Park News

Great Basin National Park
National Park Service
U.S. Department of the Interior

# The Midden

The Resource Management Newsletter of Great Basin National Park

## Nineteen Species of Terrestrial Mollusks Found in Park

by Mark Ports, retired professor, Great Basin College

Photo by Mark Ports

**One of the many terrestrial mollusks found in Great Basin National Park. This species is the Great Basin Mountain Snail, Oreohelix strigosa depressa.**

Land snails and slugs existing in the Great Basin desert may seem like a paradox with valleys of salt flats, rivers that sink into the ground, and long miles between high mountain ranges. However, in Great Basin National Park there exists today, although small and inconspicuous, 18 species of land snails and one species of slug.

During the period of spring 2014 through the summer of 2016 a survey was carried out to identify these rarely seen invertebrates found in the national park. Over 60 localities, including canyons, upland wooded slopes and mountain brush, riparian woodlands, subalpine lakes, and Bristlecone forests were sampled for terrestrial mollusks. The survey showed that land snails were most diverse and abundant with 15 species located in wooded riparian below limestone cliffs such as at the Grey Cliffs on Baker Creek.

Limestone in the form of calcium carbonate is used for shell development. Mesic litter found beneath shrubs and aspen provide food for these herbivorous species and retains moisture for their mucus used to move about on their single foot. Riparian habitats with deciduous vegetation, moist litter, and rockslides can contain a community of 8 to 12 species of land snails. Rockslides provide a deep, moist sanctuary from the heat of summer and the cold of winter. Boggy stream sides and wet springs will provide habitat for up to 11 species of land snails plus the only species of slug, *Derocerus laeve* and a water-dependent land snail, the ambersnails of the family *Succiniedae*.

The highest elevation known to be used by land snails is found in the rocky habitat of Bristlecone woodlands at 3200 meters. Here only 1 to 3 species were found, while the lowest elevation at 1800 m in sagebrush-steppe supported only 2 species. The dry, barren ground of much of the Pinyon Pine and Utah Juniper woodland apparently would not support any land snail species.

Most species of land snails inhabiting the park today are considered tiny, ranging from 2-6 mm in diameter such as the Montane Snaggletooth (*Gastrocopta pilsbryana*) and the Crestless Column (*Pupilla hebes*). The largest land snails include species of Mountainsnails (*Oreohelicidae*), such as the Schell Creek Mountainsnail (*Oreohelix nevadensis*), endemic to Nevada, and the Great Basin Mountainsnail (*Oreohelix strigosa depressa*), found in the mountains of eastern Nevada and many of the mountains

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# Terrestrial Mollusks (continued)

of Utah and Colorado. These large snails, 10-20 mm in diameter, are found in localized colonies in rockslides, sheltered by deciduous shrubs, aspen, and conifers.

It appears that the terrestrial mollusks of the national park have close affinities with the terrestrial mollusks of northeastern Nevada, such as those found in the Ruby Mountains and share many species with the land snails found today in the Wasatch Mountains of Utah. The terrestrial mollusks found in the park today are probably the remnants of a once widespread mollusk community found throughout the Great Basin and the Rocky Mountains during the wetter Pleistocene (2 mya). They have now retreated to higher elevations providing mesic habitats available in the moist, wooded mountains since the dry Holocene over the last 50,000 years.

Photo by Mark Ports

Closeup of one of the Montane Snaggletooth, only 2 mm long.

Today these invertebrates are limited to small and specialized habitats, with climate change and human disturbance making their future uncertain.

For references and details: Ports, M.A. 2019. Terrestrial mollusks of Great Basin National Park, the Snake Range, Nevada, USA. Western North American Naturalist 79(2): 247-259.

# Selected Publications about the Park


Carter, O., B. Kropp, N. Noell, J. Hollinger, G. Baker, A. Tuttle, L. L. St. Clair, and S. D. Leavitt. 2019. A preliminary checklist of the lichens in Great Basin National Park, Nevada, USA. Evansia 36(3):72-91.
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# Bonneville Cutthroat Trout Reintroduced to Snake Creek

by Jonathan Reynolds, Fisheries Biologist

In July of 2018, Great Basin National Park conducted a second rotenone treatment in the upper portion of the Snake Creek watershed to remove any non-native brook trout that had survived the 2016 treatment. In October of 2018, 74 sites (one site for every 200 meters of stream) were sampled for the presence of fish DNA. Processing of the samples was delayed due to the government shutdown, but by April of 2019 Great Basin National Park received the official report from the Rocky Mountain Research Station.


NPS Photo by Julie Long

**Park staff, NDOW, and volunteers help find Bonneville cutthroat trout in Hendry's Creek to release in Snake Creek.**

NPS Photo by Jonathan Reynolds

**Bonneville cutthroat trout being released into Snake Creek.**

The results were negative for the presence of fish DNA at all 74 sites. This good news allowed the Park to focus on the final step of the project, reintroducing native Bonneville cutthroat trout (*Oncorhynchus clarkii utah*, BCT) into Snake Creek.

The Park teamed up with the Nevada Department of Wildlife and BLM staff to collect 118 BCT from Hendry's Creek located in the North Snake Range. The BCT were transported to Snake Creek and released at various locations throughout the stream. The population will be closely monitored and more BCT will be released into Snake Creek if necessary. The population of BCT in Snake Creek should grow rapidly in the years to come, creating a conservation population and providing park anglers with a productive recreational fishery.

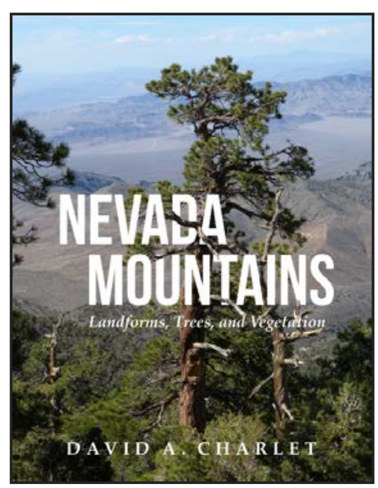
# New Nevada Book

Nevada is one of the most mountainous states in the US. Yet mapping out exactly where one range begins and another ends has never been done—until now. In this volume, David Charlet provides maps and descriptions for all 319 mountain ranges in the state.

Each mountain range entry contains a descriptive narrative and a data summary that includes the highest point, the base elevation, a brief discussion of the geology, any historic settlements or post offices located in the range, the distribution of life zones, and a list of all conifers and flowering trees.

This book is the result of over thirty years of exploration and study throughout the state.

For more information, see: [https://uofupress.lib.utah.edu/nevada-mountains/](https://uofupress.lib.utah.edu/nevada-mountains/)



# Lehman Caves Geology Reveals New Discoveries

by Louise Hose, University of Nevada – Reno

We are learning a lot about Lehman Caves geology these days. While the Snake Range is a bit of a hot bed for geologists and university students to visit and study, the area immediately around the cave hasn't received much attention. This may be, in part, because good topographic maps weren't available until late in the 20th century for this part of the Range. Even into the 1970s and '80s, geologists and their students tended to map and study the areas with better base maps. By the time decent topo maps were released for the surface over Lehman Caves, attention had been drawn to the region's fantastic Snake Range Décollement and areas of economic mineral resources.

Figure 1a. Mylonitic marble in Lehman Cave exposed in the Gypsum Annex. Photo courtesy of Dave Bunnell. 1b. Close-up photograph of the marble. Note how the layering pinches, swells, and swirls in both photos.

To this day, park literature and interpretive material consistently claim that the cave and the hillside containing it is a simple block of steeply dipping beds of Pole Canyon Limestone (NPS, 2015). Even the professional geologic literature agrees (Rowley *et al.*, 2017).
So, one of the most surprising revelations when I started studying the geology of Lehman Caves was the realization that the cave formed entirely in high-grade *marble*, not limestone (Figure 1a). Marble is the metamorphosed (altered by heat and pressure) version of limestone (a sedimentary rock), likely the Pole Canyon Limestone in this case. But, importantly, the layering is NOT bedding representing the original horizontal layers during deposition of the sediments, but "foliation," representing the direction of relative stresses that the rock has experienced (Figure 1b). That the bedrock is a marble was recognized at least as early as 1960 by U.S. Geological Survey geologists (Moore, undated) but somehow seems to have been lost in time.

The Talus Room and the Royal Gorge of Lehman Caves are dramatically different from passages on the current tourist route. These areas have few secondary calcite ($CaCO_3$) deposits (e.g., stalactites, stalagmites, flowstone, and shields). Instead of flowstone floors, the Talus Room is covered with a deep pile of talus. The walls and ceiling exhibit bedrock, which is nearly impossible to see in the tourist portions of the natural cave (you can observe bedrock in some parts of the tunnels and where blasting happened to install trails). An even greater contrast is experienced in the northwestern passages of Lehman, called the Gypsum Annex. Here, the walls, ceilings, and floors are covered with the mineral gypsum ($CaSO_4 \cdot 2H_2O$). So, why the differences?

Gypsum is highly soluble and, if formed in the cave before all the calcite "speleothems" (generic name of secondary mineral deposits in caves, such as flowstone, shields, and stalagmites), it would have been dissolved and removed when

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# Lehman Caves Geology (continued)

many of the beautiful calcite displays were deposited during the Pleistocene. This fact led me to hypothesize that there is a nearly impermeable layer of rock over the Gypsum Annex that prevented water from infiltrating from the surface. Given the difference in the Talus Room and Royal Gorge, I also suspected that those areas also had a mostly impermeable cover. Something other than marble must overlie much of the cave!

Indeed, mapping the hillside above the cave this summer (2019) revealed that metamorphosed quartz sandstone (probably Prospect Mountain Quartzite) is on the surface over most of the Royal Gorge, Talus Room, and Gypsum Annex. A large outcrop (display) of the quartzite is just west of the Picnic Area road (X on Figure 2). Shale, probably Pioche Shale, also lies on the surface of the hill west of the Lehman Caves Visitor Center. It does not appear to be on the surface immediately above the cave but the last 100 feet or so of the southwest passage in the Gypsum Annex ends where shale forms the walls.

The geology of Lehman Caves and its overlying surface is much more complex and certainly different than we have understood for decades. A complex mixture of highly fractured and faulted marble, shale, and quartzite make up the hill. The metamorphism of the limestone appears to have resulted from extensive faulting, probably associated with the Snake Range Décollement as the cave seems to have formed in a mylonitic (metamorphism along a fault zone) marble. Perhaps the discontinuous blocks of quartzite and shale are also fragments torn off and emplaced during that great, tectonic event. Detailed geologic mapping will continue as we try to better understand this area.


Citations

Moore, G.W. 1960. Summary report on the geology of Lehman Caves National Monument, Nevada: Great Basin National Park files, 8 p.

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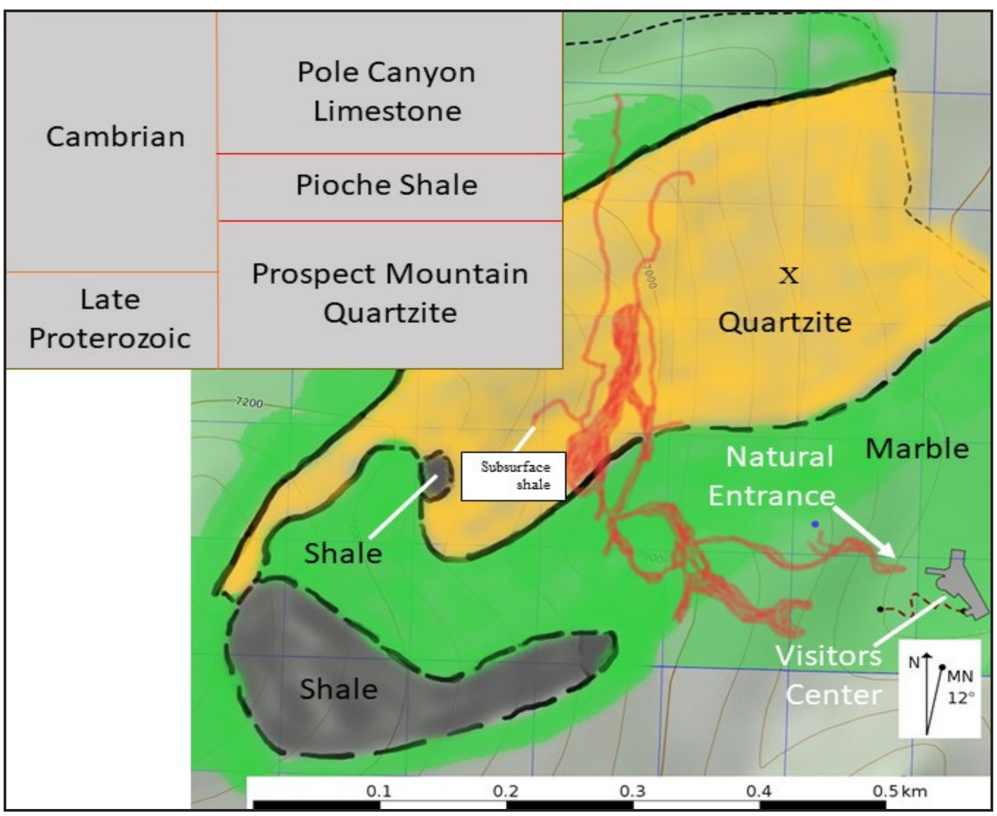


**Figure 2. Sketch map of the surface geology of the hill above the cave and west/northwest of the Lehman Caves Visitor Center. Green represents the mylonitic marble on the surface, yellow is the quartzite, and gray is the shale. The red lines represent the approximate location of Lehman Caves. The thin red line in the northwest corner of the cave is the Gypsum Annex. X marks the site of a large quartzite outcrop.**

# Strawberry Fire Burned Area Rehabilitation Plan Complete

by Meg Horner, Biologist

The Strawberry Fire burned 2,790 acres of park lands in August 2016. Sagebrush steppe, pinyon-juniper, aspen, mountain mahogany, and riparian plant communities were impacted by the lightning-ignited fire.

After the fire, the park prepared a three-year Burned Area Rehabilitation (BAR) plan. The plan addressed issues created or exacerbated by the fire. Plan objectives were to restore native plant communities, manage invasive plants, and replace minor infrastructure destroyed by the fire.

Restoration treatments outlined in the BAR plan are complete. Three aerial seedings were conducted through agreements with the Nevada Department of Wildlife and the Bureau of Land Management's Regional Seed Warehouse. Over 3,000 acres were seeded with a native seed mix. Invasive plant surveys were completed on 1,230 acres over the three-year project. Invasive plant treatments focused on cheatgrass (*Bromus tectorum*) and five target forb species with new infestations of Canada thistle (*Cirsium canadensis*), houndstongue (*Cynoglossum officinale*) and hoary cress (*Cardaria draba*) documented and treated post-fire. Infrastructure destroyed or impacted by the fire was repaired or replaced. The Strawberry Creek Road was repaired; the vehicle bridge, restroom and foot bridges were reinstalled; and information signs and trail work were completed.


NPS Photo by Julie Long

Park staff target invasive plants.

Three years post-fire, Strawberry Creek is still recovering. The condition of native vegetation, especially riparian and aspen communities, continues to improve. Management of invasive forbs and annual grasses will continue, as will vegetation monitoring to determine the success of revegetation efforts. A Round 17 SNPLMA project has been funded to improve riparian habitat and stream condition, manage invasive plant populations, and continue revegetation work.

Strawberry Creek was reopened for day use in May 2019. The canyon will continue to be day use only while the park secures funding to replace campground facilities, rehabilitate trails, and improve access.

NPS Photo by Meg Horner

Arrowleaf balsamroot flourishes post-fire in the Strawberry Creek area.

# Cave Management Plans Finalized

by Gretchen Baker, Ecologist

Photo by Gretchen Baker, NPS

Most Great Basin caves require crawling and specialized gear. Seven caves in Great Basin National Park are now open for permitted recreational use during

Great Basin National Park now has an approved Lehman Caves Management Plan and a Wild Caves and Karst Management Plan. These are the first cave management plans for the park, and they will help direct future management actions for the park's 40 known caves and over 20,000 acres of karst (bedrock that may include caves).

These plans went through the National Environmental Protection Act (NEPA) process, with a Finding of No Significant Impact (FONSI) signed by the Regional Director, Stan Austin, on September 23, 2019.

Key points in the Lehman Caves Management Plan are direction to add supplementary types of cave tours, including a virtual cave tour; rehabilitate the aging infrastructure, especially the lighting system; protect natural and cultural resources; and allow for research.

The Wild Caves and Karst Management Plan helps protect the 39 undeveloped caves in the park. Some are open by permit for recreational visits during select time periods of the year.

All other wild caves are closed except to research and management uses. Recreational permits will be approved for those who can demonstrate cave conservation ethics and their experience with horizontal and vertical caving techniques and equipment.

One recreational permit per week, with a minimum of 3 and a maximum of 6 participants, is allowed for each cave during its open period. The group needs to have enough cave experience to travel safely through the cave on their own.

In order to apply for a recreational cave permit, please contact the cave specialist at least two weeks in advance of your planned trip at Gretchen_Baker@nps.gov or 775-234-7541.

The cave and karst management plans will help the park plan for future actions. Data gaps in knowledge were identified in the plans, and one proposal has already been funded to help improve conservation at Lehman Caves.

| Cave | Dates Open | Notes |
|---|---|---|
| Catamount | Year round | Short cave |
| Ice Cave | April 1 – May 15 and September 15 – October 15 | May have some water flowing into it; relatively short |
| Crevasse-Halliday's Deep | April 1 – May 15 and September 15 – October 15 | Vertical cave and some tight crawls |
| Systems Key | April 1 – May 15 and September 15 – October 15 | Vertical section and some tight crawls |
| Broken | June 15 - October 15 | High elevation, small cave |
| Snake Creek | September 15 – May 15 | Handline recommended; H passage closed year round |
| Little Muddy | October 1 - April 15 | Tight crawls; Elevated CO2 in summer |

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*The Midden* is the Resource Management newsletter for Great Basin National Park.

A spring/summer and fall/winter issue are printed each year. *The Midden* is also available on the Park's website at www.nps.gov/grba.

We welcome submissions of articles or drawings relating to natural and cultural resource management and research in the park. They can be sent to:
Resource Management,
Great Basin National Park,
Baker, NV 89311
Or call us at: (775) 234-7331

**Superintendent**
James Woolsey

**Natural Resource Program Manager**
Ben Roberts

**Cultural Resource Program Manager**
Eva Jensen

**Editor & Layout**
Gretchen Baker

## What's a midden?

A midden is a fancy name for a pile of trash, often left by pack rats. Pack rats leave middens near their nests, which may be continuously occupied for hundreds, or even thousands, of years. Each layer of trash contains twigs, seeds, animal bones and other material, which is cemented together by urine. Over time, the midden becomes a treasure trove of information for plant ecologists, climate change scientists, and others who want to learn about past climatic conditions and vegetation patterns dating back as far as 25,000 years. Great Basin National Park contains many middens.

Great Basin National Park

# Christmas Bird Count

by Gretchen Baker, Ecologist

Come join us on Wednesday, December 18, 2019 for the 23rd annual Snake Valley Christmas Bird Count!

Last year we had a record 18 participants. We also had the most bird species ever, with 60 on Count Day. Some sightings that stood out:

- Golden crowned-sparrow at Grey Cliffs
- Northern pygmy owl on upper Lexington route (about 1/2 mile before spring)
- Northern goshawk on Baker Ranch
- Wilson's snipe at Rowland Spring
- Pacific wren on Burma Road (Sage Way)
- Ring-necked ducks at the Rearing Station on Snake Creek
- Common mergansers on the Pruess/Garrison route
- Bewick's wren in Big Wash
- Canyon wren near Lexington spring

If you were wondering what the most numerous birds were, we counted 392 Horned larks, 330 European starlings, 295 American wigeons (the first year that wigeons outnumbered mallards, and wigeon numbers have been high the last few years), 198 pinyon jays, 186 common ravens, 156 dark-eyed juncos, 119 Canada goose, and 98 green-winged teal (the most ever).


Photo by John Dickson

**Pinyon jays are one of the most numerous birds seen during Christmas Bird Counts.**

We welcome birders of all experience levels for the Christmas Bird Count. We have multiple routes, and it's a great way to get to know the park and surrounding area better. For more information, please contact Gretchen_Baker@nps.gov.

**Upcoming Events:**

**December 18: Snake Valley Christmas Bird Count**. Help with this long-term effort to quantify birds! Email Gretchen_Baker@nps.gov for more info.

**December 19: Ely Christmas Bird Count.** What's better than one bird count? Two! See how Ely's bird assemblage differs from Snake Valley. Contact nherms@blm.gov for more info.

**Winter 2020 (dates tbd): Lehman Caves Lint and Restoration Camp.** Email grba_lint_camp@nps.gov to be added to mailing list.

**February 2020: New exhibits installation in Lehman Caves Visitor Center.** These exhibits focus on "Discover the Dark." Be sure to check them out beginning March 2020!