



# CANYONS & CAVES

A Newsletter from the Resources Stewardship & Science Division

Issue No. 42

Winter 2009-2010



With a colder than average winter, the park had a number of snow days this season. (NPS Photo by Dale Pate)

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All issues can be downloaded as a PDF file from the park website  
<http://www.nps.gov/cave/planyourvisit/brochures.htm>  
Address: 3225 National Parks Highway, Carlsbad, New Mexico 88220

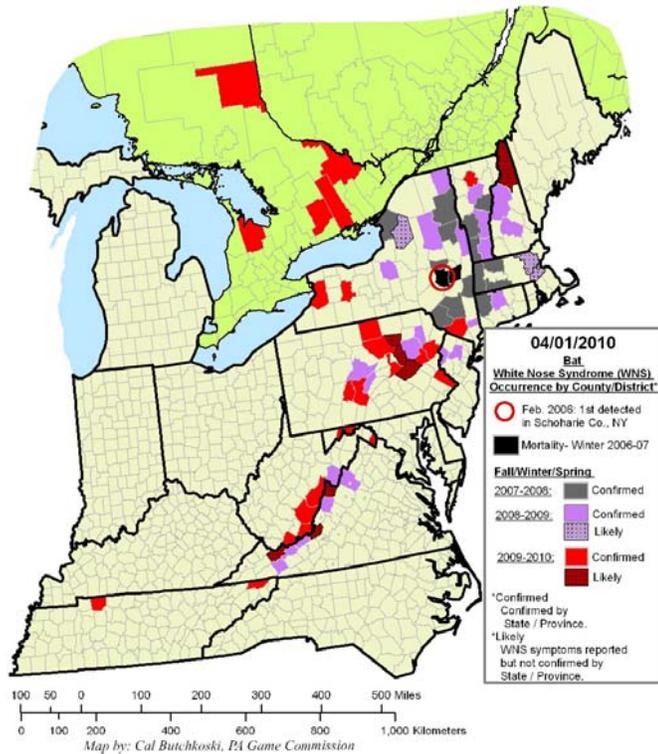
## RESOURCE NEWS

**COLD WEATHER** – Winter 2009-2010 has been colder than average this year. Based on records collected for the National Weather Service, the recorded high temperature for **December** was 66° F and the recorded low was 19° F; For **January**, the recorded high was 66° F and the recorded low was 15° F. For **February**, the recorded high was 67° F and the recorded low was 20° F. During this 3-month period, a number of storms produced 15.4 inches of snow.

**CONDOLENCES** to the family of Tim Stubbs, retired Fire Management Officer for the park. Tim recently passed away in Albuquerque.

**WHITE-NOSE SYNDROME (WNS) IN BATS** – Reports are only now beginning to surface concerning new locations of WNS in bats for this winter season. The outlook for hibernating bats remains very bleak. WNS has now also been confirmed in a hibernating bat in France, but it is unclear whether WNS has just recently been introduced to Europe or has been in Europe for many years. WNS has also been identified in several locations in Canada and in central Tennessee only about 80 miles from the Mammoth Cave area. It is believed that WNS is caused by a fungus that has been identified as *Geomyces destructans*. WNS has already killed hundreds of thousands of bats in the East and it is anticipated to continue to be spread by the bats themselves and possibly by people who have entered caves with WNS present. For those who may be visiting or working in caves of the park and the area, we ask that everyone follow the decontamination procedures for caving gear and clothing developed by the US Fish & Wildlife Service. If anyone has been in a cave that is known to contain WNS, please do not bring that gear or clothing to the park or the area. A quick reference to these decontamination procedures can be found at the following:

<http://www.fws.gov/northeast/whitenose/FINALQuickReferenceforDeconProtocolsforCaveActivityJune2009.pdf>



Map courtesy of Cal Butchkoski, Pennsylvania Game Commission.

## PROJECT UPDATES

*Dale Pate*

Infrastructure improvements at Carlsbad Caverns National Park continue to dominate the area around Carlsbad Cavern. The following is a summary of projects in progress or that will be implemented in the near future.

### COMPLETED PROJECTS

**REMOVAL OF MISSION 66 APARTMENTS** – The west pod of Mission 66 buildings was removed during the last half of February 2010. This pod consisted of 6 3-bedroom apartments built in the 1960's as part of the Mission 66 initiative to upgrade and provide better infrastructure for park units throughout the NPS. As with all structures in the vicinity of Carlsbad Cavern, these apartments with their associated water, sewer, and electrical lines were built directly on top of the cave. The Carlsbad Cavern Resource Protection Plan, completed in 2002, identified the Mission 66 structures as non-contributing to the Cavern Historic District and determined that the Mission 66 buildings were to be removed for the long-term protection of Carlsbad Cavern.



Demolition of the west pod of Mission 66 apartments began in early February 2010. (NPS Photo by Dale Pate)



A March 12, 2010 photo showing the demolition completed and the area awaiting revegetation. (NPS Photo by Dale Pate)

**CAVE RESTROOMS REHAB** – Needed for a long time, the restrooms in Carlsbad Cavern have been rehabbed. Both the Men’s and Women’s restrooms have been diminished in size and both are now located in the same (but separated) space that the women’s restroom had been located in.

**NEW BARRIER FOR LEFT-HAND TUNNEL** – A new stainless steel barred gate and barrier has been completed. The new structure was built immediately adjacent to the wooden barrier at the beginning of Left-Hand Tunnel. With this new structure in place, the wooden barrier has been removed. The wooden door with buckshot still imbedded from the lunchroom takeover with hostages in 1979 will be archived into the park’s museum. Thanks to Ruben Castillo for design and building the structure, Bill Garwood for running electricity to the site, Nash Armendarez for help with building the gate, and Stan Allison and Paul Burger for dismantling the wooden structure.

## PROJECTS IN PROGRESS

### **PARKING LOTS & ROAD IMPROVEMENTS** –

Following an Infiltration Study, completed in 1997, and the Carlsbad Cavern Protection Plan, completed in 2002, significant changes are finally being implemented to the three large parking lots visitors use when visiting Carlsbad Cavern. The two upper lots are being re-sloped to drain to the south where contaminated water runoff from the parking lots will be funneled through oil and grit separators before being released down the steep escarpment slope. Until now, parking lot runoff received no treatment and a portion of the upper lots actually drained to the north into Bat Cave Draw where contaminated runoff immediately sank into the bedrock directly above Carlsbad Cavern. The small paved area directly behind and north of the Visitor Center will continue to drain into Bat Cave Draw, but any runoff will also be funneled through an oil and grit separator before being released in the Draw.

Identified in the Infiltration Study as a significant contributor to cave contamination, the Bat Flight Parking Lot will receive the most significant changes. A bus turnaround and drop off point along with several restricted parking spaces will be relocated to the west end of this parking lot. A relatively level concrete walkway will provide easy access to the Bat Flight Amphitheater and the entrance to Carlsbad Cavern. The rest of the parking lot will have the asphalt removed and significant portions of the terraces will be revegetated with native plants. This parking lot is a part of the Caverns Historic District and as such the rock walls and terraces will remain mostly intact.

Following this work on the parking areas, Walnut Canyon Scenic Drive from the park entrance to the Visitor Center will receive minor reconstruction, particularly around all crossings of Walnut Canyon, scaling of potential rockfall on cliffs hanging directly over the roadway, and be repaved.



The Bat Flight Parking Lot with asphalt removed. (NPS Photo by Dale Pate)



This concrete walkway will give access for visitors using the restricted parking area to the Bat Flight Amphitheater. (NPS Photo by Dale Pate)

## UPCOMING PROJECTS

### **ELEVATOR SHAFTS SUPERSTRUCTURE**

**REHAB/REPLACEMENT** – Slated to begin in the fall of 2010, the superstructure steel beams will be replaced for the two passenger elevators. This process is expected to take 8 months or more to accomplish. The two remaining elevators will still be in use for ferrying visitors out of the cave.

### **TOTAL REPLACEMENT OF ELECTRICAL AND LIGHTING SYSTEM**

– Slated to begin in 2012, the entire electrical system, including lighting, will be replaced in Carlsbad Cavern. The current aging system has many deficiencies that will be corrected with this new system.

### **REMOVAL OF WOODEN STAIRCASE**

- The last wooden staircase still remaining in Carlsbad Cavern and found within the Main Corridor will be removed from the cave in the near future. Compliance work is in progress to document the remaining structure before it is removed. While the lower portion of the staircase is still in relatively good shape, the upper portion has succumbed to molds and mildew growth rendering the staircase totally unsafe for use. Additionally, the growth on the staircase is considered a health hazard a negative impact to the cave’s ecosystem.



The upper portion of the wooden staircase with molds and mildew growing on it. (Photo © Dale L. Pate)

## THE CABLE SLOT & THE MYSTERY ROOM

*Bob Crisman*

In a December 4, 2003 email message to Park Historian Bob Hoff, Bob Crisman sheds light on the Cable Slot located in the Mystery Room of Carlsbad Cavern.

*"Bob, you are correct on the location of the "Cable Slot". It is the vertical passage extending from the back of the Mystery Room, down into Lower Cave. I believe it was sometime in the 1940's when a large electrical cable was run from the Queen's Chamber, thru the Mystery Room, thru the Cable Slot into Lower Cave, then up to the Big Room. Its purpose was to provide two-way electrical feed to the Big Room for improved reliability. By the 1970's, when I returned for my second assignment at the Caverns, the cable had been abandoned. I helped remove the cable from the Mystery Room and Cable Slot, along with Harry Morrelli (electrician) and Thurman "Tooks" Ballard. I believe Jan Wobbenhorst was also on that night project with us, and possibly another person. It was a massive, heavy cable and a lot of work to get out. There was a lot of heated discussion on the best way to get it out."*



A 2002 photo of the Cable Slot in the Mystery Room. (NPS Photo by Jason Richards)

## AN UNFORGETTABLE SUMMER

*Jake Hemingway*

What is archaeology? When most people hear the term archaeology, the first thing that comes to mind is a man in a fedora hat with a pistol on one hip and a bull whip on the other. Archaeology is a systematic and methodical study of ancient history. Archaeologists analyze the past through the examination of cultural remains.

On June 21, 2009 a team of archeologists were brought into the park to begin an archeological inventory of Carlsbad Cavern. The team consisted of SCA Brigid Shaw, SCA Elle Harmon, and myself. We also had the privilege of having the seasonal geologist in the park Alex Cichon and Japanese intern Shun-go Tsunemastu join us in the field on occasion. Together we spent the summer field season locating, documenting, and assessing archeological sites. The main goal of the 2009 project was to gather accurate GPS data and update the existing database with comprehensive information.

The field work was done during the hottest months of the year and finding shade during midday was harder than finding a complete paleo projectile point. A Midland Point dating back 9,000 to 10,000 years ago was found in the field; however, shade was never located. It was rewarding to pass on archaeological knowledge to the crew members, even though Shun-go would sometimes pick up deer droppings mistaking them for artifacts. All in all, the crew gained valuable experience while contributing to the park's knowledge of archaeological sites.

Unfortunately we didn't locate the lost city of gold, crystal skulls, or Jimmy Hoffa, but what we did locate were archeological sites containing ring middens, rock shelters, rock art, historic campsites, and artifacts. The crew used information gathered in the 1940's and 1950's to relocate over one hundred sites. Twelve new rock shelter sites were also discovered. The locations of the sites were recorded using high precision Global Positioning Satellite (GPS) units. The archaeological database was updated and new site forms were generated. The information gathered on the sites visited will give the park better information of historic and prehistoric peoples. The park will therefore be better equipped to preserve and protect cultural resources.

The summer field work was a learning experience for all of us. Along with acquiring data, the crew also acquired a lot of bumps, bruises, and cuts. It didn't take long to realize that everything in the Chihuahuan Desert wanted to hurt us. Some of the insects looked like they came from another planet and wanted to sting or bite us every chance they got. I actually found a scorpion inside my shirt while getting ready for work. Nothing wakes a person up faster than a few scorpion stings first thing in the morning. The plants have evil names like cat claw, pincushion, and prickly pear. One crew member thought that there was a mountain lion behind every sotol stalk just waiting to pounce. And then there was one day when I was crawling into a small rock shelter that I came face to face with a rock rattlesnake. Regardless of the dangers, the Chihuahuan

Desert is a place of mystical beauty. After I leave, the vision of the sun setting over El Capitan will be forever in my heart.



The Archeology Team from left to right: Shun-go Tsunemastu, Brigid Shaw, Jake Hemingway, Elle Harmon and Alex Cichon. (NPS Photo)

This past summer I gained valuable experience while achieving park goals. My knowledge of southwest archaeology has grown tenfold. I learned how to process GIS information, maintain archaeological databases, manage museum collections, and supervise a field crew. I was fortunate enough to work with real professionals and was lucky to have such a great opportunity. Through archaeology I have learned the history and culture of a magnificent area. I learned a lot in the summer of 2009 and would not trade my experience for anything in the world.

## **2009 SUMMARY EXPLORATION & SURVEY CARLSBAD CAVERN, LECHUGUILLA CAVE & SLAUGHTER CANYON CAVE**

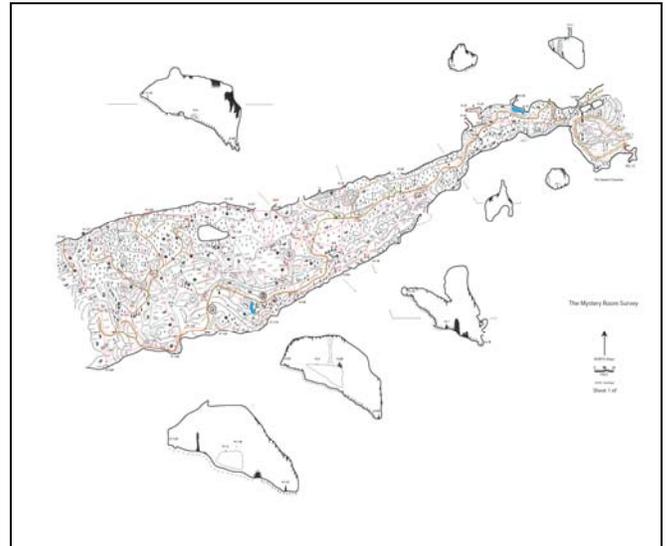
*Stan Allison, Cave Technician*

### **Carlsbad Cavern**

Exploration and survey continue at a steady rate in Carlsbad Cavern. The resurveyed length of Carlsbad Cavern is currently 28.6 miles or 46,027 meters. The official length of Carlsbad Cavern is 30.9 miles which is the length of the old cave survey. The old survey data contained redundant surveys that created an artificially high length statistic. 0.3 miles of new survey was accomplished in 2009.

The Cave Research Foundation (CRF) continued a resurvey of the Mystery Room along with survey in the New Section of Carlsbad Cavern in an area east of the Hall of the White Giant and another area adjacent to the Sand Passage. David Engel has been actively working on a digital map of the Mystery Room.

Dan Montoya and crew continued their work in the New Section including surveying a 110 foot deep pit connection from the Hall of the White Giants area to the Grand Ballroom area beneath the Guadalupe Room.



A plan view and cross-sections in the first half of the Mystery Room in Carlsbad Cavern. Drawn by David Engel.

### **Lechuguilla**

The survey of Lechuguilla Cave is now up to 128.6 miles or 206,961 meters. A total of 2.4 miles of new cave was surveyed in 2009. A total of 2.05 miles of resurvey was performed in order to correct survey errors and poor sketches in order to produce high quality maps. For 2009 there were five survey and exploration expeditions.

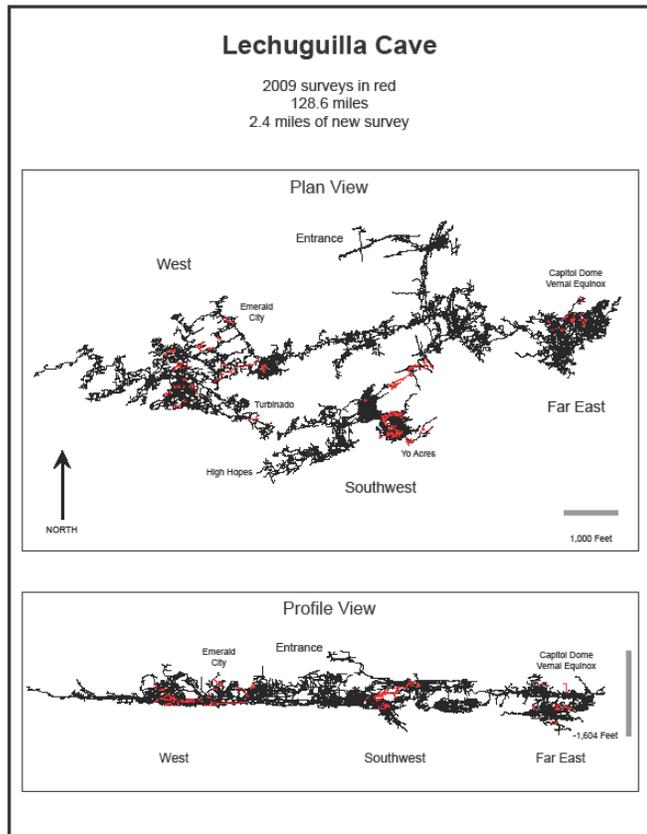
In March 2009, John Lyles led eight cavers to the Far East. A total of 0.44 miles of new survey was done on this 8-day camp. Less than 200 feet of resurvey work was performed. One team spent six days climbing the large dome at Mount Washington. A total elevation gain of 200 feet was accomplished in the dome climb. The dome was named Capitol Dome due to its shape. With only a short period of time to survey, the climbing team surveyed into a 40 foot diameter room with an 8-foot high ceiling in the final hours of the expedition. The room was found on the Vernal Equinox which inspired the name. The Vernal Equinox has rims which indicate airflow and four unexplored leads all on the perimeter of known cave, making these leads quite promising.

The majority of John's trip was spent thoroughly surveying and exploring some maze areas, none of which went very far. Much of the new survey occurring in Lechuguilla today requires dedicated cavers who are willing to work hard surveying in small, sharp passages for only 200-300 feet of survey in a long day. The highlight of this work was in finishing the survey and exploration of the El Malpais area just above Lake of the White Roses. El Malpais contains the second occurrence of rusticles in Lechuguilla Cave called Rust Never Sleeps.

Hazel Barton and Max Wisshak co-led a trip to the Southwest Branch in May. Six cavers participated in this trip. 0.39 miles of new survey was done on this seven-day trip. 1.3 miles of resurvey was done in order to aid in producing maps of these areas. Hazel led survey related to her map of the Voids, Big

Sky and Yo Acres. Max led survey related to his map of the Lake Lebarge area.

Cathy Borer and Ron Miller led a six-person expedition on an eight day trip in August. They focused on work in the Western Branch. They heavily relied on a Personal Digital Assistant (PDA) loaded with the cave survey data, survey notes and maps to perform their work more efficiently. No major discoveries were made but 0.32 miles were surveyed. Less than 200 feet of cave was resurveyed.



Plan and profile views of Lechuguilla Cave. The red color denotes passages surveyed in 2009. Map by Stan Allison.

Peter Bosted and John Lyles led ten cavers to the West Branch for an 8 day trip in October. They surveyed 0.80 miles of new cave. 0.47 miles of resurvey was performed. Climbing leads were pursued in the Emerald City area and Dire Straits. More climbing leads remain to be done in these vertical areas. One team found a room with brown flowstone, gypsum needles and flowers in the Southern Climes area. They named this area the Turbinado and left leads going with airflow. This team continued the trend of using high-tech equipment to aid in survey by having both an Ultra Mobile Personal Computer (UMPC) and a PDA with survey data, survey notes and cave maps loaded. In addition they used a "Disto X" which is an electronic device that will measure distance, bearing and inclination and has the potential to increase accuracy and reduce cave impact in the future.

Andy Armstrong led a total of seven cavers to the Southwest Branch for a seven day expedition in December. They surveyed 0.45 miles of new cave. 0.21 miles of resurvey was accomplished. Climbs were done in High Hopes and Fluted

Hall. 1,100 feet was surveyed in a new area below the Prickly Ice Cube Room overlook in the Chandelier Maze.

You can find more information on Lechuguilla Cave in the park-generated Lechuguilla Newsletters which can be found at:

[http://www.nps.gov/cave/naturescience/lechuguilla\\_cave.htm](http://www.nps.gov/cave/naturescience/lechuguilla_cave.htm)

## 2009 REVIEW CAVE SCIENCE AT CARLSBAD CAVERNS NATIONAL PARK

*Paul Burger, Hydrologist*

### CAVE AEROMICROBIOLOGY IN CARLSBAD CAVERNS NATIONAL PARK

*Diana Northup, Dale Griffin, Mike Grey*

This study will employ existing aeromicrobiological assays to profile the distribution of airborne microorganisms at various locations between the Natural Entrance and Big Room and between the Lunchroom and Lake of the Clouds in Carlsbad Cavern, Carlsbad Caverns National Park.

One aspect of the study is to determine the number of bacteria and fungi at separate points within the identified cave system using culture and molecular based methods to determine the total number of microbes, culturable and nonculturable.

The second aspect of the study is to determine the influence of humans on the presence of viable bacteria and fungi in the cave system - genetic sequencing will be used to identify bacteria able to be cultured and fungi in a natural environment (one with little human influence, i.e. Lake of the Clouds and portions of Left Hand Tunnel) versus a human impacted environment (i.e., the Main Corridor, Big Room, and the Lunchroom)

### CAVE CLIMATOLOGY

*Andreas Pflitsch*

The goal of this project, which is being conducted in Europe and the United States, is to investigate the climate of different cave systems in different parts of the world. Until now investigations have been conducted primarily in European Caves (Poland, Slovakia, Czech Republic, Poland, and Germany) where the airflow is generated by thermal factors.

In addition to the caves we are investigating in Europe, it is important to investigate caves where the airflow and the whole climatic system is generated by pressure differences between the cave air and the outside air (barometric caves). Measurements have been taken in Jewel and Wind Cave in the Black Hills of South Dakota in 2002. This study expands this research to the caves of the Guadalupe Mountains. The comparison between the Black Hills and Guadalupe cave systems will give us further knowledge about the climatology of barometric cave systems.

April 2009- Carlsbad Cavern, Spider Cave, Lechuguilla Cave  
Andreas and Stan Allison installed temperature and humidity loggers in various locations in these caves as well as others on adjacent federal lands.

July 2009 – Carlsbad Cavern, Spider Cave, Lechuguilla Cave  
Andreas and Stan Allison downloaded data from all of the installed loggers. The results of these preliminary data were presented at the International Congress of Speleology in Kerrville, Texas.

September 29, 2009 – Carlsbad Cavern and Lechuguilla Cave  
Andreas and Stan Allison installed additional loggers in these two caves to gather additional data to refine and interpret the results of the loggers already in place. They also downloaded the data from the previously placed loggers.

#### Preliminary Results

- Carlsbad Cavern has a mix of barometric and temperature driven airflow and we have some more open questions.
- Carlsbad Cavern and Spider Cave seem to have the same airflow pattern and points to them being part of a single cave system.
- Lechuguilla Cave has a strong barometric air flow regime and seems to be connected to Big Man Hole Cave and other caves and blow holes in the area. Dark Canyon does not appear to be a boundary for the cave.

#### **CAVE RADIO STUDY IN THE LEFT-HAND TUNNEL OF CARLSBAD CAVERNS**

*Brian Kendrick*

The purpose of this study is to establish a digital (text) communication link at a depth of approximately 750ft in Left Hand Tunnel of Carlsbad Caverns. Signal strength measurements will also be performed at the operating frequency of 23 Khz using the built-in strength meter on each radio. The signal strength measurements will help determine and verify the predicted attenuation of the radio signal through limestone. If there is a strong enough signal, a radio location on the surface will be attempted.

March 2009 - A new cave radio system operating at 23.4 Khz established the first two-way digital text communication in Carlsbad Caverns at a depth of 650ft (198m) near station RLHT17 in Left Hand Tunnel. Signal strength measurements made during this test combined with previous measurements in Black and Cottonwood caves determined the attenuation coefficient through the limestone. This value was smaller than typical values for limestone indicating that rock surrounding Carlsbad Cavern is relatively “dry.” By comparing the signal loss through this rock to the signal loss through air, the maximum working range for the radio system is predicted to be  $275 \pm 25$  m ( $902 \pm 82$  ft).

#### **LATE PLEISTOCENE AND HOLOCENE PALEOCLIMATOLOGY OF THE SOUTHWESTERN UNITED STATES FROM SPELEOTHEMS**

*Victor Polyak, Yemane Asmerom*

The purpose of this study is to reconstruct the climate record for the Holocene and Late Pleistocene for the southwestern United States. The study is uranium-series dating intensive and utilizes mineralogy, annual banding, stable isotope and elemental geochemistry, growth and grow rates of stalagmites and other speleothems.

The late Pleistocene and Holocene climate for the southwestern United States has not been established at a high resolution, although two papers are coming out soon that cover the first 50-80 kyrs. These papers show a climate link with the Greenland Ice Cores. The Guadalupe Mountains area is ideal for studying long-term paleoclimate because of its location and because of its caves and speleothems. The frequency and amount of precipitation in this region is sensitive to the affects of El Nino and La Nina. We see this in our Holocene stalagmites. The researchers now have several remarkably well-preserved stalagmites from several caves in both the Lincoln National Forest and Carlsbad Caverns National Park for study of the Holocene climate.

This study should accurately establish wet and dry periods during the Holocene for the Guadalupe Mountains region. This is important not only to paleoclimatologists, but to those studying and modeling present day and future climate, archaeologists, and to various government agencies. The ongoing research should extend the record into the Pleistocene. This year, the investigators continued analysis of the samples and hope to publish the results in 2010.

#### **MOLECULAR AND TAXONOMIC CHARACTERIZATION OF BACTERIA FROM THE LECHUGUILLA CAVES**

*Holger Scholz, Hans-Juergen Busse, Peter Kaempfer*

The study aims to investigate bacteria from the Lechuguilla Cave in a collaboration with Professor Hazel Barton from Northern Kentucky University by molecular and phenotypical methods to determine their exact taxonomical position and phylogeny.

Based on previous results of 16S rRNA gene sequencing, bacteria will be further characterized to the species level and using a polyphasic approach, and if appropriate, new bacterial species will be described and names will be given to these potential new species.

The investigators have obtained specimens from Dr. Barton and are continuing their analyses. No results have been reported yet.

## **OLIGOTROPHY IN CAVES: THE BIOCHEMISTRY AND METABOLIC ACTIVITIES THAT SUPPORT MICROBIOLOGIC COMMUNITY SURVIVAL IN NUTRIENT LIMITED ENVIRONMENTS**

*Hazel Barton, Bradley Lubbers, Elizabeth Rousseau, Janet Bertog*

It was recently proposed that a significant portion of the Earth's biosphere is subterranean. The discovery of such a significant geomicrobial biosphere should hardly be surprising, given that we have known for some time that these microbial interactions have shaped the global environment in which we live today. This hypothesis has been further supported by studies that reveal complex subsurface microbial ecosystems. As a result, there is an increasing interest in studying geomicrobial interactions in subterranean environments. Caves are an easily accessible environment in which to study certain geomicrobial reactions of the subterranean biosphere, without the need for sophisticated and expensive machinery with which to collect samples.

Historically, macroscopic life was the primary source of interest in cave systems. However, recently biospeleologists have turned their attention to the microscopic life in caves, revealing a unique microbial existence. The majority of these investigations have concentrated on communities sustained by a specific and measurable energy input, whether from surface organic input, sulfide or nitrite. However, there is an emerging database of information that suggest that caves, which lack a measurable energy input also contain significant and diverse microbial communities.

Caves commonly form through the erosional processes of water. Once sufficiently enlarged to allow human access, these waters have long since departed, leaving the cave exposed to an oxygenated atmosphere. The entry of organic nutrients into the system is therefore a function of the geology and depth of the cave system, with significant input from the surface being limited to the entrance zone and areas of the cave fed by surface water, whether by dripping water or actual streams entering the system. The majority of caves therefore represent an essentially oxidized and nutrient limited environment, in which microscopic life subsists by scavenging primarily inorganic nutrients using an oligotrophic lifestyle.

Based on work that has been previously carried out in cave systems, the investigators will use both Lechuguilla Cave and Carlsbad Caverns as model sulfur-base systems to continue these oligotrophy studies. To do so, they are using a combination of techniques that we are familiar with, including model-organisms, cultivation, biochemistry and molecular phylogenetic techniques to question the following hypothesis:

Microbial communities are able to subsist in extremely oligotrophic environments, such as caves, by establishing a complex carbon-sharing network. Such networks provide highly efficient scavenging mechanisms, allowing a feedback nutrient supply system. Such a system permits increased diversity through augmented opportunities to utilize those scarce energy sources that are available, such as reduced metals in the bedrock and carbon halides in the atmosphere.

Further, this diversity is not merely a functional requirement for community subsistence, but can only occur in systems where UV damage does not limit the potential species richness of the community.

## **POOL FINGERS AND CHENEILLE SPAR: INVESTIGATION OF A POSSIBLE BIOLOGICAL ORIGIN**

*Diana Northup, Penelope Boston, Leslie Melim, Michael Spilde, J. Michael Queen*

The purpose of this study is to investigate whether microorganisms help form pool fingers and chenille spar and other pool precipitates and to develop a classification of pool precipitates.

### May 2009-Lechuguilla Cave

Paul Burger, Stan Allison, and Gosia Allison-Kosior set up a pool finger experiment near the Orange Bowl in the Near East. They placed sterile thick sections of limestone, marble and dolomite in a pool with pool fingers and a control pool without pool fingers.

Gosia Allison-Kosior, Jon Mackey, and Sarah Arpin placed sterile thick sections of limestone, marble and dolomite in a pool with pool fingers and a control pool without pool fingers near the Red Sea Room.

### August, 2009-Lechuguilla Cave

Gosia Allison-Kosior, Jon Mackey, Ian McMillan, and Zdeněk Motyčka went to the Briny Pool-Bitter Waters area in the Southwest to describe pools and pool deposits.

Gosia Allison-Kosior, Ian McMillan, and Zdeněk Motyčka went to the Sugarlands area in the upper area of the cave to describe pools and pool deposits and to collect water samples for DNA analysis.

## **CAVE RADIO STUDY AT CARLSBAD CAVERNS NP**

*Paul Jorgenson, Ray Keeler, Richard Bohman*

The purpose of this study is to develop a method to have two-way communication between the cave and the surface for emergency and logistical purposes. Researchers hope to answer many unknowns about signal propagation in the limestone, dolomites, and gypsum at Carlsbad Caverns National Park.

The use of amateur radio (ham radio) communications in caves has been an ongoing, but not often publicized, process for decades. Previous studies used the lower High Frequency (HF) bands for successful voice communications. Advances in technology have miniaturized and made more robust (field friendly) the radios commercially available to hams. Using this newer, commercially available, equipment the researchers have demonstrated the ability to use wireless voice communications in caves in Arizona, Alabama, Missouri, and Indiana up to depths of about 450 feet of overburden over several years.

The desire was to test this voice communications equipment in the Guadalupe limestone as a proof of concept for possible use in other caves in the area. Left-Hand Tunnel in Carlsbad Cavern was an ideal place to test this communications system due to the depth of the passage below the surface, the level passage character, the lack of electrical wiring or other metal associated with the more accessible tourist parts of the cave, and easy access by elevator.

Using commercially available amateur radio equipment they were able to establish acceptable voice communications along a significant length of the Left-Hand Tunnel and to the surface from the underground. An area of greatly enhanced signal strength was noted and needs to be studied further. There may be an unknown void between the Left-Hand Tunnel and the surface.

The following distances (based on NPS data) were achieved:

End of Trail (L32A1) to First Bridge (DA\*2) = 1620 feet (.307 mile or 494 meters)  
End of Trail (L32A1) to Beach (BMLHT1) = 1250 feet (.237 mile or 381 meters)  
Depth achieved: 780 feet (.148 mile or 238 meters)