CANYONS & CAVES

A Newsletter from the Resource Management Offices
Carlsbad Caverns National Park

Issue No. 12 **Spring 1999**

Edited by Dale L. Pate
Special Thanks to Paula Bauer & Bill Bentley

TABLE OF CONTENTS

Look for Issues of *Canyons & Caves* at the following website: http://www.caver.net/caca1.htm; caca2.htm; etc

RESOURCE NEWS

SLAUGHTER CANYON CAVE NEWS – Recent research by Victor Polyak and Paula Provencio on the guano deposits in the cave have produced interesting results. These deposits have changed over time to crystallized hydroxylapatite. Hydroxylapatite is a common phosphate mineral that forms by the reaction of bat guano with calcite or limestone. The bat bones in the guano deposits are well preserved because they now consist of the mineral apatite. Victor and Paula write "*Of particular interest is the length of time necessary to convert guano to apatite. From the evidence thus far considered, it seems that the guano deposit in Slaughter Canyon Cave is extensively altered and covered with a moderately thick calcite flowstone. This would suggest that the guano is relatively old*." Their preliminary interpretation is that the guano in the cave could exceed one-half to one million years in age. More information concerning these guano deposits will be passed on as soon as it becomes available.

Based on Victor's dissertation work on the age of several different caves in the Guadalupe Mountains, they feel that Slaughter Canyon Cave is 7 million years old.

WILD ANIMALS – With warmer weather here, the different species of animals that live and utilize the park are out and about. **Snakes**, **bats**, and **all other animals** should be left undisturbed in all areas of the park. If **snakes** are observed in visitor-use areas, they should be coaxed off trails and parking lots, not moved. Also if **bats** are found in reach of visitors along the main trails or in visitor use areas of the cavern, resource management staff should be notified. If no one can be found then contact a Law Enforcement Ranger. Under no circumstances should **bats, snakes, or other animals** be removed from the area they were found without an approved research permit.

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 coldest heaviest snowstorm of the season, he did discuss issues concerning areas north of the park and the National Cave & Karst Research Institute with some of the staff. He and his entourage were also taken on a tour of Lower Cave.

NEW WORLD DEPTH RECORD – On August 19, 1998, a Polish expedition connected a cave known as *Pl-2* to *Lamprechtsofen* to become the deepest known cave in the world at 1,632 meters (5,354 feet). *Lamprechtosofen* is located in the Northern Alps of Austria. For an up-to-date list of long and deep caves of the US and the world, look at the following world wide web site on the Internet: *www.pipeline.com/~caverbob/wlong.htm*

H'UE H'UE CAVE, a lava tube on the island of Hawaii, recently surpassed Lechuguilla Cave in depth when it was surveyed to a depth of 1,623 feet (495 meters). Lechuguilla Cave is now the 3rd deepest known cave in the US at 1,567 feet (478 meters) deep. Kazamura Cave (also a lava tube cave system on the island of Hawaii) is still the deepest known cave in the US at 3,609 feet (1100 meters) deep. Lechuguilla remains the deepest known limestone cave in the US.

INSIDE EARTH – In 1998 a newsletter was begun that serves as a forum for information and idea exchanges between NPS units that contain caves. These can be found at the following website: *www.nature.nps.gov/grd/geology/index.htm*

NEW WATER LINE – In this January 1999 photo, the new water pipeline and accompanying infrastructure can be easily seen from the escarpment edge near the Visitor Center. (NPS Photo by Stan Allison)

JAGUARS IN NEW MEXICO

(***Felis onca,*** and more recently ***Panthera onca***)
by Dale Pate

When most people think of jaguars, they think of jungle areas in South and Central America. Known in Mexico as "El Tigre", these beautiful cats also inhabit northern areas that are much drier and range up to 9,000 feet or higher in elevation. Evidently, jaguars were fairly common in the southern portions of New Mexico and Arizona, and south and east Texas before 1900. The jaguar is a spotted cat approximately the same size as the mountain lion and is the 3rd largest cat in the world behind the tiger and the African lion. A specimen that was killed in 1903 near Center City, Texas measured 6½ feet from the nose to the tip of the tail and weighed 140 pounds. Its tail is shorter than that of the mountain lion.

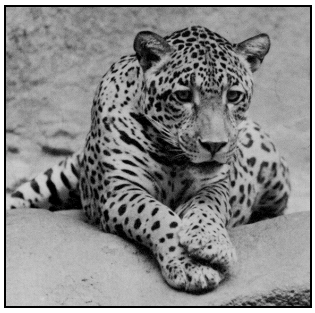
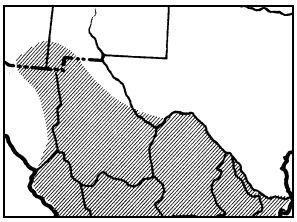


Photo by Lowell Nash and borrowed from "The Mammals of Texas" by William B. Davis and David J. Schmidly.

There are numerous reports of jaguars from New Mexico with the northernmost sighting being in Santa Fe in 1825. The earliest report of jaguars in New Mexico came from Coronado in 1540 when he was on his way north to the Zuni area. The most recent sightings of a jaguar in New Mexico was in 1996 when a hunter's dogs treed one in the southwestern part of the state. This sighting, as well as one in northeastern Arizona around the same time, came only shortly after the jaguar was placed on the endangered species list for the U.S. Earlier in this century, it was thought that the jaguars found in New Mexico and Arizona were old males that had been driven from their home territories by losing disputes with other males. It is more likely though that there was an established population in the U.S. that was decimated by the early 1900's. In southeast Arizona, there have been rare sightings of jaguars throughout this century.

The food habits of jaguars are not well known, but in Mexico they tend to feed on peccaries, deer, and large ground-dwelling birds. They are also apparently fond of cattle and other stock. There are very few accounts of jaguars attacking humans.



A range map of *Panthera onca* showing its present northern range. This illustration was borrowed from the Petersen Field Guide Series titled "Mammals" by William Burt and Richard Grossenheider and published in 1980.

I began to wonder when jaguars last were in the area of the park when I read a trivia sheet of facts that had been compiled by a former park guide, Jerry Epperson. This compilation of facts came from various Superintendent's Monthly Reports. From the trivia compilation was this intriguing sentence. "*Jaguar bones found in Bat Cave*." In the January 1958 Superintendent's Monthly Report I found the following statement: "*The bones recovered under the Bat Cave seating area were identified by the U.S. National Museum as those of a pleistocene jaguar, Felix atrox*." Obviously, the sentence from the trivia compilation was not quite accurate. The bones had been recovered from the entrance area to Carlsbad Cavern where the amphitheater is now instead of in Bat Cave. I then found a report by Lloyd Logan, a paleontologist funded by the Smithsonian, that listed *Felis atrox* as the extinct "American lion". The remains of this large cat from the Pleistocene era had also been found in other caves of the Guadalupe Mountains and over much of North America. The Pleistocene was a period in earth's history lasting from 3-million to 10,000 years ago. So presumably, the spelling of the genus name *Felis* was wrong in the Monthly Report and the statement that the animal was a jaguar was also incorrect. Weighing 700 to 800 pounds as an adult, the "American lion", *Felis atrox,* was a monster five to six times the size of today's jaguar.

I have found no records that indicate jaguars have lived in the Guadalupe Mountains, but Vernon Bailey in his 1928 publication reports that Carl Livingston told of a hunter who in 1920 brought a fresh jaguar skin into Carlsbad and sold it at one of the local stores. He did not find out where the jaguar had been killed, but presumed it was in the local area.

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SKUNKS OF THE PARK

by Ken Geluso

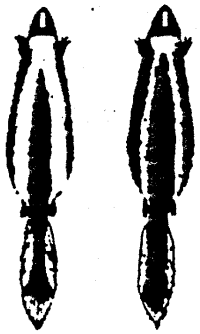
Common Hog-nosed Skunk (*Conepatus mesoleucus*) – Although hog-nosed skunks live in a wide variety of habitats

Western Hog-nosed Skunk

Illustration borrowed from Texas Parks & Wildlife Bulletin No. 111.

in New Mexico, including deserts, grasslands, and woodlands, all confirmed records of this species in the park are from the reef. Not surprisingly, most sightings have been made along the heaviest traveled road in the park—the paved one between Whites City and the Visitor Center. I have seen 16 hog-nosed skunks during my studies, fourteen along Walnut Canyon, one in Bat Cave Draw, and one in the juniper peneplain. During my many trips up and down Walnut Canyon, I have seen twice as many hog-nosed skunks as striped skunks (2.3 to 1 ratio). I have never seen, nor are there any reports of hog-nosed skunks from Rattlesnake Springs or habitats in the flatlands along the base of the escarpment.

Striped Skunk (*Mephitis mephitis*) - The striped skunk is widely distributed in the park and is the only species of skunk



Striped Skunk

Illustrations borrowed from Texas Parks & Wildlife Bullentin No. 111

inhabiting Rattlesnake Springs. On this parcel of land, I observed them only in the picnic area and adjacent grassy fields. Park personnel who have lived at the ranger station also have noted striped skunks in the horse pasture and on the lawns around their homes. Striped skunks also occur in habitats of the reef, and similar to hog-nosed skunks, most encounters occur along Walnut Canyon. I have seen six striped skunks along this canyon during my studies. In addition, Keith Geluso observed one on a wooded knoll near Yucca Cabin on 23 July 1991, and I observed another on the juniper peneplain on 23 July 1993.

Western Spotted Skunk (*Spilogale gracilis*) – The only confirmed record of spotted skunks for Carlsbad Caverns National Park is based on a black and white photograph of this species in *Animal Life of Carlsbad Cavern* by Bailey

Western Spotted Skunk

Illustration borrowed from Texas Parks & Wildlife Bulletin No. 111

published in 1928. The photograph shows a spotted skunk standing on a rock ledge "at the doorway of the Carlsbad Cavern." Park files mention that a spotted skunk was trapped by Denny Constantine near the park entrance in 1956. I eventually will contact Denny to obtain details and to see if the skunk was captured on park property. The paucity of records of spotted skunks in the park may have more to do with the skunk's habits than a true reflection of its abundance. For example, spotted skunks are not prone to walking along or crossing roads like the other species inhabiting the park.

This article was taken from a report titled "Mammals of Carlsbad Caverns National Park: An Annotated Checklist" by Ken Geluso.

NEPA IS 30

by Renee Beymer

The National Environmental Policy Act of 1969 was written 30 years ago this year. The law, commonly known as NEPA, is "*our basic national charter for protection of the environment*." It was sponsored by every single member of the U.S. Senate Interior Committee at that time, and President Nixon dramatized its significance by signing it on January 1, 1970, as "my first official act of the decade…"

Secretary of the Interior Bruce Babbitt has endorsed continued attention to NEPA, saying, "*Since its passage, NEPA has been a strong tool in protecting public resources and controlling external threats to Interior resources and programs…I view the public trust to carry out our stewardship of Interior's resources and responsibilities to be the very essence of the policy set forth by NEPA and call upon you to join me in renewed attention to using NEPA effectively in the business of the Department.*"

In this anniversary year, it is good to review some of the basic founding principles of this important law. The act's main sponsor, Senator Henry 'Scoop' Jackson, emphasized to the Senate that this is not a case of 'nature vs. man': "What is involved is a congressional declaration that we do not intend, as a government or as a people, to initiate actions which endanger the continued existence or the health of mankind: That we will not intentionally initiate actions which will do irreparable damage to the air, land, and water which support life on earth. An environmental policy is for people. Its primary concern is with man and his future.

"The basic principle of the policy is that we must strive in all that we do to achieve a standard of excellence in man's relationships to his physical surroundings. If there are to be departures from this standard of excellence they should be exceptions to the rule and the policy. And as exceptions, they will have to be justified in the light of the public scrutiny…"

Congress had two basic objectives when it made NEPA the law: <u>preventing environmental damage</u> and <u>ensuring that agency decision-makers take environmental factors into account</u>. The following overviews of the objectives is taken from the NEPA Deskbook (Environmental Law Institute, 1989) [with my comments enclosed].

PREVENTING ENVIRONMENTAL DAMAGE

Section 2 of NEPA expressly declares a purpose of promoting *efforts "which will prevent or eliminate damage to the environment*" while encouraging productive and enjoyable harmony between people and their environment. Section 101 pursues this objective, declaring it the national environmental

policy that the federal government use all practicable means to "*fulfill the responsibilities of each generation as trustee of the environment for succeeding generations*."

Federal agencies' slighting of these responsibilities and overall lack of concern for environmental protection occasioned NEPA's passage. Congress had seen *accumulating "evidence of environmental mismanagement*," and it viewed increasing citizen indignation and protest over federal agency action or inaction as indicative of the "*public's growing concern*" about this mismanagement.

Congressman John Dingell spoke of man's exploitation and free use of the resources, "*[w]e have not yet learned that we must consider the natural environment as a whole and assess its quality continuously if we really wish to make strides in improving and preserving it*." Congress determined that federal agencies would never again act without heed to the environment, declaring *a "national policy to guide Federal activities which are involved with or related to the management of the environment or which have an impact on the quality of the environment*."

To ensure that federal agencies followed this policy, Congress created in NEPA a statute regulating those agencies. Congress was aware that "*if goals and principles are to be effective, they must be capable of being applied in action*." Hence, Congress *incorporated "certain 'action-forcing' provisions and procedures…designed to assure that all Federal agencies plan and work toward meeting the challenge of a better environment*." The most important of these "*action-forcing*" devices is the environmental impact statement (EIS).

ENSURING THAT AGENCY DECISION-MAKERS TAKE ENVIRONMENTAL FACTORS INTO ACCOUNT

Informed, environmentally responsible decision-making is an objective in itself as well as the means by which Congress sought to achieve environmental protection. The District of Columbia Circuit court observed that,

"*The harm against which NEPA's impact statement requirement was directed was not solely or even primarily adverse consequences to the environment; such consequences may ensue despite the fullest compliance. Rather NEPA was intended to ensure that decisions about federal actions would be made only after responsible decision-makers had fully adverted to the environmental consequences of the actions, and had decided that the public benefits flowing from the actions outweighed their environmental costs. Thus, the harm with which courts must be concerned in NEPA cases [EISs, but not EAs] is not, strictly speaking, harm to the environment, but rather the failure of decision makers to take environmental factors into account in the way that NEPA mandates.*"

As the Supreme Court put it, "*NEPA does set forth significant substantive goals for the Nation, but its mandate to the agencies is essentially procedural*."

In crafting these "*action-forcing procedures*," Congress envisioned a scheme of agency self-regulation; it did not create a regulatory body to enforce compliance. This is why judicial enforcement of the Act [resulting from lawsuits against agencies] is so important.

It is judicial review that has given NEPA its significance. The Act places regulatory obligations on agencies without apparent means of oversight. By the conscious choice of its drafters, NEPA internalizes each agency's environmental obligations and is thus essentially self-regulatory in nature.

NEPA's enforcement ultimately depends on the courts. Fortunately, the action-forcing provisions of the Act neatly lend themselves to judicial enforcement. The importance of the role these provisions have played in fostering judicial acceptance of the Act cannot be overemphasized. Judges may, and usually should, reasonably question their competence to second-guess the scientific determinations of administrative agencies. Judges may also lack understanding of or sympathy for claimants' environmental goals.

But all judges understand procedure. The requirement that an EIS must be filed as a condition precedent to an action is just the sort of requirement that taps familiar judicial strains. Implementation of the procedural provisions of NEPA is judicially comfortable.

NEPA litigation, while not extensive [by 1989; there have been more recent cases against NPS], constitutes a significant proportion of the environmental litigation against the government (about 70 percent in 1980).

Next Issue: Agency Actions Under NEPA

LOWER CAVE HISTORIC ARTIFACT REMOVAL

by Stan Allison

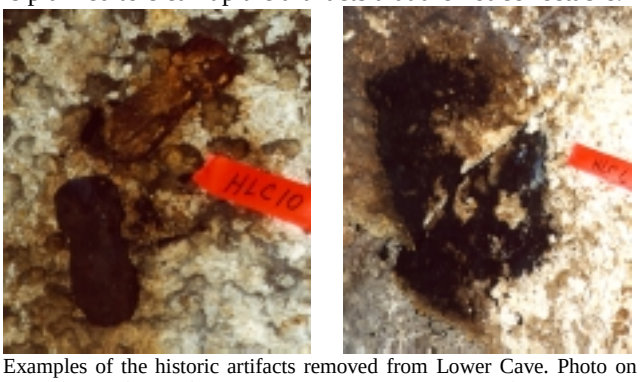
It all began in the early 1900's when Jim White was lowered 90 feet from the Jumping Off Place to Lower Cave in Carlsbad Caverns. Since that time people have been leaving their mark on Lower Cave. Over the past 94 or so years, explorers, photographers, staff and visitors have left behind evidence of 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.

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.

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 artifacts that are not collectable.



Examples of the historic artifacts removed from Lower Cave. Photo on the left is of two flare handles. Note the staining of the popcorn surrounding the handles. Photo on the right is of a deteriorated piece of cloth. (NPS photos)

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.

BATS OF LECHUGUILLA UPDATE

by Scott Sievertsen

Bat species identification in Lechuguilla Cave was a focus of a 5-year study by Pat Jablonsky. Despite the fact that there have been no live bat sightings within the cave since the breakthrough in May 1986, the skeletal remains of a number of species have been found there. The goal of the study was to locate, document, collect, and identify the species from the skeletal remains of the Chiropteran fauna found in the cave. Skulls from 48 different specimens found in the cave were carefully collected to identify the species type. With the exception of one specimen from each species, all other collected skulls are in the process of being returned to their original locations. This process of returning the bat skulls to the cave began in January 1999 when seven were returned to the Western Borehole.

Of the approximately 100 known bat skeleton remains found in the cave, 50 skulls were removed from the cave and identified to genus and species. The breakdown of identified species are as follows:

* 29 *Myotis ciliolabrum* (Western Small-footed Myotis)
* 7 *Myotis volans* (Long-legged Myotis)
* 1 *Myotis velifer* (Cave Myotis)
* 3 *Myotis yumanensis* (Yuma Myotis)
* 7 *Corynorhinus townsendii* (Townsend's Big-eared Bat)
* 1 *Eptesicus fuscus* (Big Brown Bat)
* 2 *Lasiusus cinerus* (Hoary Bat)

The study results provide a good, initial understanding of the bats found within Lechuguilla Cave and has raised some interesting questions for future studies. Based on several factors, none of the bat remains found in the cave appear to be older than 10,000 years before present. It is likely that they are much younger and probably did not enter the cave system through the existing natural entrance. Was there another entrance to Lechuguilla Cave at one time? The majority of the remains were recovered from the Southwest Branch (30 specimens) and the Western Borehole (11 specimens), with only 7 specimens recovered from the known entrance passages. What does the distribution of remains within the cave suggest? Prior to this study, *Myotis ciliolabrum* had only been collected by Ken Geluso in 1992 at Lowe Springs within the park and skulls from that species were collected by Pat Jablonsky from Carlsbad Cavern, also in 1992. Yet, over half of the collected skulls from Lechuguilla Cave represented this species. Why did they appear to prefer Lechuguilla over any of its neighbors?

These and more questions are yet to be answered about the bats of Lechuguilla Cave. The secrets they yield will help us further understand the events that make up the history of life within Lechuguilla.

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OH! THE DAMAGE DONE

by Dale Pate

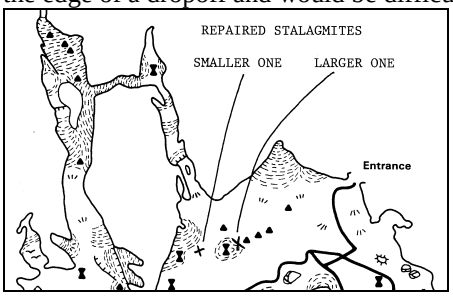
Slaughter Canyon Cave was discovered in 1937 when Tom Tucker was searching for lost goats. Early exploration in the cave found large deposits of very old bat guano. Studies by several different researchers beginning in 1954 and continuing through 1989, have shown that this guano is older than 28,000 years old while Polyak's and Provencio's work indicate that the guano may be far older than ever suspected (see Resource News in this issue). Despite the fact that most of the nitrates had been leached out, mining of this guano began in 1939 and early 1940. Anyone entering Slaughter Canyon Cave today can easily see evidence of the mining and the tremendous damage that occurred from this activity.

Obviously, much of the damage can be attributed to the guano mining, but some of it appears to have been senseless vandalism.

Robert Nymeyer heard about the cave from Bill Burnet and others which prompted he and several of his caving friends to visit the cave for their first time on September 18, 1938. Over the next four years, he would visit the cave another six times. Nymeyer kept excellent records of his visits to the Slaughter Canyon Cave and describes his experiences in the cave in his book "*Carlsbad, Caves, and a Camera*" which was published in 1978.

On May 26, 1940, Nymeyer found that the entrance to the cave had been gated and that a guano-mining operation was in full force. In his book he states, "*There were some evidences of vandalism seen in the stubs of broken stalagmites, but not too many*." Nymeyer returned to the cave again on October 4, 1942. He once again described more vandalism. "*I found quite a bit more damage to the front half of the cave from the mining operations, but the colorful back sections were still beautiful and mostly intact. More evidences of vandalism were seen. Most of the white-capped stubby black stalagmites . . .that dotted the ledges behind the Colossus (the Monarch) were gone; some still lay in rubble at the foot of the wall. In many places only broken stubs revealed where colorful small stalagmites had stood*."

A few damaged speleothems were recently found broken with the pieces lying nearby. One of the stalagmites was large and quite heavy. I invited Jim & Val Werker to help us restore this large stalagmite and on July 16, 1998, they along with Tom Madison, Paula Bauer, and myself entered the cave to do just that. The broken pieces of the stalagmite were lying on a high, flowstone ledge on the edge of a dropoff and would be difficult to repair.



Location of repaired stalagmites in Slaughter Canyon Cave. (Portion of map courtesy the Cave Research Foundation 1976)

The stalagmite had been broken in three pieces. The lower piece was the largest and was quite heavy. To prevent it from falling off the ledge, it was tied to a larger flowstone mound. The base of the stalagmite had new calcite growth on it so it was first necessary to chip this growth away. A hole was then drilled into the base and a stainless steel rod was inserted into place and secured with a special epoxy. A matching hole was drilled into the bottom of the larger piece and more epoxy was applied. The large piece was set upright and left tied in position to prevent it falling over before the epoxy had time to dry. The top piece of the stalagmite was epoxied on without any other preparation. A return trip the next day was made to remove the rope holding the stalagmite in place.

Since the stalagmite is under an active drip, it should continue to grow and should heal the small cracks that are still visible where the stalagmite had broken. A smaller stalagmite near one of the trails was also repaired on this same day. See the photos below.

Though much of the damage in Slaughter Canyon Cave can never be repaired, we can carefully fix the pieces we still have.

Jim Werker repairs a small stalagmite in Slaughter Canyon Cave. (NPS Photos by Dale Pate)

SECOND ANNUAL "SAVE OUR CAVE DAY"
by Jason M. Richards

The second annual "Save Our Cave Day" was a great success. On February 12, 1999, a total of 54 participants donated their time, energy and efforts, cleaning and restoring the fantastic resource we work in. The crew consisted of 38 employees, two Cave Research Foundation volunteers, and 14 shadow students from P.R. Leyva Middle School.

During the walk-through with Aleta Knight and the cave resource staff, various worthy projects were identified throughout the cave. Pat Jablonsky led a team of intrepid "lint pickers", sprucing the underground concession area. Tom Bemis, Bill Yett and team, removed "junk" from the King's Palace area. Stan Allison and a group of eight scrubbed the flowstone on the trail in Lower Cave. The "wetman" Gary Vequist, led a group of good-humored individuals cleaning pools. Barbe Barker, and Vicki Williams, representatives of the Cave Research Foundation, had a group restoring the Longfellow's Bathtub area. Earl Coppersmith and Aleta Knight tackled big rocks in the old elevator rubble area next to the trail outside the underground concession. Finally a man with a good sense of humor, Noel Carrasco, led a large group of shadow students from P.R. Leyva Middle School picking up emery chips along the trail.

Free lunch was served for all participants. However; when it was determined that "MRE's" were being served, only the shadow students remained. Although their taste buds are not mature, they had a great time rummaging through and trading the various gourmet delights.

This was our second year of coming together as a team for the same cause: cleaning and restoring the resource we are stewards for. "Save Our Cave Day" is also a day for knocking down division walls and enjoying who we are, people working *ultimately,* for the same cause. A very big **THANK YOU** to all that participated, and to those that made it possible.

ENEMY OF THE DARK

by Steve Oakes

A wonderful resource that few people link to Carlsbad Caverns National Park lies above the surface. The clear desert night-time sky provides a plethora of deep sky astronomical objects that delight persons of all ages. Unfortunately, the clear, dark skies that the southwest is known for is being threatened by pollution. Not just particulates spewed into the atmosphere and generally referred to as "air" pollution, but pollution from outdoor light fixtures known as "light" pollution.

What are these two types of pollution and how do they relate to astronomy at Carlsbad Caverns National Park? Well, the answer is more complicated than one may imagine.

Light pollution itself can be broken down into different components and possess several threats. The most basic threat is glare, which is light that shines directly into an observer's eyes. Also known as light trespass, it is light that is distributed where it is not wanted or needed. Street lighting, for example, should light streets and sidewalks, not shine into second floor bedroom windows or illuminate rooftops. Also known as spill light, light trespass occurs wherever light shines beyond the intended target and onto adjacent properties. More detailed components of light pollution follow from a "*Sky and Telescope*" web page. I have copied several key components. Credit is to be given to Mr. Arthur Upgren, author of the article. (The article in its entirety can be found at www.skypub.com/backyard/lightpol.html)

> *Skyglow is what the term "light pollution" properly denotes. The sky has a certain minimum surface brightness even in the most pristine, unspoiled environment. This natural component of skyglow has four sources: faint airglow in the upper atmosphere (a permanent, low-grade aurora), sunlight reflected off interplanetary dust (zodiacal light), starlight scattered in the atmosphere, and background light from faint, unresolved stars and nebulosity. Airglow peaks around the maximum of the 11-year sunspot cycle; the other sources vary with the hour of night and the seasons. But their combined average is well known.*
>
> *A typical suburban sky today is about 5 to 10 times brighter at the zenith (that is the point in the sky directly overhead) than the natural sky. In city centers the zenith may be 25 or 50 times brighter than the natural background.*
>
> *Near-horizontal light is especially destructive. A light beam aimed straight up is usually not the worst kind. It escapes into space quickly, passing through what astronomers call one "air mass." A ray aimed 10° above the horizon, on the other hand, passes through 5.6 times as much atmosphere -- 5.6 air masses -- polluting all the way. A ray that skims the horizon pollutes up to 10 air masses, though not much of the light is left by the time it goes through the last few of them.*
>
> *Full-cutoff shielding inside light fixtures is the essential remedy for both glare and skyglow. A lamp should send all its light down where the light is intended to be used, not upward or sideways.*
>
> *"Full cutoff" is usually taken to mean that no light rays from the fixture go above the horizon, and that at least 90 percent of the light is blocked in the near-sideways range from 0° to 20° below the horizontal plane.*
>
> *Many full-cutoff fixtures are becoming available in various styles. The best ones rely entirely on reflection above the bulb rather than refraction by a plastic cover hanging below it. They provide not only less waste and glare but smoother, more uniform illumination. When people see what well- designed lighting looks like at night, they want it for their own area.*
>
> *An example of what full-cutoff fixtures can do, was demonstrated in Middletown, Connecticut. Extensive sky-brightness measurements of the zenith were taken at two sites. One was at the Van Vleck Observatory on the Wesleyan University campus, and the other two miles away in wooded, semirural suburbia. The campus had, until recently, a night sky more than 20 times brighter than the natural sky background. The sky over the wooded spot was only four to five times brighter than the natural level. The change in two miles was remarkable -- from a nearly invisible Milky Way to views of the Sagittarius and Scutum starclouds on good nights.*
>
> *In 1994 the university agreed to replace most of its walkway lights within a block of the observatory with properly shielded fixtures. The sky brightness at the zenith dropped by almost half – and objects 0.6 or 0.7 magnitude fainter than the previous faintest objects were being observed for the first time in years.*

Air pollution is more obvious on how visibility can be affected, especially when one sees the emissions coming out of a smokestack. Although heavy industry is lacking in the immediate Carlsbad area, large smelters and other industry in Mexico cause unnaturally high particulate loads in the air.

The area around the park is heavily used for agriculture and pesticide use is high. In fact some studies have shown the Pecos River basin to have one of the highest pesticide loads in the country. To what extent these pesticides are airborne and affect air quality and visibility are unknown.

Another consideration is the capability of the soils and ground cover to hold down soil and dust particulates. Due to the low levels of precipitation, there is not much vegetation to hold soils in place. Consequently, when the ground gets disturbed by off trail vehicles, grazing activities, wildlife disturbance, fires, construction, agricultural activities and significant weather events (windstorms, heavy rain, snow etc.) the amount of particulates suspended in the atmosphere can be substantial.

So what is Carlsbad Caverns National park doing in the area of air pollution? A decisive step towards protecting air quality came with the amendments to the Clean Air Act in 1977. Selected areas, designated as Class I, were to be protected from existing and future manmade air pollution.

Carlsbad Caverns National Park is designated a Class I area, as are other national parks and wilderness areas larger than 20 square kilometers. In 1987, the Interagency Monitoring of Protected Visual Environments (IMPROVE) program grew out of a five-year old NPS visibility monitoring program. IMPROVE, composed of the four federal land management agencies, the Environmental Protection Agency (EPA), and three regional-state agencies, contracts air quality work to universities and private research organizations.

Of some 68 IMPROVE sites, the closest to Carlsbad Caverns National Park is Guadalupe Mountains National Park. Other relatively nearby sites include Big Bend National Park, Gila Wilderness (USFS), Bandalier National Monument, and Chiricahua National Monument, Arizona. At the Guadalupe Mountains National Park site, four machines suck air into specialized filters twice a week. Each filter is designed to trap different particulates. The particulates collected include ammonium sulfate, organic carbon, soil, ammonium nitrate, zinc, lead, selenium, and bromine. Weekly, the filters are replaced and sent to University of California at Davis for analysis. This data is summarized once a year and a report is sent to the park.

In addition to the filtering project, Guadalupe Mountains National Park also hosts a device that measures the light transmission properties of the atmosphere both day and night. This instrument, known as a transmissometer, has two main components, a light source (transmitter) and a light detector (receiver). The basics of the operation is that the transmitter sends out a light beam for ten minutes each hour. The receiver gathers this light and outputs a calculation of how much light is "lost." This measurement tells the percent transmission of the atmosphere. Using the path distance of the light beam, visual range can be derived. The visual range, usually expressed in kilometers, is how far one hypothetically could see on a flat earth.

Some may remember the air quality instruments that used to sit in Carlsbad Caverns residents' yards. These instruments, called nephelometers, read the color difference between the sky and a target, measuring to what extent a point source was obscured. Today, the transmissometer is able to incorporate "the light scattering and absorbing properties of the atmosphere along a selected sight path," -- thus taking into account a much greater swath of atmosphere than a single point. Easy access to high points with a clear line of sight to the desert floor, and more extreme wind conditions made Guadalupe Mountains National Park a better site for the transmissometer and filter station. However, the excellent applicability of these instruments to Carlsbad Caverns is obvious and should be a tremendous resource for any researcher of air quality.

Specifically, in 1997 a project statement was developed identifying the challenges to maintaining a Class I airshed at Carlsbad Caverns NP. A description of the recommended project or activity has been submitted along with budgetary information as part of a comprehensive evaluation of the surface resources and the mandates to protect them.

Staff members have entertained the need for action to further reduce light pollution at the park and in the surrounding communities. In 1996 the park obtained a copy of the city of San Diego's light pollution ordinance. Over the past several years, measures have been taken at CAVE to reduce the amount of outdoor security lighting, primarily for the benefit of the world famous bat colony. In turn, such measures have also helped reduce light pollution. Park employees also are voluntarily turning off their outdoor lights. Many employees savor the dark sky conditions. With wonderful views of comets Hale-Bopp and Hyakutake from their front porch still in memory, many park employees are reluctant to leave outdoor security lamps on all night.

In addition to casual observing, formal astronomy programs have been conducted at the caverns with assistance provided by The Albuquerque Astronomical Society and graduate students of astronomy from New Mexico State University.

Staff members are currently working on more formal arrangements and written documentation to establish specific criteria that management can follow. After a credible program is developed and implemented with measurable results recorded and sound methodology used, the various communities will be approached with the confidence of demonstrated progress.

In our area, the Resource Management team feels that the quality of night sky viewing is one of the resource treasures of the park. The natural absence of blocking vegetation and the location at the top of an exposed ancient reef allows for an unobstructed view of the night sky. Efforts by each and everyone of us can be undertaken with the knowledge we have attained. At least two American cities (San Diego and Tucson) have passed light pollution ordinances. Evening security lights are not necessarily bad, in most cases the design of the fixture is the main culprit to light pollution. Information on light pollution can be obtained from the International Dark Sky Association (IDA). The address is 3545 N. Stewart, Tuscon, Arizona 85716. They maintain a web site, which includes its fact sheets and newsletters, at http://www.darksky.org/~ida/index.html. Better knowledge can result in better skies.

Where is your hometown?