

INSIDE EARTH

A NEWSLETTER OF THE NATIONAL PARK SERVICE CAVE & KARST PROGRAMS

Edited by Dale L. Pate

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Website Address:

<http://www.nature.nps.gov/grd/geology/index.htm>

Webmaster: Tim Connors: tim_connors@nps.gov

ANNUAL REPORT FOR THE FISCAL YEAR 1998

by Ronal Kerbo

The National Park Service through the Geologic Resources Division has been coordinating Service wide assessment of resources in cave and karst areas as mandated by the FCRPA, for the last three years. This has been accomplished through the position of the National Cave Management Coordinator providing technical assistance and allocating small cave project funds through the Science and Technical Services Branch of GRD.

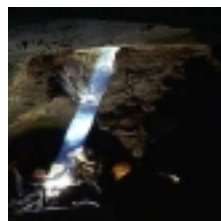
During the fiscal year 1998 accomplishments were made in the areas of cave conservation, protection, interpretation and park program support. Highlights of the program follow:



INSIDE EARTH NEWSLETTER AND CAVE PROGRAM WEBSITE

This year marked the launching of an Internet web-site for the cave and karst program and the first issues of *INSIDE EARTH*, A

Newsletter of the National Park Service Cave and Karst Programs. The web-site and newsletters have been well received by both the national and the international speleological community. To date there have been almost 2000 combined "hits" on the web-site's three issues of the newsletter. The first issue was specifically dedicated to communication. In part the first article stated: *Cordell Roy, former superintendent of Timpanogos Cave National Monument has pointed out that there is a lack of adequate communication between parks established for their outstanding speleological or karst resources. To properly manage, protect, interpret, conserve, and understand our cave and karst resources we need to exchange information on a wide variety of topics. Topics that range from proper construction material for cave trails, and how to clean algae from cave walls and speleothems to the standards for conducting cartographic surveys of caves, and how to implement a permit system for the use of undeveloped back-country caves. What is needed within the NPS, which is responsible for the management and protection of thousands of caves, is a forum where information, expertise, program components and general information can be exchanged... here is the first issue of the newsletter, edited by the competent hand of Dale Pate, cave specialist at Carlsbad Caverns National Park. Dale is a former editor of The Texas Caver as well as a person very active in cave exploration, surveying, and conservation. Thanks to his persistence our forum has taken on a shape.*



PARK UPDATES AND PROJECTS

HAVO - Hawaii Volcanoes National Park: A draft action plan for the caves of Hawaii Volcanoes National Park was written during a site visit to the

area from January 12 to 16. A set of cave survey standards based on those in use at Carlsbad Caverns, Cumberland Gap and other parks were recommended for implementation by the cave specialist Bobby Camara. Several meetings were held with members of the Hawaii Speleological Survey (HSS), a group doing most of the cartographic surveys in the park. A follow-up with both the park and the HSS will include assistance with the

incorporation of a cave-mapping program called Compass with a GIS program called ArcView.

CAVE - Carlsbad Caverns National Park: The cave program money continues to fund research projects in the Park. This research in the caves of CCNP continues to be on the forefront of cave science. Speleologist Victor Polyak recently released information that establishes ages on the formation of caves of the Guadalupe Mountains including *Carlsbad Cavern* and *Lechuguilla Cave*. In *Carlsbad Cavern*, the following dates have been determined: Big Room – 3.9 to 4.0 million years old (myo), Bat Cave – 6.0 myo. In *Lechuguilla Cave*: Glacier Bay – 5.7 to 6.0 myo, Lake Lebarge area – 5.2 myo

ELMA - El Malpais National Monument: The cave program contributed \$1,000 to the 10th anniversary stewardship symposium at El Malpais National Monument which was attended by a group of about 60 scientists, researchers, friends of the park, and speleologists. The Symposium was a great success and will provide the focus for future research at the Monument and enhance the interpretive story with the visiting public. Of particular speleological note was the microbiological report on work being conducted by researcher Diana Northup and a cave stewardship workshop facilitated by the division.

GRCA - Grand Canyon National Park: With support from the Division, noted speleologist and co-author of *Cave Minerals of the World*, Carol Hill started a study of the minerals of the caves of the Grand Canyon. Ms Hill's work is focused on determining the roll of various ore bodies present in the canyon's geologic strata on the speleogenesis of the caves.

SEKI - Sequoia and Kings Canyon National Parks: Through the Geologists in the Parks program, the cave program contributed funding to continue the on-going cave inventory and assessment project in the Park. Thanks to this funding the cave resources office was able to keep an assistant cave specialist on staff to conduct backcountry cave inventory fieldwork. This enable the cave resources office to produce a series of award winning cave maps documenting *Crystal Cave*. *Crystal Cave* is the second longest cave in the park at 2.94 miles in length.



MEETINGS AND OTHER PROJECTS

NPS-77 Update And Rewrite: Mike Wiles, cave resource specialist from JECA was brought in to Denver to assist with the rewrite of the Cave Management Section of the old NPS-77. Thanks to Mike's assistance the cave section was the first of the geology section rewrites to be submitted to the Washington office for final editing

before going out to the Parks for review and comment. The cave section has under gone substantial revision and the drafts have been through several reviews by field cave specialists.

Interagency Cave Management Agreement: An interagency agreement for cave management has been written in cooperation with a BLM cave specialist Jim Goodbar in Carlsbad, New Mexico. The agreement provides for cooperative management of cave and karst resources among the USGS, BLM, USFS, USFW, and NPS. Since the passage of the Federal Cave Resources Protection Act in 1988, no effort had been made to assure cooperation among the major agencies involved in managing and conducting or supporting research in the caves on federal lands.

Interagency Cave Resources Workshop: A first of its kind, a two-and-a-half day interagency cave resources workshop in Denver included 10 participants from four agencies, NPS, BLM, USFWS, USFS and a representative of the Cave Research Foundation. Some of the accomplishments of the meeting included agreeing to the following: **1.** Add "karst" to the language describing cave resources management, since the majority of caves exist in karst, and cave resources can be neither understood nor managed without also understanding and managing the karst ecosystems of which they are an integral part. **2.** To establish an interagency cave and karst working group to cooperate on issues related to cave and karst resources management. **3.** To have approved an Interagency Agreement for Cave and Karst Resources Management between BLM, USFW, NPS, and USFS. (NPS-BLM Washington office will contact USGS to pursue that agency's addition to the agreement). **4.** To develop interagency guidelines for cave and karst resources management. **5.** To enhance cooperation and communication through the establishment of an Intranet system for use by federal employees engaged in cave and karst resources management. **6.** To develop a comprehensive resources list for cave and karst management. **7.** To develop a report on the status of federal cave and karst conservation and management. **8.** To summarize and update the significant caves list. **9.** To continue discussions about the National Cave and Karst Research Institute, which may have authorization before the end of this congressional session, (but no funding). **10.** Representatives from NPS, BLM, USFS and CRF will continue working on a national cave cartographic survey standard.

Consultation With USFS: As a follow-up to previous consultation with the USFS on *Papoose Cave* in Idaho, an action plan to set priorities for research needs in the cave was drafted by the division. The plan was compiled with in-put from the cave resources staff at Carlsbad Caverns and the USFS national cave management specialist, Jerry Trout. As a side benefit to the Service, cave diving guidelines developed by GRD, for *Papoose Cave* are being adapted for use in *Lilburn Cave* by the



Sequoia- Kings Canyon cave specialist. *Papoose Cave* is a difficult and deep cave on the Salmon River District of the Nez Perce National Forest in Idaho.

The National Speleological Society Convention (NSS) was held at the University of the South in Sewanee, Tennessee. 12 cave specialists from the NPS attended

the Convention and participated in a variety of meetings and sessions. The cave program assisted with the travel for several of the NPS cave specialists attending this very important annual meeting of speleologists and cave explorers. Bobby Camarra (HAVO) led a special session on current speleological work in HAVO. Joel Despain and Greg Stock (SEKI) were recipients of the NSS Cartographic Medal Award for their maps of *Crystal Cave*. Mike Wiles (JECA), Rod Horrocks (GRBA) and Stan Allison (CAVE) all presented speleological papers covering work from South Dakota to Mexico. A meeting was held for all NPS cave specialists in attendance. Many of the NPS specialists were speakers at special sessions ranging from the National Cave Management Symposium Steering Committee to sessions on research and exploration in *Lechuguilla Cave* (CAVE).

SUMMARY

The cave program for FY 1998 was focused on the following:

- service-wide small cave assessment projects
- technical assistance requests for cave resources management
- attendance at cave/karst professional meetings
- agency and federal wide meetings on cave/karst issues.
- Lectures/programs on Service-wide cave/karst issues
- development of cave/karst newsletter and web-site

A break down of the cave program's \$30,000 was as follows: Mineralogical Project in GRCA caves: \$5,000; Assistance to cave assessment at ELMA: \$1,000; assistance to cave assessment at SEKI: \$4,000; assistance to cave assessment at HAVO: \$2500; assistance to cave related geologist-in-the parks program: \$2500. Interagency Cave and Karst Meeting, which resulted in draft of Interagency Agreement for Cave and Karst Management: \$4850. Travel by cave specialists to professional meetings, technical assistance in parks and training at MACA, CAVE, GUMO, the National Cave Management Symposium and the National Speleological Society Convention: \$7,860. Computer software for web-site development: \$500. Assistance to WR for cave NNL assessments and assistance to California Department of Natural Resources at *Mitchell Caverns* Natural Preserve \$1700.

PARK UPDATES

Carlsbad Caverns National Park

by Dale Pate

Pre-design Plan for Carlsbad Caverns Area – The Denver Service Center is preparing a Pre-design Plan for the developed surface areas above *Carlsbad Cavern*. With input from the Infiltration Study that was prepared by staff from the Colorado School of Mines, this plan will decide whether segments of the present infrastructure will be removed, mitigated or left in place. This extremely important document will be open for public review through the NEPA process. Changes being considered in the plan are the removal of the Mission 66 housing, the complete or partial removal of the maintenance facility, partial removal of the Bat Flight parking area, redesign of most parking and road areas to mitigate fluid leakage from vehicles and several other infrastructure changes. In conjunction with the development of this plan, a separate plan is being developed that will lead to the remodeling of the entire Visitor Center. . Anyone wanting to receive the Draft Pre-design Plan when it becomes available should contact the Superintendent, Frank Deckert at the following address: Carlsbad Caverns National Park, 3225 National Parks Highway, Carlsbad, New Mexico 88220

Lechuguilla Cave Surpasses 100 Miles – A survey expedition led by Peter and Dave Jones in December 1998 netted over 6,000 feet of new survey to bring the total length of *Lechuguilla Cave* to 100.6 miles (161.9 kilometers). A more recent survey led by Steve Reames brought the total length of the cave to 100.85 miles (162.3 kilometers). This expedition concentrated its efforts on re-sketching passages that lacked detail on the map and correcting loop-closure errors in the data.

In only 12 ½ years, *Lechuguilla's* surveyed length has increased from 200 feet to over 100 miles. The cave is truly a significant national treasure that can be compared with other natural treasures such as Yosemite, Yellowstone, and Grand Canyon. We would like to express our appreciation to all those volunteers who have donated their valuable time and expertise to document this special place.

Environmental Assessments (EA's) – A new access culvert is planned for *Lechuguilla Cave* that will address access, environmental, security, and safety concerns for the entrance area. This EA will be released for public review soon with the actual replacement of the present culvert tentatively planned for 2000. Low walkways are also being planned for the Rookery area of Lower Cave in *Carlsbad Cavern*. An EA in progress will address resource concerns and describe the preferred alternative in our effort to protect this beautiful area.

Corrosion Residues – This past autumn, the National Science Foundation funded a project for nearly \$300,000 that will examine the role microorganisms play in the

dissolution of cave walls in *Lechuguilla* and *Spider Caves*. This dissolution has created a substance called corrosion residues. Both caves have large amounts of these residues covering walls and ceilings and, in general, these residues tend to be clays intermixed with iron and manganese oxides. Diana Northup, Dr. Penny Boston, and several other prominent microbiologists are recipients of this grant for which the project will also serve as Ms. Northup's dissertation. Early research indicated the presence of microbial communities within these residues including fungi and bacteria. More recent research has found several interesting facts. The pH levels of residues found in *Lechuguilla* range from 1.3 to 12.8 while the discovery of concentrations of rare earth elements in the corrosion residues in both caves have provoked new ideas and theories on the origin of corrosion residues. To find out more about this research, visit Diana's website at: <http://www.i-pi.com/~diana>

Babbitt Visits the Park – Secretary of the Interior, Dr. Bruce Babbitt, visited the Carlsbad area in January. Though his trip was cut short by the heaviest snowstorm of the season, he did discuss issues concerning state and federal lands found within the Cave Protection Zone north of the park, Wilderness Study Areas, and the National Cave & Karst Research Institute with park staff and local Bureau of Land Management officials. He and his entourage were also given a tour of Lower Cave.

Canyons & Caves – The Resource Management Offices (which include cave resources) produce a quarterly newsletter named "*Canyons & Caves*." This newsletter contains news items and articles on various resource topics concerning Carlsbad Caverns National Park. To view these newsletters on the web, visit the following: <http://www.caver.net> Once there, go to the title "Caves & Canyons".

Lava Beds National Monument

by Kelly Fuhrmann

The 1998 field season at Lava Beds has been very busy. Cave reconnaissance activities have turned up 23 new caves. An additional 97 caves have been monumented. An ongoing project using a Global Positioning System (GPS) to locate all known caves has been completed and incorporated into the Geographical Information System (GIS) coverage of the park. Our fall season Student Conservation Association intern has designed a new GIS cave map for the park on a digital orthophotoquad overlay. This will be a very useful management tool. Cave mapping projects are continuing with the help of the Cave Research Foundation and National Speleological Society.

Cave-gating projects are being organized for the future. A new gate for *Crystal Cave* will be designed this winter and installed in the spring. Four others gates are being planned.

Bat research for the 1998 maternal season has been completed. One of our *Corynorhinus* colonies was quite elusive this summer and was not located until late in the season. The estimated outflight count data from both the *Corynorhinus* and *Tadarida* colonies indicates a comparatively stable population trend. We hope to arrange a cooperative research project for next summer that will use new infrared video technology for more accurately estimating outflight numbers of bats in our seasonal *Tadarida* colony. In addition to population trend information, we also continued to research the correlation between cave temperature and relative humidity (T/RH) variations and *Corynorhinus* maternal colony movements. We have found that these bats are pretty particular about the cave environmental conditions. One hibernaculum cave was monitored last winter for T/RH conditions. Two different hibernaculum caves will be monitored this winter in addition to three maternity roost caves.

The fall/winter cave projects include reconnaissance and numbering of two extensive trench systems in preparation for monumenting next summer, updating the cave management plan, monitoring cave environmental conditions, continuing our cave photomonitoring project, and completing monumenting in the Cave Loop trench. Our park scoping session for the NPS Inventory and Monitoring initiative was held during the first week of November. It was week of intensive planning. We definitely have our work cut out for us.

Sequoia and Kings Canyon National Parks

by Joel Despain

ADMINISTRATIVE HAPPENINGS

Crystal Cave Management Plan: *Crystal Cave* is the second longest cave in the parks with three miles of passage, and it is also the only commercialized cave at Sequoia and Kings Canyon. The cave contains many outstanding resources including rare speleothem types such as 94 shields, a unique variety of raft cone, as well as at least six endemic cave-adapted invertebrates, and several species of bats. A management plan for the cave was approved and signed by the Superintendent at the end of 1998. The plan is complicated, and divides the cave's passages into six separate management designations. The commercial tours, operated by the Sequoia Natural History Association, are allowed only on the cave's paved trail. Wild Tour participants may be escorted to areas below Marble Hall, up to the Shield Room and in parts of the Catacombs. Cavers, led by Trustees, and off-duty SNHA employees may visit the wild tour areas and most other sections of the cave. However, some areas may only be visited when tours are not operating and a few spots may only be visited once per year, per Trustee or employee. There are also 30 different sections of the cave that are closed. Closed areas include the Oberhansley's Entrance, the Pool Room, Whitewash Canyon, and the Sugar Cookie

Passage. These are set aside for a variety of reasons including bats habitat, invertebrate protection, and the protection of pristine and delicate areas.

The plan is made clear through the use of the new *Crystal Cave* maps. A color-coded set of maps has been created to show which areas are under what restrictions. These will be available to Trustees and the SNHA staff.

Cave Management Staffing: Seasonal Cave Specialist, Greg Stock, worked in the Parks for 18 weeks during the summer of 1998. His position was funded by money from the Cave Management Program base account, from surplus funds from "leave without pay", and from the Geologic Resources Division (GRD). The GRD money did come with strings. The funds were set aside to inventory abandoned mines, tailings piles and prospects.

Funding for seasonal staffing in 1999 remains in doubt. A Park-Service-wide initiative known as Resource Careers will absorb most discretionary funding within the entire Resource Management Division at the Park in 1999. Hopefully funds from the Geologic Resources Division to support survey and inventory in *Soldier's Cave* will provide funding for a seasonal employee in 1999.

CAVING PROJECTS

Crystal Cave Survey: Four years, 90 survey trips and thousands of hours of drafting time have brought the Park to the completion of the *Crystal Cave* Mapping Project. And what a finish it was! In July the maps received the Medal (first place) at the Cartographic Salon at the 1998 NSS Convention in Sewanee, Tennessee.

Now the park will use the maps as tools in the management and understanding of *Crystal Cave*. Maps have been produced to illustrate the new draft management plan for the cave. Another version will soon be going to print (more than a year late) for sale to visitors to the cave in 1999. Since the NSS Convention, maps have also been used to determine the distribution of biological monitoring plots in the cave.

Crystal Cave Restoration: It was another fun and successful *Crystal Cave* Restoration weekend October 17 and 18. This year we focused on an old nemesis - the blast rubble in the Fault Room. Muscles strained and sweat flowed as 20 volunteers struggled to move the large rocks up to the cave trail and out to the surface. Most of the smaller rocks from this area have been removed now, and the cleared area is beginning to undermine the tour trail. Next year will require a new approach to this old problem, or perhaps a new project.

Crystal Cave Biology: Thirty-four biological monitoring plots have now been established in *Crystal Cave*. These are scattered through the cave's dry upper levels, as well as low wet levels, and can be found in sandy areas, on flowstone in mud, or on breakdown.

Each plot is .3m square and marked by flagging. They are checked by two observers watching for 10 minutes, or a single person watching for 20 minutes. All wildlife and organic matter noticed is recorded. The observation times also allowed photos to be taken of *Crystal's* invertebrate wildlife. Forty-two observations have been made on the plots and animals have been observed 13 times. Often the plots show no activity on a single observation, but over time it is hoped that they will provide a picture of the distribution and populations of the cave's invertebrate animals.

Soldier's Cave Mapping: Five mapping trips entered *Soldier's Cave* in the last seven months and have extended the cave's surveyed length to 2102 feet and to a depth of 260 feet. The survey work focused on areas near the Waiting Room including the Starlight Room area, the Contact Room and the Bacon Room. It is hoped that next summer funding will allow a concerted effort to be made on the cave's re-survey.

Hurricane Photography: As usual, there were four *Hurricane Crawl* photo trips this year. Dick LaForge and Mark Fritzke and other assistants took photos in two areas. One trip traveled to the Star Chamber, an extensive well decorated upper level area. Another trip focused on the cave's lower levels and first formation rooms. Dave Bunnell photographed the "back" rooms of the Pleiades area, which is another beautiful upper level area. In particular, pictures were taken in the rooms Celaeno and Alycone, named for two of the stars in the Pleiades. Bill Frantz continued his photo-documentation work in the Pumpkin Palace area about half way through the cave from the lower entrance.

Hurricane Survey: A final survey trip went to the Pleiades area in August. A well decorated room and adjacent passages were surveyed, largely finishing the area. A few leads still exist in *Hurricane* but the best ones are challenging climbs. A new map of *Hurricane Crawl* was drafted this winter and will appear along with several articles in the June 1999 issue of the NSS News.

Hurricane Dye-Trace: A dye trace test of *Hurricane Crawl Cave* was completed in June. Dye was placed in a flowing creek just upstream of a sink, which was believed to be the source for the cave's stream. Charcoal receptors were placed in all nearby streams and springs both on the surface and in the cave in preparation for the test. Dye was found in five of the dye receptors (known as bugs). The positive bugs had been placed in the large stream that briefly appears in the Mizar Maze, in the very small stream in Dusted Canyon, in Pumpkin Palace where a significant stream emerges and flows down into Carotene Canyon, at three springs just downstream from the cave's lower entrance, and in a surface stream just below the end of the marble containing the cave. Somewhat surprisingly several smaller streams, including two in the Schist Canyon part of the cave, did not produce positive results.

Cave Research Foundation in Redwood Canyon: It was another successful summer in lower Redwood Canyon as the Cave Research Foundation (CRF) mounted numerous weekend expeditions. Trips this year continued work on many past projects including survey, hydrologic research, maintenance of the canyon's facilities, and restoration in *Lilburn's Cave*. Survey work in the cave was done in support of the quadrangle map set that is currently in production. While many of the more than 80 maps have been completed, many more remain to be finished. Coordinating the project and the chief cartographer is Peter Bosted. Other cartographers are Brad Hacker, John Tinsley, Bill Frantz and Joel Despain. Unfortunately a plan to take two bear boxes into the canyon this year failed due to communication problems concerning their size and weight. We will attempt to get these bear boxes to the research cabin in 1999.

Cave Research Foundation in Mineral King: It was a momentous year for cavers in Mineral King. The 21-acre White Chief property, which contains 12 caves including the longest cave in Mineral King, was acquired by the Park Service. This gave CRF surveyors full access to *White Chief Cave*. By the end of this fall much of this extensive mazy, multi-level cave had been surveyed. Several years of effort in *Cirque Cave* were also completed this year by Roger Mortimer, who finished a fine map of this unusual cave. The map documents 1700 feet of passages and rooms including *House Cave*, the Lake Room and the Mud Room. Overall the cave is "u" shaped.

The Mineral King project also extended to the northern end of Mineral King this year with work in *Jordan Cave* and *Empire Mine Cave*. Survey work was started but not completed in both caves.

Other Survey and Biology Projects: Survey work also took place this summer in *Clough Cave*. Though the cave had been mapped in the 60s, the Park lacked data and the map was incomplete. To protect the bats that have been moving back into the cave, the survey was done at night and some of the cavers' lights contained a red filter. Bats are less sensitive to red light. Survey work in *Carmoe Crevice* and *Salamander Cave* was also completed in 1998. *Carmoe* is 1,500 feet (454 meters) long and 210 feet (64 meters) deep. Initial biological inventories were also conducted in both caves.

Paleo-magnetic Dating: Sediment samples were collected on several trips to *Crystal*, *Bear Den*, *Hurricane*, and *Clough* caves in late summer. The sediments will be analyzed by Dr. Ira Sasowsky from Akron State University. The point of the analysis is to determine the general age of the sediments based upon the orientation of small magnetic particles within the dirt and clay. As you may be aware, the earth's magnetic poles wander and occasionally switch. At times in the Earth's past the positive end of the Earth becomes the South Pole, and the negative end the North Pole. When

magnetized sediments settle out of water they orient based upon where the positive and negative ends of the earth lie. Sediments are referred to as normal or reversed if the magnetic sediments in them are oriented toward the North Pole or South Pole respectively. The last switch of the Earth's magnetic field was more than 710 thousand years ago. It is very possible, perhaps even likely, that no cave sediments in the Park are that old. In the least, if all of the samples are normally magnetized, we will have established a maximum age for these caves. Results are expected back in the spring.

Park Employee Participation: A concerted effort was made this year to include park research and resource management personnel in caving trips. There are several reasons for this. For one thing, we needed the help; also by having park employees participate in trips we hoped to gain their appreciation for this significant, but little known part of the park. Park employees helped survey for isopods and millipedes in *Crystal Cave* and surveyed in *Soldier's* and *Clough Caves*.

Mining Inventory: A significant effort was undertaken during the summer of 1998 to complete basic inventories of the abandoned mining sites around the park. Most of this mining activity took place in 18th Century. Special funding from the Geologic Resources Division helped pay for the work last summer. Mines in Cedar Grove, Redwood Canyon, Mineral King, and along the Middle Fork of the Kings River in the parks backcountry were all visited. Inventories attempt to assess the mine sites as threats to human safety and as environmental hazards. In general, it was found that park mines are small, safe and pose no environmental threat. However, a few sites may be reexamined to determine if mitigation of the site might be needed.

1998-1999 WINTER PROJECTS

A number of office based projects will be undertaken this winter. It is hoped that we will complete maps of *Hurricane Crawl*, *Carmoe Crevice*, *Panorama and Clough Caves*. In addition I hope to complete at least two *Lilburn* quadrangles in support of Peter Bosted's huge effort to complete the quad set for the cave. The *Crystal Cave* book will be thoroughly revised this year with an emphasis on a new layout, an update of the Geology and History Chapters, and inclusion of several maps of the cave. Data from the 1988 biological inventories and from a few mineralogical features documented in *Crystal Cave* will be entered in a database this winter as preparation for their inclusion in as Arcview GIS coverage of caves and their resources. 1988 and 1987 radon exposure calculations for the *Crystal Cave* staff were completed in December.

Wind Cave National Park

by Rod Horrocks

Wind Cave recently said goodbye to long-term Cave Management Specialist, Jim Nepstad, who is pursuing other career goals. Jim's legacy included addressing critical sewer line and parking lot runoff issues over the cave while directing the cave survey to 81 miles.

Rod Horrocks was chosen as Jim's replacement and is currently trying to assimilate large quantities of information left by Jim. Currently, Rod is working on identifying cave management issues and determining the direction that the cave management program will go at Wind Cave National Park. Thus far, Rod has reworked the *Wind Cave* inventory form and procedures, simplifying and standardizing it while adding some new data fields and procedures. He has also prepared a new, more detailed map of the tour routes of the cave for cave management and maintenance purposes and updated *Wind Cave Happenings* for 1998 (summary of cave survey work in 1998).

Marc Ohms has left *Jewel Cave* and is now Rod's fulltime assistant. Marc has recently finalized a Black Hills cave and karst bibliography. He also checked the *Wind Cave* survey data set for errors, looking for blunders and incorrect tie-ins. He identified numerous mistakes, correcting many bad loop-closures. He has also created a new photo catalog of features that are on the cave inventory at *Wind Cave*.

We are currently working with Mike Wiles at nearby Jewel Cave National Monument in an attempt to standardize cave management within the Black Hills. We are also preparing to host the fifth annual Wind/Jewel Cave Restoration Camp, to be held in May. Kathy Petty and Sandy Kramer will be assisting with the direction of 20 cavers from eight states and Canada for the camp. Work is also continuing on the new elevators. It is hoped that they will be operating by the end of May.

Recent survey and inventory work in *Wind Cave* has concentrated in the Colorado Grotto, Historic and Half-Mile Hall sections of the cave. Marc Ohms discovered a major new lake below the Historic Section of the cave, the first large lake found outside of the Lakes Section of the cave. He also discovered a large room beyond the former eastern perimeter of the cave. The area had lots of airflow, but only led to 800 feet of survey. The current surveyed length of *Wind Cave* is 83.27 miles, making it the eighth longest cave in the world and the fifth longest in the U.S.

CAVE RESEARCH FOUNDATION PROGRAMS

by Mike Yocum

The Cave Research Foundation (CRF) has established two programs to help agencies and other organizations manage and protect cave resources. These programs are the Geographic Information Systems (GIS) Resource Development Program and the Educational Resource Development Program.

The goal of the **GIS Resource Development Program** is to assist CRF personnel, federal agency staff, and others in accessing and utilizing spatial data, GIS applications, and other software tools for the purpose of cave and karst resource management. A longer-term goal is to use GIS to develop a collective knowledge and support base for cave conservation, protection and management.

Many federal agencies face increasing responsibilities coupled with decreasing staff and budgets. Resource managers often need answers to questions requiring information from many separate data sources. Traditionally, providing these answers can be a time-consuming and labor intensive task. The integration of separate data sets via the medium of GIS makes such questions simple requests that are easily answered. The answers can be displayed graphically as well as in tabular or chart form.

The spatial analysis and data querying functions of GIS make it possible to ask and easily answer questions such as, "How many cave salamanders are within a given area?" "How much known cave passage is under a specific surface area?" "Where do we have cave resources within five hundred feet of a logging area, populations of endangered species, and slopes greater than fifteen percent?" A well-planned GIS system is invaluable to organizations that have minimal staff yet require high quality data management to aid in the decision-making processes of cave and karst conservation and protection.

The development of a GIS that is a comprehensive system for identifying resources, assessing and monitoring cumulative effects, and defining acceptable limits of biophysical changes, requires time and effort to develop. CRF's program offers assistance in developing a GIS plan, as well as training, on-going technical assistance, and access to the most accurate sets of spatial data required for implementing the plan.

The second program, the **Educational Resource Development Program** has a general aim of making information about cave and karst resources more widely available through the development of audiovisual and multimedia educational materials. This program has two primary goals: The first is the development and dissemination of educational resources (primarily

multimedia and audiovisual) to the general public about the significance of caves and karst. The second is to provide assistance to federal agencies that want to create interpretive exhibits and displays for the general public.

Hardware and software - utilizing digital video, digital still, and computer graphics and animation packages - are available to create presentations that can be rendered in standard VHS, CD-ROM, and world wide web formats.

For further information contact:

Mike Yocum,
329 East Main Street
Frankfort KY 40601-2331
Telephone: (502) 227-7254
Email: myocum@mis.net

LOWER CAVE HISTORIC ARTIFACT REMOVAL

by Stan Allison

It all began in the early 1900's when Jim White was lowered 90 feet from the Jumping-Off Place to Lower Cave in *Carlsbad Caverns*. Since that time people have been leaving their mark on Lower Cave. Over the past 94 or so years, explorers, photographers, staff and visitors have left behind evidence of their visit in the form of various items. One of the most common artifacts found in Lower Cave has been the ubiquitous wood flare handle. Apparently, these wood handled, magnesium flares were used by early cave photographers to illuminate places such as the Rookery for their photos. Other items such as wooden matches, batteries, a cigarette package and unidentified decomposing stuff were left in Lower cave. Most of the items were probably left in the cave prior to the 1940s.



Two historic wooden flares handles found in Lower Cave. Note the staining on the popcorn from the deterioration of the wood.
(NPS Photo by Dale Pate)

Several negative impacts to the cave environment occurred due to the presence of these artifacts. The wooden flare handles in wet areas were decomposing into the cave staining flowstone, popcorn and stalagmites as well as leaving small bits and pieces of wood on various formations. It is likely that the cave ecosystem was negatively altered by the introduction of carbon matter in the form of wood. Since the natural ecosystems in *Carlsbad Caverns* have very little input in the way of food, any additional input can greatly modify the ecosystem. Negative impacts were also occurring to the artifacts. Many of them were decomposing badly in the high humidity of the cave. Another problem was that over the years people had moved some of the items. When moved out of context many of these items no longer tell the story that they would have in their original position.



Broken bottle and bits of rusted wire. (NPS Photo by Dale Pate)

Because of the negative impacts to both the natural and cultural resources, the Cave Resource Office began working with the Cultural Resource Office in documenting and removing these items from Lower Cave. The Cultural Resource Specialists, in conjunction with the New Mexico State Historic Preservation Office classified all of the artifacts as "isolated artifacts". These are single objects without physical association to other objects. Location of these artifacts and their content are as much information as can be gained. An isolated artifact does not need excavation to be removed.

The first step in the process was to tie the location of all of the artifacts into the *Carlsbad Caverns* resurvey. Once this was accomplished pictures were taken of the artifacts and each assigned a number. The final step in the process was to remove the artifacts from the cave. Several trips were made into Lower cave to remove items that were then accessioned into the park museum. Another trip is planned to clean up the debris that is not collectable.

Currently 63 items have been identified, surveyed, documented and removed from Lower Cave. One wooden torch handle has been purposefully left behind for interpretation purposes. From the bottom of the ladders into Lower Cave it is located just past the constriction in the passage and on the right. This is a

relatively dry area and the handle should remain intact for some time. The success of this project was due mainly to the cooperation of the Cultural Resource Office and the Cave Resource Office. The final result is that both the natural and cultural resources of Lower Cave will benefit from this project.

A MESSAGE FROM THE EDITOR

Dale L. Pate

This issue of *Inside Earth* begins the second year of publication for this important newsletter. Three issues were produced in 1998 that covered a range of topics and included the text for the Federal Cave Resources Protection Act of 1988 and the Code of Federal Regulations implementing the Act. These newsletters are a communication link for National Park Service (NPS) cave managers and for the public who may have an interest in cave management issues in our national parks. Park units that have caves within their boundaries are encouraged to submit articles or brief updates on activities within their park.

I would like to say "thanks for a job well done" to Jim Nepstad, the former cave resources specialist at Wind Cave National Park. Through Jim's hard work and excellent leadership on tough issues such as leaking sewers and rapid infiltration, Wind Cave is a more protected place. We all wish him well as he moves up the ladder in his career with the NPS.

**EDUCATION
IS THE BEST TOOL
A CAVE MANAGER
HAS.**

NATIONAL PARK SERVICE CAVE AND KARST AREAS

Abraham Lincoln Birthplace National Historic Site
2995 Lincoln Farm Road
Hodgenville, Kentucky 42748

Acadia National Park
P.O. Box 177,
Bar Harbor, Maine 04609

Amistad National Recreation Area
P.O. Box 420367
Del Rio, Texas 78842

Aniakchak National Monument and Preserve
P.O. Box 7
King Salmon, Alaska 99613

Big Bend National Park
P.O. Box 129
Big Bend, Texas 79834

Big South Fork National River and Recreation Area
Route 3, Box 401
Oneida, Tennessee 37841

Bighorn Canyon National Recreation Area
Box 458
Fort Smith, Montana 59035

Bering Land Bridge National Preserve
P.O. Box 220
Nome, Alaska 99762

Buffalo National River
Box 1173
Harrison, Arkansas 72601

Carlsbad Caverns National Park
3225 National Parks Highway
Carlsbad, New Mexico 88220

Cedar Breaks National Monument
82 North 100 East Street
Cedar City, Utah 84720

Channel Islands National Park
1901 Spinnaker Drive
Ventura, California 93001

Chesapeake and Ohio Canal
National Historical Park
P.O. Box 4
Sharpsburg, Maryland 21782

Chickamauga and Chattanooga
National Military Park
P.O. Box 2128
Ft. Oglethorpe, Georgia 30742

Colonial National Historical Park
P.O. Box 210
Yorktown, Virginia 23690

Coronado National Memorial
4101 East Montezuma Canyon Road
Hereford, Arizona 85615

Craters of the Moon National Monument
P.O. Box 29
Arco, Idaho 83213

Cumberland Gap National Historical Park
P.O. Box 1848
Middlesboro, Kentucky 40965-1848

Death Valley National Monument
P.O. Box 579
Death Valley, California 92328

El Malpais National Monument
P.O. Box 939
Grants, New Mexico 87020

Glacier National Park
West Glacier, Montana 59936

Grand Canyon National Park
Box 129
Grand Canyon, Arizona 86023
Grand Teton National Park
P.O. Drawer 170
Moose, Wyoming 83012

Great Basin National Park
Baker, Nevada 89311

Great Smoky Mountains National Park
Gatlinburg, Tennessee 37738

Guadalupe Mountains National Park
HC 60, Box 400
Salt Flat, Texas 79847

Hawaii Volcanoes National Park
Hawaii National Park, Hawaii 96718

Jewel Cave National Monument
RR 1, Box 60AA
Custer, South Dakota 57730

Kaloko-Honokohau National
Historical Park
73-4786 Kanalani Street 14
Kailua Kona, Hawaii 96740

Kings Canyon National Park
Three Rivers, California 93271

Lake Mead National Recreation Area
601 Nevada Highway
Boulder City, Nevada 89005-2426

Lassen Volcanic National Park
Mineral, California 96063

Lava Beds National Monument
P.O. Box 867
Tulelake, California 96134

Mammoth Cave National Park
Mammoth Cave, Kentucky 42259

Mount Rainier National Park
Tahoma Woods, Star Route
Ashford, Washington 98304

Natchez Trace Parkway
RR 1, NT- 143
Tupelo, Mississippi 38801

North Cascades National Park
2105 Highway 20
Sedro Woolley, Washington 98284

Olympic National Park
600 East Park Avenue
Port Angeles, Washington 98362

Oregon Caves National Monument
19000 Caves Highway
Cave Junction, Oregon 97523

Ozark National Scenic Riverways
P.O. Box 490
Van Buren, Missouri 63965

Pinnacles National Monument
Paicines, California 95043

Pu'uhonua o Honaunau
National Historical Park
P.O. Box 128
Honaunau, Hawaii 96726

Rocky Mountain National Park
Estes Park, Colorado 80517

Russell Cave National Monument
Route 1, Box 175
Bridgeport, Alabama 35740

Saint Croix National Scenic Riverway
P.O. Box 708
Saint Croix Falls, Wisconsin 54024

Sequoia National Park
Three Rivers, California 93271

Shenandoah National Park
Route 4, Box 292
Luray, Virginia 22835

Sunset Crater Volcano National Monument
Route 3, Box 149
Flagstaff, Arizona 86004

Theodore Roosevelt National Park
P.O. Box 7
Medora, North Dakota 58645

Timpanogas Cave National Monument
Rural Route 3, Box 200,
American Fork, Utah 84003

Valley Forge National Historical Park
P.O. Box 953
Valley Forge, Pennsylvania 19481

War in the Pacific National
Historical Park
P.O. Box FA
Agana, Guam 96910

Wilson's Creek National Battlefield
Route 2, Box 75
Republic, Missouri 65738

Wind Cave National Park,
R. R. 1, Box 190
Hot Springs, South Dakota 57747

Wrangell-St. Elias National Park and Preserve
P.O. Box 29
Glennallen, Alaska 99588

Wupatki National Monument
H.C. 33, Box 444A
Flagstaff, Arizona 86004

Yellowstone National Park
P.O. Box 168
Yellowstone National Park, Wyoming 82190

Yukon-Charley Rivers
National Preserve
P.O. Box 167
Eagle, Alaska 99738

CONTRIBUTORS TO THIS ISSUE

Stan Allison
Carlsbad Caverns National Park
3225 National Parks Hwy.
Carlsbad, New Mexico 88220
Phone: 505/785-2232, ext. 363
Email: stan_allison@nps.gov

Kelly Fuhrmann
Lava Beds National Monument
P.O. 867
Tulelake, California 96134
Phone: 916/667-2282
Email: kelly_fuhrmann@nps.gov

Rod Horrocks
Wind Cave National Park
R.R. 1, Box 190
Hot Springs, South Dakota 57747-9430
Email: rod_horrocks@nps.gov

Ronal Kerbo
NPS-GRD
P.O. Box 25287
Denver, Colorado 80225-0287
Phone: 303/969-2097
Email: ron_kerbo@nps.gov

Dale Pate
Carlsbad Caverns National Park
3225 National Parks Hwy.
Carlsbad, New Mexico 88220
Phone: 505/785-2232, ext. 368
Email: dale_pate@nps.gov

Mike Yocum, Director
329 East Main Street
Frankfort KY 40601-2331
Telephone: (502) 227-7254
Email: myocum@mis.net

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