done with NEPA compliance. These plans have resulted in a great reduction of impacts on cave and karst resources. In particular Carlsbad Cavern has benefited from the redesign of the parking lots to include oil & grit separators, the rehabilitation of the Bat Cave Parking lot and the removal of a Mission 66 six-plex. Thanks for all of your many contributions to Carlsbad Caverns National Park, Dale and best of luck in your new position!

With Dale's departure, Stan Allison has been Acting Cave specialist. Tom Bemis has made a Michael Jordan like move and come out of retirement to assist with the Cave Resource Office three days per week. A permanent Cave Technician is in the process of being hired and the Cave Specialist position is planned to be hired in the future. Hopefully by the end of 2013 the Cave Resources Office will have three permanent employees.

Lechuguilla Cave Exploration, Survey & Cartography

With fewer staff to coordinate activities, there has only been one full expedition to Lechuguilla Cave this year. From May 5-12, Derek Bristol led a team of 10 to the Western Branch. James Hunter and Derek spent the week climbing the Kansas Twister, a 410 foot climb that eventually popped up into the second largest

room in Lechuguilla Cave, which was named Munchkinland. Munchkinland is over 600 feet long and average passage width exceeds 100 feet, while average passage height exceeds 120 feet. The room was named because people in pictures of the area look like munchkins in comparison to the huge passage.

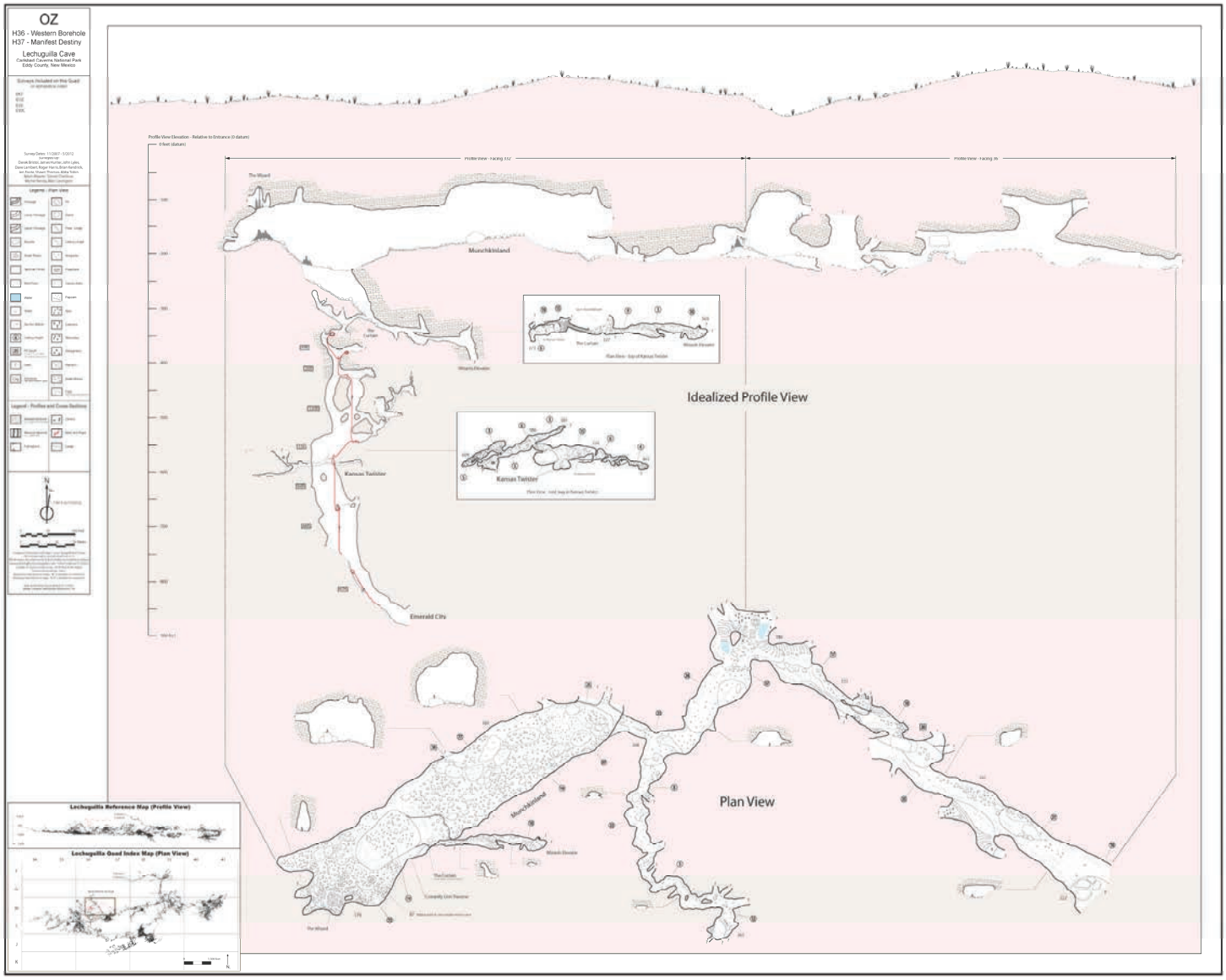
In addition to the large passages numerous other interesting features were discovered in Oz. Extensive weathering has taken place in many passages resulting in fascinating sediment floors with extensive deposits of blue endellite clay. Flowstone, stalactites and cave pools are also abundant in certain areas. Airflow is present in the area and there is a large tray formation in the area. The Oz area is at the same level as the top of Boulder Falls and is very high in the stratigraphy where there hasn't been much cave found in the past. Approximately one mile of cave has been surveyed in Oz so far and many large walking leads, pits and dome climbs remain. Oz has already extended the plan and profile footprint of the cave and two large walking passages leads are heading north away from known cave. Derek Bristol has drafted a beautiful map of the Oz area which won a blue ribbon at the 2012 NSS Convention Cartography Salon.

While the main part of the Kansas Twister Dome is 410 feet, it is possible to drop a rock from the highest rigging point and have it fall 530 feet to the bottom of a talus slope in Emerald City. This is the deepest pit known in Carlsbad Caverns National Park and the Guadalupe Mountains.

John Lyles is leading a team to the Far East and Max Wisshak is leading a team to the Far West in November.

Spider Cave Exploration, Survey & Cartography

Chris Amidon led a survey trip to work on resurvey close to the Spider Cave en-



Derek Bristol's map of the recently discovered Oz area in Lechuguilla Cave. This map was entered in the 2012 National Speleological Society Cartography Salon's Experienced Category and won a Merit Award. Map by Derek Bristol.

trance in March, 2012. Pushing a series of squeezes with airflow, Chris and team found themselves in a walking passage going both directions. A return trip through these squeezes called the Widow Makers wasn't made until September when Paul Burger led three trips with Chris Amidon and Stan Allison to continue survey in this new area. Over ½ mile of cave has been surveyed so far beyond the Widow Makers including the largest known room in Spider Cave which is over 200 feet long 40 feet wide and 15 feet tall. One end of the room has a spectacular calcite decorated area and the other side of the room continues in two large walking passages that have yet to be explored. An estimated 100 leads remain to be explored and although most of them are typical Spider Cave crawls, there are a few walking leads. The new area which is tentatively being called Gilead has extensive gypsum deposits with gypsum flowers and gypsum needles in addition to extensive flowstone areas and pools. In general the area is heading north in a series of east/west parallel passages. These new discoveries bring the length of Spider Cave up to 4.3 miles of cave. Paul Burger has drafted a beautiful map of all 4.3 miles of cave.

Carlsbad Cavern Restoration

Pat Jablonsky led her annual lint camp to Carlsbad Cavern which resulted in 31.5 pounds of lint removed by 16 volunteers in 268 hours. From 1988-2012 Pat's lint camps have resulted in 415.5 pounds of lint removed by 354 volunteers working a total of 7,387 hours. Thanks for all of your excellent work Pat! CRF continues their excellent work in performing various restoration projects led by William and Tammy Tucker.

Cave Research Activities

Two recent publications involving cave & karst research at Carlsbad Caverns National Park. The November issue of Geology contains an article titled: "Climatic backdrop to the terminal Pleistocene extinction of North American mammals" by Victor J. Polyak, Yemane Asmerom, Stephen J. Burns, and Matthew S. Lachniet. This paper provides evidence that terminal Pleistocene animal extinctions in the southwestern USA may have been in large part due to climate change. Using data from shelfstones in the Big Room of Carlsbad Cavern, a stalagmite in Fort Stanton Cave the authors present evidence of a severe ~1,500 year long drought at the Pleistocene terminus from 14,500 years ago to at least 12,900 years ago. This drought was only briefly and mildly interrupted by the Younger Dryas. Most of the shelfstone dates in the Big Room were from 14,000 to 25,000 years ago which was interpreted as the pools being full to the brim during the last glacial period.

The July 2012 issue of International Journal of Speleology includes an article titled: "Petrographic and isotopic evidence for late-stage processes in sulfuric acid caves of the Guadalupe Mountains, New Mexico, USA" by Palmer M.V. and Palmer A.N. This paper focuses on the latest transition of Guadalupe Mountain caves from H_2SO_4 speleogenesis to processes dominated by CO_2 equilibria. The authors employ microscale petrographic mapping to document the complex geochemical evolution of the hypogene caves of the Guadalupe Mountains. This paper does not assign specific dates to geochemical events, but rather attempts to provide information that can help determine the genetic history of these caves. The authors hope that this information can be used in the future to improve the efficiency of numerical dating and paleoclimatology in addition to defining diagnostic features in other sulfuric acid caves.

Upper Dry Passage in Silver Creek Cave, Grand Canyon National Park. NPS Photo.

Craters of the Moon NM & Preserve

See the 'From the Field Report' on rockfall hazrads submitted by John Apel on page4.

Grand Canyon National Park

Submitted by Steven E. Rice

An inventory trip to the North Rim of the Grand Canyon was accomplished August 23-26, 2012. The caves visited were Shorty Cave and Silver Creek Cave. Participants included Steve Rice, Graham Schindel, Cynthia Valle, Jason Ballensky, Andy Armstrong, Bonnie Armstrong, David Harris, and Garrett Jorgensen. The caves have streams and feed into Bright Angel Creek so the group looked to finish exploration of the caves' extent and install and maintain logging equipment.

On the way to the trailhead on August 23rd, Steve, Graham and Cynthia installed water level logging equipment at Robber's Roost Spring. It is hoped that this equipment will help determine how quickly the spring responses to precipitation events as this spring has been observed discharging from several hundred gallons per minute to almost no flow. On the 24th the pressure transducer gage at Emmett Spring was checked, found to

Bonnie Armstrong manages a smile while exiting the cold, wet, and shredding entrance crawl of Silver Creek Cave. August 2012. NPS Photo.

be in good shape and the data downloaded without issue. Unlike the majority of springs in the park, Emmett Spring has a single large rectangular entrance which makes it ideal to gage and record flow. Then Shorty Cave was entered to place a register and evaluate the potential of a survey project since the cave doesn't have a map. Flow and water quality measurements were taken on Bright Angel Creek.

On the 25th the group headed to Silver Creek Cave and Angel Spring. The spring discharges from the Muav Limestone along solution enhanced bedding planes. After a nasty entrance crawl, a register was placed in Silver Creek Cave. One team tried to find a continuation to the cave passages while two other teams surveyed and installed a gage to monitor flow levels and water temperature. A little continuation to the cave was found but no major breakthroughs. The survey team added 266ft to the length of the cave. The third team was able to take some pictures in addition to installing the gage.

The group hiked back to the cars and chips and cookies without incident on the 26th to wrap up a productive trip.

Grand Canyon-Parashant NM

Submitted by Eathan McIntyre

This year's cave report reflects the first year here at my position here at Parashant NM as I have started in April 2011. It has been a great experience being able to do meaningful cave work. To begin with, a large portion of my work was to resume the work of my predecessor Kyle Voyles, who was instrumental in developing a program for the unique cave resources of Parashant. I've begun cave inventories, packrat midden dating, cave meteorology, and bat hibernaculum studies along with assembling a WNS protocol, Cave database, and a draft Cave Management Plan.

Cave Education Exhibit

I've designed a Cave Exhibit which was constructed by our handy volunteers, Tom Parkinson and Pete Kerns. This exhibit is now being directed by our interpretive staff, Amber Franklin, who has added numerous props and décor to enhance the educational experience. This exhibit has turned into a huge hit and we've been able to showcase it at local venues such as Junior Ranger Day, Get Outdoors Day, and at Bryce Canyon National Park-geology festival. Amber is currently adapting the exhibit into a traveling exhibit which will bring a "Parashant Cave Experience" to schools and parks to encourage youth and cave education. Amber has also developed a K -12 curriculum that can be used to create lesson plans in tandem with the exhibit.

Radon Monitoring

The radon monitoring in Parashant caves is still in its preliminary phase with sampling done in a few caves. Using OSHA and EPA guidelines, I am able to calculate the "Working Level Month" limit for radon exposure (Typically 170 hours per month at 200 pCi/L). For PARA2204 Cave, values ranged from 0 to 95 pCi/L over a 24hr period.

In PARA2602 Cave, the results also indicated an elevated range of radon levels from 7 to 64 pCi/L over an 8hr period. Even with these elevated radon levels, the exposure is still within acceptable range largely due to the limited time personnel actually stay within the cave environment.

Overall, my 2012 projects will continue to progress including 3D cave survey for thermal modeling in PARA2204 Cave, August 2012, and cave gating at PARA0901 Cave taking place FY2015 or sooner.

Up and Coming Plans

Fall 2012: White Nose Syndrome soil sampling in 10 caves
Winter 2013: Bat Hibernaculum counts, Paleontology inventory in PARA3504

Caverns, 14 weeks, Cave Leads Ground-truthing and Inventory

Spring 2013: Cave Microbiology sampling

Fall 2013: Maternity Roost habitat Characterization with Thermal Modeling

Great Basin National Park

Submitted by Gretchen Baker

July 2012, park staff entered Model Cave to download data loggers and check water levels. The water level typically rises during snow melt so that most of the cave is inaccessible. Because this high water level was anticipated, the staff were surprised to not find water where it had been expected and were able to crawl through the muddy passages. Eventually a sump was reached and park ecologist Gretchen Baker saw Model Cave amphipods, known only to that cave, in the water. She showed the amphipods to two park interpreters that were on the trip and as they were looking, a four-inch pale fish came to the surface. They took several photos of the fish, which was later identified as a brown trout.

Pale brown trout found in Model Cave. NPS Photo.

The Grand Canyon-Parashant National Monument Cave Exhibit was designed by resource management, built by volunteers, and directed by interpretive staff. NPS Photo

Jewel Cave National Monument

Submitted by Rene Ohms

Jewel Cave has experienced significant elevator problems this year. Most of the issues seem to be related to a major lightning strike in July. The cave has been closed on and off for several days or weeks at a time, as repair technicians and the power company work toward a resolution. Tours and caving trips have been canceled as a result, creating frustration for both visitors and cavers. It is hoped that the elevators will be fixed shortly and will remain reliable.

A new caving permit system was adopted at Jewel Cave in spring of 2012, which incorporates a trip-by-trip risk assessment based on the principles of operational leadership. Although there is room for improvement, so far the system seems to be working well. Trips are evaluated on objective risk criteria, including team experience, medical and SAR training, nature and duration of the proposed trip, and distance from the entrance. The benefits of the trip to park management are also evaluated and assigned a score.

In March, rescue pre-planning for the black & blue taped trail between the end of the Mind Blower and Cloud Nine was completed. During the pre-planning process, rescue obstacles such as tight constrictions, vertical drops, or delicate areas are identified, and the gear, anchors, techniques, and time required to move a patient through the obstacle are determined. Pre-planning has now been completed for the Wild Caving Tour, the Hub Loop, and from the Target Room to Cloud Nine.

In October, the monument received several original pencil draft maps from Jan Conn, which had been stored at her home near Custer for the last 50+ years. The maps are not only fascinating to look at, but they contain some passage names and lead notations that had been lost in subsequent map updates. Dan Austin is working on adding these notes to the current digital map. Once this is done,

Before and after shot of restoration done in the historic part of Jewel Cave. NPS Photo

the maps will be accessioned into the park's museum collection. The digitization of the Jewel Cave map has been completed, and the entire cave is now in Adobe Illustrator. The map is kept up-to-date after each survey trip.

The historic area restoration project continued this year, and is on track for completion in 2013. The restoration crew has made significant progress over the last 3 summers, and has greatly changed the appearance of the Heavenly and Dungeon tour routes. Dust, lint, and candle wax have been removed from the cave, revealing crystals and colors that were previously buried. Several tons of material have been removed, mostly old fill that had been used to level out the floor, and the cave looks and feels a little more "cavey" now.

The visitor center is being remodeled next spring, and will have brand new exhibits by the time the summer 2013 season begins. The exhibits include a "fake cave," with realistic nailhead spar walls, a cave crawl through, information on current research and geology, plus exhibits on surface resources and their connection to the cave.

Lee-Gray Boze left Jewel Cave in early June, to take a job with the USGS in Menlo Park, California. It is not anticipated that the term position he vacated will be filled. Kelly Mathis remains in a term position at JECA, working primarily on the historic area cave restoration project.

Despite the elevator issues, there have been several exploration trips in Jewel Cave since the last issue of *Inside Earth*. The current surveyed length is 162.13 miles. Two 4-day camp trips (one in April and one in July) pushed the southern boundary of the cave, and a significant extension with strong airflow was discovered. It is hoped that cavers on the next trip will find their way across the "line" that seems to stop the cave in that direction, and find a breakthrough with larger passage.

Lava Beds National Monument

See the article on new cave monitoring protocol for the Kalamath I&M network on page 6.

Oregon Caves National Monument

See the article on new cave monitoring protocol for the Kalamath I&M network on page 6.

Timpanogos Cave National Monument

Submitted by Cami McKinney

Water-tracing, Groundwater and Geochemistry Investigations

Water-tracing and groundwater investigations were conducted during 2012, at Timpanogos Cave National Monument (TICA), to help National Park Service (NPS) Resource Managers understand the scope and characteristics of the contributing watershed, which may extend outside the NPS boundaries and into the adjacent U.S. Forest Service. Water in TICA is seasonally restricted to five primary sites (Hansen Lake, Middle Lake, Cavern of Sleep, Hidden Lake and Soda Pop Pit) and the sheet-flow and drip waters that contribute to these pools. Water levels in Hansen and Middle Cave Lakes are strongly tied to the spring snowmelt and precipitation. In contrast, water levels in Cavern of Sleep and Hidden Lake remain relatively constant.

One aspect of this study was qualitative dye tracing. On April 13, 2012, frozen 'bombs' of concentrated Eosine, Fluorescein, and Rhodamine WT were dropped at selected sites from a helicopter flown over the boundary between TICA and the National Forest. Activated charcoal receptors placed in the five principle cave pools (Hansen Lake, Middle Lake, Cavern of Sleep, Hidden Lake and Soda Pop Pit) and the American Fork River downstream of TICA were replaced each week and analyzed for the dyes. To date, dye has not been recovered from the sites,

Lower Level restoration project at TICA. Photo 1: staff and volunteers remove old fill dirt. Photo 2: the fill is gone but flowstone is still dirty. Photo 3: the resulting clean flowstone. Use the blue flag in the ceiling of the passage to oriented between the photos. NPS Photo.

although this is an ongoing investigation and further traces are planned for October 2012.

Concurrent with dye tracing, ten weeks of geochemistry data suggest differences among cave pools and the American Fork River. The pH values for all sites display a downward trend over the course of the study. The American Fork River maintains the lowest SpC. Values of SpC at Hansen Lake are consistently lower than the other pools. Temperature data from Hansen Lake are stable and 0.5 C° lower than data from Cavern of Sleep and Hidden Lake, potentially illustrating a difference in source waters. Interestingly, Middle Lake warms 0.5 C° during this study from that of Hansen Lake to that of Cavern of Sleep, which perhaps indicates a shift in recharge from melt water to that of phreatic groundwater.

Lower Passage Restoration

Restoration work in Timpanogos Cave's Lower Passage continues for the fourth year. The last three years have seen trail removal, artifact documentation, and speleothem restoration. To date, over 300 pounds of man-made material has been removed, much of it in small fragments. Utilizing staff and volunteer labor, the project has moved into its final, clean-up phase. Much effort has been concentrated on restoring flowstone floors that were covered with silt and cobbles during trail construction in 1922.

The final phases of the project will include bridge removal, restoration of natural water flow to the uncovered flowstone, and speleothem reattachment. In October, the first-ever Timpanogos Cave Restoration Camp will focus on this area. For the future, a project to remove blast rubble fill from Lower Passage is in the planning stages.

Cave Management Plan

After two years, the TICA Cave Management Plan is near releasing. Park staff presented the findings to the IMR Re-

gional Director John Wessel's and other regional staff members in May. The group approved of the plan while asking for greater attentions to be made to safety concerns inside the cave. After more than two years, the plan will be released to the public later this year.

Wind Cave National Park

Submitted By Rod Horrocks

Projects

We recently completed the two-day Wind Cave portion of the Black Hills Cave Restoration Camp (8/27-28/2012), where we removed 801 pounds of debris from two areas along the tour routes; in the Eastern Star Room along the Garden of Eden Tour Route and in the Cathedral along the Natural Entrance Tour Route. This included 648 pounds of rotting wood, 138 pounds of asphalt, and 15 pounds of lint, hair, and dust.

Research

South Dakota School of Mines and Technology geology student, Everett Brill, completed his senior geology research project this last spring to study stream cobbles in Wind Cave. This project revealed that there was once a flowing stream in the bottom of Wind Cave Canyon and that at least three paleo entrances into Wind Cave had opened up and closed over time. The stream-worn cobbles were washed into the cave during flood events after wild fires, which also washed in sand, organic debris, insects, charcoal, and silicified siderite concretions. Everett found that the cobbles had originated from two sources, the stream bed in Wind Cave Canyon and from Tertiary gravels that cap the surrounding ridges and terraces.

Dr. Andreas Pflitsch is continuing his research on the barometrically breathing caves in the Black Hills. He is currently conducting more in-depth monitoring of the breathing well on the Lady C Ranch, which appears to be connected to Wind Cave. The well is located 4/10 of a mile south of the park or 1 ¾ miles straight line distance from the Southern Comfort area of Wind Cave.

Dr. Art and Peg Palmer just finished their field work for a joint project with Jim Paces and John Stamm from the USGS to date and analyze calcite wall coatings in the Lower and Middle Levels of Wind Cave. Jim is now continuing his portion of the work to radiometricly date the various layers found in the wall coatings from the top of Boxwork Chimney down to Calcite Lake. It is hoped that this project will provide a history of the water table fluctuations in Wind Cave as well as the chemical and climatic environments at the time that those coatings were deposited.

Personnel:

Mathias S. Oppolzer, from Humboldt-University in Berlin Germany, recently started his three-month internship at the park in September. He is conducting a cave temperature research project with Dr. Andreas Pflitsch as well as helping the park's Physical Science staff with on-going projects. He will complete his internship on 12/4/2012.

Dan Austin, an employee of Jewel Cave National Monument will be assisting the Physical Science office at Wind Cave for two days a week for the next six months (October-March). One of the projects he will be assisting with is the next generation of the Wind Cave digital map. This version will be different from the 2009 digital map as it is being drawn at 20'/inch instead of 50'/inch and will be divided into seven levels instead of three. To date, 9 ½ quads (which cover 1,000' x 1,500' ea.) out of a total of 21 quads have been completed.

The park will be announcing a Physical Science intern position for the summer of 2013. Housing and daily expenses will be provided for this position. Applications may be emailed or sent to the park by December 1, 2012 to the following addresses:

Rod_Horrocks@nps.gov
or
Wind Cave National Park
Attn: Rod Horrocks (2013 intern position)
26611 US Highway 385
Hot Springs, SD
57747

Cave Management Plan

Since the last reported length of the Wind Cave survey in *Inside Earth*, cavers have increased the length of the cave by 1.49 miles; establishing the current length of 139.17 miles. Although the Wind Cave survey is currently the fifth longest cave in the world, it is anticipated that it will drop in the list to sixth shortly, possibly by the time this is published.

We have partially ridgewalk the newly acquired Casey property for cave and karst resources. Thus far we have found 3 caves, 17 rockshelters and 20 karst features on this 5,500 acre tract. One of the most interesting finds is a gypsum karst area with a short cave actually in the gypsum.

Mathias Oppolzer reads instruments, lower levels of Wind Cave. Photo by Peter Sprouse.

National Park Service
U.S. Department of the Interior

Cave and Karst Program
Geologic Resources Division
P.O.Box 25287
Denver, CO 80235-02787

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Editor
Andrea Croskrey

Article Contributors
Dale Pate
Gretchen Baker
John Apel
Katrina Smith
Shawn Thomas

Comments?
Write to:
Inside Earth
Geologic Resources Division
P.O.Box 25287
Denver, CO 80235-02787
Email or call:
andrea_croskrey@nps.gov
303-882-1115