NSS News

April 2020



CALENDAR

USA

May 15–17, 2020—**SERA Summer Cave Carnival** will be hosted at Camp Tubb, Rock Island, TN. The 69th event is hosted by Cookeville's Upper Cumberland Grotto. Nestled in a wooded peninsula off the Caney Fork River, the venue offers private camping. Accommodations are primitive campsites with bathrooms and showers. RV's and campers can also stay at nearby parks such as Rock Island State Park and other RV friendly spots. With 7,316 caves nearby, there will be plenty of chances to "Get Dirty" with the UCG. Pre-registration available at http://bit.ly/SERA2020

May 18–22, 2020—Conservation of Fragile Karst Resources: A Workshop on Sustainability and Community", informally referred to as **UNESCO Karst 2020**. On the campus of Western Kentucky University in Bowling Green, KY and hosted by WKU, the George Wright Society, and the Mammoth Cave Area Biosphere Reserve. For additional information please visit our website https://unescokarst2020.com/.

May 22–25, 2020—**Celebration of Life** for Kerry Rowland at Ennis Cave, near Mountain View, Arkansas. Come join the many friends of Kerry to celebrate his incredible life. Contact Randy Rose at Randalrose@sbcglobal.net for more information.

May 22–25, 2020—**Speleofest** is a 4-day cave event in Bonnieville, KY hosted by the Louisville Grotto and held at the Lone Star Preserve. Early arrival on May 20th & 21st is offered for an additional cost. We offer many cave trips and focus on being a true caver event. Caving, camping, banquet, live band, crate stacking contest, plus more. Breakfast is offered on Sat & Sun mornings. Website: Speleofest.com or if you have questions contact Holly McClintock at hollymcclintock.caves@gmail.com

June 12th–20th, 2020—**National Cave Rescue Commission Cave Rescue Operations and Management Seminar**: Camp Pinnacle, Voorheesville, NY. Register at: https://ncrc.regfox.com/ncrc-2020-national-seminar or https://bit.ly/2k6hPl3

June 19–21, 2020—**Karst-O-Rama** at Great Saltpetre Cave Preserve, Mt. Vernon, Kentucky. Crawl, climb, or walk your cadaver here as we're bringing Karst-O-Rama back from the dead! Cave trips and camping, vendors, and a live band with a costume party pair well with our sauna, hot tub, n creek splashing, the resurrected speleo-olympics and noodle wrestling, and of course feeding your thirst at the Guano Grill for three days of downright deadly fun! KOR is hosted by the Greater Cincinnati Grotto with pre-registration discounts and info available soon! More info: http://karstorama.com or kor@karstorama.com.

July 27–July 31, 2020—NSS Convention in Elkins, WV. https://caves.regfox.com/nss-convention-2020

July 30–August 3, 2020—Rescue Technician: Cave I/II course, Pro-Board Certified, NFPA 1006. Taught by Huntsville Cave Rescue Unit. Location: Union Grove, AL (near Huntsville). Cost to Cavers: $90. ProBoard certification: $320 (in-state) / $540 (out-of-state)

More information: www.hcru.org/rescueclass

August 25–August 30, 2020—NCRC **SPAR class** hosted by Pacific Northwest Region in Bend Oregon. Registration info to follow later.

September 4–7, 2020—**CaveFest**. Sewanee Mountain Grotto is hosting our annual auction and party in the heart of TAG over Labor Day weekend. There will be led cave trips, bat flight float trips, music, dancing, beer (must be over 21) and a potluck dinner. Campground amenities include: Bath house with flush toilets and hot showers, hot tub and a sauna. There is no registration fee, but the campground charges a $10.00 camping fee per person for the 3-night weekend. Proceeds from the event and auction go back into the caving community!For additional information go to: https://www.facebook.com/groups/SMGCaveFest/. Pre registration will be available to pay camping fee and preorder shirts. If you don't do Facebook you may visit http://caves.org/grotto/sewaneemountaingrotto or email mgmills52@gmail.com

October 8-11th, 2020—Columbus Day weekend). The **Cave-In** is the Southeastern caving community's legendary yearly celebration of Caves and Caving. Attendance hovers around 1000 of your caving friends. TAG is also the main fundraiser for the Dogwood City Grotto – to keep us going and helping new cavers, teaching safe vertical practices, and protecting caves and access to them. Profit made from the event is returned to cavers in the form of grants to various projects throughout the caving community.

October 9-12, 2020— The San Joaquin Valley Grotto is hosting the 2020 Western Regional Meeting at Camp Edison on Shaver Lake. Camp on the shore of beautiful Shaver Lake! Local caving opportunities include marble caves in the surrounding Sierras. Stay tuned for more information!

June 28-July 2, 2021—**NSS Convention** in Weed, California! Nestled in a pine forest in extreme northern California, the 14,000-foot Mount Shasta Volcano stands guard over the rugged City of Weed. Named after her founder, Abner Weed, this historic lumber town rests at the intersection of California's mountainous limestone ridges and mysterious lava tubes. Hundreds of caves in the nearby hills can provide challenges for a lifetime of explorers. We hope you can join us for the 2021 NSS Convention in Weed, CA. http://nss2021.caves.org/

2022-NSS Convention in Custer South Dakota. Dates TBD.

Send items for the calendar to davebunnell@comcast.net at least 4 weeks before desired month of publication (e.g., by April 1 for the May issue).



Val Hildreth Werker

Cave Conservation is increasingly international in its scope. Participants in a cave restoration workshop in Slovenia held by our Conservation Chairs Val Hildreth Werker and Jim Werker.

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ABOUT THE COVER

Front cover:

Cave Softly, by Chris Howes. The image was shot within the constraints of the path, very literally, with the help of Judith Calford in the foreground, Val Hildreth-Werker in the distance and Kathy Peerman holding a flash a little behind me holding the camera. The flashes (memory says five or six of these, with more than one at different locations) were all radio-slaved strobes, manually set to different intensities to balance relative distances from their subjects. Some, flashes were placed on the ground between the taped path, which itself is narrow, using only rocks already in the path to prop them up to attain the correct angle for the lighting. This was indeed an exercise in conservation constraint. A print of this image hangs in Sperka Hall in the NSS Headquarters, sponsored by prAna

Back cover:

Bottom: Light pours through the natural entrance to Carlsbad Caverns in New Mexico. As a heavily visited show cave, the Caverns faces continual conservation challenges. Photo by Sonia Meyer. See her article on page 23.

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April 2020
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Global Cave Stewardship: IYCK2021

Val Hildreth-Werker and Jim C. Werker, NSS News Conservation Joint Chiefs

Celebrate the International Year of Caves and Karst 2021! Plan special IYCK community events! Cavers around the world will reach out to their neighbors and share the stories of underground science, wonder, life, and water.

Public outreach and education are our best tools if we want communities to advocate for cave conservation and karst protection.

Survival of vital karst groundwater resources depends on community understanding. Protection of caves and the important resources they harbor depends on communities caring about spelean values. Engage, involve, and lead them to understand and care about our at-risk natural and cultural heritage in caves and karst. If graffiti begets graffiti in caves, and if footsteps beget footsteps—then it follows that stewardship will beget stewardship.

Engage people with the wonderful stories of cave exploration—stories of exploration in spelean sciences—stories of cave discoveries and awe-inspiring expeditions—stories of vulnerability and shocking destruction. Involve the public through experiential learning—invite them to help in cave cleanups—take them on educational cave/karst tours—teach them through hands-on experiential learning activities. Reach out to help people understand that karst, caves, and their contents are important, vital, and vulnerable—among some, increasing concern and deep commitment to stewardship will follow.

Plan IYCK Outreach Events! Arrange special outreach events for 2021! Turn your annual grotto, regional, and national activities into International Year Events! Start now and simply follow the reporting Guidelines for the International Year of Caves and Karst 2021. Be part of the action—Include your events on the international list! See the Planning Guide on the IYCK website at http://www.iyck2021.org/ Engage—Involve—Understand! See the March 2020 issue, pages 12-13 for more on the IYCK.

Launching USA Cave Animal of the Year

In this Annual NSS News Conservation Issue, we announce a new outreach tool—our USA Cave Animal of the Year program! Look inside to meet the animal honored with outreach information and recognition this year! Many thanks to the German Cave Animal of the Year team who initiated their program over a decade ago—it has expanded internationally over the past year or so, with programs growing in Italy, Australia, Switzerland. In 2020, the US is joining the throng. A team in each country selects a cave dweller to celebrate, develops outreach materials, and informs the public about their chosen Cave Animal of the Year—see articles and online links in this issue. Gretchen Baker and a team of US speleo-biologists are collaborating on our USA Cave Animal of the Year! See http://www.caves.org/conservation/caveanimaloftheyear/

International Workshops: Cave Restoration is Possible

This year, Jim and Val had the honor of collaborating with cavers from several countries to produce international workshops covering various strategies in cave conservation, protection, and restoration. We design our conservation workshops to include classroom presentations as well as nose-to-the-flowstone, in-cave work. We teach the theory, philosophy, and management of cave restoration through PowerPoint talks and group discussions. The workshops typically continue inside a cave, with participants applying minimum-impact techniques and protocols to cave restoration.

In recent years, cavers around the world have been joining forces to clean trash out of caves and sinkholes—but in many countries cave restoration activities are rare or have not been initiated. Over the past year-and-a-half, we accepted invitations to participate in seminars and conduct training workshops in Brazil, Italy, and Slovenia. Drawing international participants from surrounding countries, the workshops in Europe connect cavers from many karst regions. After the events, our international collaborators continue to build cave conservation networks, training opportunities, and volunteer projects.

While cavers in the US accomplish most cave work by volunteering (exploration/survey, conservation/management, and admin tasks), in many countries around the globe volunteering for cave conservation is a new trend. For example, in Brazil ongoing annual volunteer events (new to Brazil's national-level cave management) are now organized to follow up on the first International Cave Conservation and Restoration Course that we cooperatively conducted in 2014.

Articles in this issue describe this new international movement for networking sustainable techniques in cave restoration, graffiti assessment/removal, speleothem repair, and minimum-impact caving ethics. In May 2020 we will lead a workshop for the UNESCO Karst2020 conference at Western Kentucky University. Later this year, Jim & Val will travel in Italy doing workshops for various caving areas.

We sincerely thank our colleagues around the world (see articles within) for reaching out to us. The global effort in cave conservation/restoraton is spreading rapidly as we ramp up to celebrate the International Year of Caves and Karst 2021!

International Year of Caves and Karst (IYKC)

Time to Start Planning! Augment your annual national, regional, and local events with Cave Awareness Outreach Activities and celebrate caves through IYCK! The IYCK has incredible potential to advance speleology in many and great ways, but only if we all work together to make it possible.

- This will be the biggest and most important speleological event ever, but only if you participate. The purpose of the International Year of Caves and Karst (IYCK) is to teach the world about the importance of caves and karst.
- Public understanding and support of caves and karst is currently very limited. As a result, funding, regulations, and opportunities for exploration, research, and management are also very limited.
- The International Union of Speleology (UIS) has declared 2021 as the IYCK in a major effort to make the world aware of how caves and karst are valuable to all people.
- To make the IYCK a success, the UIS is calling on all of its member countries and other organizations to begin planning a series of public lectures, programs, demonstrations of techniques, and others activities for 2021.
- To get involved, download the newest UIS Bulletin from http://www.uis-speleo.org/downloads/uis-bulletins/uisb612.pdf It has the IYCK Planning Guide which will teach you all you need to know about how to join the IYCK. The Planning Guide will also be posted soon on the IYCK website at http://www.iyck2021.org/ and follow the link for Downloads.

George Veni, PhD - Executive Director, National Cave and Karst Research Institute (NCKRI) and resident, International Union of Speleology (UIS)
gveni@nckri.org

Introducing the USA Cave Animal of the Year for 2020

Gretchen M. Baker, Michael E. Slay, and Matthew L. Niemiller

As cavers, we've probably all seen interesting creatures underground (in addition to our caving partners). Some of these critters may be known, while others are a mystery. Species such as bats and salamanders may be easy to observe while smaller species (invertebrates such as millipedes, spiders, and springtails) require getting up-close and personal with the cave floor and perhaps putting on that pair of reading glasses stashed in your cave pack. Over the past few years, the Biology Section of NSS has been producing regional cave life guides (Virginias, TAG, and Ozarks) with the goal of providing more information on North American cave species. Premiering in 2020, we are launching another way to focus more attention on our cave animals by developing a US Cave Animal of the Year program.

Background

Germany started a Cave Animal of the Year program in 2009 to garner more interest in subterranean life. They launched a website with beautiful photos and information (https://hoehlentier.de/en/). In 2019, Italy followed (https://animalidigrotta.speleo.it/), as well as Australia (https://www.caveanimaloftheyear.org.au/). Switzerland is launching their program in 2020. Val Hildreth-Werker decided it was time for the USA to get on board and asked Gretchen Baker to help. Gretchen wanted to get it right, so recruited cave biologist experts, Matt Niemiller and Mike Slay, who joined the team.

USA Cave Animal of the Year 2020

The USA Cave Animal of the Year for 2020 is the Great Basin Cave Pseudoscorpion (*Microcreagris grandis Muchmore*). It is a small arachnid in the family Neobisiidae and in the genus Microcreagris. This pseudoscorpion genus includes more than 20 related species, is found throughout the world, and includes both cave and surface species.

The Great Basin Cave Pseudoscorpion has a rather interesting history. The Lehman Caves National Monument Custodian (similar to today's superintendent), T.O. Thatcher, noted and collected the first specimens in the 1930s. However, it took until the 1960s for the pseudoscorpions from the cave to be identified, when Dr. William Muchmore determined it was a new species and formally named it *Microcreagris grandis*. Since then, this species has been found in other caves in Great Basin National Park (Nevada), including alpine caves. However, it has not been found in caves on other mountain ranges. Pseudoscorpions are the top invertebrate predator in park caves.

More about Pseudoscorpions

Pseudoscorpions are small arachnids and are distant relatives of spiders, scorpions, harvestmen, and mites. They resemble scorpions but lack the stinging tail. Consequently, pseudoscorpions are sometimes referred to as false scorpions or book scorpions. Most species are very small, up to three-tenths of an inch (8 mm) in length and possess eight legs and large claw-like appendages called pedipalps that they use to grab prey. They eat a variety of insects, including flies, beetles, larvae, and tiny springtails. There are almost 30 families of pseudoscorpions with more than 3,500 species found throughout the world. Some live above ground, but many live in caves. In the US and Canada, 150 cave pseudoscorpions are known, and many of these cave species occur in small geographic areas. Most US cave pseudoscorpions are considered rare or endemic (found only in that location), indicating they may have been isolated or adapted to very specific living conditions.

Because cave pseudoscorpions may be rare and found in just one small area, it is important to disturb them as little as possible. Throwing trash into a sinkhole, letting contaminated water wash into a karst area (limestones and other soluble rock terrain that contain caves), or spraying graffiti in a cave could release toxic chemicals that could devastate these creatures and the animals they eat. Although they may be small to our eyes, they are huge in the cave ecosystem. Toppling an apex predator could have many consequences on the rest of the life in a cave.

Why Cave Animals Are Important

People marvel at the beauty of caves, but many people don't realize our caves are home to an amazing diversity of animals! Some of these animals have interesting adaptations to live in a world of complete darkness and often very low food resources. Worldwide, there are many species of animals that live in caves. Cave Animal of the Year seeks to increase awareness of these fascinating animals and the importance of caves as their homes.

How You Can Participate

We need your help spreading the word about Cave Animal of the Year. First, visit the website: https://caves.org/conservation/caveanimaloftheyear/ where you'll find more information about pseudoscorpions and caves habitats for animals. Please share the website address with friends and your Grotto social media. If you're lucky enough to find a pseudoscorpion while caving, help others see it and learn about these cave species. We hope you have a great year of visiting, exploring, and conserving habitat for our fascinating cave animals.

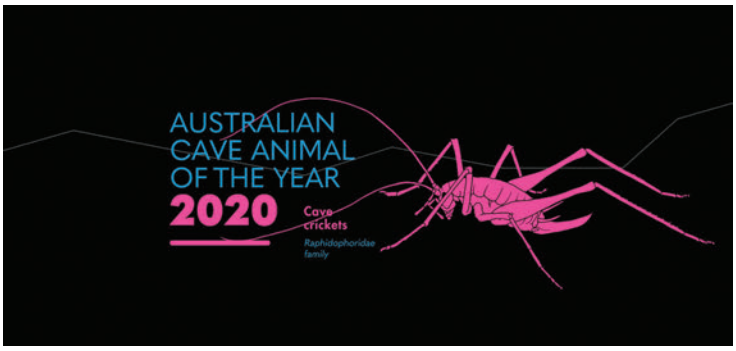


Microreagris grandis

David Hunter

2020 Australian Cave Animal of the Year

Cathie Plowman (Australian Speleological Federation)





Garry K. Smith

What a lovely surprise when reading the October NSSNews magazine to realise that our poster, bookmark and sticker had won three awards between them at the 2019 NSS Convention. Thank you to the Salon coordinators and to NSS members for their kind support.

Our 2020 Australian Cave Animal of the Year is not a single animal species but 22 different related species! There are 22 described species of Australian cave crickets and collectively they are the 2020 Australian Cave Animal of the Year. Australian cave crickets have an extensive family tree with eight genera within the Australian Rhaphidophoridae family (pronounced Rap-hid-o-phor-idea).

Cave Animal of the Year campaigns are gaining momentum. The German Speleological Society commenced their program in 2009, Australia and Italy followed suit in 2019 and our Swiss speleological colleagues have just advised that their web page is operational.

We're excited that efforts are underway for a US Cave Animal of the Year effort. These programs are building community awareness of cave animals and the importance of caves as animal habitat.

Very sadly, it is not a good time for cave animals, or any wildlife, in many parts of Australia at present. As you have no doubt seen in media coverage, extensive bushfires have been burning in many parts of Australia since October 2019. Most of the karst and cave areas in New South Wales, Victoria and South Australia have been significantly affected. While plenty of well-deserved media attention has been given to notable mammals such as koalas, there will be impacts on cave ecosystems. Extensive areas of vegetation have been burnt, ongoing hot and dry conditions mean less moisture in cave areas, and any water that is present will be contaminated by smoke and ash.

To find out more about our program please see our Website and like us on Facebook. https://www.caveanimaloftheyear.org.au/ Meanwhile, all the very best with your own speleological projects.

Australia's Bushfires Landscape Rehab Appeal

Australian Speleological Federation

Extensive and uncontrolled bushfires in Australia are still burning in the states of New South Wales, Victoria, and South Australia. The scale of these fires is unprecedented and damaged areas include most of the cave and karst areas in these three states. The impacted cave areas include several that were enjoyed by the International Congress of Speleology in 2017 and these are Jenolan Caves, Wombeyan Caves, and Yarrangobilly Caves. The Australian Speleological Federation has commenced a Go Fund Me crowdfunding effort to raise support for restoration, repair, rehabilitation, and post-fire scientific monitoring. Full details regarding the appeal and listing affected cave areas: www.gofundme.com/f/cave-landscape-bushfire-rehabilitation-appeal

Join Together to Make a Difference!

Funds raised will go directly to:

- Projects aimed at cleaning and restoring caves and karst areas.
- Immediate on-ground works to affected cave areas.
- Cave entrance stabilization, fencing, stairway replacements (for areas not covered by insurance).
- Rehabilitating vegetation in cave landscapes.
- Rehabilitating critical habitats for bat and cave fauna populations.
- Research projects to assess long-term bushfire impact on fauna and cave environments.
- Bat population post-fire surveys.
- Replacement of entrance identification cave tags where needed.

The Australian Speleological Federation (ASF) is an Environmental Organisation focusing on the primary objective of protecting Australia's cave and karst environments and is registered as an Environmental Organisation by the Department of Environment and Energy, Canberra. The ASF is the national caving body in Australia, with more than 800 members, 22 caving clubs, and represents Australia in the International Union of Speleology.

To receive a tax deduction receipt please e-mail: asf.karstfund.info@gmail.com

To donate through bank transfers, please contact lueena@bigpond.com for direct information.

AU Caves Karst Bushfires website: www.caves.org.au/conservation/karst-conservation-fund

Find ASF on Facebook: https://www.facebook.com/asfcavers/

Permission is given to re-post, share, and reprint this message to help spread awareness of this fundraising effort.

The recent ongoing bushfires have severely damaged many cave areas across Australia.

Your donation to the Australian Speleological Federation will help restore cave ecosystems.

Donate here: www.gofundme.com/f/cave-landscape-bushfire-rehabilitation-appeal

Clean Up the Dark Workshop in Sardinia: Beyond Removing Trash in European Caves

Ferdinando Didonna, Fedele Messina, Val Hildreth-Werker, and Jim C. Werker

Impronte — Imprints and Impacts in the Dark: Let Us Leave No Trace

All traces of human impact, even the smallest ones, leave our mark on the natural world.

Ethics, respect of place, space, and time are intrinsic components of the study of caves.

More than a decade ago, Italians initiated an organized effort to clean trash out of sinkholes and caves—now it is time to advance the movement called Clean Up the Dark. In 2019, the Italian Speleological Society hosted an international meeting and invited Jim Werker and Val Hildreth-Werker to collaborate and lead a workshop on cave conservation and restoration.

Background

Organized through coordination and sponsorship of the National Commission of Speleology Schools, Clean up the Dark, the Conservation Division of the National Speleological Society (NSS), and the Italian Speleological Society (SSI) in collaboration with the ICNUSSA A.P.S, the seminar was held in in the small town of Urzulei, on the island of Sardinia, Italy, April 16-17, 2019, as a part of the annual international speleology meeting called Raduno Internazionale di Speleologia. The Sardinians named this event Impronte 2019. (Impronte translates as imprints or footsteps).

In pursuing its stated purpose of protecting caves, SSI invited Val Hildreth-Werker and Jim Werker, leading experts in the field of cave conservation and authors of the 600-page, peer-reviewed volume titled Cave Conservation and Restoration, to present a workshop. The workshop program included both didactic and practical cave activities covering several topics: the minimum-impact ethics of caving behavior; protocols for removing contemporary graffiti while keeping historic and cultural elements intact; and restoring or repairing human-damaged cave formations.

The Program

The structure of the seminar included classroom theory and examples, followed by practical in-cave graffiti assessment, careful cleaning and removal, and visual documentation.

First day phase 1: Theory of the protection, cleaning, and restoration of cave resources with preparation and tips for practical work.

First day phase 2: In-cave demonstration on how to document, assess historic and cultural markings for protection, and restore impacted cave surfaces and formations. Restoration protocols and practice through participant teamwork in the cave.

Second day phase 3: Processing collected data, viewing team photos of in-cave processes. Questions and answers. Review of completed work at each team site.

Closing: Discussion of problems addressed, evaluation of accomplishments, future plans for continuation, final conclusions.

Eighteen speleologists participated from Sardinia and various regions of Italy. The attendees all arrived with solid speleological foundations and great enthusiasm for this caving workshop. Participants included professional speleologists, researchers, and cavers.

The Challenge

Change caving style! Switch to minimum-impact caving practices.

Deeply understand mindful conservation caving, as well as sustainable restoration techniques.

Ethics and nature are fundamental, and our society is increasingly attentive and oriented toward safeguarding the Earth and reducing the negative impacts that man can have on the environment. However, both on the surface and underground there are many cases in which caves are still threatened by human action such as vandalism, intentional dumping, and bad caving practices that leave aggressive marks and negative impacts on pristine spelean environments and also on popular cave sites that receive many visitors.

The practice of responsible, low-impact caving is evolving. Negative impacts can result from old, out-dated caving habits as much as from intentional vandalism. Caving practices are evolving in a new direction. Many of the old practices for what we formerly considered responsible caving have been replaced by minimum-impact protocols. As the starting point, many are adopting leave-no-trace ethics. While caving standards are essential, those of the past can be progressively upgraded to conform to modern knowledge, science, experience, observation, and discoveries. This perspective is valuable for all—veteran cavers, seasoned speleologists, neo-speleologists, show caves managers, as well as amateur spelunkers.

Of course, some long-established standards continue to be rules of good caving practice, such as walking only on well-defined path-ways, or staying within distinctly impacted areas of a cave. Also, once a cave has been surveyed and explored, the small side areas of minimal interest should be kept off limits to lessen further negative effects from the speleologist. We should all constantly improve, perfect, and disseminate the skills, techniques, and attitudes of reducing human impacts and enhancing protection as we visit, enjoy, and study caves.

Updated approaches to cave investigation are resulting in notable minimization of the effects of exploration. Through photographs, Val and Jim demonstrated striking improvements in speleothems and cave surfaces that were restored and subsequently protected outside of the pathway boundaries—concretions, flowstones, pools of water, sediments—many features recover a natural appear-ance and balance when no longer subjected to touch, rubbing of gear, footsteps, and detrimental activity.

Further implementing this low-impact approach, when an exploratory path intertwines with "sensitive" areas, we should mark "perennial points of contact" to provide a few footholds, handholds, and touch-points for balance to safely moving through the cave. In this way, each caver can limit their inevitable impacts to only the previously tainted points along the route. Thus, new caver impacts are limited—the visible effects of human movement are confined to a few well-defined points—and damage is no longer spread throughout an area previously explored.

Translation of Theory to Good Practice

Historically, the protection of caves was dependent on limited access. Years ago, we were only thinking of ways to protect caves from unwanted visitors. In Italy, cavers then began participating in projects to clean the dark "*Puliamo il Buio*." Now we are learning to implement a variety of successful measures that may help make such restrictive controls unnecessary. Positive techniques shared by Val and Jim include the removal of contemporary graffiti, reconstructing speleothems, cleaning areas muddied-up by footsteps, and extraction of intrusive materials.

Graffiti, writing, or drawing on a wall or surface has existed since ancient times. While sometimes of enormous value for its artistic

or anthropological content, modern graffiti generally is viewed as the marking of one's passage through an area, and it is considered defacement and vandalism.

Participants implemented or discussed many aids, such as photos, videos, field tests, appropriate supplies and materials, as well as potential logos and icons. This workshop addressed study and analysis of caving protocols and potential international symbolism for low-impact caving. Pioneers in this field, Val Hildreth-Werker and Jim Werker, helped the veteran and the newcomer participants develop new skills, asses sites and evaluate techniques.

The objective of this workshop was to examine strategies to better conserve caves worldwide. Val and Jim teach the foundational principle of primum non nocere, first do no harm. They emphasize that innovation, research, and science-based decisions will continue to inform new strategies for our ever-evolving current best practices in the recovery, restoration, and protection of cave resources. We will use this foundation as we work in Italy and across Europe to network cave conservation activities and promote information-sharing.

Outcomes—Cleaning is Possible! Cave Restoration is Possible!

The most valuable achievements of the workshop were the in-cave experiences that personally taught each of us that delicate cave restoration is possible. In the cave, we had to remember and follow the steps that Val and Jim gave us as protocols for science-based cleaning and restoration. When the human trash, imprints, and contemporary graffiti are cleaned away, the restored cave has greater potential of being protected and respected. Trash begets trash—graffiti begets graffiti—and stewardship begets stewardship. Observation of past projects gives proof—clean it up and most future visitors will notice, understand, appreciate, and help to keep it clean. A recovered, restored cave is better protected from future aggression and neglect.

The Italian Speleological Society (SSI) intends to offer more workshops based on the success of this first one. We are posing upcoming workshops in the framework of Puliamo Il Buio (Clean Up the Dark). Our sincere thanks go to the NSS Conservation Grant and the ISS for supporting us in this endeavor. We deeply appreciate the passion and knowledge that Val and Jim share with us.

Graffiti Mitigation - *Premium non nocere* - First Do No Harm

Val Hildreth-Werker & Jim C. Werker

- Understand techniques to aid in the first steps graffiti assessment—carefully inspect, inventory, and evaluate cave walls, ceilings, and floors that are tagged with contemporary graffiti.
- Find, recognize, and avoid harming evidence of potential cultural and historic markings, drawings, and signatures.
- Seek professional oversight and opinion.
- Define site-specific steps for assessment and protection of any resources with cultural, historical, or natural heritage significance. Plan strategies for removal of the modern graffiti and intervention to prevent ongoing damage.
- Determine tools, supplies, and techniques to employ.
- First, carefully test techniques and use a light touch. Always use circular motions when removing graffiti.
- Document and make photographs—Before, During, and After. Recognize the value of archiving and preserving pictures that show technical low-impact processes and the improvements resulting from conservation-protection strategies.



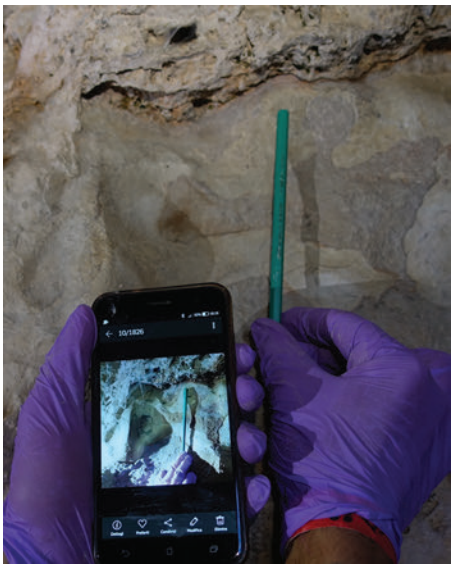
Val Hildreth-Werker

Is it new? Is it old? Are those real cultural markings? What's the pink blob? Call in the experts! Do the proper inventory and analysis. Protect potential historic and cultural marks layered among the contemporary graffiti.



Val Hildreth-Werker

Above: Always start restoration by first testing dry techniques—dry brushing sometimes works best. First test with a soft, clean paint brush, then work up from nylon to stainless-steel bristles according to substrate and media. Below: if media smears, try lifting off with blue painters tape or duct tape before brushing.



Val Hildreth-Werker

Use smart phone cameras to document processes. Compare features of the wall to the image on the phone. Find the "10" in the "before" phone image, and notice it's gone in the "after" image. The green pencil is placed in the same position for easy reference in both images.



Val Hildreth-Werker



Val Hildreth-Werker



Val Hildreth-Werker

Teams of three cavers work together. They document the site, the process, and their progress with before, during, and after photos. The green pencil remains on the wall as a consistent point of reference in photos. Testing proves this graffito requires a wet-brushing technique with spray bottle of water, stainless steel brush, and sponge to catch paint chips and excess water. Photos alert the team to the white area of their paint-scrubbing zone! They create a clever palette of colors from cave soils and rock dust, then use a paintbrush to dab dots of color in a pixelating artistic style and blend/re-color their over-zealous white zone. Lesson learned: Circular motions! Always use circular motions when scrubbing graffiti! Circular motions help blend the edges!



Val Hildreth-Werker



Val Hildreth-Werker



Val Hildreth-Werker

Above and below right: When other removal methods don't work on a tough graffito, carefully try a drill with a stiff plastic or fine stainless steel rotary brush. Think circular motions and patience. Be vigilant in monitoring the progress. Avoid making deep scars in the rock surface.



Val Hildreth-Werker

Cavers clean and refit the pieces of stalagmite, find the exact position that "clicks" into place, check to make sure the outside textures match along the joint, and make a couple of pencil tick-marks across the joint so the click-fit is easy to find again. The museum-grade epoxy that Jim & Val currently recommend is Buehler EpoxiCure 2 Resin and Hardener—mix 4 parts Resin to 1 part Hardener and fold the mix gently for only 3 minutes to avoid air bubbles. Apply a thin layer of epoxy to the center of the break—it will squeeze out to the edges. The cavers celebrate a strong, successful, cave-safe speleothem repair joint!

International Conference "Sustainable Management of Show Caves"— Classical Karst (Slovenia), October 2019

Dr. Rosana Cerkvenik, Škocjan Caves Park, Slovenia
Dr. Mitja Prelovšek, Karst Research Institute ZRC SAZU, Slovenia
Val Hildreth-Werker and Jim C. Werker, NSS Conservation

The only cave many people ever enter is a show cave. In Slovenia, we depend on show caves to help the general population understand the importance of our classical karst resources. Show caves are interesting, easily accessible and, as such, our most valuable karst asset for public outreach and education. Show caves offer everyone the fascinating personal experience of visiting a semi-isolated underground environment that has been developing for several hundreds of thousands or millions of years.

Processes of time and geology on the Earth's surface are very different from underground processes that form and decorate spelean environments. As a result, show caves can be highly vulnerable ecosystems that are sensitive to tourism. For long-term (sustainable, centuries-old) touristic visitation, show cave managers must adapt their intervention strategies and tourist activities to the natural constraints of any given cave. This management concept, generally called "carrying capacity," is challenging for many show caves, and staying within the acceptable limits of "carrying capacity" is especially difficult in commercial show caves with increasing trends toward more and more visitors.

Sustainable Show Cave Management Conference

In October 2019, an international conference titled "Sustainable Management of Show Caves" took place in the Škocjan Caves Park, located in the Classical Karst plateau of southwestern Slovenia, in the northwest region of the Dinaric karst. This unique place was inscribed in the World Heritage List in 1986. The Škocjan Caves Regional Park, with 413 hectares conserves an exceptional limestone cave system comprising one of the world's largest underground gorges, which the Reka River has cut vertically up to 100-meters into the limestone bedrock. Downstream, the gorge enlarges to more than 150-meters high and more than 120-meters wide, creating a passage known as the Martel Chamber that exceeds two million cubic meters in volume, and as such, ranks as the eleventh-largest cave chamber in the world. The underground gorge is spectacular, with many rapids and waterfalls, while the vast underground passages and chambers expose stunning variations of limestone bedrock and secondary cave formations.

Cooperation of show cave managers with research institutions is considered crucial for sustainable show cave management through resource monitoring and science-based decisioning—thus, the conference was organized by the Škocjan Caves Public Service Agency (manager of the Škocjan Caves) and the Karst Research Institute (associated with the Science Research Center (ZRC) at the Slovene Academy of Sciences and Arts (SAZU). The focus of the Institute's research includes both the Slovenian region of Karst, (Kras in Slovene), and the geomorphological phenomena known as karst.

The main purpose of the conference was presentation of the theoretical and practical issues of "carrying capacity" from different scientific viewpoints (illumination, CO2, temperature, subterranean fauna, monitoring, mitigation, and so on); show cave management; and show cave restoration of past actions and impacts that were not sustainable. All together 37 participants from 6 countries attended the conference, presenting 14 lectures. Much science-based information focused on the sustainable use of show caves, with participants discussing many good and bad practices for cave management.

Sustainable Cave Restoration Workshop

An important part of the conference was dedicated to cave restoration, presented by the two most well-known experts, Val Hildreth-Werker and Jim Werker. Following their theoretical presentation covering the philosophy and techniques of sustainable cave restoration and speleothem repair, the in-cave workshop took place in areas that were opened to the public a century ago—the relict and speleothem-decorated passage of Škocjanske Jame (Škocjan Caves). Workshop participants actively focused on the most common problems in show caves—graffiti, carbide dumps, off-trail footprints, and broken speleothems. The participants made notable progress with their hands-on restoration work in the Škocjan passage. The management team of Škocjan will continue the effort with scheduled sustainable restoration events.

Outcomes

Since we fruitfully shared experiences in show cave management, monitoring, and sustainable restoration, we expect to organize a similar meeting in the next 4-5 years. Meanwhile, as mentioned above, restora-



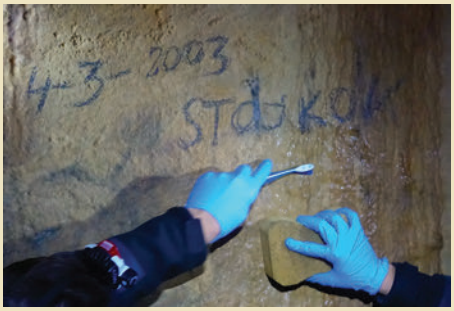
Škocjan Caves Underground Canyon. Photo by Borut Lozej, Škocjan Caves Park

tion activities will continue in the Škocjan Caves Regional Park. Additionally, personnel from the The Institute of the Republic of Slovenia for Nature Conservation (the main national professional organization in the field of nature conservation, established in 1999 by Slovenian legislation known as the The Nature Conservation Act) who participated in the October workshop are organizing a similar event for small show caves across Slovenia, to be held in April this year.

Editor's Acknowledgements

We extend our sincere gratitude to the management and research team of the Škocjan Caves Park and the Karst Research Institute ZRC SAZU for organizing the meeting and graciously hosting us in Slovenia. Special thanks go to Rosana Cerkvenik and Mitja Prelovšek for submitting this article and for their personal attention in making our introduction to the Classical Kras of Slovenia enjoyable and productive.



















Sustainable Cave Restoration Workshop at Škocjanske Jame in Slovenia — Montage of many hands working together during the training event to remove contemporary graffiti, old paint marks, debris and mud from gour pools, muddy off-trail footsteps, and piles of dumped carbide. Sponges and large black plastic bags provide catchments for the cleanup/restoration efforts. Exam gloves protect the cave and the cavers. Plans for ongoing restoration projects are underway for this important speleological heritage site.
Photos by Val Hildreth-Werker Photo of Val (above center) by Serena Liso.

Volunteering as a Tool for Cave Protection and Conservation in Brazil — Case Study: Gruta Rei Do Mato, Minas Gerais

Luciana Alt, Vitor Moura, Bambuí Speleological Research Group

Gruta Rei do Mato (GRM) is a relevant Brazilian show cave located within in a protected Natural Monument in the state of Minas Gerais (MG). Annually, the cave receives an average 19,000 visitors. The GRM Management Plan (Ambiente Brasil 2012) recorded damage to many different cave resources with various potential reversibility levels. There is obvious damage to archaeological attributes, rocky surfaces, chemical and clastic deposits, with possible alterations to microclimate and cave fauna dynamics. These negative impacts are mainly due to: public use activities, walkway and lighting infrastructure installation, operation and maintenance, and industrial pollutant sources surrounding the cave. A radius of 1.5 miles around GRM is occupied by industrial activities (especially pig iron industry, cement factory, and limestone mines), urban use, and agricultural use. Native vegetation, also at risk from the abundant anthropogenic pollutants, covers significant areas within the protected Natural Monument and its surroundings.

Aiming to reduce damages in the cave, to train Minas Gerais State Forest Institute (IEF-MG) employees who are responsible for cave management, to make the community aware of the cave's importance and fragility, the Volunteer for GRM Conservation I was held in September 2018 with 12 participants and two instructors. Volunteer activities included both practical and theoretical activities, conveying a solid conceptual basis on best cave conservation practices. This type of Volunteer Project is a national-level pioneering action in Brazil. Due to the positive results obtained, Volunteer GRM will be repeated annually. The Volunteer for GRM Conservation II was held in November 2019, with 10 participants and two instructors. Both activities were voluntarily coordinated by Bambuí Speleological Research Group members, with institutional and logistical implementation by IEF-MG and financial support from the National Speleological Society / USA.

Volunteer Methodology

Each volunteer event (2018/2019) merged practical and theoretical activities, conveying a solid conceptual basis on current best practices in cave conservation and restoration. Each activity provided about 8 hours of lectures and 10 hours of practical activities. Without solid conceptual foundation, conservation actions can potentially cause irreversible damage to the cave. Theoretical PowerPoint presentations merged concepts and images to make important points:

- Introducing Caves: Importance, Fragilities, and Impacts.
- Cave Conservation Ethics and Basic Concepts.
- Cave Conservation and Restoration Case Study: Ballet Cave, MG.
- Minimal Impact Techniques and Procedures for Speleothem Cleaning and Trash Removal.
- Best Current Practices on Lamp Flora Mitigation and Control.

In the cave, the instructors first demonstrated proper minimum-impact cave restoration techniques. Volunteers then performed practical activities with instructors' supervision and support in two regions of GRM—first near the cave entrance and then in the aphotic zone (Figure 1).

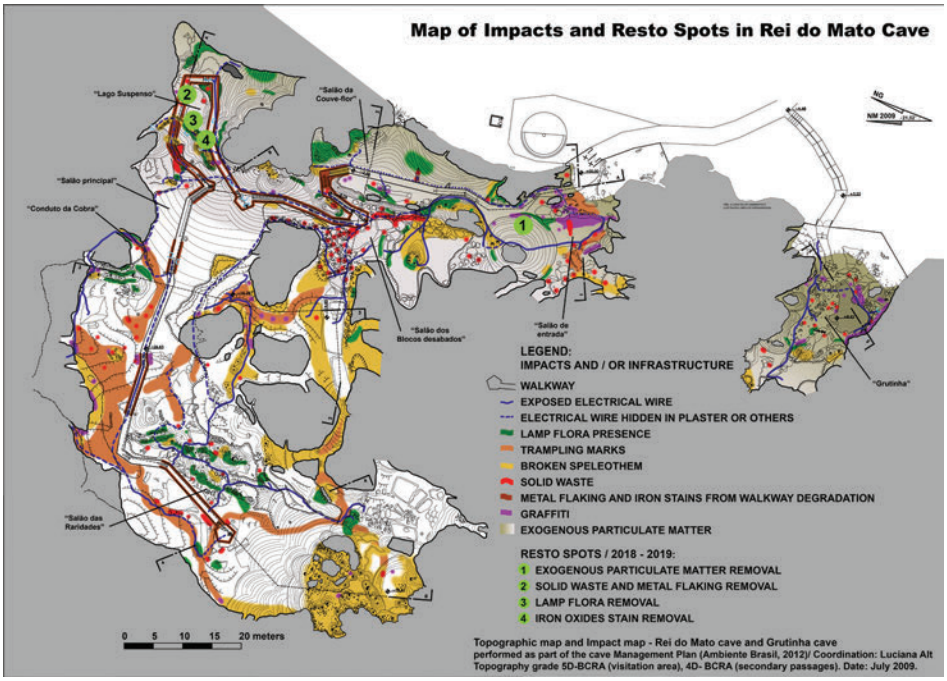


Figure 1- Map of Impacts and Restoration Areas

Tangible Outcomes in Cave

Restoration Point 1 is a speleothem located near the cave entrance. This speleothem is covered by exogenous particulate matter, mainly originating from industrial pollution sources located around the cave. At Resto Point 1, an area of about 2.5m^2 was cleaned and restored in 2014 during the International Cave Conservation and Restoration Course ICCRC (HILDRETH-WERKER ET. AL., 2016). This restored window was expanded to about 10m^2 in September 2018, and to about 25m^2 including complex repair surfaces such as microtravertines in November 2019 at the Volunteer GRM II (Figures 2 A to D).

For the first step at Resto Point 1, we used dry techniques with clean, soft-bristled brushes to remove particulate matter. Next, we applied wet cleaning techniques with deionized water, soft brushes, absorption pads, and water containment barriers. No chemical was applied in this process.

`As a tool for environmental education, volunteers created repair windows that allow visual comparison between areas with and without conservation intervention. The repair windows allow a clear view of the results, especially the visual impact reduction and aesthetic enhancement of the cave, as can be seen in Figure 2. These windows can be used to encourage visitors to think about the cave's fragility and vulnerability to anthropogenic impacts.

In Resto Point 2, after a careful fauna inspection to avoid removing any visible organisms, volunteers collected about 10 kg of non-organic trash and metal flaking from the walkway degradation. (Figures 3A, 3B).

Resto Point 3 is a set of speleothems partially covered by lamp flora. In 2014, during the ICCRC, the instructors tested Point 3 with H_2O_2 (hydrogen peroxide) at a concentration of 20% by volume over an area


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Figure 2A – Resto Point 1 – Before (2019)


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Figure 2B – Resto Point 1 – After (2019)


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Figure 2D – Detail of the wet cleaning process over microtravertines (2019)


Luciana Alt

Figure 2C – Wet cleaning process (2019)

of about 60cm^2. The H_2O_2, applied according to internationally accepted protocols, is the only chemical compound acceptable to use for reduce photosynthetic organisms in caves, as it does not generate toxic waste to the environment. Its degradation releases hydrogen and water (Olson, 2006; Boston, 2006). Between 2014 and 2018, the lights were repositioned and replaced with LEDs. During this four-year period, there was no recolonization of the cleaned site at Resto Point 3.

Therefore, we decided to extend the 2014 repair window by about 1.5m^2 in 2018, plus 3m^2 in 2019. Volunteers followed safety standards, shooed or moved invertebrates out of harms way, and gently removed surface particulate matter to the extent possible, while carefully avoiding the spread of lamp flora spores. Then H_2O_2 was applied at a concentration of 20% with 30 minutes of contact time. In other words, after applying, we waited about 30 minutes for the product to act on the surface. Sequentially, we rinsed and captured all rinse water (to prevent spread of flora and product). We used deionized water, soft bristle brushes, absorption pads, and water containment barriers. We purchased the hydrogen peroxide and the deionized water from a standard chemical laboratory. For safety protection, we used long latex gloves, masks, goggles, long-sleeved blouse, and pants. We also used dense EVA foam to protect small sensitive areas in the cave floor from trampling impacts.

Resto Point 4 is a stalagmite covered by a layer of iron oxide deposits resulting from degradation of the steel walkway system. We again used the H_2O_2 at a concentration of 20% for the iron oxide removal. In 2018 we tested the removal of this iron oxide layer using dry brush techniques followed by wet cleaning with deionized water. Results were slow and oxide removal insufficient. The H_2O_2 application test was performed on a 10x10cm window in a barely visible location. The H_2O_2 was extremely efficient in removing dirt associated with iron oxide without causing visible damage to the speleothem surface. After the test, in a 10x10cm window, we restored a face of the stalagmite measuring about 80cm height and 60cm diameter (Figures 5 A to C). This is a promising technique to reduce impacts caused by degradation of the steel walkways constructed over vast important areas of the cave. In 2019, volunteers remediated about 0.8m^2 of a different stalagmite.

The Volunteers' Experience

At the end of each volunteer event, we sent the participants 10 questions by e-mail. The questions sought to improve the next Volunteer GRM, hear the participant's personal gains, and understand if the volunteering activity achieved its main objectives. — Reduce anthropogenic damage in GRM. — Raise awareness about cave importance and fragility. — Encourage changes in attitude toward cave conservation.


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Figure 3A – Metal flaking on the walkway


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Figure 3B – Detail on metal flaking removal in Resto Point 2.

Volunteers freely wrote in their comments, which made the answer-analysis process complex and time consuming. In the tabulation process, similar answers were grouped and compiled into sentences to summarize the concepts cited by interviewees. In the statistical analysis, the values presented constitute the percentage obtained between conceptually similar responses in relation to the total number of respondents. The following 2018 results were answered by 11 participants.

Main positive points for Volunteers were: expansion of personal knowledge about caves, cited by 55% of participants; personal contribution to reduce impacts in GRM, cited by 45% of participants; and good theoretical and practical approach for activity, cited by 45% of participants.

The main negative point from Volunteers, cited by 36% of participants, was that they would like the activity to last longer (more days), to restore a larger area of the cave. The main improvement point for the next Volunteer GRM, cited by 55% of participants, is the need to expand advertisement about the activity and increase the number of participants.

The main significance of Volunteer for GRM Conservation I was the contribution to reduce impacts in the cave, cited by 55% of participants. Contribution to improve the visitor experience in the cave (by reduction of visual impacts and increase of scenic beauty) was cited by 27% of participants.

When asked if Volunteering contributed to thinking about the caves in a different way, all Volunteers answered in the affirmative. The main points cited were: awareness of the importance and fragility of caves; expansion of knowledge about cave fauna; increased affection and interest for GRM and/or for the cave environment.

When asked how important Volunteering was to their personal experience, 45% of respondents said they felt personal satisfaction in contributing to cave protection. 18% cited that they learned to work well in teams. Another 18% mentioned that they broadened their knowledge of the cave environment. And 18% mentioned that they acquired new knowledge to disseminate in the classroom and other environments.

When asked how they intend to apply the knowledge acquired in the Volunteering activity, 27% of participants mentioned that they want to spread the knowledge acquired to cave visitors to help reduce damage caused by human action in the caves. 18% mentioned that they would like to apply the new knowledge in personal projects and/or professional activities. 18% cited that they felt encouraged to undertake additional academic training (postgraduate) involving caves.

Responding on how they felt about contributing to GRM conservation, 55% mentioned that they felt pleasure, happiness and/or satisfaction in contributing to cave conservation.18% mentioned that they felt useful and important to be part of Volunteer GRM and to contribute to environmental restoration efforts.

Among the participants, 64% had never participated in a volunteer action for nature conservation. And 100% of the participants said they would like to participate again in the conservation activity for Volunteer GRM.

Results of the questionnaire represent success in conservation accomplishments through volunteer activity, which reached the objectives of sensitization regarding the importance and fragility of the caves and contributed to participants' change-of-view regarding speleological heritage.

Testimonials from Volunteers

"People who see our work in Rei do Mato Cave will surely realize that there are people who care about caves." (Alysson Almeida)

"When visitors arrive at Rei do Mato Cave, they will take a closer look at the speleothem that has been restored near the entrance, and will understand how the surrounding surface activities may cause major impact on the cave natural conditions." (Sheila Marcelino)

"Volunteering has made me realize that there is much more life inside the cave that the eyes can't see, and the preservation of these sites is extremely important." (Jéssica Costa)

"There is no way not to be sensitized by such a beautiful environment, imposing and at the same time delicate and fragile. We need to raise awareness among the authorities and the population to better and better protect our karstic environment." (Maria Honorina Pereira Rocha)

"Whenever in contact with visitors, I will be able to debate a little about the theme, to form an increasingly consolidated awareness of the importance of caring for the cave environment." (Marilza Carvalho)

"The experience was amazing, I only have positive points to highlight about volunteering. I found a new and expanding area that stimulates me in choosing a masters and doctorate degree related to cave biology (...)." (Jessica Costa)

"I felt useful for doing something that will benefit the cave visitors as they will enjoy something that I helped to restore." (Sheila Marcelino)

"I felt happy, because I work here and I learned to love this cave, which is good for her, is good for me too." (Marilza Carvalho)

Conclusion

Internationally, voluntary actions are relevant for cave conservation. Volunteering for cave conservation at the national level is a pioneering action in Brazil.

Due to the positive results obtained in the reduction of anthropogenic impacts in GRM, in awareness of the importance and fragility of caves, and in stimulating changes in attitude to protect speleological heritage, the Volunteer GRM events will be repeated annually. This action could potentially be repeated in other Brazilian caves.

Acknowledgements

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References

AMBIENTE BRASIL. **Plano de manejo do Monumento Natural Estadual Gruta Rei do Mato. Viçosa: Instituto Estadual de Florestas.** 2012. 261 f.:il

BOSTON, P. **Anthropogenic and Foreign Chemicals in Caves.** p. 57-60. In: Cave Conservation and Restoration. Hildreth-Werker, V.; Werker, J. C. (ed.). Huntsville: National Speleological Society, 2006. 600p.: il.

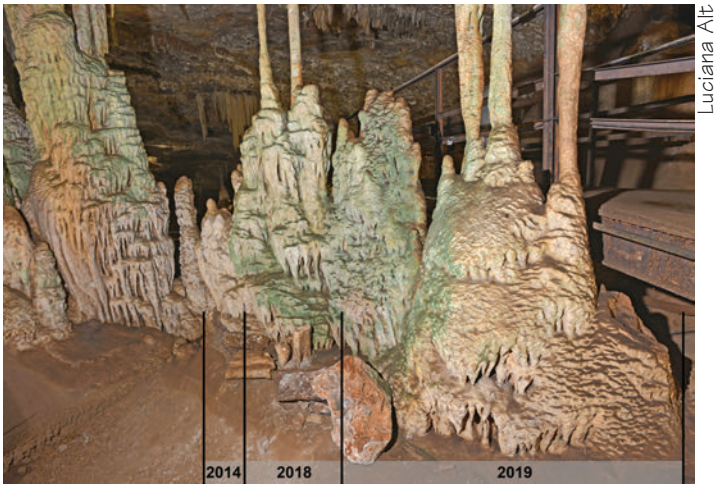
ELLIOT W. **Biological Dos and Don'ts for Cave Conservation and Restoration – Best management practices.** P. 33-42. In: Cave Conservation and Restoration. Hildreth-Werker, V.; Werker, J. C. (ed.). Huntsville: National Speleological Society, 2006. 600p.: il.

HILDRETH-WERKER V. & WERKER, J., 2006. **Cave Conservation and Restoration.** Huntsville, Alabama: National Speleological Society. 600p. ISBN 1-879961-15-6

HILDRETH-WERKER V. ET. AL. First International Cave Conservation and Restoration Course in Brazil. Huntsville, Alabama: NSS News, April 2016, p. 8-10.

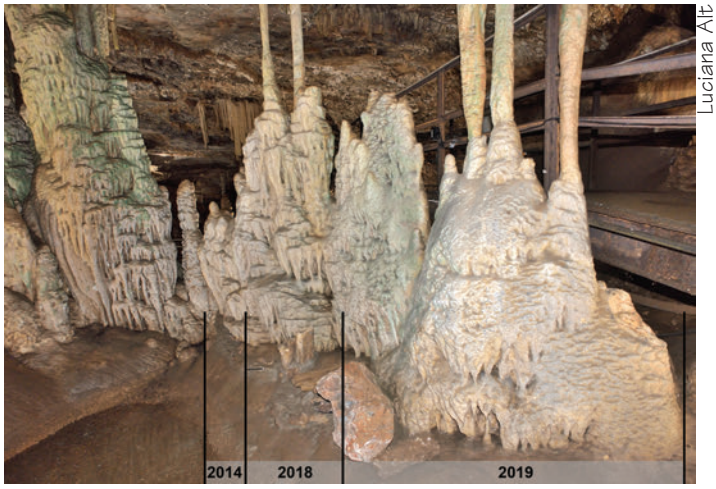
OLSON, R. **Control of Lamp Flora in Developed Caves.** p. 343-350. In: Cave Conservation and Restoration. Hildreth-Werker, V.; Werker, J. C. (ed.). Huntsville: National Speleological Society, 2006. 600p.: il.

PULIDO-BOSCH, A. ET. AL. 1997. **Human impact in a tourist karstic cave (Aracena, Spain)**. Environmental Geology 31 (3/4) June 1997 7 Q Springer-Verlag



Luciana Alt

Figure 4A – Repair Point 3 – Before (2018)



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Figure 4B – Repair Point 3 – After (2019)


Luciana Alt

Figure 5A – Repair Point 4 – Before (2018)


Luciana Alt

Figure 5B – Wet cleaning process (2018)


Luciana Alt

Figure 5C – Repair Point 4 – After (2018)


Vitor Moura

Figure 4C Repair Point 3 – Group working in wet cleaning process.


Vitor Moura

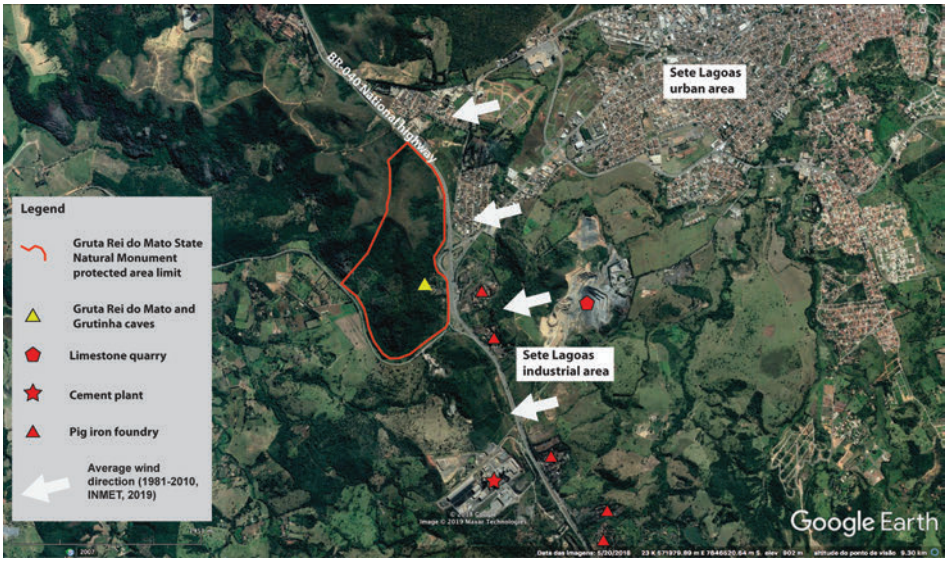
Group shot from Volunteer for GRM Conservation I, 2018

Study of Industrial Particulate Deposits in Caves at Gruta Rei do Mato State Natural Monument, Minas Gerais, Brazil

Luciana Alt, Vitor Moura
Bambuí Speleological Research Group



Figure 1A. Dark cloud of particulate matter originating from a pig iron foundry photographed from GRM Visitor Center. Figure1B. Pig iron foundry near SNMGRM protected area (State Forest Institute/IEF-MG archives).



Map 1

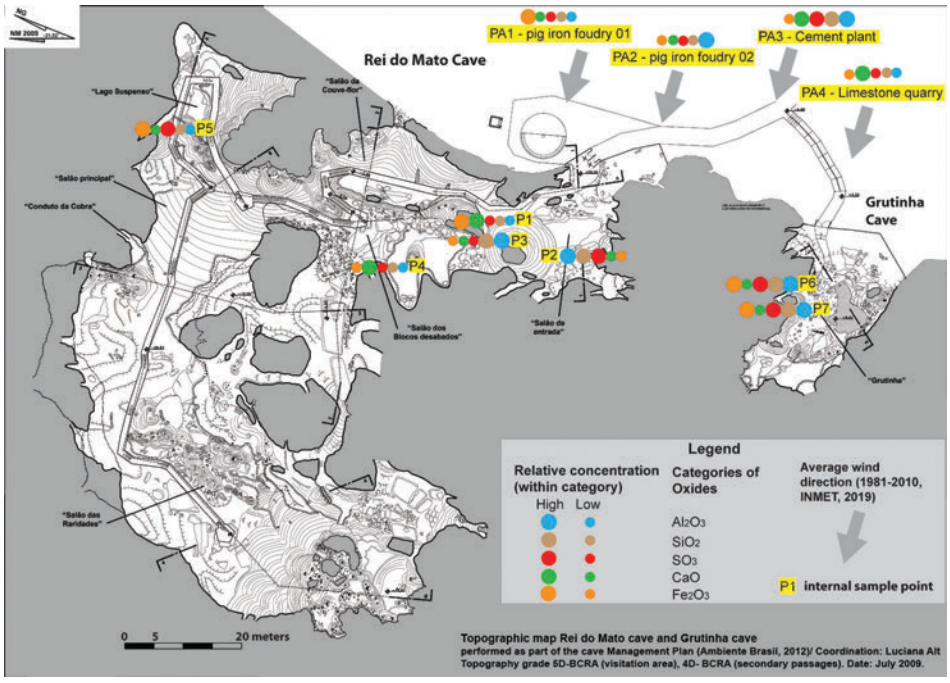
This work aims to present a preliminary analysis of impacts related to the accumulation of particulate matter in two caves, Gruta Rei do Mato (GRM) and Grutinha, both located in the Gruta Rei do Mato State Natural Monument (SNMGRM), in Sete Lagoas, Minas Gerais, Brazil. These caves have received an average of 19,000 visitors per year over the past 5 years. GRM is renowned for large underground chambers decorated with speleothems of significant scenic value, while Grutinha is an important archaeological and paleontological site harboring important rock art styles that date to 10,500 BP (Neves et al., 2012).

In recent years, dark gray airborne particulates have accumulated on speleothems, rocky surfaces, and rock art panels at GRM and Grutinha. Since 2014, the authors have monitored a point in the GRM entry zone, registering significant increases in particulate deposition.

Surrounding the State Natural Monument, in a radius of 2.5 kilometers, are industrial plants producing a variety of products: industrial pig iron foundries, cement plants, a limestone quarry, a fertilizer manufacturing plant, as well as urban and agricultural zones. Significant areas of the protected Natural Monument are covered by native vegetation (Map 1 and Figure 1).

Background

According to Queiroz et al. (2007), in an X-ray diffraction study that analyzed the particulate matter of the atmospheric aerosol over the city of Sete Lagoas, identified the most common minerals present: calcite, quartz, hematite, and talc. The composition ratio showed the indices of more than 30% for calcite, between 10% and 30% for quartz, and between 3% and 10% for both hematite and talc. Several chemical elements were also identified and associated with industrial processes existing in the region: analyses show the expected presence of Al, Ca, Fe, K, Mg and Na; however, other elements are also present including Mn, K, Cr, Cu, As, Zn and Ti. The study reports that the analyzed particulate matter revealed a contribution of 31% from the pig iron foundries, 20% from soil particulate remobilization, 14% from fuel combustion association, and 12% from cement and ceramic product manufacturing.



Map 2: Collection site of the 7 internal samples of particulates accumulated on speleothems and rocky surfaces located inside GRM and Grutinha



Figure 2. Flowstone at GRM Entrance area. 2A—April 2014, restoration window where we cleaned with dry techniques, followed by wet cleaning techniques (Photo: G. Sorragi); 2B— September 2018, internal sample P1 collection site, the speleothem showed new particulate accumulation since the 2014 cleaned window area. (Photo: L. Alt); 2C—September 2018, speleothem after dry and wet cleaning methods, performed during the practical activities of Volunteer GRM 2 (Photo: L. Alt).

The remaining components are due to other industrial activities.

A later work, Jacomino et al. (2009), sought to identify the contribution of the main sources of particulate emission in the atmospheric aerosol composition present in the Sete Lagoas urban area. Soil samples, solid residues, and particulate matter inhalants were analyzed using X-ray diffraction techniques for mineralogical and chemical element identification. The analysis of mineralogical composition of soil samples, solid residues, and particulate matter present in the aerosols indicated a marked presence of silicates, carbonates, and iron oxides. Calcite was the most abundant mineral in the particulate inhalants, measuring greater than 30%. The most abundant chemical elements in soil and solid residues samples were: Al, Ba, Ca, Fe, K, Mg, Na, Ti and Zn. In the inhalable particulate samples the most common elements detected were: Na, Fe, Cl, and Ba. The work indicates that the main sources of pollution are: resuspension of soil and asphalt dust at 26.3%, industrial fuel burning processes at 18.1%, cement and ceramic products manufacturing process at 11.8%, totaling 56.2% of the total variability. Although not determining the percentage contribution of the pig iron foundries, the study concludes that particulate inhalants from the industrial pollution sources are predominant along BR-040 National Highway, which is relevant because the roadway runs along the borders of the Natural Monument (SNMGRM).

Methods

Aiming to analyze the origin of the airborne particulates deposited in GRM and Grutinha caves and the possible correlation with surrounding industrial activities, Alt and Moura, in September 2018, collected 11 samples of particulate matter. We collected the samples manually, using talc-free vinyl procedure gloves with instruments and containers free of contamination (sterilized and subsequently washed with deionized water). We performed collections during and after the Volunteering for GRM Conservation 2, conducted by the Bambuí Speleological Research Group and State Forest Institute, with support from the National Speleological Society (See accompanying article in this NSSNews issue). We collected 7 internal samples of particulates accumulated on speleothems and rocky surfaces located inside GRM and Grutinha (Map 2). For correlation analysis with probable sources emitting particulate matter, 4 external samples were collected from surrounding industries: two pig iron foundries, a cement plant, and a limestone quarry. An NSS Conservation Grant supported both the volunteer workshop event at GRM and the subsequent lab analysis of our particulate samples.

In 2014 a restoration window was made at GRM during the International Course on Conservation and Restoration of Caves held at GRM and Maquiné Caves (See article in April 2016 NSSNews). In this window of about 2.5m2 the particulate matter was cleaned from the surface of a flowstone speleothem located at the entrance of the cave (Figure 2). We monitored new particulate accumulation in the restored window between 2014 and 2018. In 2018, the particulate matter we collected from the flowstone window-zone that was established and cleaned/restored in 2014 corresponds to the point named P1-GRM.

In the laboratory, the samples were analyzed by X-ray Fluorescence (XRF), performed at the Technological Characterization Laboratory (LCT/USP). According to Galvão et al. (2018), this method, as well as other X-ray Fluorescence-based variables, is commonly used for high sensitivity and multi-element identification, yields satisfactory results, practicality, and lower costs, and facilitates characterization dynamics and environmental monitoring actions in Brazil. The contents presented were measured in a pressed sample, in STD-1 (Standardless) calibration, concerning the non-standard analysis of the chemical elements between fluorine and uranium, in a Malvern Panalytical X-ray fluorescence spectrometer, model Zetium. The values were normalized to 100%. Fire Loss (FP) was performed at 1.020 °C for 2 hours.

Predominant oxides	Average concentration (%)
CaO	24,9
SiO_2	14,4
Fe_2O_3	14,3
Al_2O_3	5,4
SO_3	2,8
Total contribution in the average fraction (%)	61,8

Table 1. Predominant oxides and average concentration in internal sam-ples collected at GRM e Grutinha

Results and Discussion

The results indicate a direct correlation between the internal (collected from caves) and external (collected from industrial plants) particulate samples, in terms of presence or similar concentration of some oxides and

External sample source	Oxide and element predominance
Pig iron foundries	Fe_2O_3, Cl
Cement plant	SiO_2, SO_3, MgO
Cement plant and Limestone quarry combined	CaO, SrO, BaO
Pig iron foundries, Cement plant and Limestone quarry combined	Al_2O_3, Na_2O, K_2O, TiO_2, CrO_3, MnO, ZnO

Table 2 – Correlation between external sample sources (pig iron foundries, cement plant and limestone quarry) and presence of oxides and chemical elements in internal samples collected at GRM and Grutinha

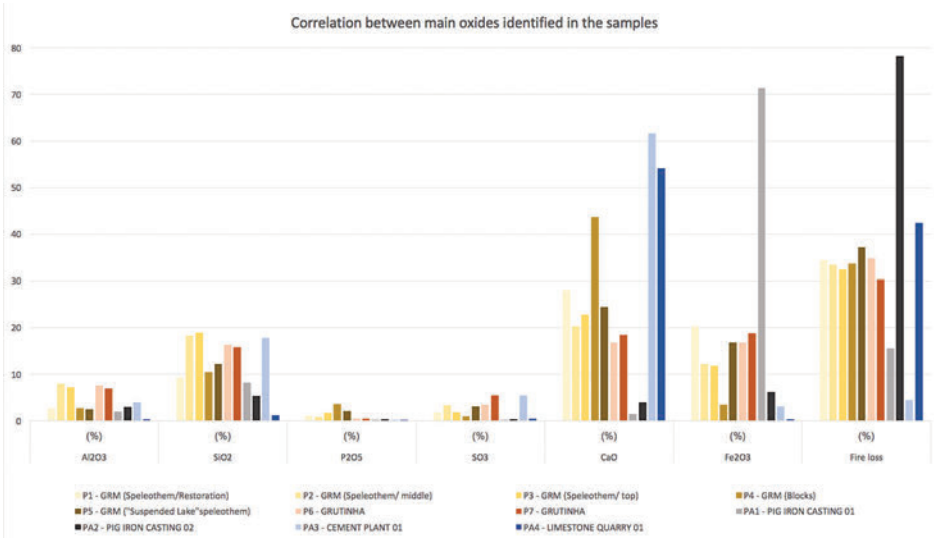


Figure 3. Correlation between main oxides identified in the samples

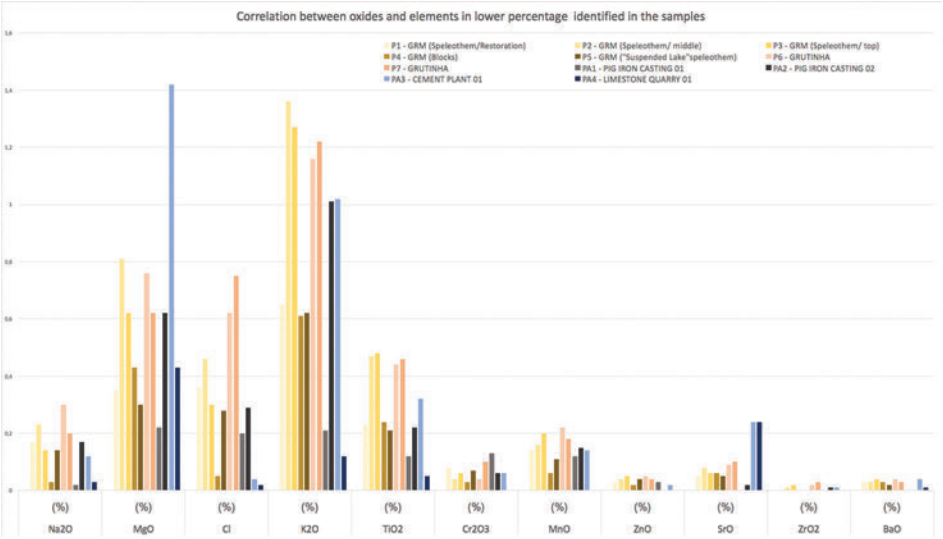


Figure 4. Correlation between oxides and elements in lower percentage identified in the samples

chemical elements. This direct correlation is particularly visible in terms of oxide concentration: CaO, SiO2, Fe2O3, SO3 and Al2O3 (figure 3, table 1). Calcium oxide appears to be the most common, with an average concentration of 24.9% in internal samples; followed by silicon oxide, with an average of 14.4%; iron oxide, with an average of 14.3%; aluminum oxide, with an average of 5.4%; and sulfuric oxide, with an average of 2.8% (table 1). These results corroborate the trends obtained from Queiroz et al. (2007) and Jacomino et al. (2009), predominantly for calcium, silica, and iron oxides. Our study also indicates a significant and worrisome presence of aluminum and sulfuric oxides in the internal samples. At a concentration lower than 1.5%, a direct correlation was observed in terms of presence and/or similar concentrations of MgO, K2O, TiO2, Na2O, CrO3, MnO, ZnO, SrO and BaO oxides (figure 4). We also show the correlation between the internal and external samples of the concentration of chlorine (figure 4).

Based on these preliminary results, it appears that the pig iron foundries present a correlation in the concentration of iron oxide (Fe2O3) and chlorine, as the possible primary source of this fraction of particulate matter in the caves. The cement plant sample shows a predominant correlation in the concentration of oxides: SiO2, SO3, MgO, indicating that this industrial activity is probably the primary source of this fraction of our analyzed particulate matter. The samples from the cement plant and limestone quarry, combined, show correlation in the concentration of oxides: CaO, SrO, and BaO, indicating that these activities are probably primary sources of this fraction of particulate matter from the caves. Finally, analyzing the correlations of the concentrations of oxides: Al2O3, Na2O, K2O, TiO2, CrO3, MnO, and ZnO, the combined contributions of the external sample set are evident from the pig iron foundries, cement plant, and limestone quarry. Some oxides, such as P2O5, detected in the internal samples, do not correlate with the external samples, requiring the future identification of their sources (Table 2).

Conclusions and Recommendations

Several oxides and elements identified in the analysis, such as CaO, SiO2, Fe2O3, SO3 and Al2O3, are related to industrial processes and were also detected in previous particulate and air pollution studies in Sete Lagoas (Queiroz et al., 2007; Jacomino et al., 2009). These data indicate that the particulate matter introduced into GRM and Grutinha possibly arise from the surrounding anthropogenic industrial activities. Some oxides and elements detected, such as sulfu-

ric oxide (SO3) and chlorine, are pollutants and are potentially harmful to the cave environment, cave fauna, and rock art panels.

There may be a correlation between the accumulation of particulate matter in the caves and the prevailing winds. In Sete Lagoas, the Annual Resulting Wind Direction between 1981-2010 comes from 77.4 degrees average direction, corresponding to the frequent northeast by east winds (INMET, 2019). Most of the sampled industrial activities are located east of the SNMGRM area, which potentially provides direct transport of the particulates to the protected area and caves. The BR-040 National Highway can also act as a factor for transportation and remobilization of particulate matter from industrial activities, enhancing its accumulation in the caves.

The main environmental impacts arising from the accumulation of anthropogenic particulate deposits in caves are: (I) aesthetic alteration of cave speleothems and rock art panels; (II) potential negative impacts to cave fauna; (III) potential chemical changes in speleothems, rock art panels, and rocky surfaces; and (IV) potential damages in occupational health of guides.

Aiming to corroborate and deepen this analysis, and to continue the environmental monitoring of the caves, we initiated a second particulate collection/analysis study in November 2019. The characterization and monitoring of the particulate matter as an environmental indicator should form the technical basis for carrying out actions of protection and management within the SNMGRM, in accordance with recommended actions cited in the protected area Management Plan (Ambiente Brasil, 2012).

Aiming toward effective environmental protection of Rei do Mato, Grutinha, and other caves of SNMGRM, the results show the urgent need for environmental control of the emission sources located around the protected area of the Rei do Mato State Natural Monument.

Acknowledgements

We sincerely appreciate the IEF-MG/SNMGRM team, especially the manager, Maria Honorina Pereira Rocha, for daily efforts to protect the heritage of this important natural heritage site. We extend gratitude to the NSS Conservation Grant, and in particular to Val Hildreth-Werker and Jim Werker for their support of these actions.

References

AMBIENTE BRASIL. Plano de Manejo do Monumento Natural Estadual Gruta Rei do Mato. Viçosa: Instituto Estadual de Florestas, 2012. 261f. :il.

GALVÃO, E. S.; SANTOS, J. M.; LIMA, A. T.; REIS, N. C.; ORLANDO, M. T. D.; STUETZ, R. M. Trends in analytical techniques applied to particulate matter characterization: A critical review of fundaments and applications. Elsevier: Chemosphere 199, 546-568. 2018.

INMET. Normal Climatológica do Brasil 1981-2010 – Mapa e planilha de Direção Resultante do Vento (Graus). Available in: http://www.inmet.gov.br/portal/index.php?r=clima/normaisClimatologicas, access 11-25-2019.

JACOMINO, V. M. F.; BARRETO, A. A.; TAVARES, F. V. F.; PEIXOTO, C. M.; RODRIGUES, P. C. H. Avaliação de qualidade do ar em um polo produtor de ferro-gusa. Eng. Sanit. Ambiental. Vol. 14, No. 4, 511-520. 2009.

NEVES, W.A.; ARAÚJO, A. G. M.; BERNARDO, D. V.; KIPNIS, R.; FEATHERS, J. Rock Art at the Pleistocene/Holocene Boundary in Eastern South America. PLOS One, 2012. Available in: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0032228, access 11-25-2019.

QUEIROZ, P.G. M.; JACOMINO, V. M. F.; MENEZES, M. A. B. C. Composição elementar do material particulado presente no aerossol atmosférico do município de Sete Lagoas, Minas Gerais. Quim. Nova, Vol. 30, No. 5, 1233-1239, 2007

NEWS & NOTES

Cave Conservancy Foundation undergraduate and Graduate Fellowships in Karst Studies Academic Year 2020-2021

The Cave Conservancy Foundation provides funding in support of cave and karst related research by students. Research on caves and karst in any field, including but not limited to archeology, biology, engineering, environmental science, geography, geology, hydrology, and social science are eligible. The research may involve caves and karst areas anywhere in the world, but applicants must be full-time students at a U.S. college or university.

Undergraduate Fellowship in Karst Studies ($6,000)

Applicants must provide 1) a letter of intent, 2) a research proposal of 5,000 words or less, and 3) undergraduate transcripts, plus 4) a letter of support from the research faculty advisor submitted directly by the advisor. Email all application material, with "request receipt" notation and "CCF-UG Fellowship Application" in the subject line, to Dr. Daniel Fong at dfong@american.edu and to cavecv@aol.com. Be sure to cc yourself to ensure that the email message was sent successfully. **The submission deadline is May 1, 2020**. The award decision will be announced by June 1, 2020. Email Dr. Fong with any related questions or concerns.

Graduate Fellowship in Karst Studies – Master ($7,000) or Doctorate ($20,000)

Applicants must provide 1) a letter of intent, 2) a thesis or dissertation research proposal of 5,000 words or less, and 3) graduate transcripts, plus 4) two letters of recommendation including one from the thesis or dissertation advisor, submitted directly by the recommenders. Email all application material, with "request receipt" notation and "CCF-MS Fellowship Application" or "CCF-PhD Fellowship Application" as appropriate in the subject line to Dr. Annette Engel at aengel1@utk.edu and to cavecv@aol.com. Be sure to cc yourself to ensure that the email message was sent successfully. **The submission deadline is May 1, 2020**. The award decision will be announced by July 1, 2020. Email Dr. Engel with any related questions or concerns.

Cave Conservancy Foundation 2019 – 20 Academic Karst Studies Fellowship Awards CCF Academic Fellowship, Ph.D. level

Lauren Ballou, Texas A&M-Galveston (Department of Marine Biology)

"Assessing the biogeographic distribution of anchialine cave fauna using Typhlatya (Crustacea: Atyidae) and Remipedia (Crustacea) as model taxa"

CCF Academic Fellowship, M.S. level

Anna Harris, Western Kentucky University (Department of Geography and Geology)

"Quantifying the impacts of timber harvest on karst systems in the Tongass National Forest, Alaska"

CCF Academic Fellowship, Undergraduate level

Levi Trumbore, University of the South (Department of Biology)

"Cave Biodiversity of Cumberland Gap National Historical Park"

Acknowledgement and appreciation are extended to Drs. Annette Engel and Daniel Fong for this annual program's leadership and to the many others that assisted. Please see our website www.caveconservancyfoundation.org for information on 2020 – 21 fellowships.

Caves for Bats

Collaborative Work between Puerto Rico Caves Conservation Committee and Bats Conservation Program

Ángel D Vega

Puerto Rico Speleological Society, angel.d.vega@outlook.com

In 2018, the Bats Conservation Program of Puerto Rico (PCMPR in Spanish) and an investigation led by Natalie Nieves1, visited and documented roosting sites, compared previously recorded data, and proved the great island loss of frugivorous and nectarivorous bats, provoked by the hurricane disasters of 2017. The abundant number of bat skulls collected in caves like Bonita and Matos serves as evidence of the need to protect bat species while they recover from a severe drop in population.

PCMPR adopted the strategy from the Latin-American and Caribbean Web for the Conservation of Bats (RELCOM2 in Spanish) with the goal of identifying significant bat habitats and certifying them as important places for the conservation of bats (AICOM and SICOM in Spanish). Yanire Martinez from PCMPR and Angel Vega from Caves Conservation Committee (CCC) started a work alliance directed toward identifying caves that need bat habitat protection. As part of this new informal alliance, Angel provided location information and safety on cave trips, while Yanire provided knowledge and expertise on bat identification and processed the requests to RELCOM for certification. By December 2019, of the 15 sites we visited, RELCOM certified 10, and on appeal with proof through our data, 4 more were certified and added to the list. Meanwhile, the Department of Natural and Environmental Resources3 (DNER) collected necessary certification data for 16 additional caves that were also identified as important bat habitats.

Findings of 2019

In the Arecibo area, two caves were selected: Matos and Culebrones. Angel Matos Cave, included in Natalie's investigation, had a considerable amount of bat skulls around the cave entrance, mainly the remains of fruit bats. Cave internal temperature was found lower than a visit two years before. The team observed fishing bats—a new report that inspired an additional investigation to better understand the fishing bats' diet.

John Rosa4 periodically placed guano traps and analyzed content during the year. The Cave of Culebrones (Cave of the Boas) has a huge bat colony and is a natural laboratory for PCMPR and Interamerican University students. This cave provides the unique experience to watch, up close, the Puerto Rican boa catching bats as they exit at dusk. Inside the cave we found a small, round passage, fresh air on one side, and very hot on the other, thus decided to wait and venture there later.

William Gerena organized a few cavers to inspect the access to the waterfalls in Vientos Cave System, and PCMPR was invited to collect information on the bat population near the Volcan entrance. The extensive guano coverings in this cave are a spectacular scene of black waterfalls, that show us how abundant the population has been for many years. Skulls from 4 different species were collected here. Unexpectedly, Yanire recognized a fishing bat flying over the water spring, deep in the cave, far from a river or lake—Rossana Vidal also detected its signal with the Echo Meter5.

Cucaracha Cave and Madama Cave in Aguadilla gained our interest for being hot caves with reports of bad air, so we decided to visit them during the winter months. Cucaracha Cave (Roach Cave) is said to have the largest bat colony in the island and has a negative history of stories telling of lack of air and loss of consciousness due to high concentrations of carbon dioxide (CO_2). Our safety plan was to make sure we had cavers with us who knew the cave. Tom Miller, geologist who wrote an analysis of the cave6 ,accompanied us along with several cave rescue experts including Johnsy Carrion, who brought equipment to measure temperature and CO_2. Cavers helped the members of PCMPR descend a few meters into the cave entrance, and just as they passed the dripline, the electronic CO_2 meter reached 7500 ppm, the alarm went off, and the display dashed out. Instead, Tom used Dragger tubes and measured. As the first group entered the cave, he recorded between 2 and 2.5% CO_2. All who entered the cave went through and returned to the surface without incident.

We noted that temperature was lower, number of bats was lower, and number of roaches was lower than than observed on previous visits, but the bat colony seemed strong. This experience, between amazing and terrifying, left a lasting impression of what a hot cave with bad air really is. My friend Efrain Matos described it best as, "guanifying." To finish the day, we went to Madama Cave, which is a vertical hot cave with additional reports of bad air, but only to watch and register the evening bat exodus. For our future entry to this cave, we expect to be as prepared and well-equipped as if it were a cave rescue operation.

Next phase took us to Grillo Cave in Aguas Buenas, sort of the beginning of the Aguas Buenas Cave System. Ronald Richards had made an investigation of this system in 20027, which we used as reference. Initial observation of the cave at dusk revealed just a few bats around the entrance, which was surprising because we heard stories of an enormous colony. PCMPR was unable to participate in this visit. We found three or four chambers with bats, but no obvious window or crevice for bats to exit. We also found a new floor collapse inside the cave above the river passage, which we must further investigate. Jose "Chino" Gomez and Efrain Matos, from Norman Veve Troglodite Grotto (GTNV in Spanish) completed a linear map during our exit—the map will serve as a start for later exploration of the external topography to find where bats enter and exit the cave.

Jimenez Cave in Manati was an old guano mine with an extensive bat population. An elaborate horse-driven system was used to extract the guano through a man-modified pit. The family house is right on top of the cave and a school is a few feet off one of the exits. Exploring the cave, we found trash left by the mining tasks, and placed the site on the top of our cave cleanup list. A hot chamber was found near the extraction pit, with a considerably large bat colony. As we saw the bats leaving the cave, in a later visit, we noted the colony was greater than what we found and there must be some hidden roosting chambers. The PCMPR started collecting environmental data in the cave and captured bats for identification. Hexan Gonzalez supported the effort by developing a cartography of the cave, on which PCMPR can plot the data. Also, Angel Acosta used lidar and caveGEOmap8 to create a 3D map that detailed the cave's internal topography.

Bonita Cave in Toa Alta has been on PCMPR's visit list for some time. They noted that after the 2017 flooding, bats were found drowned inside the hot chamber due to a back-flooding configuration of a specific down-stream cavity. We explored the up-stream, southern passage of the cave. The passage has running water, loose

sediment bottom, many roof bell-holes, and some cavities on a higher level that seem like paleo-segments. We saw lots of bats flying on the main passage. Two tunnel-like chambers that were about two meters above water level had bat noises and black-tainted walls that suggested roosting sites. We suspected those to be the main roosting chambers, but we were unable to climb for visual inspection. The up-stream passage ends where water flows out of the limestone, through tight passages that we didn't explore. Before this trip, Michael Martin, a local caver, mentioned that there is another chamber with guano mounds and lots of bats located 100 meters south of this passage—thus, we have our next candidate for a topographic map and tight-squeeze exploration.

As we started coordinating with other groups, the Scientific Committee of SEPRI was visiting Rio Camuy Cave Park in search of the troglodytic Alloweckelia gurneei9, and planned to visit Clara Cave, the main show cave of the Park, to observe bats coming out. Luis Alberto Nieves coordinated a few members of PCMPR to accompany them and help with bat species identification. The bat population had been affected by the Rio Camuy flooding event and was recovering, but the troglodyte was not found.

Another alliance opportunity surfaced when Miguel Babilonia, President of the Foundation for Speleological Investigations of the Puerto Rican Karst (FIEKP in Spanish), invited Yanire to Cave Number 42 in Utuado to help in the effort to protect this bat-dwelling cave. At this site, a huge population of bats was added to the list that will be monitored and preserved.

Some caves were located on the southern karst region (not well known to us), which provided the great opportunity to meet and work with the United Speleological Society of the South (SEUS in Spanish), who explored and documented most, if not all, caves in southern Puerto Rico. Carlos "Pucho" Cruz, who wrote an article describing Naranjo Cave9, coordinated the visit permits with the limestone quarry in Juana Diaz. This cave is inside the quarry and mining happens extremely close to it. We followed Pucho down a scary trail through the loose quarry rocks until the entrance passage showed us some spectacular religious rock paintings from the previous century. To reach the bat chambers, we went through a guano-polluted stream and used safety handlines—as always, worth the effort and the smell. It was the first time I saw a dead bat still hanging from its claws. We climbed as far and high as possible to see one bat chamber. The best way to see the entire population was by descending a multi-pitch pit trail with very difficult access, but we did not have the time to required for that route.

Later in the year, Ivan Nieves with SEUS filmed part of a cave documentary in Mapancha Cave of Peñuelas, and of course, we hopped along. This became an unexpected concurrent event—we had people to film, guides from SEUS, bat people from PCMPR, entomology students from the University, and explorers from SEPRI. Ramon "Moncho" Torres of SEUS guided the PCMPR team, led by Wilkins Otero, to access and assess the hot chamber in the main cavity. Meanwhile, Pucho Cruz led SEPRI explorers to the Oregano vertical entrance, where we descended and con-firmed that no bats remained in that cavity. Entomology students noted lack of abundance of insects in the forest surrounding the cave. PCMPR was able to plot the collected data on a cave map, thanks to an article Tom Miller11 wrote some years back.

To close the year of visits, we left Tortuga Cave in Guanica as our last visit, mainly due to reports of internal temperatures reaching 100 °F and everyone who visited in the recent past told us we were going to die there. At last, Miguel "Miguelon" Martinez agreed to guide us, and PCMPR decided to capture bats during their exodus, instead of trying to reach the hot chambers. Yanire Martinez and Yadiamaris Aviles placed a harp trap on one of the cave entrances and waited for bats to exit. Miguelon and I explored the first two levels to find only 2 bats. The hot chamber was supposed to be on the third level, but it was too risky trying to reach it without a back-up rescue team present. To our surprise, evening came, night came too, and bats were nowhere to be found; no bats came out ei-ther of the two entrances. The only written reference we had was a 1990 investigation from Carlos Conde11 with mention of a bat population; otherwise, verbal reports from the past two years all described bat populations of varying sizes. Definitely, this cave requires observations throughout the year to detect whether the colony has moved or uses the cave roost on a seasonal basis. Also, Miguelon observed that the rock plate at the entrance had moved from its previous position and suspected this movement happened during the earthquakes of autumn 2019. It is uncertain how this cave may have been effected in January 2020 by additional nearby seismic activity that created enough force to collapse man-made structures.

Conclusion

Bat populations in caves are slowly recovering from natural disasters in Puerto Rico. In addition to learning tips for bat handling and identification, I have also come to realize that cavers and spelunkers are a nuisance to cave biota, especially bats—our exploration, picture documentation, high beam headlamps, and loud voices disturb the well-balanced cave life. My obvious conclusion is that caves must be protected for bats, not for cavers, because we are the visitors, not the owners. I will echo part of the conclusion from Eleonora Trajano13:

"From the point of view of the bats, caves must be protected to allow species most dependent on this kind of shelter to maintain viable populations. From the point of view of cave communities, all bat species, independent of their conservation status, must be locally protected."

Cited References

1. Natalie Ann Nieves (2018). Climate Change and the impact of hurricanes on the survival of bats in small is-lands. Interamerican University of Puerto Rico. (unpublished work)
2. Proyecto Asistencia Técnica para Conservación de Vida Silvestre en Puerto Rico. Ramón Luis Rivera Lebrón. Departamento de Recursos Naturales y Ambientales
3. Instructivo de solicitud de AICOMs y SICOMs, Red Latinoamericana y del Caribe para la Conservación de los Murciélagos, 30 de Octubre de 2018
4. John Rosa Rosas (2019). Remarkable variation in the diet of Noctilio leoporinus in Puerto Rico: the fishing bat turns carnivorous. Interamerican University of Puerto Rico. (unpublished work)
5. Echo Meter Touch, a handheld bat detector featuring a highly-sensitive microphone, from Wildlife Acoustics, Inc.
6. Thomas E. Miller, Ph.D. Analysis of the System of Cueva Cucaracha (Rio Chico), Aguadilla, Puerto Rico, Submitted for Legislative Project 2052, November 12, 2010
7. Ronald T. Richards, 11 Nov 02. The Caves of Aguas Buenas, (from Ron's personal unpublished Cave Notes)
8. Acosta-Colon, Angel & Candelaria-Soberal, José. (2018). caveGEOmap: User-friendly Cave Mapping Soft-ware.
9. Carlos A. Cruz Rodríguez y José M. Díaz Pérez. Sinópsis del Cerro Cuevas en Juana Díaz, Sociedad Espeleológica Unida del Sur, Inc. (SEUS), Espeleorevista de Puerto Rico, Num 5, julio - diciembre 2011
10. Alloweckelia gurneei. Holsinger & Peck, 1968, Worls Amphipoda Database
11. Thomas E. Miller. Cueva Mapancha. Espeleorevista de Puerto Rico, Num. 6, Enero-Junio 2012
12. Carlos Conde Costas y Carmen Gonzalez. Las cuevas y cavernas en el Bosque Xerofiiico de Guánica. U.S. Geological Survey San Juan, Puerto Rico. Acta Científica 4 (1-3):113-126, 1990
13. Trajano, Eleonora. (1995). Protecting caves for the bats or bats for the caves?. Chiroptera Neotropical. 1. p 19-22.

A Cautionary Note on the Value of Guano Deposits in Caves

Danielle Cordani & Merlin Tuttle

Bat guano has played an important role in human history, from the extraction of saltpeter for gunpowder during the American Civil War to the harvest of natural fertilizer. Not surprisingly, this rich substance boasts yet another use as a window into the past, but only if left undisturbed[1].

Intact accumulations are goldmines of scientific value. In addition to supporting entire ecosystems of life found nowhere else, guano deposits contain invaluable records of past conditions. These records sometimes date back thousands of years, revealing changes in climate, vegetation, pollution, and much more[1-4].

In a recent study published in the journal of *Paleogeography, Paleoclimatology, Paleoecology*, a team of researchers analyzed a 129-centimeter-long (4.2 ft) guano core preserved in a Jamaican cave[4]. Led by Ph.D. student, Lauren Gallant, the team traced a detailed history of accumulating atmospheric pollutants, changes in plant life, and evolving industrial and agricultural practices. The far-reaching impacts of human activity were traced over 4,300 years. They even detected the introduction of synthetic fertilizers, the onset of nuclear weapons testing, and the Industrial Revolution.

But what makes guano such a uniquely powerful environmental indicator?

Clues about the past are frozen in glaciers, buried in sediment beneath oceans and lakes, and recorded in tree rings. These natural archives carry biosignatures, such as isotopes of carbon and nitrogen, that allow scientists to view fluctuations in temperature, precipitation, and the chemical composition of our environment[1-4]. Bat guano is an especially attractive medium for paleoclimatologists because it can provide longer-term records than tree cores and unlike glaciers, is found on almost every continent[1]. Gallant and her team found a better record of environmental contaminants in guano than in nearby lake sediments[3]. Especially in tropical regions, caves can provide shelter from fluctuations in heat and humidity that degrade these historical records. In fact, in many places, bat guano may be the only proxy available for scientists to reconstruct the past.

Cave-roosting bats are typically colonial and can consistently deposit substantial quantities of guano, year after year. It is often laid down in a series of identifiable strata, each layer representing a distinct time period[2]. These layers carry information about environmental conditions and the flora and fauna bats consumed[1-3].

Insect bodies contain carbon ratios indicative of the plants they feed on. Insectivorous bats then pass those ratios through their feces into guano deposits[5]. The same follows for fruit and nectar-eating bats. Because these ratios vary among plant communities, Gallant suggests they may provide critical information about long-term changes in climate and/or agriculture[3]. For example, C3 carbon ratios are found mostly in forests and in wheat, rye, and oats. C4 ratios are found in arid climates or crops such as corn, sugarcane, or sorghum, and often correspond to periods of drought and deforestation[3,5].

Several researchers have used guano cores to document the large proportions of agricultural pests consumed by bats[4-6]. In Jamaica, Gallant and her team found a shift towards C4 plants that correlated with increased sugarcane production, suggesting bat suppression of sugarcane pests[3]. As bat populations worldwide experience stress from habitat loss and human activities, such evidence supports arguments for conservation.

To serve as historical indicators, guano deposits spanning even a few years can prove helpful, but they must remain intact. Unfortunately, as a result of human extraction and careless disturbance, few remain[1,3]. Those that do should be carefully protected.

Systems are needed for identifying, reporting, and conserving undisturbed guano deposits. Such information may be used to preserve potentially important deposits and the bats that contribute to them. Careless footsteps can destroy hundreds or even thousands of years of invaluable records. Next time you encounter a guano deposit, afford it the same respect as a rare speleothem. Strictly limit disturbance by walking around them or sticking to a single trail that will cause the least damage.

For more information, please visit our resource titled, *Finding, Protecting, and Restoring America's Historic Bat Caves,* at MerlinTuttle.org.

References

1. Wurster, C., Bird, M., and McFarlane, D. (2010). Bat guano: record of climate change. Access Science.
2. Petit, M.G., and Altenbach, J.S. (1973). A chronological record of environmental chemicals from analysis of stratified vertebrate excretion deposited in a sheltered environment. Environmental Research *6*, 339–343.
3. Gallant, L.R., Grooms, C., Kimpe, L.E., Smol, J.P., Bogdanowicz, W., Stewart, R.S., Clare, E.L., Fenton, M.B., and Blais, J.M. (2019). A bat guano deposit in Jamaica recorded agricultural changes and metal exposure over the last > 4300 years. Paleogeography, Paleoclimatology, Paleoecology *538*.
4. Clark, D.R., LaVal, R.K., and Tuttle, M.D. (1982). Estimating pesticide burdens of bats from guano analyses. Bulletin of Environmental Contamination and Toxicology *29*, 214–220.
5. MIZUTANI, H., McFARLANE, D.A., and KABAYA, Y. (1992). Nitrogen and Carbon Isotope Study of Bat Guano Core from Eagle Creek Cave, Arizona, U.S.A.. Journal of the Mass Spectrometry Society of Japan *40*, 57–65.
6. Marais, D.J. des, Mitchell, J.M., Meinschein, W.G., and Hayes, J.M. (1980). The carbon isotope biogeochemistry of the individual hydrocarbons in bat guano and the ecology of the insectivorous bats in the region of Carlsbad, New Mexico.



An eroded ancient guano deposit reveals annual layering. Photo by Merlin Tutttle

Anthropogenic Carbon Dioxide in Carlsbad Cavern

Sonia Meyer, MIS Intern*, Carlsbad Caverns National Park

The National Park Service (NPS) is monitoring carbon dioxide (CO2) in Carlsbad Cavern to assess the park's current conditions as part of a Visitor Use Management (VUM) study. The VUM Framework analyzes visitor impacts on both visitor experience and park resources to conserve natural resources. The first steps of the framework are to assess current conditions, define the desired conditions, select indicators, establish threshold limits, and monitor them. This is an iterative process that relies on data-driven analysis.

The impact of poor air quality on visitor safety is a concern, especially on high visitation days when visitors congregate in long elevator lines, resulting in elevated CO_2 levels. Anecdotal data indicates that visitors can wait in line for up to two hours on these busy days. Documenting CO_2 levels is also important to help establish the current conditions in Carlsbad Cavern as part of the VUM study. Additionally, several studies have shown that CO_2 levels can impact speleothem growth. If the monitoring reveals a strong correlation between CO_2 levels and visitation, these data can be used to establish management strategies to manage visitor use in the cave based on desired CO_2 levels.



NPS Photo by Sonia Meyer

CO_2 sensor in the King's Palace

Impacts of Elevated CO_2 Levels

The table below outlines CO_2 concentrations and the corresponding effect on humans with outdoor and indoor ranges for reference.

The relationship between carbon dioxide and speleothem growth is an important and delicate one. Carbon dioxide is a driving factor in karstification. The higher the concentration of CO_2 in cave water, the more calcite ($CaCO_3$) that water can hold, leading to calcite supersaturation. When this calcium-laden water reaches an air-filled void, carbon dioxide will degas, then the solution can no longer hold as much calcite, and the calcite is deposited creating speleothems. However, high CO_2 air levels disrupt the natural balance by preventing CCO_2 degassing from the water to the air, thereby preventing calcite deposits and slowing speleothem growth.

Additionally, high concentrations of carbon dioxide in cave air can deteriorate cave walls by corroding speleothems and can harm cultural resources such as images painted on or pecked in to the rock. Several researchers have calculated limestone corrosion thresholds ranging from 2,400-2,900 parts per million (ppm), which could damage or destroy rock art and speleothems. In addition to the human health effects, the alteration of Carlsbad Cavern's fragile microclimate via elevated carbon dioxide levels could severely impact the cave.

CO_2 Concentration	Effect on Humans
300-400 ppm	Outdoor
350-1,000 ppm	Recommended for indoor spaces
1,000-2,000 ppm	Drowsiness, poor air
2,000-5,000 ppm	Headaches, sleepiness, stagnant air, loss of attention, increased heart rate, slight nausea
5,000 ppm	Workplace exposure limit (40-hour work week)
10,000-20,000 ppm	Life-threatening if untreated electrolyte imbalances and metabolic changes
>40,000 ppm	Immediately dangerous to life and health

Sources and Mechanisms Affecting CO_2 Levels in Caves

Visitor exhalation has repeatedly been found to be the primary anthropogenic source of CO_2 in show caves. There are several natural sources of CO_2, including diffusion from soils and epikarst, dripwater degassing, microbial decay of organic matter, and transport of endogenous CO2 in geologically active regions. Natural methods of reducing CO2 levels include air diffusion and advection. Barometric and convective airflow plays an important role in natural CO_2 fluctuations.

Microclimate Research in Carlsbad Cavern

Cave water also helps to mediate CO_2 levels in wet caves, by stimulating airflow and providing opportunities for gas dissolution into water. Since Carlsbad Cavern is a dry cave, in that it does not have any flowing water, air advection is the most likely mechanism to return CO_2 levels to starting levels after tours finish and visitors exit the cave.

Historically, climate research at Carlsbad Caverns National Park has been conducted with a focus on airflow and its relation to the drying of cave formations. This drying was due to the chimney effect created by the artificial entrance—the elevator shaft. As a result of the airflow research, revolving doors with airproof seals were installed at the base of the elevator shaft in August 1972 to act as an airlock and reduce (but not eliminate) the airflow.

Carlsbad Cavern is a static cave—cold

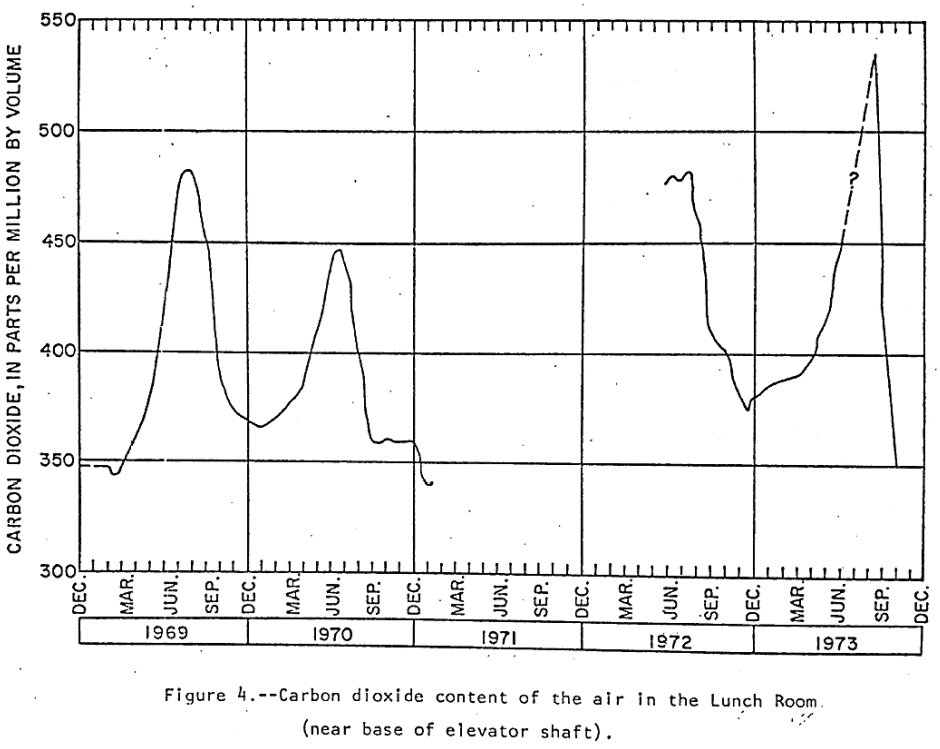


Figure 1. Graph of CO2 levels in the Lunch Room, 1969-1973 (McLean 1976)

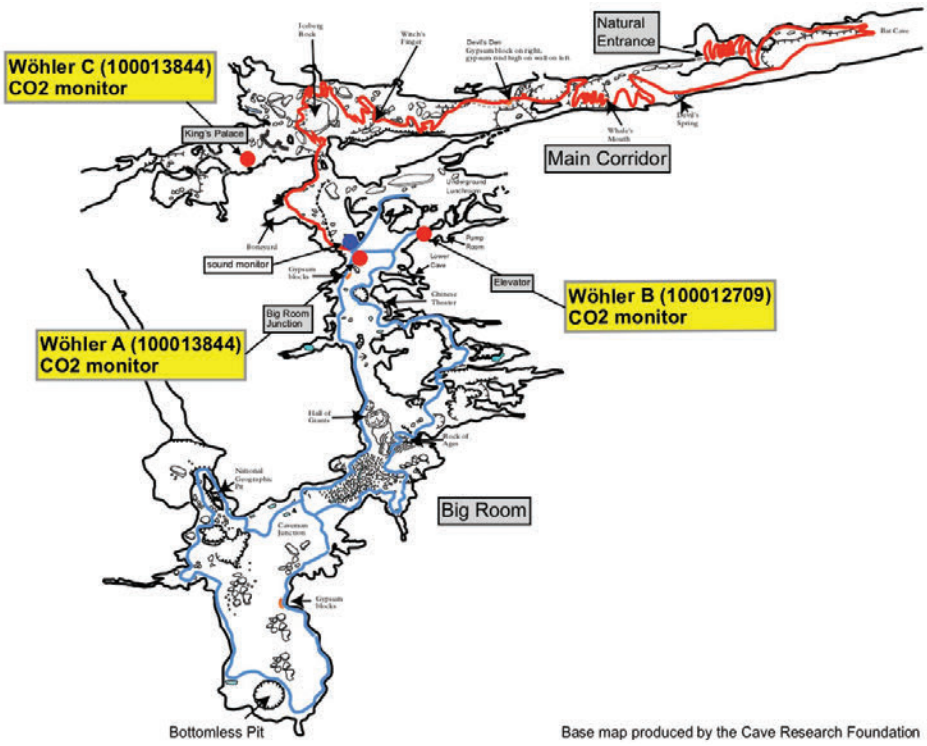


Figure 2. Map of CO_2 sensor locations in Carlsbad Cavern

dense winter air easily enters the cave and displaces the internal air, resulting in high ventilation regimes in the winter. Researchers and observers all noted that the increased ventilation during the winter results in evaporation while the summer resulted in condensation on railings, trails, and formations. McLean (1971) noted that sealing the elevator shaft would likely reduce the air exchange caused by the chimney effect. Reduced airflow would increase CO_2 levels, and there was indeed an increase in CO_2 levels in 1973 after the installation of the revolving doors. Figure 1 shows seasonal variation in carbon dioxide concentration, with a winter minimum and summer maximum, in accordance to the cold trap ventilation regime.

The most recent research on airflow in Carlsbad Cavern conducted by Dr. Andreas Pflitsch and his graduate students determined that the influences are more complicated than previously thought. Killing-Heinze (2017) determined that Carlsbad Cavern has complex air circulation patterns due to the combination of huge chambers with smaller connecting tunnels. Barometric airflow is a secondary component that affects the climate in Carlsbad Cavern primarily in the Left Hand Tunnel, however the carbon dioxide monitoring only took place in areas affected by convective airflow.

Monitoring Equipment

CO_2 concentrations were measured using three Wöhler CDL 210 CO_2 Data Loggers with a working range of 0 to 2,000 ppm, a resolution of 1 ppm, an accuracy of 50 ppm or 5% of the reading, and a sampling at a rate of 5 minutes. The sensors were deployed in June 2019 at locations shown in Figure 2. Wöhler B was placed near the elevator because it is an area that sees large congregations of people waiting in long elevator lines on peak days. Wöhler A was placed in the Big Room Junction because it is a central point in the cave that receives traffic both from the elevator and the Main Corridor. Wöhler C was placed in King's Palace because the park runs five tours a day to King's Palace.

Data Analysis

Data analyzed in this article was collected from June to July 2019 from the CO_2 monitors in the following locations: elevator, Big Room Junction, and King's Palace. CO_2 levels are compared to daily visitation data and surface temperature readings. The visitation data are provided by the fees staff based on the number of tickets sold. The surface temperature data, logged hourly, are provided by the Bureau of Land Management and National Park Service from the BATDRAW weather station.

Conclusion

This study shows that throughout June and July 2019, CO_2 levels were cumulatively increasing and not returning to starting levels in the evening (Figure 3). During the period of the study, the highest CO_2 concentration was recorded at 1,473 ppm. While this is well below the OSHA safety limit of 5,000 ppm for a 40-hour work week, concentrations over 2,000 ppm can have some adverse health effect on humans and may impact visitor experience. Limestone corrosion thresholds range from 2,400-2,900 ppm. The CO_2 levels are continually increasing throughout the summer.

The lowest CO_2 concentrations are logged between 8:00 a.m. to 9:00 a.m. The

highest CO2 concentrations are logged 2:00 p.m. to 4:00 p.m. In both the elevator and the Big Room Junction, CO_2 levels peak on the weekend, with Saturday producing the highest values. While the surface temperature does not appear to have an effect on normalized CO_2 levels in the summer, it is expected to have a significant effect in the winter (Figure 4).

The data revealed a very strong positive correlation between visitation numbers and CO_2 levels at the elevator (R=+0.93) and Big Room Junction (R=+0.92) (Figure 5). This is expected given the high visitation and low air circulation in summer months in accordance with Carlsbad Cavern's ventilation regime of summer stagnation. This may change over time as visitation declines and air circulation increases in the winter months in accordance with the wintertime cold trap ventilation regime. It is important to not extrapolate these preliminary results across the year, as further carbon dioxide monitoring is needed to capture the effects of this seasonal variation.

Two major limitations of this study are the sparsity and quality of data due to the short two-month monitoring period, various data losses, and the unreliability of the data due to the mathematical corrections for automatic baseline calibrations. These results are preliminary and should not be extrapolated past June and July of 2019. Starting in August 2019, carbon dioxide monitoring will continue for a year. With more data, stronger conclusions and seasonal patterns can be better determined.

This preliminary work establishes standard operating procedures for a future yearlong study. The results from the yearlong carbon dioxide study will be used to establish current CO_2 conditions in Carlsbad Caverns as part of VUM study to monitor microclimate changes over time. In addition to establishing current conditions, CO_2 is important to monitor with regards to visitor safety, cave conservation, and visitor experience.



NPS Photo by James Jeffers

Sonia collecting CO_2 data in King's Palace

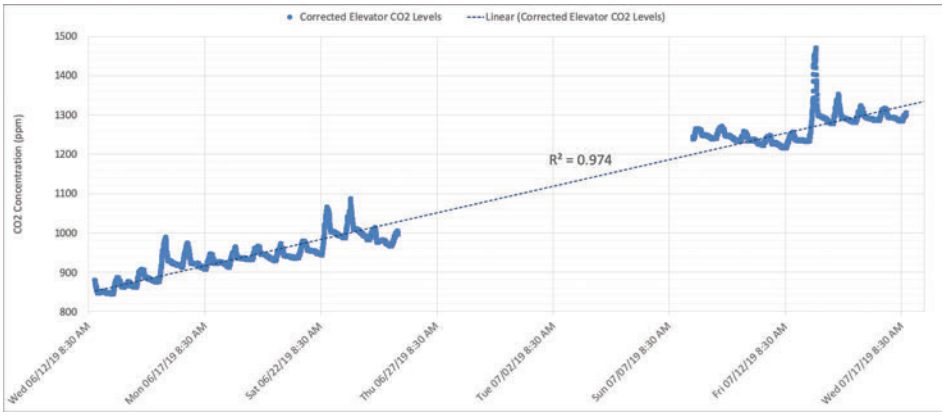


Figure 3. Graph of corrected CO_2 levels at the elevator, June-July 2019

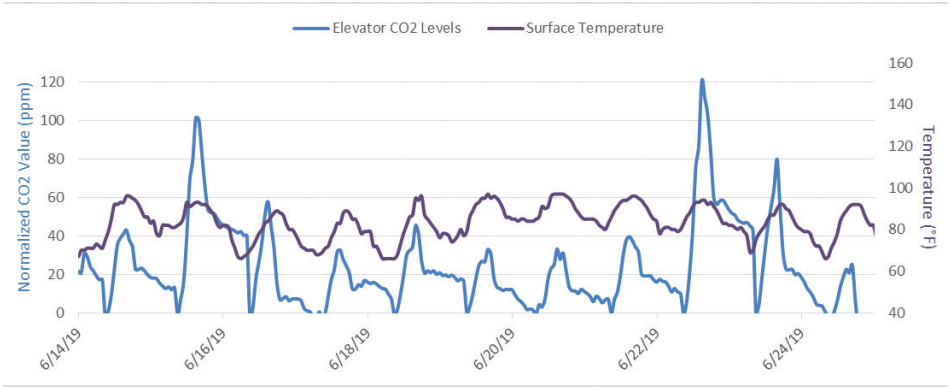


Figure 4. Graph of surface temperature versus CO_2 level at the elevator, June 2019

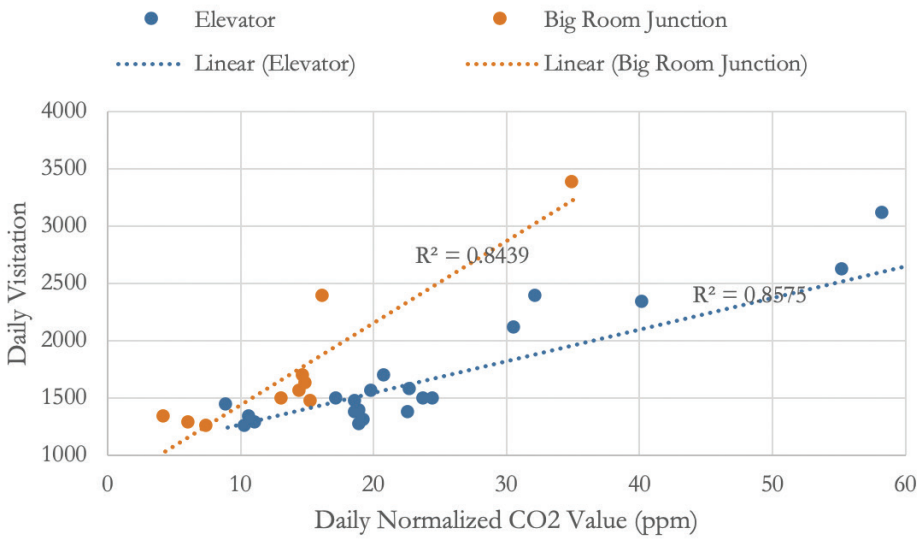


Figure 5. Scatterplot of daily visitation and CO_2 values at the elevator and Big Room Junction, June-July 2019

Author's Note

*The Mosaics in Science (MIS) internship program seeks to promote under-represented minorities in science within the National Park Service, and is administered by the NPS, Environment for the Americas, and Greening Youth Foundation.

The full research paper, providing more extensive information and cited references, can be found on the Karst Information Portal: https://digital.lib.usf.edu/SFS0070378/00001?search=Sonia+=Meyer

Colorado Caves and Hot Springs Under Threat by Proposed Mid-Continent Quarry Expansion at Glenwood Springs

Richard Rhinehart

Despite escalating concern and opposition by Glenwood Springs area residents, businesses, and city and county agencies, the Bureau of Land Management's Colorado River Valley Office in Silt is considering a proposal by Denver's Rocky Mountain Resources (RMR) to expand the Mid-Continent Quarry near Glenwood Caverns.

It took three attempts by the politically connected Denver mining and resource development company to submit a proposal that was accepted by the BLM, the previous two being returned as incomplete. The acceptance of the proposal by the BLM in mid-August 2019 allows the permitting process to continue, requiring additional scientific studies and allowing for public review and comment.

Expansion Permit

RMR is requesting authority from the federal government to increase the size of the limestone quarry from its current 15.7 acres to 321 acres. The resulting quarried limestone will be trucked off the mountain to a Union Pacific Railroad loading facility near the Target and Natural Grocers stores in western Glenwood Springs. Daily, up to 137 rail cars will be processed and transported east through the Moffat Tunnel underneath the Continental Divide to a new rail transfer facility adjacent to Denver International Airport. If approved, the permit will allow ongoing daily quarrying operations for a minimum of 20 years, to as many as 60 years.

The limestone from the quarry is projected to be used as aggregate for concrete used in Colorado's Front Range cities, including the construction of highways, bridges, buildings, and more. Many Front Range limestone quarries, including Castle Concrete's Snyder Quarry on the eastern rim of Williams Canyon north of Cave of the Winds at Manitou Springs, have shuttered in the last decade. The increasing scarcity of limestone aggregate encourages mining companies to consider other potential sites as sources. Potentially, this expanded quarry at Glenwood Springs could be worth 6.5 billion or more dollars in gross revenue over the term of operation.

White Rive Plateau and Transfer Trail Loop

As a part of the federal permitting process, the BLM and RMR contracted with Collier Consulting of Stephenville, Texas to conduct geophysical studies of the Mississippian-age Leadville Limestone strata immediately north of the commercial showcase, Glenwood Caverns. The firm was directed to study the quarry region, along the historic Transfer Trail route from Glenwood Springs to the central White River Plateau. The summer 2018 studies used both electrical resistivity and seismic methods to determine whether caves might exist below the surface.

This region of the White River Plateau is known to have caves along the margins of the limestone monocline. This includes the eastern rim of Oasis Creek to the west, and the eastern rim of Cascade Creek to the southeast. Speleologists suspect there are also caves within the Transfer Trail loop but so far, no cave entrances have been discovered. Cavers are actively walking the region in hope of finding indications of caves.

In their November 2018 report to the BLM and RMR, Collier Consulting reported they decided to run their survey lines along the Transfer Trail loop, as they felt the loop's interior was too rugged, steep, and heavily vegetated to safely enter. The results of these surveys indicated several areas where caves were suspected. However, Collier Consulting played down these potential caves, owing to an apparent lack of understanding of local geology and cave development on the southern flank of the White River Plateau.

Hypogenic Caves, Not Epigenic

While knowledgeable area geologists and cave scientists recognize the caves of the region are strongly hypogenic—created through the action of uprising hot mineral water from great depth—the Collier Consulting team instead apparently assumed that epigenic cave development created local caves like Glenwood Caverns and Cave of the Clouds. Epigenic caves are common to areas like the sinkhole plains of Kentucky and the Edwards Plateau of central Texas, formed by descending, slightly acidic water from the surface. Not finding indications of disappearing streams, sinkholes, and other classic karst topography on the quarry expansion site, the Collier Consulting team assumed that many of the anomalies identified in their surveys were simply filled passages of clay and rock, rather than potential caves.

Age Misinterpreted

Collier's team also greatly misunderstood the age of the caves near Glenwood. They assumed paleokarst development that occurred when the Leadville strata was exposed during the Pennsylvanian Period about 323 million years ago was when today's caves were created. Instead, well-documented scientific studies indicate development of Glenwood Caverns and nearby Groaning Cave to the northeast occurred only 1.5 to 4 million years before present. This exceptional misinterpretation of the age of caves led Collier's team to assume that most caves of such a great age had collapsed tens of millions of years ago, or have long been filled with ancient sediment.

Speleogenic Knowledge is Vital

Knowledgeable cavers who reviewed the 2018 report in October 2019 advised the BLM during a comment period for drilling test wells that these surveys had identified numerous potential caves on virtually every survey line along the Transfer Trail loop. These caves were found in both the upper and middle Leadville Limestone strata, as is common throughout the White River Plateau. Many of the passages are evenly spaced geographically, suggesting strong joint development of a complex system. Such a cave could be similar to the maze-like passages of Groaning Cave.

It is because of the hypogenic development of these caves that they have not been known and explored by the prospectors



Norman R. Thompson

Kathy DuChene begins her descent into Witches' Pantry Cave

of the late 19th century and more recent cave explorers. The Leadville Limestone of this region has not eroded sufficiently to begin exposing high domes and ascending passageways of caves. At Groaning Cave, the entrance passage is fortunately one of the higher passageways currently known in the 15-mile system. Glenwood Caverns, with more than three miles of known passage, was only discovered when Charles Darrow heard whistling of moving air from a tiny hole no more than an inch in diameter, just south of the Iron Mountain summit. If Darrow had not been close to the outcropping when summer thunderstorms were moving into the Glenwood area in July 1895, it is possible Glenwood Caverns would still be unknown today, owing to the lack of a humanly-passable natural entrance.

Drilling Project Proposed

In late September 2019, the BLM accepted for consideration an RMR proposal to drill five exploratory wells along the edges of the proposed quarry footprint. These wells, up to 250 feet in depth, were proposed to determine the volume and nature of underground water flows through the region. This in itself is a continued misunderstanding of the geology, again suggesting epigenic cave development with underground streams like those found in Kentucky and Texas.

Allowing a standard 30-day public review period for the proposed drilling project, the BLM neglected to publicize the request. In the final days prior to the comment deadline, the public learned of the project when Garfield County formally objected to the proposal, stating the drilling was in violation of current county permits. RMR noted in their project request that they would collect rock cores for each of the wells, an uncommon action for water wells. By collecting and studying the rock cores, RMR would better understand the Leadville Limestone and Dyer Dolomite below the surface. This would allow them to cherry-pick areas of greater purity of the limestone in the permitting process.

Federal law allows mine owners securing precious minerals to avoid paying annual permit fees. If the limestone can be shown through chemical analysis to be exceptionally and uncommonly pure—in excess of 95 percent—RMR could then claim the rock was a precious mineral, thus not subject to federal fees that apply for aggregate rock. Only a decade ago, the previous owners of the Mid-Continent Quarry were involved in a lawsuit with a customer regarding the purity of the limestone. In this precedent-setting case, experts from the BLM testified the rock failed to meet this purity test and varied in purity depending on the local geology.

In early December, Congressional Representative Scott Tipton, whose district includes Glenwood Springs, requested in writing the BLM conduct a full Environmental Assessment for the drilling project. "[The] BLM should operate under an abundance of caution in the area, especially regarding any activity that may impact the hydrology of the hot springs," Tipton wrote Colorado State BLM Director Jamie Connell. "Any such damage could prove beyond devastating for this community and the local tourist economy."

Increasing Media Coverage

Increasing public awareness and action by Garfield and Pitkin County communities west and south of Glenwood Springs in opposition to the quarry expansion has greatly increased regional media coverage. Print, digital, radio, and television media from Grand Junction to Denver produced reports on the expansion proposal in the latter months of 2019. These reports detail the disruption to the local resort community, along with an anticipated increase in particulate matter in the air, noise from mining operations and loading of rail cars, along with issues regarding truck transportation of the crushed rock through residential and commercial neighborhoods in the city.

Through encouragement by the City of Glenwood Springs, which has allocated $1.2 million in funding in 2019 and 2020 to aggressively fight the expansion, media also have reported the potential disruption of water to the treasured hot springs. Groundwater flows down the rock strata into the Carbondale Collapse Basin along the Roaring Fork Valley from all compass directions. It is this water that dissolves the Eagle Valley Evaporates at great depth. The mineralized hot water then ascends the Leadville Limestone strata back to the surface. By eliminating one of the sources of the infiltration of groundwater through complete removal of the limestone strata by quarrying, the water volume could potentially be reduced. Colorado water law specifically protects the volume of water that emerges through the hot springs at Glenwood.

There also is increasing concern by the public regarding potential damage or destruction of caves within the quarry footprint. It is likely this region has significant cave passages that are as yet unknown, created by the uprising hot mineral water when the Colorado River was flowing at that elevation. Cavers with the Colorado Cave Survey of the National Speleological Society met with BLM geologists in late July to discuss and instruct about the potential damage to caves and karst features. This on-site meeting offered an opportunity to explain the hypogenic development of the caves and why entrances are uncommon.



Richard Rhinehart

Rob McFarland prepares to climb down into the vertical pit entrance on the day of the late October discovery.

Public hearings for the quarry expansion permit are scheduled to begin in the late spring or early summer of 2020. The BLM announced in August they would be conducting a full and detailed Environmental Impact Statement regarding the quarry expansion. This process will last until at least mid-2020. Whatever the BLM decision will be—either approving the permit or denying it—it is anticipated the losing side will appeal the decision to a court of law.

Complicating issues is the potential influence of politically appointed staff. Secretary of the Interior David Bernhardt is a native of Rifle, Colorado, 27 miles west of the hot springs and Glenwood Springs. He also is a past lobbyist and partner with Denver's powerhouse lobbying firm, Brownstein Hyatt Farber Schreck. One of the founding partners of the firm is the father of RMR's CEO, Chad Brownstein. RMR has retained the services of the Denver firm to lobby the federal government to approve their submitted permit.

Although Secretary Bernhardt told Congress he will avoid involvement in matters regarding his former clients, in early June, 2019, he visited the Silt, Colorado Field Office of the BLM for a private meeting with local staff members. This is the office that is directly considering the permit application. In addition, the BLM's national office is scheduled to move to Grand Junction, Colorado, 86 miles west of Glenwood Springs by the early summer of 2020.

Members of the Colorado Cave Survey continue to closely monitor this permitting process, providing comments when appropriate to the BLM, and updating Colorado cavers.

The Promise of Witches' Pantry Cave

Richard Rhinehart

The western Colorado resort community of Glenwood Springs received welcome news in early January 2020 that will help in an ongoing battle against a politically connected mining development corporation that has proposed an expansion of a mountainside limestone quarry.

Discovery and Description

Witches' Pantry Cave, a previously unknown, pit-entranced cave, is located within the footprint of the proposed Mid-Continent Quarry expansion. With only about 150 feet of passage at this time, it is the longest known cave north of Glenwood Caverns, which has about 3.5 miles of surveyed passageways and rooms.

Discovered in late October 2019, Witches' Pantry confirms caver suspicions that the southern flank of the White River Plateau uplift is filled with caves created through hypogenic cave development. Rising hot mineral water 2 to 4 million years ago created caves in the Leadville Limestone strata as it made its way to springs along the ancestral Colorado River valley, several thousand feet above the current river.

Only a handful of trips visited the cave before to heavy winter snows arrived prior to Thanksgiving. During the few trips in early November, visiting cavers and cave scientists reported the cave has exceptional promise for the discovery of additional passage, as well as scientific study.

Promise of Passage and Paleo-remains

Warm, moist airflow from a low squeeze encourages further exploration at the cave's lowest known level. The entrance chamber of the cave is filled with rocks, dirt, and debris. This may be associated with collapse of the surface millennia ago, providing an entrance. On the surface, the pit entrance is well hidden, and dozens, if not hundreds, of animals over the centuries have unexpectedly tumbled into the entrance chamber.

In December 2019, a paleontologist inspected samples of bones collected from the surface of a debris cone in the entrance chamber and reported they are from fairly recent domestic sheep and deer. One leg bone of a young bear was also identified. It is anticipated that potential excavation of the cone by paleontologists will likely discover additional bones of greater antiquity.

Although the upper entrance chamber has old drying flowstone with draperies and stalactites, the cave's lower level, reached through a tight squeeze and narrow, descending chimney, is moist and alive. Flowstone, stalactites, and draperies in this chamber are reminiscent of decorations found in Glenwood Caverns, located further down the mountain.

Protecting Witches' Pantry

Colorado members of the National Speleological Society prepared a detailed report of the new discovery that was submitted to the Bureau of Land Management Silt Field Office in early December. The Colorado Cave Survey has nominated the cave as a significant cave under the 1988 Federal Cave Resources Protection Act to encourage additional protection and management by the agency.

The decision to announce the cave discovery to the public as a part of the campaign against the quarry expansion was carefully considered. Though Colorado cavers generally do not publicize underground discoveries, the location within the potential expansion of the quarry required cavers to alert the public. If the quarry expansion is approved by the Bureau of Land Management, the cave will be completely destroyed through rock removal within only a few decades.

Once warmer spring temperatures arrive in March and April, cavers will again return to Witches' Pantry Cave. Approval for digging through a tight squeeze in the cave's lower level has been requested to continue exploration. Paleontologists have indicated an interest in visiting the cave to have a better look at the debris cone and remaining bones. A thorough survey will be undertaken at that time.

There is also interest in running electrical resistivity survey lines over the mountain near the cave to see if additional cave passageways can be identified. New survey data can be compared with older data from a 2018 study along the roads which identified multiple anomalies. Cavers believe these indicate multiple cave passages, while the engineering consulting firm that conducted the study has stated these are paleocaves from 300 million years ago, and so are filled with shattered rock and clay.

Meanwhile, the residents and businesses of Glenwood Springs are excited with the news of the cave discovery. It may be that Witches Pantry Cave will be the key to stopping the expansion project.

Sims Sink Nature Preserve 2020

text and photos by Buford Pruitt, Jr., NSS 17920 RL FE

The NSS-owned Sims Sink Nature Preserve, Suwannee County, Florida, was established for the primary purpose of protecting the Santa Fe Cave Crayfish (*Procambarus erythrops*). This species is listed by the State of Florida as Threatened, Florida Natural Areas Inventory as Critically Imperiled, and IUCN as Endangered.

Its underwater cave was known to cave divers and pointed out to Richard "Dick" Franz in the early 1980s, who collected the original specimens from which the crayfish was scientifically described. In addition to being the species' type locality, Sims is also its 'mother lode,' containing more individuals than all the other known habitat caves combined times ten or twenty. The cave is of moderately small size, so as you can imagine it is not available for recreational cave diving.

Imperiled Species Habitat

I originally donated the preserve to The Nature Conservancy in 1987 and then ushered its transfer to the NSS in 2016. I made a preliminary map of the underwater cave in 1987 and the preserve was sized and configured to encompass the cave and entrance sink, being just a hair under two acres. Sometime during the 1990s, two solution pipes opened up on my property to the south of the preserve. I set minnow traps and captured *P. erythrops* in both, which suggested that the pipes were connected to Sims Cave.

NSS member and cave diver Matthew Bull offered to make a new map of the cave that might include the two solution pipes. However, after his first dive there, he warned that the low, silty passage leading in that direction might be too restrictive for him to access. Preserve Co-manager Kelly Jessop, who by that time was conducting water quality research in the cave, confirmed the difficulty. Bull mapped the passage to about 75 feet south of the main cave, but I estimate that the solution pipes are perhaps another 100 feet south of that.

I have recently carved out an approximately one-acre parcel that includes the two 'new' solution pipes. This tract is intended to be added to the Sims Sink Nature Preserve.



Tevis Kouts in Sims Sink solution pipe entrance, February 2017. Note there is very little vegetation on the limestone wall.



Vegetation colonizing Sims Sink solution pipe entrance, January 2020

NSS member and land surveyor Andy Belski has offered to prepare a legal description of the preserve addition in coordination with NSS counsel Jay Clark to make the land transfer via a quitclaim deed. This will hopefully be accomplished before this year's convention.

Scientific research is another preserve management priority. Franz estimated the cave to harbor perhaps as many as 500 *P. erythrops* when he did a mark-recapture census early in the 1980s. Jessop's very recent direct-count census places the number closer to 200. Does that mean the population has dropped to 40% of its 1980 level? Or, does it mean that the mark-recapture method overestimated the number? We don't know, but Jessop currently makes periodic counts, and hopefully those will point our management of this outstanding habitat unit in the direction of long-term species preservation.

Dr. Thomas Sawicki, University of Florida, conducts research on cave and aquifer stygobitic crustaceans. Some of his findings were obtained from Sims Cave data and specimens as part of his broader research on phylogenetics and gene flow in *Crangonyx grandimanus* and *C. hobbsi*. His work also includes discovering and describing several new species of amphipods from Jackson, Washington, and Volusia Counties, Florida. He has lately published at least three papers on the subjects in refereed journals.

The Florida Fish and Wildlife Conservation Commission (FWC) has a history of working cooperatively with landowners to manage critical habitats harboring imperiled species. FWC's attitude is to become involved in such management only on a 'willing landowner' basis. In other words, FWC does not 'take' land via eminent domain, instead only offering expertise and advice to landowners who want FWC involvement. Indeed, we most certainly do want FWC involvement, and to that end have included in the management committee retired FWC wildlife biologist Paul Moler.

Benefits of Removing Creosoted Wood Platform

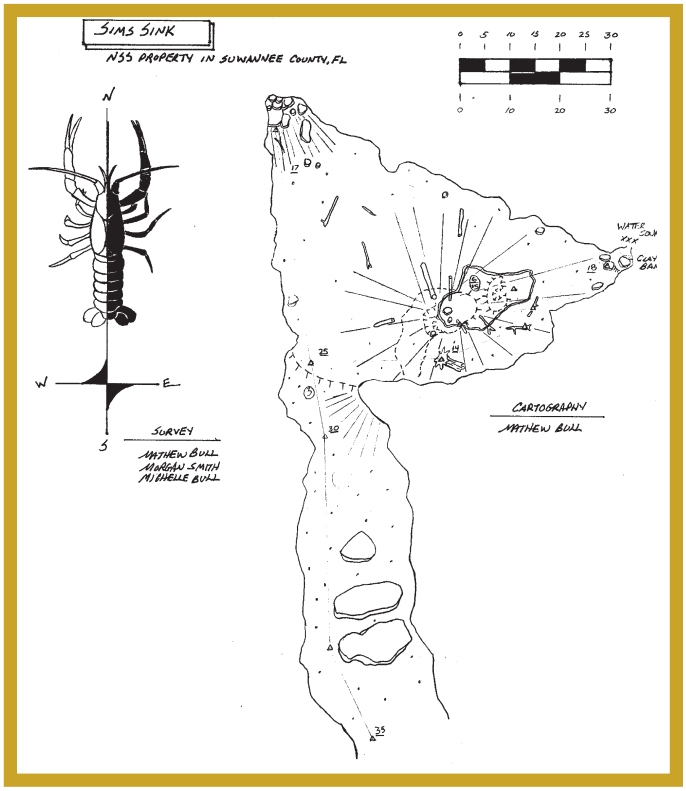
In previous Sims articles published in the NSS conservation issue, I mentioned our removing a coal tar creosoted wood platform that covered the cave entrance and prevented a lot of organic material from reaching the cave. This was important to the crayfish because they consume detritus and its incorporated invertebrates. One way to look at the platform is that it acted as a 'dam' that obstructed detrital and energy flow into the cave. Another perspective is that coal tar creosote is highly toxic to crayfish, so rain percolating through the platform carried the toxic creosote into the cave. One suspected reason for the drastic drop in the cave's crayfish population is that very creosote; however, now that the platform has been completely removed, we hope that any damage it may have caused will reverse. We'll see.

Another impact from the platform was its shading of the sinkhole's sides. This prevented vegetation from flourishing on the twelve-foot-diameter limestone solution pipe entrance into the cave, resulting in fewer invertebrates being susceptible to falling in and providing sustenance to the crayfish below. Before-and-after photographs of a portion of this pipe show the revegetation status from immediately after the 2018 platform removal to January 2020. Colonization of the rock wall is ongoing, slowly but surely.

Surface Habitat

A third preserve activity is the removal of invasive native tree species like laurel oak (*Quercus hemisphaerica*) and black cherry (*Prunus serotina*). I am replacing them with species that live longer and have more value to wildlife, including live oak and Shumard oak (*Q. virginiana* and *Q. shumardii*, respectively), and soapberry (*Sapindus saponaria*). Native ground vegetation such as coontie (*Zamia integrifolia*) is also being introduced. There are plans to assist the migration of other desirable native plant species into the epigean environment of the preserve.

Altogether, the Sims Sink Nature Preserve supports several NSS missions. First, it preserves outstanding imperiled species habitat. Secondly, it offers research opportunities in an underwater cave and phreatic aquifer regarding water quality and troglobitic and stygomorphic crustaceans. Third, it preserves the cave itself and whatever other resources that may exist there. Fourth, it provides a service to the public in terms of green space and biodiversity, even though this may be cryptic to the general population. The society's membership can be justifiably proud of this preserve, as it demonstrates to other parties that the NSS can and does care about caves for far more than just recreation.



New Staff, New Caves, Renewed Sustainability — SCCi Update for 2020

Amber Lehmann, Kris Green, Christine Walkey, Aidan Campbell

Southeastern Cave Conservancy Inc. continues to set the gold standard in cave and karst conservation. Since our last update, much has happened within the organization that will propel us to the next level. Since 2019, we have added two more full-time staff to administer two areas we consider vital to our conservation mission—land management and education. Under the leadership of our Executive Director, our Land Manager has been overseeing conservation efforts on the 4,500+ acres of land we manage, and our Director of Outreach and Education has been educating the general public on what we do, who we are, and our underlying mission of protecting cave and karst environments.

Protecting Caves in Seven States

As many cavers already know, SCCi currently manages 31 preserves located in six southeastern states that contain 170+ caves and an untold number of karst features. 2020 will mark the year that these stats change. In Tennessee, we have under purchase contract a property that contains four caves (to be revealed soon), and one very significant cave in Virginia, Cyclops Cave. Cyclops is a highly decorated cave in Russell County, extremely popular cave among Virginia cavers. The acquisition of Cyclops will expand our territory into our seventh state. The purchase of Cyclops is unique in that we MUST raise $150,000 before we close in May. By the time this article goes to print, we will have kicked off our fundraising campaign to save this cave and protect it forever. We have already received pledges for over $5,000 from various organizations and grottos to help in our efforts. If you or your grotto would like to make a secure donation, you can do so at savecyclops.org. This will be the 32nd preserve SCCi protects—please help us reach our goal.

Full-time Land Manager

Our boots-on-the-ground land management is imperative to understanding the scope of not only what lies below but also on the lands above our caves. Preserving caves is of the utmost importance, but we cannot forget that conserving the lands that encompass our preserves is also vitally important. Adian, our Land Manager, has been conducting high-level plot inventories of trees related to a potential carbon credit program. When SCCi's current application to sell carbon credits is accepted, it will give us an additional line of capital we can use to aid in the stewardship of our preserves.

Aidan's surveys have not only established the potential for selling carbon credits, but have also identified numerous endangered or threatened species, as well as a myriad of invasive species on our preserves. Planning is underway for the eradication of these invasive species to ensure the native species have a chance to thrive. In addition, the inventory has helped inspire projects such as developing a trail plan that aids a fire mitigation strategy.

We also are working with the American Chestnut Foundation, discussing and testing the feasibility of chestnut restoration on our Johnson's Crook and Fox Mountain Preserves. Adian has coordinated efforts on our Henson Preserve to remove multiple dumpsters of construction and household trash from the forests and along the roads. He has also established a trail system that currently stretches over 10 miles along old roadways and through the preserve's forested areas, forming necessary partnerships with regional conservation groups and the county to ensure the longevity of our work.

Full-time Director of Outreach/ Education

Along with our conservation efforts from a land management perspective, we have significantly increased our education efforts across the Southeast. The future of cave and karst protection is education—now, more than ever. Gone are the days of keeping cave locations hidden. Social media, online communication, and public articles about our caves (not condoned by us) have left us with only one weapon—education. Without public outreach on the significance and importance of caves and the species that inhabit them, no one will care enough to continue protecting them. Christine, our Director of Outreach and Education, continues to expand our presence through community groups, festivals, caving events, and conferences. These educational efforts reach thousands of people each year, many of whom have never been in a cave.

We are launching the updated and revitalized program, Project Underground. This is a hands-on, real-world educational program that encompasses many aspects related to caves—from speleogenesis to environmental challenges of the modern world and the threats they bring to caves, karst, and their inhabitants. Project Underground is an environmental education program designed to promote better understanding of caves and karst environments including their geological, hydrological, biological, and historical values. It is designed to provide supplemental material for educators of kindergarten through high-school-aged students. Project Underground provides activity guides with student participatory games, projects, and science-based lesson plans for classroom use. The lessons in the Project Underground guide can be used to teach citizens of all ages about karst topography and the management needs of cave and karst resources. The 5th edition of Project Underground is set for release in early 2020. Workshops to train educators will take place across the United States and we will establish state coordinators to expand offerings.

Sustainability

In conclusion, 2019 was an extremely significant year for us and 2020 looks to be even better. We have created a path to sustainability that is vital to our future as an organization and the future of our preserves. In an environmental context, "sustainability" can mean finding a way to use resources



Howards Waterfall Group Trip, by Christine Walkey





in a manner that prevents their depletion. At SCCi, we use the term "sustainable" to describe the organization as being able to sustain itself over the long term, perpetuating its ability to fulfill its mission. Sustainability in this context includes the concepts of financial sustainability, as well as leadership succession planning, adaptability, and strategic planning. Without these concepts, there would be no future for SCCi and the caves and land we protect. If you are currently a member, we thank you for your support. If you would like to become a member, you can do so here at saveyourcaves.org/join.



Four photos from the new acquisition, Cyclops Cave in Russell County, VA. Photos by Brian Williams



Activities at Earth Day



Update on the Western Cave Conservancy

Steven Johnson, Marianne Russo

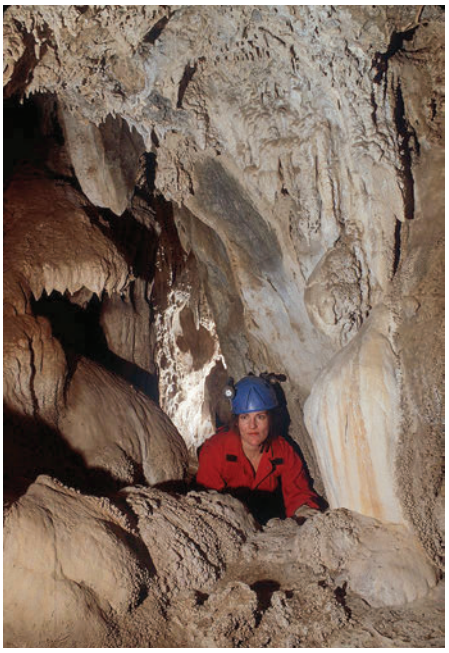
It's been at least ten years since the Western Cave Conservancy has contributed to the NSS News Conservation issue, so we would like to give our fellow NSS cavers an update on what the WCC has accomplished in recent years. As we are sure our fellow conservancies have also experienced, there have been long periods where little seems to happen and then short bursts of very positive activity. We are having one of those positive periods now, which has stimulated us to share our news.

WCC's Second Cave Acquisition

We're excited to announce that the WCC has purchased our second cave! This property, known as Cave of the Catacombs, is in Calaveras County, California. While this may not seem terribly exciting to our eastern counterparts, opportunities to purchase caves in the west come along pretty rarely, as few caves are on private land. These caves are often important for many reasons (conservation, recreation, scientific study), and the fact that they are difficult to acquire has required considerable patience and persistence. Our new acquisition, while small in size, harbors significant archeological remains, provides habitat for the Townsend's Big Eared bat, and offers limited seasonal recreation for cavers.

Our Missions

Since owning caves may never be the biggest part of the WCC mission, we've been using other approaches to promote conservation of caves (and reasonable access for cavers). These include entering into Memorandums of Understanding (MOUs) with government or private landowners to assist them in the management of their caves; providing information and assistance to cave owners and land managers; and developing our matching grant program.



Dave Bunnell

Cave of the Catacombs

Right: Pristine stalactite displays in Windeler Cave, managed by the WCC

Cave Manangement and Trustee-led Trips

We currently have an MOU with one government agency, the Stanislaus National Forest, to assist with the management of the very beautiful and pristine Windeler Cave. In exchange for our installation of a gate system with electronic security and clearing the access road for fire safety, we are able to offer cavers opportunities to visit this cave under a trustee-led trip system which allows six trips per year rotating between central California grottos and out-of-area cavers.

We have just recently been able to start a second trustee program on a property owned by another conservation organization, which includes several caves (two of which are significant in size, with approximately a mile of passage each). These caves had never been available for legal visitation until the WCC was able to secure a MOU after a recent change of ownership. Volunteers with the WCC carefully document exploration and survey work as well as gating of several cave entrances and a hazardous feature associated with some earlier mining activity. Recently the owners have allowed us to start a pilot program of trustee-led recreational trips into one of the larger caves, VR..

Cooperative Success with the Forest Service

In the past several years we have also worked with the Tahoe National Forest in their efforts to acquire Avalanche Cave and several smaller karst features in the high Sierra. We provided cave maps, photos, and historical information during this process, and when the property transfer was complete, we conducted two trips to the cave to introduce Forest Service personnel to the location and the caves. (We were assisted in this effort by members of the Mother Lode Grotto who had extensive experience with these particular caves.) We are pleased that these caves will now be protected from logging activities, and cavers have the blessing of the Forest Service to access them freely.



Dave Bunnell

Matching Grants for Conservation and Science Projects

For many years, the WCC has offered matching grants for conservation projects and scientific activities. In order to promote more such projects in the West, we are formalizing our guidelines so that we can advertise the availability of these funds to cavers (and other conservation- or research-minded groups). We're optimistic this will encourage grottos and other caving organizations to think seriously about starting scientific or conservation projects. (Note: the guidelines aren't final by press time for this article, but should be available on our website soon.)

Seismic Monitoring Station

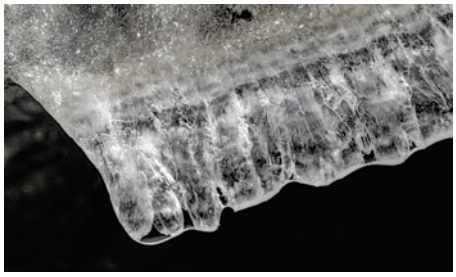
Another interesting recent activity was the installation of a seismic monitoring station at the Weller Natural Preserve (a 15 acre preserve owned by the WCC, and site of Rippled Cave). Last year one of our volunteers reported that the University of California and the U. S. Geological Survey were looking for sites suitable for long-term installation of seismic stations. This network of stations will be part of the ShakeAlert system (www.shakealert.org), an earthquake early warning system for the West Coast. After contacting them to see if they would be interested in our preserve, and meeting with their scientist on the site in February of 2019, we found that they were very enthusiastic. A month later their crew arrived, drilled a 10-foot hole for the monitor, poured concrete pads for the antenna and other equipment, and made a mess of our

gravel-covered parking area. (They ordered fresh gravel delivered and by the end of the two days, our parking area was better than ever!) A few weeks later the final electrical work was done and the station was wired for telephone and internet along with the preserve's field house.

Legal Expertise

Finally, approximately a year ago we invited Rafael Langer-Osuna from the San Francisco Bay Chapter of the NSS to be on the WCC Board of Directors. Rafael is an attorney and partner with the firm of Squire, Patton, Boggs LLP which has 44 offices in 19 countries. Through Rafael, the firm provides pro bono legal services to the WCC. This arrangement has been very beneficial for us: if he doesn't have the expertise in a specific area of law, he is able to use the services of other attorneys in the firm. For instance, we recently had a concern about possible environmental issues and he was readily able to obtain the needed advice from a colleague. He has already proved his worth, several times over, updating and improving our Liability Waivers and Non-Disclosure agreements, reviewing other legal documents, and most recently shepherding us through a new property purchase.

Want to keep in touch with what's going on with the WCC? Visit www.westerncaves.org and subscribe to our e-mail list!



Steven Johnson



Mike Davies.

Above, crystal-clear drapery in Windeler and right, Guy Graening in VR, (a WCC trustee cave)

Tribute to Caver, Friend, and Conservation Advocate Dick Blenz, 1925—2018

Dave Jackson, NSS#60740RL,FE

Have you ever had a friend who understood you so well that you could go for a year without seeing them and pick up right where you left off, almost in mid- sentence? Maybe this person is someone you met in school, about your age, with similar shared experiences. Or maybe it's someone you met caving, with the bond created by incredible shared explorations. Maybe it's even someone who lives right around the corner.

In my case, my friend lived over 1000 miles away, was separated from me in age by nearly six decades, and never once went caving with me. But every time I saw or talked with Dick Blenz, it was as though he had just stepped away for a minute and come back. I only saw Dick once a year at Convention, but I talked with him often on the phone and by email, and he always treated me as a friend and equal—it didn't matter that the closest I could come to some of Dick's experiences was to read about them in WWII history books. As a fellow caver and fellow engineer, Dick shared his ideas and enthusiasm with me as though we'd been friends forever.

I met Dick Blenz in a most unusual way. In 2012, I checked my email one day and found that someone I thought I had never met had just decided to provide massive support for my CaveSim invention and project. In 2018, I used it to teach over 25,000 people in six states about cave conservation. Supported and encouraged by Dick Blenz and others, CaveSim has grown since its inception in 2010. By 2018, CaveSim Programs produced 57 days of cave/karst educational programs. In 2019, we conducted 79 days of experiential learning. In 2020, the CaveSim Team expects to lead more than 120 days of cave outreach programming.

If you climb into your way-way-back machine, you may remember that CaveSim wasn't always in a big enclosed trailer. It used to live in my basement and garage, and it took me and a big crew of friends about 8 hours to set it up each time I moved it. In 2012, I decided that moving CaveSim by hand was untenable, and I asked friends and grottos around the country to support the purchase of a trailer to house CaveSim. When I got the email saying that someone whose name I didn't recognize was providing about 1/7th of the funds for the project, I was shocked. How had Dick even heard about my project? Now, with the benefit of hindsight, I realize that Dick had watched me set up CaveSim at the 2011 Convention. He didn't stay for the whole 8-hour process, but he came by the gym in Glenwood Springs to periodically check on our progress. Sometimes when you have a several thousand pound cave to set up, you forget who's watching.

Dick was passionate about conservation education. He firmly believed that to protect caves, you need to inspire young people to become advocates for cave conservation. He believed in this so strongly that he invited countless strangers to go caving in his very own Buckner Cave. When Dick saw what I was doing, I guess he thought that it was like his conservation education projects, but mobile. Dick's support for CaveSim was not a one-time thing. Between 2012 and 2018, he provided support in numerous ways—Dick sponsored programs AND shared his engineering wisdom with me. I remember being in the campground at Convention one year, trying to help Dick repair the window mechanism on his car, all the while talking with him about engineering.

From my perspective, Dick was always young at heart. When I spoke with him the last time before he passed in 2018, he was launching enthusiastically into a new engineering project with an Arduino (a kind of programmable one-chip computer). So many people that I come in contact with on a daily basis rarely try something new, but Dick never shied away from embarking on a new adventure. Dick was also kind, wise, and caring.

Just as he would say to me, I will now say to him, "Dick, you're a rare breed of engineer." My hope is that both you and I can learn from Dick, even though he's no longer with us. I hope we can reach out to someone we haven't met, and I hope we can lend them a hand as they embark on their own great projects. If we do that, we'll make our world a better place, and we'll be richly rewarded. Dick Blenz, thank you for all that you have done for us.

It Takes a Village: Cave Conservation, Outreach, and Education

Val Hildreth-Werker, Kathleen Lavoie, and Dave Jackson



Experiencing the joy and excitement of exploration at a CaveSim event in Ridgway, CO. Photo by Hannah Brown, Colorado Parks & Wildlife.

NSS Cave Conservation Group and Grotto Awards

"Everyone likes a compliment." It was true in 1865 when Abraham Lincoln wrote it, and it's still true today. Giving a compliment doesn't take much work. You probably know a Grotto or other hard-working organization that could use a little recognition and encouragement for their cave and karst conservation efforts. It's easy to help a group receive recognition. Send e-mails to Kathleen Lavoie (lavoiekh@plattsburgh.edu) and (valhildrethwerker@caves.org) to describe their accomplishments and recommend them for the NSS Group or Grotto Award for Conservation of Cave and Karst Resources. These awards are given annually, and are announced at the NSS Convention banquet.

Because some projects really do require a village, the 2019 G&G Awards recognized three organizations from across the US that are all working together in conservation-outreach through CaveSim. Two NSS Grotto Conservation Awards honored The MET Grotto of New York City and the Southern Colorado Mountain Grotto. The NSS Group Conservation Award honored the founders of CaveSim, Tracy and Dave Jackson. These three organizations have been working together for over seven years to reach-out and teach the general population about the vital story of cave and karst conservation.

Long-Term Commitment from Grottos

Since 2013, the MET Grotto has consistently been among the first to provide annual financial support to bring CaveSim to the NSS Convention. By supporting CaveSim's trip to Convention each year, MET Grotto and many other grottos around the country help the CaveSim Team do free public outreach. In 2019, 34 grottos, organizations, and individuals from 20 states helped bring CaveSim to Cookeville, Tennessee. CaveSim conducted five days of public programs prior to Convention, teaching non-cavers about the importance of conserving caves, karst, groundwater, and bats. Also, CaveSim was free to the public during all five days of Convention, and some of the local residents stayed for over two hours to see CaveSim's carbide demos, play with cave rescue equipment, explore the mobile cave, and try vertical caving.

The Southern Colorado Mountain Grotto has supported educational CaveSim programs in a variety of ways since 2010. Grotto members frequently help facilitate programs at schools and events for the public, assisting with SRT lessons, carbide demos, and bat biology lessons. During some events, grotto members have helped teach over 750 kids and adults about cave conservation in a single day. For other programs, grotto members have traveled with CaveSim staff for a week at a time to bring educational programs to rural schools.

All told, members of the Southern Colorado Mountain Grotto have given thousands of hours in public educational outreach, helping people understand the importance of cave and karst conservation through experiential learning.

CaveSim Outreach

Tracy and Dave Jackson of CaveSim were recognized with the 2019 NSS Group Conservation Award. Since 2010, they have used CaveSim to teach over 25,000 kids of all ages to love and appreciate caves (adults of all ages, too!). The programs have evolved and grown these ten years—early on, CaveSim started out as a tool to teach cave rescue trainees to cave softly. Today, exploring the CaveSim trailer is just one of many components of the CaveSim Program. In 2020, activities meet state curricula standards and 60% of Cave Sim events are conducted for K-12 schools. Students do labs about microbiology, WNS, karst topography, and engineering. Hands-on activities teach about cave rescue, the safety and physics of vertical caving, and the importance of bats. Students learn chemistry from carbide demonstrations and electromagnetics from cave rescue phone (field phone) demos.

During 2019, the CaveSim Team conducted 79 days of programs around the country. Literally hundreds of people make all this possible by donating cave rescue gear, vertical gear, money, and time. With deep gratitude, Dave and Tracy Jackson feel that the award really is a group award, and that everyone who has helped CaveSim over the years has received the 2019 NSS Group Award for Conservation of Cave and Karst Resources. To keep up with the latest happenings, check out www.cavesim.com/news. CaveSim will be at the 2020 NSS Convention in Elkins WV. Stop by. And send in nominations for the G&G Awards.



David Coleman

A girl learns about the physics of haul systems by hoisting herself with pulleys donated by Vertically Speaking (based in Aurora, CO verticallyspeaking.com) at a CaveSim program in 2019.



A boy in rural Colorado has fun with the squeezebox. Photo by Colorado Parks & Wildlife staff.

NSS HQ Conservation Expo and Leave No Trace Symposium—December 2019

Fennigan Spencer #66177, NSS Conservation Expo Chair / NSS Bat Ball Chair



Wildsouth LNT Educators

The National Speleological Society's Conservation Expo was held December 28–31 2019 at the NSS Headquarters in Huntsville, Alabama. This free public event brought together like-minded groups to share the lifestyle of Leave No Trace with independent missions, ideas, and opportunities, all based on environmental conservation. Each day was filled with presentations from local environmental organizations, academic professors, adventure groups, and related companies that All had to meet one qualification—A core belief in Leave No Trace!

A primary goal of the Leave No Trace (LNT) Symposium brought together outdoor enthusiasts with area conservationists to explore the different kinds of recreation we all engage in and how individuals and groups can work together to preserve and sustain our outdoor environments.

Expo Activities

Interactive presentations and demonstrations were conducted with a focus on the vast recreational opportunities that are enjoyed near the NSS Headquarters in Huntsville including kayaking, caving, camping, hiking, mountain biking, and more. Exciting outdoor trips provided attendees with the opportunity to experience a variety of activities first hand. Ten lucky attendees were able to explore the local Shelta Cave with a trip led by the Southeastern Cave Conservancy Inc (SCCi), focusing on low-impact caving and educating the team on cave resources and conservation. Others attended demonstrations on topics like building LNT campfires and digging cat holes. Dur-ing free time the attendees had a chance to mingle with friends both old and new. Conservationists, grotto affiliates, and organization reps discussed the event and planned ways to get more people involved in conservation ethics.

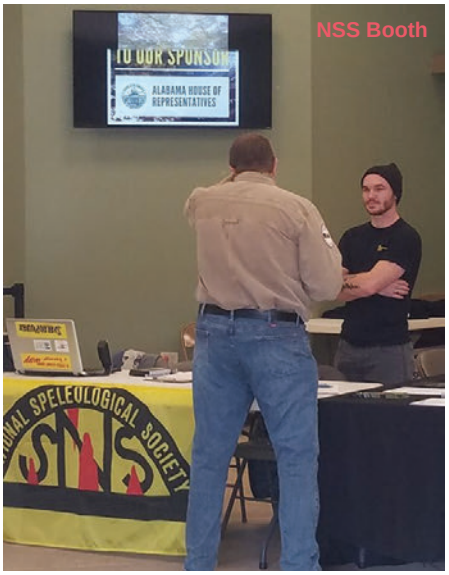
NSS HQ attendees and exhibitioners alike were in awe of the NSS property and what it has to offer. The Headquarters property is the perfect venue for a hugs variety of functions, with multiple meeting rooms, a 10,000-square foot ballroom, and 96 acres that feature two covered pavilions and one open-air pavilion. The site also includes a playground and picnic area. Expo attendees hiked and toured the property with delight.

Sponsors

A special and hearty thanks goes out to all of our sponsors! Financial and exhibition sponsors included The Honorable Alabama State Representative Rolanda Hollis, Butterfly Outdoors, Black Warrior River Keeper, White Wolf Expeditions, Manitou Cave, Ms. Cameron Vowel of Birmingham Alabama, Southern Environmental Technologies, Cross Tek Construction, National Cave and Karst Research Institute, South Eastern Cave Conservancy Inc., and RISE Raptor Project. This event was possible only with their tremendous support!

Volunteers

The event also required a tremendous effort and support from our wonderful NSS



Member Volunteers—Bill Jackson, Geary Schindel, Maureen Handler, Amanda Willis, Mat Ward, Cherith Herdt, Tevis Kouts, Joe Horton, Bill Torode, Bob Roth, Ken Bailey, Mat Ward, Kate Gribbon. These all worked tirelessly behind the scenes to make sure the event was seamless!

Future Forward

The Expo is a great opportunity to extend the NSS mission and showcase the facility and the work of the NSS. With 13 sponsors, 3 teachers, and 2 exhibitors, the 2019 event provided conservation education to over 100 people. Each of the sponsors and educators are committed and excited to return again in December 2020. The upcoming NSS Conservation Expo of December 2020 is expected to double in size. We are inviting Dave Jackson and CaveSim to participate along with many others. Hope to see you at this year's NSS Conservation Expo, December 28 & 29, 2020!



How to leave no trace with human waste



Rise Raptor group in the conference room

Submit Abstracts for Conservation & Management Session, NSS Convention in Elkins, West Virginia July 27– 31, 2020

Calling for presentations, PowerPoints, workshops, or panel discussions for NSS Conservation & Management Tuesday Talks. Please send Val Hildreth-Werker a quick email of your intent to present: valhildreth-werker@caves.org

Limit abstracts to 250 words or less. Include title of your presentation and the authors' names, professional affiliations, mailing addresses, and e-mail addresses. For later publication in the *Journal of Cave and Karst Studies*, abstracts must draw a conclusion or explain the upshot of your study or project in a concluding sentence. Equipment will be available for PowerPoint presentations.

We invite abstract submissions for any Cave or Karst Conservation or Management talks addressing stewardship, outreach education, cave management, minimum-impact caving, or restoration. Send abstracts by June 1, 2020 to valhildrethwerker@caves.org

2020 Cave Conservancy Roundtable at NSS Convention

The Twenty-second Annual Cave Conservancy Roundtable is scheduled at the 2020 NSS Convention on 31 July 2020, Friday starting at 1:00 PM. The theme is "Working to inspire future conservancy leaders to acquire the knowledge and skills needed to serve and to meet future challenges; to motivate cavers and environmentalists to participate in the conservancy's work; to build infrastructures of support in relevant communities."

Victor A. Schmidt Conservation Award

The annual Victor A. Schmidt Conservation Award recognizes one NSS member who, over time, has demonstrated outstanding dedication to the conservation of caves. Nominations for candidates are solicited by the NSS Awards Committee. The recipient will be approved by the Board of Governors upon recommendation of the Awards Committee.

The recipient must have been a member in good standing of the Society for at least two years immediately prior to his/her name being submitted as a candidate. The Awards Committee shall give preference to candidates who have not received the Outstanding Service Award or Honorary Membership.

To nominate a caver for a the Victor A. Schmidt Conservation Award, please send complete resume and nomination letters describing the caver's contributions to cave/karst conservation over many years. Send nominations by November 15 each year to:

Ellie Watson ellie.thoene@gmail.com

Conservation Task Forces: Making a Difference

NSS Conservattion Task Forces (CTFs) make a difference in karst areas around the United States. Since passing of the Federal Cave Resources Protection Act of 1988, many CTFs are recognized by local federal agencies as primary representatives of the caving community on conservation issues in their areas. NSS members of CTFs are helping to manage caves on behalf of public and private landowners.

A CTF is a great way to gather like-minded people and make good things happen in cave and karst conservation. Some CTFs have a specific project that may take a year or two to complete. Other CTFs lead ongoing projects that continue for many years. A CTF may tackle a significant cave vandalism problem, or it may work alongside landowners and civic leaders to clean up a groundwater pollution source. Due to the ongoing efforts of CTFs, caves are mapped and inventoried; management plans are written and implemented; restoration and cleanups are accomplished: cave habitats are restored. Any cave/karst conservation, management, outreach, restoration, or protection concern fits.

Join an existing CTF

http://caves.org/conservation/CTFS.shtml

Establish a New CTF

Create an NSS Conservation Task Force to focus on local, regional, national, or international cave and karst conservation issues. If your work would benefit from CTF designation, contact the NSS Conservation Division, Val Hildreth-Werker werks@cunacueva.com

Save-the-Caves Conservation Grant

The Conservation Committee is authorized to award up to $5,000 annually from our NSS Save-the-Caves Fund to make grants of up to $1000 to Internal Organizations, Grottos, Conservation Task Forces, Conservancies, or to indi-vidual NSS members for specific projects that involve cave or karst conservation, restoration, cleanup, or outreach.

The Conservation Committee is responsible for establishing the application, review, and award process. Recipients of these grants shall submit written reports to the Society as stipulated by the Chairman of the Conservation Committee. To be considered for a grant award, applications must include adequate description of one or more of the following:

- scientific investigation of cave or karst conservation problems;
- speleological research that will directly contribute to cave or karst conservation;
- remediation of ecological problems in cave, karst, or pseudokarst areas;
- hands-on, in-cave efforts to restore cave passages to a former ecological state;
- equipment and supplies for conservation or restoration projects that include hands-on participation from cavers;
- or public outreach to inform and raise awareness of cave and karst values.

Conservation Grants are awarded throughout the year, subject to availability of funds and number of applications received.

Save-the-Caves Conservation Grant Application Process

For relatively uncomplicated grants to NSS members and activities, send an e-mail application that includes the following points. Institutions and foundations should submit the more formal NSS grants application available on the NSS website. Priority is sometimes given to conservation projects that provide quantitative research data. Awards are based on the nature of the project and available funds.

Please specify in your application:

- who the applicant is (name, address, telephone number and other contact information)
- who the official grant recipient is to be (name or organization, title, address, etc.)
- what, specifically, the project and/or research will entail
- what benefits are expected
- when the work is to be done
- dollar amount being requested from the NSS, including how that money will be used
- a statement assuring the NSS that an article for publication, video, powerpoint, presentation, and/or other comparable account of the completed project or research will be provided in a form accessible to the membership to account for expenditure of NSS funds.

Please call or e-mail the Conservation Grants contact person if you need more information: Val Hildreth-Werker (575) 895-5050 valhildrethwerker@caves.org

NSS Conservation Web Pages and Cave Conservation Facebook Group

All things caving are about conservation! Stewardship choices kick in on every cave trip. All of caving is about mini-mum-impact choices and acts of protecting!

The NSS Conservation Pages are online at caves.org/conservation/

Check out the Cave Conservation Facebook Group for cavers across the speleo spectrum! It's a broad, quick, all-in-one, spot on Facebook to serve the global caving and cave-interest communities! Join us, add members, repost, and share the site. https://www.facebook.com/groups/257740784385806/

Support Cave Conservation — Donate to Save-the-Caves Fund

Caves, cavers, and the NSS appreciate your financial support!

Our Saves-the-Caves Fund supports NSS Conservation Grants.

Contributions are tax deductible, of course!

Please specify Save the Caves — find fourth item in list after you click on blue link

- Donate through our online app https://caves.org/nssapps/donate.shtml
  To specify Save the Caves, find fourth item in list after you click on blue link
- Donate via a PDF that can be completed online and mailed or emailed in.
  https://caves.org/donate/Donate.pdf
- Use the comment area provided in links above to include a note – a good place to list your gift as a special tribute to a friend or loved one with your Save-the-Caves Donation in Honor or in Memory of someone.

NSS Conservation Network

The NSS Conservation Network is an email resource expressly developed (at the request of Val and Jim) to quickly disseminate important and often 'short-fused' conservation-related updates to IOs and interested individuals. Send info bursts to werks@cunacueva.com and stevenlsmith@usa.net

Notices are sent out on an 'as needed' basis, with often with months between send-outs to IO Conservation Chairs (or overall Chair if the IO doesn't have a Conservation Chair), and to any individual caver who asks to be on the Conservation Network addressee list.

NSS Conservation Memberships

Gift the caves and yourself—or gift the caves and honor a friend or relative with an NSS Gift Membership! Any type of Membership can be gifted. Find all NSS Member categories at http://caves.org/info/membertypes.shtml

Regular Gift Membership – 18 years and over; full membership privileges, including an electronic subscription to the *NSS News* for a total of $40.00

Conservation Regular – combines a Regular NSS membership with electronic *NSS News*, plus a donation to cave conservation, to total $140.00

Conservation Life – goes to endowed funds for Life Membership in the NSS ($1000) plus a $1,000 donation to cave conservation, totaling $2000.00

April 25, 2020
Cleveland Grotto Work Day at Hidden River Cave

The American Cave Conservation Association cordially invites NSS members from any grotto to join us on a special restoration work day and also honor the accomplishments of the Cleveland Grotto and other NSS members as we prepare for a Grand Opening of the Sunset Dome Tour into Hidden River Cave.

8:00 am CST–Volunteer work project
Noon–2:00–cookout and presentations
2:00–Caving at Hidden River

Please RSVP to:
hiddenrivercave@gmail.com
If you plan to attend.



HISTORICAL NOTE: "DIVING THE LITTLE COLORADO RIVER RESURGENCE"

In his article in the March 2020 *NSS News*, Adam Haydock calls the Little Colorado River resurgence "a destination that has never seen the light of a human enter its darkness." That gives the impression that his team was the first to dive there. That is not the case. In 1965, when I was beginning my cave-hunting in the Grand Canyon, I noticed that the Blue Spring USGS quadrangle showed the location of the namesake spring on the W (left) side of the Little Colorado canyon. I accordingly did a recon hike down the intimidating Blue Spring "Trail" to the site. I found that the named spring was only the one farthest upriver; there were multiple risings downriver as far as I had time to go. The one that looked largest to me was across the river in its right bank, where water was welling up forcefully from a slot-like passage about four feet wide. Not being a diver, I hiked out without further investigation.

Much later, at the 1986 NSS Convention, I had the pleasure of caving with the famous cave diver Sheck Exley, and mentioned my observation from 21 years before. After grilling me about it, he promptly recruited fellow diver Butch Farabee and Ranger Rick Mossman of Grand Canyon National Park for a visit to the Little Colorado. They climbed down for their own recon, with a pony tank, and Exley dived forty feet into one cave (perhaps the one I recommended to him), while the others took turns checking half a dozen smaller ones. As far as I know, they never came back there, but Exley published a trip report in *Underwater Speleology*, August 1987, p. 5-6, available online at:
https://nsscds.org/wp-content/uploads/2016/06/UWS_Vol_14_004.pdf

Exley published a supplement in the next (October 1986, V. 14/5) issue of *US* (URL same as above but 005.pdf), in which he location-mapped 19 springs along a half-mile of river, and sketched the best one he entered. It is much smaller than Haydock's cave, and its northerly course suggests that it is probably on the E (right) side of the river. So it seems that Exley, and later Haydock, mapped two separate discharge-spring caves. Haydock calls the one he surveyed "the" Blue Spring Resurgence, so I surmise that it is the one singled out on the topo map.

I warned Exley, and would warn other divers, to be wary of breathing in "air" bells in these springs. There may be enough dissolved CO_2 in the groundwater to make the atmosphere hazardous.

Donald G. Davis

UNDERGROUND UPDATE

Ian Reuter

The Carbide Dump

Blue Ridge Grotto
February 2020, Vol. 55, Number 2

Despite temporary defeat after numerous detonations, Mark Minton is still hopeful his blowing lead in the Lower Complaint portion of **Butler Cave** will lead to big discoveries. Blocked by a large sandstone boulder, the passage trends towards a drainage divide and blank space on the map.

Birmingham Grotto Newsletter

Birmingham Grotto
February 2020, Vol. 50, Number 2

After finishing up the mapping of Hayden Tunnel Cave, Bradley Jones set his sights on nearby karst features. Ridge-walking to a number of LIDAR leads, Bradley discovered three new caves, which have been mapped and submitted to the Alabama Cave Survey. Of the three, **Dairy Creek Cave**, at 411 feet long, is perhaps the most exciting. Ending in a sump, Bradley notes Dairy Creek almost certainly has significant underwater passage and would make for a great diving lead.

The Kansas Kaver

Kansas Speleological Society
November 2019, Vol. 36, Number 3

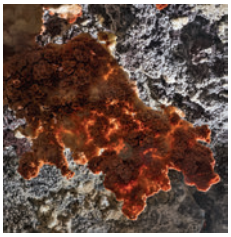
Bryan Bain and Dan Johnson descended the entrance pit of **Lost Windmill Cavern**, in Butler County, Kansas, negotiating two tight squeezes on the way down. Once on the bottom they set off surveying in the wet passages, collecting 479 feet of passage in tight dimensions. The trip ended in going passage with much still left to survey.

The Region Record

Virginia Region of the NSS
Winter 2019, Vol. 32, Number 4

The original entrance to West Virginia's **Dry Cave** was likely dammed in the early 20th century, cutting off visitation for nearly 60 years. This changed in 1968 when, according to Phil Lucas, Roger Baroody entered the cave via its dry entrance, and subsequently added the sporting, highly-decorated cave to the West Virginia Speleological Survey database. From that point forward Dry Cave saw its fair share of visitation, with two separate maps having been drafted. The latest re-survey project, spearheaded by Greg Springer, was nearing its end in 2019, when Nicky Socky wormed his way through an overlooked high lead. Crawling into a massive chamber, Nick opened up a whole new round of Dry Cave exploration. Close to a mile of new cave has been surveyed, with much more certain to be mapped in the future. The new sections of the cave share the same unique steep bedding-plane development as seen in the rest of the cave, in addition to numerous impressive formations including square soda straws, snow-white gypsum, and helictites.

Raquel Brunet examines large puff-balls on the floor of a newly discovered lava tube on Mauna Loa, on the Big Lisland of Hawaii. Below, thin orange crusts from the same cave.





Sag Rag

Shasta Area Grotto
September-October 2019, Vol. 38, Number 5

A rescue had to be called out after a group of four young adults entered **Pluto Cave**, a frequently visited California lava tube, to practice meditation near the end of cave's walking passage. One of the individuals opted to explore a crawl solo, becoming stranded when his only light source went out. Rescuers were on the scene quickly. The victim was found uninjured and was able to exit under his own power.

Bill "Bighorn" Brockel has completed mapping **Composure Cave**, a 1,122-foot-long lava tube system located in California's Siskiyou County. The complex has four entrances, and comes within feet of Chinquapin Cave, which Bill surveyed in 2017.

Valley Caver

The Mother Lode Grotto
Winter 2019, Vol. 57, Number 4

Walking above a large trench running through the red lava flow on the northern slopes of Mauna Loa, Dave Bunnell and companions discovered two new lava tubes. Coated with fluffy white minerals and rounded puff-balls, the virgin passages maintained relatively comfortable dimensions (see photos, above). **Brunet-Bunsch Cave**, the longer of the two caves, shows more variability in passageways, whereas almost the entire floor of the 455-foot long **Red Top Cave** is coated by breakdown boulders. The abundant mineralization seen in both caves is typical of caves found near the source of lava flows in which they reside.

NEWS & NOTES

Black Hills Conservancy acquires new caves

The Black Hills Cave and Nature Conservancy (BHCNC) signed a purchase agreement, on Feb. 28th, for the land needed to create the *Dark Canyon Cave Preserve* in South Dakota. This preserve will protect 8 caves from undue impact, and ensure caver access in the future. The most notable of these caves are Brooks Cave, which intersects the Madison aquifer similarly to Jewel and Wind Cave, and Dahm Spring Cave, which boasts an underground pond containing a paleontological site, as well some of the most pristine and beautiful flowstone formations in the Dakotas. This purchase is the culmination of two years of work and the willingness of a local land owner, who has been a long-time friend to the caving community. For more information about this preserve, or to donate to the continued protection of these great caves, please visit: www.blackhillscaves.org or email bhcnc@caves.org

Adam Weaver
Vice-President, BHCNC
Adam@caves.org

PRESIDENT'S MESSAGE

Conservation is one of the pillars of the NSS. We Explore, We Study, and We Protect.

I hope you've enjoyed and are inspired by this excellent issue on a small part of the many many conservation projects performed by our members at the local, state, and national level. It sheds light on what can be done with many hands, with vision and good leadership. I'm very proud of the work done by our membership and partners—it not only helps protect and restore caves—but also our water and land resources.

"Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it is the only thing that ever has"
Margaret Mead

YM – Your Membership Software.

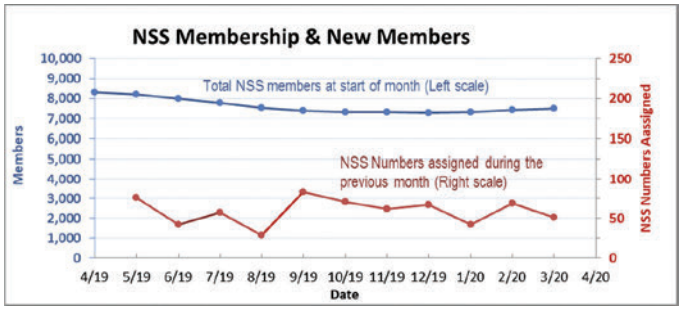
More than a year ago, we implemented a new software to help track our memberships. We are continuing to learn and apply many of the resources on YM to the benefit of our members. We have elections for our directors coming up and we use YM to contact our members for electronic voting. This has made it simpler and easier for our members to select our directors, who will guide the NSS in the following years. However, not all of our members have signed on to YM and updated their contact information. We use a service to send you a ballot by e-mail but not all our members have recorded or listed their current e-mail addresses. If we don't have an e-mail address, the NSS office sends out a ballot by mail. Our current mailing costs for elections exceeds $1,500. We can help reduce these costs by making sure your contact information is up to date if you have e-mail.

NSS Benefits

Over the coming months, I'll use this column to highlight many of the benefits of being a member of the NSS. One of the best-known benefits is the *NSS News*. It offers articles on a wide range of articles on caves and caving, safety and techniques, conservation efforts, science, news from our many grottos and sections, updates on regional and national events, outstanding color photography, and sad to say, obituaries of our members.

Vertical Section of the NSS

With spring well on its way across much of the country, many grottos will be out training new members. I wanted to highlight the Vertical Section of the NSS. They have helped develop new vertical techniques, held training and vertical contests at the NSS Convention, and improved safety across the NSS. You can visit their website at www.caves.org/section/vertical/. The link on their training pages offers manuals for Basic and Intermediate vertical training programs. These are excellent resources and I recommend your grotto training officer, as well and new and seasoned vertical cavers, download the information and incorporate it into your vertical training program and practices. The important skills detailed in the manuals need to be practiced in a controlled setting under experienced eyes. Mastering these skills will minimize accidents and incidents and improve vertical caving efficiency.



Vertical cavers are also encouraged to purchase a copy of *On Rope*, an NSS publication that covers all aspects of vertical caving including information on equipment, techniques, and safety. Membership in the Vertical Section is also open to all NSS members in good standing and includes many benefits. For more details, visit the NSS Vertical Section Website noted above.

Membership Trends

Bob Hoke has been tracking membership for the NSS for a number of months. It looks like our membership trends have stabilized over the last few months (see graph). We've initiated efforts to contact folks whose membership has lapsed and asked them to renew. We are also working on adding some additional benefits to NSS membership.

Our membership numbers ending in February were 7,464 members, which is an increase from the end of January of 68. We are working on making sure this trend continues. If you would like to help with our membership efforts, you can contact Kim Fedrick at membership@caves.org. Grotto leadership should also be getting the monthly summary of NSS database updates, which lists new members in their area to call and invite to a meeting and also folks that have lapsed membership.

Internal Organizations Committee has been preparing a monthly newsletter for grotto leaders (and the membership). Grotto leaders are encouraged to share information with the membership at their meetings. You can download the IO newsletter from the NSS Website at www.caves.org.

All of our members are ambassadors for caving. Encouraging new cavers to join the NSS family is important to pass along our values – We Explore, We Study, We Protect.

Geary Schindel

CLASSIFIED ADS

SPELEOBOOKS.COM 518 295 7978. Cave and bat gifts, books, clothing and jewelry. Prompt personal service since 1973.

West Virginia Cave Books
www.WVASS.org

If your Grotto or Region is looking for new caves to explore in the Virginia area, RASS can offer your group a place to camp in Bath County, VA. There are more than 100 caves within an hour drive. We support cave conservation and education. Contact Jason Hart at JHARTCAVESVA@gmail.com 3

The Richmond Area Speleological Society (RASS) supports cave conservation, education and research by offering grants to assist projects aligned with these goals. To receive a grant request application please email us at rass-grants-committee@googlegroups.com. Applications reviewed quarterly. 12

New WV Cave Books: Bulletin 20 Caves & Karst of the Culverson Creek Basin, WV by Lucas, Balfour, and Dasher. 336 pages, 364 caves, 208 photos, 80 maps. Color copy on USB drive. $35 postpaid;.Bulletin 21 Caves and Karst of Mercer & Summers Counties, WV by Schaer and Dasher. 186 pages, 226 caves, 131 photos, 62 maps. $25 postpaid. WVASS, PO Box 200, Barrackville, WV 26559 WVASS@PrehistoricPlanet.com 12

AD RATES: Now based on the number of lines your ad takes up. It is a flat rate of $3 per line. As a guide, a line holds 43-45 characters + spaces at our font and size. 10% discount for runs of 3 months or more.Payment must precede publication, but copy should be e-mailed to the editor (nssnews@caves.org), to reserve space. Copy should be received one month prior to publication date (e.g., by May 1 for a June issue). Make checks payable to the National Speleological Society and send to: Att: NSS NEWS ADVERTISING, 6001 Pulaski Pike NW, Huntsville, AL35810.

April 2020





SERA

69th

Cave Carnival

Upper Cumberland Grotto
Camp Tubb, Rock Island, TN

May 15th-17th

Event located at Camp Tubb, Rock Island, TN

Primitve Camping offered with bathrooms, showers, and pavilion

RV/cabin camping conviently located 2.7 miles from event at Rock Isand State Park

7,316 caves within 50 miles of event
Blue Spring Cave
Lockwood Cave
Secret Cave
And countless others..!

Caney Fork, Rocky, and Collins River conviently located for kayaking and swimming

Rock Island, Fall Creek Falls, Burgress Falls and many other state parks located within 50 miles

For more information

uppercumberlandgrotto@gmail.com

http://bit.ly/SERA2020

