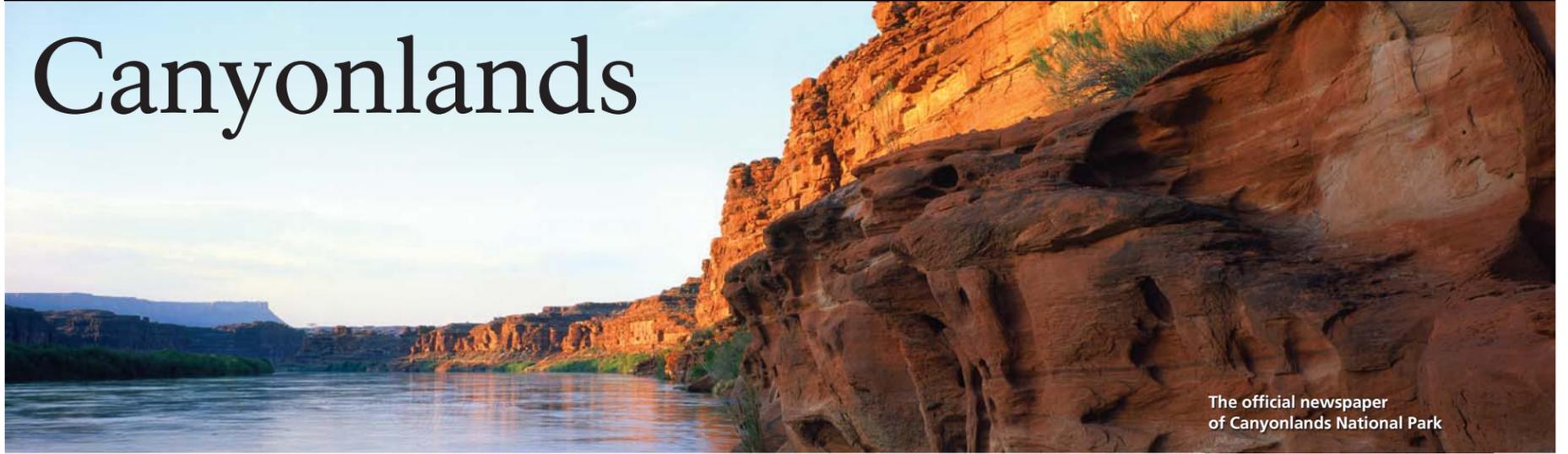




Canyonlands



The official newspaper
of Canyonlands National Park

River Survey Completed

BY SUE EININGER

DESPITE THE PRISTINE BEAUTY AND EXPANSIVE SOLITUDE THAT MANY of us experience in Canyonlands, there are numerous reminders that we are not the first people to wander the canyon rims or seek shade beneath the riverside cottonwoods. Talk to anyone who has frequented the Colorado and Green river canyons and they will likely tell of seeing prehistoric masonry structures, long-abandoned campsites, numerous rock art images and historic inscriptions during their travels. These types of archeological sites have been the focus of a multi-year study—the Canyonlands River Corridor Architectural and Rock Art Survey—funded by entrance fee collections and Vanishing Treasures funds which have been set aside for the preservation of the park's cultural resources.

Fieldwork for this project was conducted from 2004 through 2006. One hundred and twenty sites were documented along the shores of both the Colorado and Green rivers. Only about a quarter of these sites are considered new discoveries. Most had been previously identified by park rangers and archeologists in the 1970s and early 1980s, and many have been visited by cowboys, miners and river runners traveling through the canyons. Photographs and brief site descriptions had been recorded, but in order to better interpret and manage these sites, more detailed information was needed.

Working from riverside camps, archeologists documented the sites collecting both archeological data and condition information. Sites were described, mapped and photographed in order to fully document their remains and determine what activities occurred within them. This information will be compared with data from other projects to piece together the bigger picture of the prehistoric and historic lifeways of the river canyons.

Although there are still unrecorded sites along the rivers, the scheduled field work phase of this project is complete and we are in the process of compiling and analyzing the data collected. Based on our preliminary observations, the cultural remains represent several thousand years of use and occupation along the river corridors. The earliest sites are associated with the activities of archaic hunter-gatherers (6,000 B.C. to A.D. 500) who utilized the river canyon resources seasonally. The majority of the project sites belongs to the Late Formative Period (11th to 13th century A.D.), representing people of a more sedentary lifestyle who relied on agriculture as well as hunting and gathering. The various habitation, storage, and rock art sites of this period exhibit characteristics of both the ancestral Puebloan (formerly known as Anasazi) and Fremont prehistoric traditions. More recent sites are attributed to historic 20th century mining and ranching activities, much of which continued up until the creation of Canyonlands National Park in the 1960s.

Condition information was also collected, describing site damage, identifying natural and human disturbances and evaluating the potential for future damage. Site condition was found to be quite



One of the many sites surveyed along the Colorado and Green rivers.

variable across the project area, with sites ranging from largely intact to mostly destroyed. At some locations, prehistoric walls stand at their original height with little apparent deterioration. At others, walls have completely collapsed and only a few pieces of scattered stone indicate their original location. Sites exposed to both natural weathering and human activities are typically in the worst condition.

Precipitation, water runoff, wind and rodent nesting were the most commonly observed forms of natural disturbance. Foot traffic, climbing into structures, graffiti, artifact collection and rearranging wall stones were the most prevalent forms of human disturbance. Though many of these human impacts were unintentional, it was apparent that many visitors, eager to view the sites, were unaware of the cumulative effect of their actions on the fragile remains. Many of the sites we see today are visible to us because they are located within relatively protected environments. Others are more exposed to the elements and heavily visited. As a result, these sites are the most vulnerable to deterioration.

Canyonlands was established in part to protect the area's spectacular archeological resources. This involves preserving not only the physical remains of these sites, but their potential to help us understand the people and activities they represent. Archeological resources are non-renewable and as such, they typically cannot be "fixed." The best way to protect them is to prevent, or at least minimize, disturbance and damage. As park visitors, you can help by treading carefully, leaving artifacts where you find them, viewing structures from outside, and being careful not to touch rock art panels. Visiting these sites responsibly will help ensure their preservation and provide future visitors the opportunity to wonder about the people who came before.



Welcome!

"That in order to preserve an area in the State of Utah possessing superlative scenic, scientific, and archeologic features for the inspiration, benefit and use of the public, there is hereby established the Canyonlands National Park..."

This passage from the public law passed by Congress in 1964 set aside a remarkable landscape containing much of the Colorado and Green river basins around their confluence. As Americans, we hold this to be a special place that preserves a part of this nation's natural and cultural heritage.

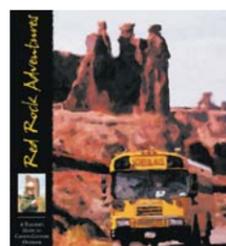
Canyonlands offers a full spectrum of discovery and experience. The Island in the Sky provides a raven's view of endless canyons and mesas. The Needles, whether accessed by vehicle or on foot, is a visual feast that constantly teases you into wanting to see what's around the next sandstone fin or knob. Venturing into the remote canyons of the Maze District allows visitors to lose and find themselves at the same time. Finally, floating the calm waters of the Green or Colorado rivers is nothing short of soothing therapy for the soul, while the rapids of Cataract Canyon below their confluence rouse your spirit.

Canyonlands is a place to make and share memories that can sustain you for a long time to come. I hope you rest, relax, recreate and, most importantly, remember your time here. As you leave the park behind, please take a piece of it home in your heart. On behalf of the dedicated National Park Service staff and our many volunteers, I truly hope that you safely enjoy your visit.

Kate Cannon
Superintendent

User Fee

Thanks to you, improvements are being made throughout the park. See back page for details.



TEACHERS!

Red Rock Adventures: A Teacher's Guide to Canyon Country Outdoor Education contains over 100 science activities for grades one through six. Topics are taken directly from the Utah State Science Core Curriculum guidelines and are correlated to the National Science Standards. To download lesson plans and learn more about the program, visit www.nps.gov/cany and click on "For Teachers."



IT'S ALIVE!

Watch your step as you're exploring the park. See the back page for more information on living soil crusts.



National Park Service
U.S. Department of the Interior

Canyonlands Park News

Published By

Canyonlands Natural History Association (CNHA), a nonprofit organization that assists the National Park Service in its educational, interpretive and scientific programs. CNHA's goals include enhancing every visitor's understanding and appreciation of public lands by providing a selection of quality, educational materials for sale at the park visitor centers. For more information, contact CNHA at (435)259-6003, or visit their website at www.cnha.org.

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Cover Photo

The Colorado River in Meander Canyon

The National Park Service cares for the special places saved by the American people so that all may experience our heritage.

Local Experts

AMONG YOUR FIRST IMPRESSIONS OF Canyonlands National Park, you may have found yourself wondering, "How does anything live here?" Plants and animals face months without rain, scorching temperatures and hungry predators ready for their next meal. Yet somehow they survive these harsh conditions. Though a park ranger could certainly answer your well-founded question, so might a local fourth grader.

Every fall, fourth graders in southeast Utah participate in an outreach program sponsored by the National Park Service that relates Utah state science standards to the rich outdoor classroom surrounding their schools and towns. Fourth graders come to Canyonlands every year to specifically study the adaptations of the plants and animals that live here.

Fourth graders aren't the only southeast Utah elementary students that benefit from the National Park Service's outreach program, Canyon Country Outdoor Education (CCOE). Every student, from kindergarten through sixth grade, will participate in one of CCOE's science programs each year. Topics include plants, geology, primitive technologies, landforms, winter ecology and even what it's like to be a park ranger. Students travel from surrounding schools into Canyonlands as well as to Arches National Park and Natural Bridges and Hovenweep National Monuments to participate in a creative and hands-on learning experience. With over 90% of southeast Utah managed as public lands, the CCOE program allows students to get out and experience the National Parks, which are literally in their backyard.

A typical CCOE field trip is full of natural and cultural experiences. The fourth graders who visit Canyonlands hike the



How many fourth graders does it take...? Blanding fourth graders enjoy the Needles District's Cave Spring Trail as they learn about cowboys, prehistoric rock art and plant adaptations.

Cave Spring trail which is like a walk back through time. Students peek in long-abandoned feed bins that still contain grain, gaze upon ancient handprints adorning cave walls and discover cowboy artifacts along the trail. Understanding that humans have survived in this area for thousands of years builds upon important critical thinking skills for many students. Seeing the vegetation that crowds sections of the trail provides an excellent teaching tool for discussing the adaptations that plants possess to acquire enough water. Students learn how waxy leaves, spines, long roots and the excretion of salts onto leaves help plants endure the hot and dry climate of Canyonlands.

In addition to the guided hike, students rotate through learning stations centered on the field trip topic. CCOE puts a creative twist on learning fundamental science concepts that helps engage students. For example, the fourth graders visiting Canyonlands role play to experience what

it might be like to be either a predator or its prey. While pretending to be a deer, they are blindfolded and forced to use their sense of hearing to listen for approaching "mountain lion" steps. Then the roles are reversed and the "mountain lion" uses its sense of sight to spot "deer" trying to camouflage themselves among the bushes and rocks.

As the bus pulls away at the end of the day, students are leaving with smiles on their faces. Hopefully, they leave not only with the knowledge of how animals and plants survive in Canyonlands, but also with a closer connection to the natural world around them.

For more information on Canyon Country Outdoor Education, including internship opportunities and program curriculums, visit the "For Teachers" section of the park's website: www.nps.gov/cany.



Interpretive program at Grand View Point



Mountain biking on the White Rim Road



Sunrise at Mesa Arch

Exploring Island in the Sky

Basics

- Visitor center is open 8:00 a.m. to 6:00 p.m. from April to late October, and 9:00 a.m. to 4:30 p.m. the rest of the year. Features exhibits, book and map sales, audio-visual programs, backcountry permits, general information, and park rangers on duty.
- There are no free water sources at the Island. Water is sold in the visitor center at the front desk and at a vending machine outside.
- Orientation movie: *Wilderness of Rock* is shown on request at the visitor center (15 minutes).
- Vault toilets are located at the visitor center, Grand View Point, Green River Overlook, Upheaval Dome, White Rim Overlook and Willow Flat Campground. The visitor center toilets are wheelchair accessible.
- Campground at Willow Flat has 12 sites available on a first-come, first-served basis. No water or hookups provided. Nightly fee is \$10 per site.

Scenic drive

A 34-mile (round-trip) scenic drive allows visitors to tour the entire mesa top. The *Road Guide to Canyonlands - Island in the Sky District* offers an insightful narrative for the trip and can be purchased at the visitor center. A self-guided driving tour CD is also available for sale or loan. Wheelchair accessible overlooks include Grand View Point, Green River Overlook and Buck Canyon Overlook. There are picnic areas at White Rim Overlook and Upheaval Dome.

Interpretive activities

- Interpretive brochures are available for Mesa Arch and Upheaval Dome.
- Ranger programs: Geology talks (30 minutes) are presented daily at 10:30 and 11:30 a.m. at Grand View Point (April to late October). Afternoon talks and activities are presented daily (April to September). Check at the visitor center or campground for times and topics.

For kids

Free Junior Ranger booklets are available at the visitor center. Kids age 6 to 12 can earn a Junior Ranger badge by completing five or more activities in the book. For hiking, kids enjoy peeking through Mesa Arch and climbing the back of the whale at Whale Rock. Use caution as there are unfenced overlooks on both of these trails.

What to do with your day

First, stop at the visitor center for current information on trails, roads, interpretive programs, weather, or to watch the park orientation movie.

If you have 2 hours:

Drive to Grand View Point or Green River Overlook. Hike to Mesa Arch.

If you have 4 hours:

Drive to Grand View Point, Green River Overlook and Upheaval Dome. Hike the Grand View Point, Mesa Arch, and Upheaval Dome Overlook trails.

If you have 8 hours:

Visit every overlook. Hike several mesa top trails or one of the more strenuous trails descending to the White Rim. Enjoy lunch on the trail or at White Rim Overlook or Upheaval Dome picnic areas.

If you are interested in geology:

View the exhibits at the visitor center and pick up a geology handout. Visit Grand View Point to see the rock layers. Visit Upheaval Dome and hike to the first overlook. There you can learn two theories about how the crater might have been formed.

If you are interested in natural history:

View the visitor center exhibits and pick up a free natural history handout. As you pass through Gray's Pasture, watch for mule deer or bighorn sheep. Walk the Mesa Arch or Neck Spring trails and learn about native plants.

If you are interested in human history:

View the visitor center exhibits and pick up a free handout. Hike the Aztec Butte Trail to see ancestral Puebloan ruins. Hike the Neck Spring Trail to view remnants of the ranching era. Old fences and corrals are visible along the scenic drive and Murphy Point Trail. Also, old mining roads are visible from most overlooks.

If you are interested in watching sunrise/sunset:

Find out sunrise and sunset times at the visitor center. Visit Mesa Arch at dawn. Visit Green River Overlook or Grand View Point at dusk for incomparable views of sunset over the canyons. Hike to the top of Aztec Butte for a spectacular view of the Island in the Sky and surrounding countryside.

A Glimpse of the Past

BYCHRIS GOETZE

ARCHEOLOGISTS USUALLY DEAL IN BIG PICTURE issues such as “How did prehistoric people organize themselves socially,” or “What was the population of a particular area at a particular time?” These kinds of questions are used to try to interpret how groups of people lived during prehistoric times. However, once in a while archeologists get the chance to focus on the life of a single individual. Such an opportunity arose in 2005, when visitors in a remote part of Canyonlands reported finding a small leather bag eroding out of a sand dune. The bag was collected by park archeologists and sent to scientists in Flagstaff for analysis. The results provide a much more personal glimpse of the past than the practice of archeology usually offers.

The bag was made of antelope hide and was divided into two smaller compartments by a leather strap wrapped around the middle. The bottom compartment, approximately the size of a softball, had been filled with seeds from the marsh-elder plant (*Iva xanthifolia*). The upper compartment contained a small, smooth river cobble and three small leather pouches, two of which were empty. The third pouch contained 40 chipped stone flakes, a biface, and a tool made of shaped antler. The mouth of the bag had been secured in the same way as the middle part, by wrapping it with a leather strap. Leather and plant materials from the cache were subjected to radiocarbon dating which determined that the bag was abandoned between A.D. 770 and A.D. 970.

While the particular species of marsh-elder in the bag has not been found in Canyonlands, it is available in surrounding areas. The scientists performed a number of experiments to try and determine how the seeds might have been used. Marsh-



Above left: The bag shortly after recovery, with two pouches separated by a leather strap. Above right: One of several pouches found in the upper compartment.

elder seeds are best collected in the fall and may actually be the last available seed before winter. While bitter in taste, the seeds in the bag would have provided a nutritious snack that otherwise might not have been available in the landscape. The scientists speculate that the amount of seed in the bag would have been enough to stave off hunger while looking for something better to eat.

The chipped stone flakes were identified as being from a very specific chert source located near the Island in the Sky District of Canyonlands. Because of the presence of better-quality cherts throughout the area, the scientists suggest that the bag owner was visiting the Island in the Sky area for another purpose but took the opportunity to scavenge the material for future use. The shaped antler and the small river cobbles are thought to be part of a kit used for turning the flakes into useful tools. The other empty pouches could have been used to protect the hand of the flintknapper during tool manufacture, or they may have been used to carry finished tools.

The scientists’ summary interpretation is that the bag belonged to a flintknapper and hunter who may have been on a late fall hunt. Since he was in the vicinity of a chert material source, he saved a number of flakes that, using the antler and smooth river cobble, he could later turn into finished projectile points. While we can’t know for sure, the bag was probably cached within territory regularly frequented by the owner. Caching a tool kit could save precious hours during a hunt by eliminating the need to search for raw material if another projectile point were needed. The bag of seeds would have served as emergency rations. Presumably, the bag was placed in a location that was easily remembered, in anticipation of future need.

A find like this leather bag is literally a time capsule, providing a rare glimpse of an individual’s personal property. It is a unique opportunity to ponder not the big picture questions that archeologists obsess over, but the life of an individual in prehistoric society. For additional information on the bag as well as photos, please visit the park’s website at www.nps.gov/cany.

Doing the Right Thing

Sometimes people do the right thing. That was the case when Sam and Ashley Grimes caught up to a ranger and reported that they had found some kind of object eroding out of a sand dune. The object turned out to be a prehistoric leather bag (see adjacent article). Their find, and the way in which they handled it, contributed to a wealth of archeological information about a particular individual and his personal belongings.

Archeological artifacts are not important in and of themselves. The pot sitting on your mantle piece, the arrowhead in your kitchen drawer, while interesting, provide little scientific information about how people lived prehistorically. From an archeological perspective, the important thing about an artifact is the information it provides when it is found in context, that is, the location where the original user left it. If an object is removed from its context without the benefit of scientific evaluation, it no longer has any archeological value.

You too can help further archeological research by following a few rules:

- If you find an object, don’t collect it. It is illegal and destroys the archeological and scientific value of the artifact.
- Note the location on a map if possible. If you have a GPS unit, get a plot and write a brief description about where the object is located.
- Report your find to the nearest visitor center or ranger station.
- Make sure you leave your name, address and phone number so that a park archeologist can contact you if they have questions or need further information.

Please help us better understand how prehistoric people lived and worked in the Canyonlands area by responsibly reporting any artifacts you might find. Your contributions will help further archeological research and reward all of us with insights into lives lived long ago.

Exploring The Needles

Basics

- Visitor center is open 8:00 a.m. to 5:00 p.m. from April to late October, and 9:00 a.m. to 4:30 p.m. the rest of the year. Features exhibits, book and map sales, audio-visual programs, backcountry permits, general information, picnic area, and park rangers on duty.
- Water is available year-round at the visitor center and at the Squaw Flat Campground.
- Orientation movie: *Wilderness of Rock* is shown on request at the visitor center (15 minutes).
- Restrooms are available at the visitor center and Squaw Flat Campground (wheelchair accessible). There are also vault toilets at Elephant Hill.
- Squaw Flat Campground has 26 sites available first-come, first-served. No hookups. Nightly fee is \$15 per site.

Scenic drive

The scenic drive continues 7 miles past the visitor center, ending at Big Spring Canyon Overlook. Along the way are several pullouts for short hiking trails, viewpoints and a picnic area. Graded gravel roads lead to Cave Spring, where there is an interpretive trail, and to the Elephant Hill trailhead, where there is a second picnic area. The Elephant Hill access road provides excellent views of the Needles from a car (about one mile from the pavement).

Interpretive activities

- Interpretive trails (with printed guides) include Cave Spring, Pothole Point, Roadside Ruin and Slickrock.
- Campfire programs are presented five nights a week at Squaw Flat Campground (April to October). Check at the visitor center or campground for topics and times.

For kids

Free Junior Ranger booklets are available at the visitor center. Kids age 6 to 12 can earn a Junior Ranger badge by completing five or more activities. The Cave Spring Trail, featuring a cowboy camp and prehistoric pictographs, is always a hit with kids. Pothole Point is another popular hike, especially if the potholes are full of water. Before you set out, rent a kids’ discovery pack from the visitor center. Packs include a naturalist guide, binoculars, hand lens and more (small fee and deposit required).

What to do with your day

First, stop at the visitor center for current information on trails, roads, interpretive programs, weather, or to watch the park orientation movie.

If you have 2 hours:

Drive to Big Spring Canyon Overlook and hike the Pothole Point trail along the way. Drive to a view of the Needles on the Elephant Hill access road.

If you have 4 hours:

Explore the scenic drive and graded dirt roads. Hike the Cave Spring, Pothole Point and Roadside Ruin trails or the longer Slickrock trail.

If you have 8 hours:

After exploring the scenic drive, hike to Chesler Park or around the Big Spring-Squaw Canyon loop. Enjoy lunch on the trail.

If you are interested in geology:

View the exhibits at the visitor center and pick up a free geology handout. Every Needles trail provides unique views of rock formations, and marine fossils are visible in the canyon below Big Spring Canyon Overlook (follow the Confluence Trail).

If you are interested in natural history:

View the visitor center exhibits and pick up a free natural history handout. Bighorn sheep are seen most frequently from overlooks along the Slickrock Trail. Squaw, Lost and Salt Creek canyons are great for early-morning birding.

If you are interested in human history:

View the visitor center exhibits and pick up the free human history handout. Hike the Roadside Ruin and Cave Spring trails. If time permits, visit the Peekaboo rock art panel in Salt Creek Canyon.

If you are interested in watching sunrise/sunset:

Find out sunrise and sunset times at the visitor center. Sunrise is spectacular from the campground area, especially along the short trail over the butte between Loops A and B. Visit Pothole Point or Wooden Shoe Arch Overlook as the glow of sunset washes over the Needles.



Pothole Point



On the trail to Chesler Park



Rock spires in Chesler Park



A raft plunges through a rapid on its way through Cataract Canyon.

Backcountry Areas

Much of the land in Canyonlands remains undeveloped, a fact evident at any of the overlooks along the Island in the Sky scenic drive. The park's primitive character has made it a popular destination for backcountry travel. In every district, rugged roads, trails and rivers provide paths into remote corners of the park.

The White Rim Road, a 100-mile loop below the Island in the Sky mesa, is a favorite of mountain bikers and four-wheel drivers. The Needles provides ideal itineraries for backpackers in search of solitude. The Maze offers opportunities for lengthy exploration by foot and vehicle. Due to its remoteness and the difficulty of roads and trails, travel to the Maze requires more time, as well as a greater degree of self-sufficiency.

Yet another way to see the park is on the rivers. Boaters can float down the flatwater sections of the Colorado and Green rivers to the Confluence, or continue downstream to face 14 miles of rapids as the river tumbles through Cataract Canyon.

Rock art enthusiasts should be sure to visit Horseshoe Canyon, a detached unit of Canyonlands northwest of the Maze. A moderately strenuous hike leads to a series of pictograph panels created by hunter-gatherers over 2,000 years ago.

If you're interested in planning a trip to any of these areas, request a copy of the *Canyonlands Trip Planner*, or visit our website at www.nps.gov/cany.

Thanks to You

CANYONLANDS NATIONAL PARK WILL ENCHANT YOU WITH ITS MYSTERY AND BEAUTY. MILES of roads and trails offer access to a colorful geologic wonderland in the heart of the high desert of southeastern Utah - a masterpiece of nature's work. From sagebrush and claret cup to bighorn sheep and lizards, hundreds of species of plants and animals weave color and texture into Canyonlands' diverse landscape.

With all this majesty, hundreds of thousands of hikers, campers, boaters and other outdoor enthusiasts are drawn to Canyonlands each year. The park's popularity creates a challenge - to assist and protect its visitors, while preserving the natural and cultural treasures that brought them here in the first place. With your park fees and continued support, we can meet this challenge together.

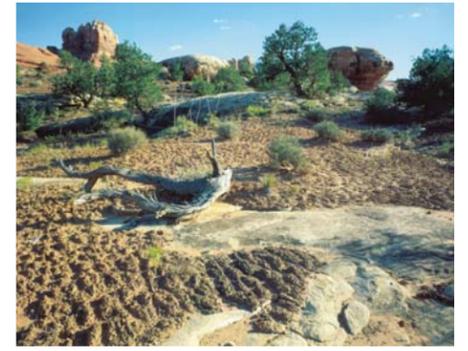
In 1996, Congress authorized the Recreational Fee Demonstration Program in order to reverse the deteriorating scope and quality of federal facilities and address natural and cultural resource issues. In 2004, Congress passed the Federal Lands Recreation Enhancement Act that continues the fee programs for an additional 10 years. Prior to these programs, user fees were returned to the general fund of the federal government and parks were reimbursed only for their collection costs. Now, Canyonlands keeps 80% of camping and entrance fees. During the past ten years, over 5 million dollars in retained fee revenue has been put to work at Canyonlands.

The park's trail crew continues to perform maintenance and rehabilitation on over 120 miles of trails. All of the paved roads at Canyonlands have received preventative maintenance that extends their life and makes travel safer. Campsites have been rehabilitated both in the frontcountry and along the White Rim Road.

National Park Service employees and volunteers work hard to protect the resources of Canyonlands. Now you're a partner in this important work. Thanks to you, park facilities and programs are improving, and visitors can continue to experience this national treasure for generations to come.



Preventative maintenance like crack sealing extends the life of park roads.



WATCH YOUR STEP! Biological soil crust is a living groundcover that forms the foundation of high desert plant life in Canyonlands and the surrounding area. This knobby, black crust is dominated by cyanobacteria, but also includes lichens, mosses, green algae, microfungi and bacteria.

Protect Your Park

- Avoid trampling biological soil crusts. Always walk on trails, slickrock or in sandy wash bottoms.
- Pets are not allowed on hiking trails or four-wheel-drive roads, even in a vehicle. Pets may be walked along paved roads and in the campground, but must be leashed at all times.
- Protect water sources. Do not swim or bathe in potholes or intermittent streams.
- Preserve your heritage. Do not enter, alter or deface archeological sites. Leave artifacts undisturbed.
- It is illegal to remove natural or cultural features including plants, rocks, artifacts, driftwood or antlers.
- Vehicles and bicycles must travel on designated roads.
- ATVs are not permitted.

Protect Yourself

- Drink at least one gallon of water per day if you're active in the desert.
- Always carry a map, adequate clothing and flashlight in the backcountry.
- Remain in one place if you become lost or separated from a group.
- Always let someone know where you are going and when you expect to return.
- Never cross a canyon that is flooding.
- During lightning storms, avoid lone trees and high ridges. Sit in a vehicle if possible.
- Be careful near cliff edges, especially when rock surfaces are wet or icy.

Solving the Mystery of Upheaval Dome

BY NEAL HERBERT

WHEN YOU PEER INTO UPHEAVAL DOME AT the Island in the Sky, you are looking into a giant question. In an area where the dominant landform consists of flat layers of sedimentary rock carved into mesas and canyons, how did this strange circular dome come to be?

Every geologic layer found in Canyonlands formed in a distinct environment. The tall Wingate Sandstone cliffs that frame much of the park where once a sea of sand dunes. The thin white layer which forms mesa tops (known as the Kayenta Formation) was formed by the sediment in shallow braided streams.

Though initially flat and (more or less) uniform, over millions of years these layers have been eroded into today's landscape. With few exceptions, this work was done by water, both flowing and during freeze-thaw cycles, acting against the gradual rise of the Colorado Plateau: a geologic province encompassing all of southeast Utah where the average elevation is now 5,000 feet above sea level.

Upheaval Dome is one of the exceptions. Water—and its capacity to shape the land—cannot account for an area where rock layers are so dramatically deformed. In the center, rocks are pushed up into a circular

dome: rocks that were once buried a mile underground and are not visible anywhere nearby. Surrounding the dome is a circular ring of cliffs bent downwards toward the Green River. What force created this scene? Geologists can't agree, except to say that it must have come from either deep within the earth, or deep space.

A thick layer of salt, thousands of feet below the surface, underlies much of southeast Utah and Canyonlands. Under immense pressure from the weight of the rock above it, the salt becomes like toothpaste in a tube, flowing away from areas where the pressure is greatest. Because salt is less dense than sandstone it can flow upwards, eventually rising to the surface and deforming the surrounding rock in the process. Some scientists believe such an event occurred at Upheaval Dome. Over millions of years, both the salt and the rock that was above it have been entirely removed by erosion.

Other scientists believe this feature has more in common with an impact crater than a salt dome. They estimate that roughly 60 million years ago, a meteorite roughly one-third of a mile wide slammed into the earth at what is now Upheaval Dome. The impact created a huge explosion, sending dust and debris high into the atmosphere. The impact initially created an unstable crater that partially



Impact crater or salt dome: an aerial view of Upheaval Dome looking toward the Green River.

collapsed. As the area around Upheaval Dome reached an equilibrium, the rocks underground heaved upward to fill the void left by the impact. Erosion has since washed away the meteorite debris, providing a view into the interior of the impact crater, exposing rock layers once buried thousands of feet deep.

Recent research seems to favor this interpretation. Geologist studying the Wingate Sandstone around Upheaval Dome have found areas where the rock has been sig-

nificantly compacted. By comparing the structure and properties of these rocks with nondeformed samples, they determined that the most plausible geologic process capable of causing the stress is a meteorite impact.

Experiments and field work testing this hypothesis will continue this year. In the meantime, the origins of Upheaval Dome will remain a mystery.