



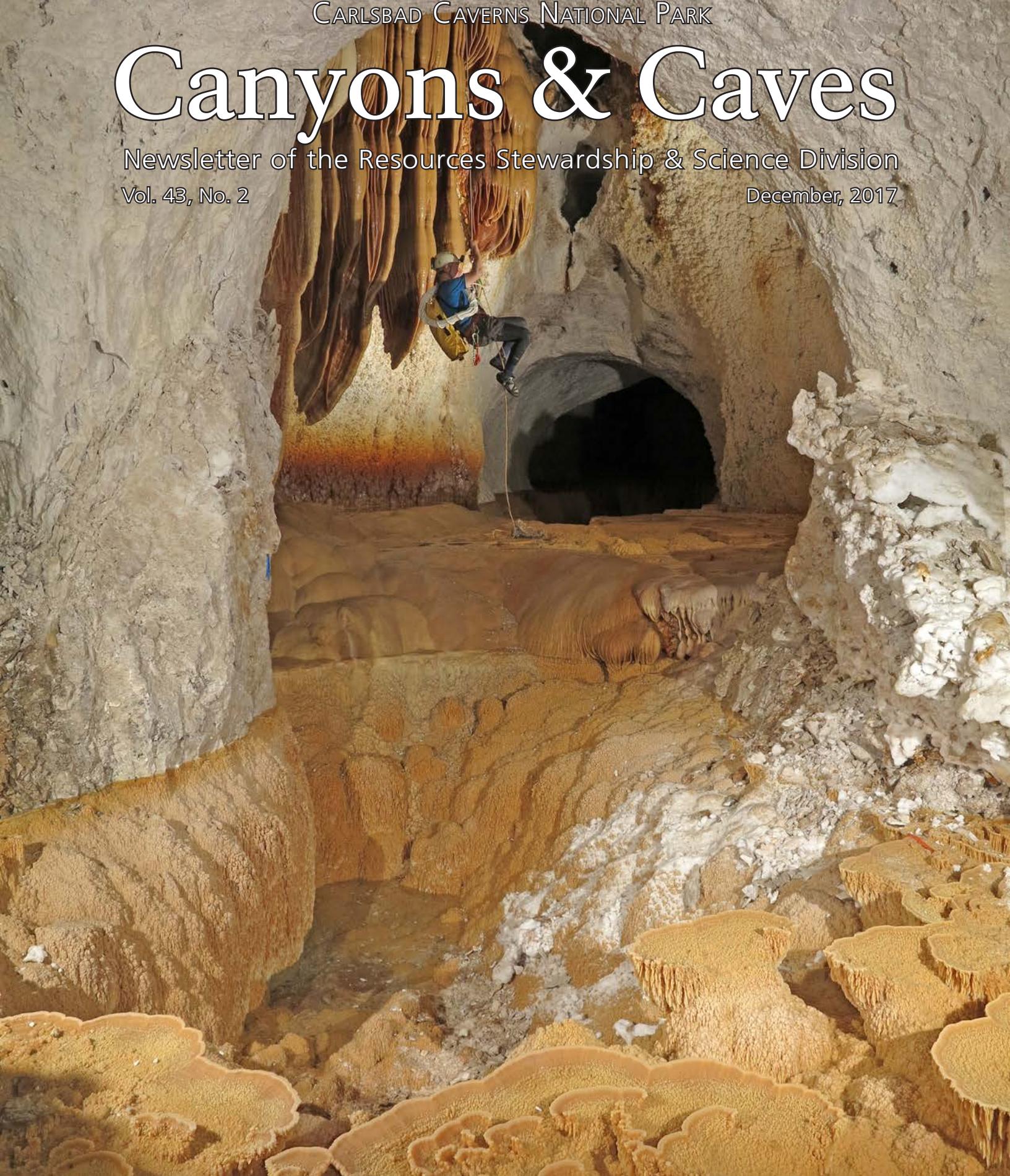
CARLSBAD CAVERNS NATIONAL PARK

# Canyons & Caves

Newsletter of the Resources Stewardship & Science Division

Vol. 43, No. 2

December, 2017





## Editor's Letter

You will soon see some major changes in the Division of Resource Stewardship and Science at Carlsbad Caverns National Park, as we are currently in the process of re-staffing several open positions. The Cultural Resources position is currently open. The Biologist and a Physical Science Technician (Term position) will soon be opening. Once these positions are filled, we will have a fully functioning Resource Management team, something the park hasn't seen for a long time. Down the road you will see interns and occasionally seasonals working on various projects. You will also see the continuation of our aggressive volunteer program. Thus far this year, we have had 167 volunteers donate 7,522 hours of labor towards numerous projects in the park. These projects have included projects in Carlsbad Cavern, such as, cave restoration, cable camouflaging, lint cleaning, and abandoned infrastructure removal projects. On the surface, volunteers have helped us with trail work and exotic weed removal projects. Although, it seems like the more we accomplish, the more projects we find that need to be done, it is still an exciting process. We invite everyone to join us in moving Resource Management at the park forward during the upcoming year.

A handwritten signature in black ink that reads "Rodney D. Horrocks".

## Calendar

### January

- JAN 14-15: Cultural Landscape Inventory of Carlsbad Cavern begins
- JAN 17-26: Cultural Landscape Inventory continues
- JAN 20-27: National Cave Rescue Commission regional seminar in Bend, TX
- JAN 27-FEB 3: John Lyles leads Far East expedition in Lechuguilla Cave
- JAN 28-FEB 2: Paul Burger leads Spider Cave survey trips

### February

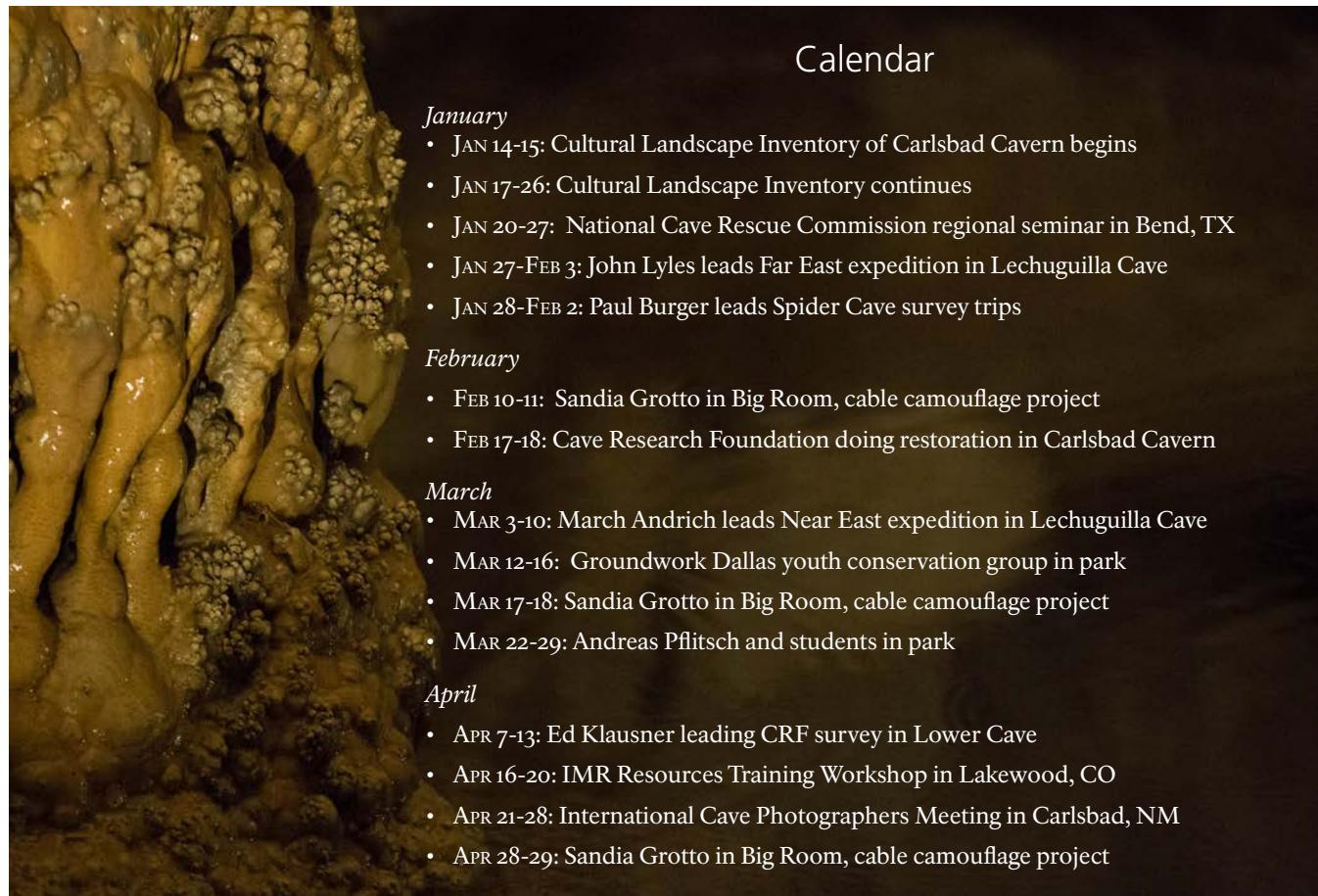
- FEB 10-11: Sandia Grotto in Big Room, cable camouflage project
- FEB 17-18: Cave Research Foundation doing restoration in Carlsbad Cavern

### March

- MAR 3-10: March Andrich leads Near East expedition in Lechuguilla Cave
- MAR 12-16: Groundwork Dallas youth conservation group in park
- MAR 17-18: Sandia Grotto in Big Room, cable camouflage project
- MAR 22-29: Andreas Pflitsch and students in park

### April

- APR 7-13: Ed Klausner leading CRF survey in Lower Cave
- APR 16-20: IMR Resources Training Workshop in Lakewood, CO
- APR 21-28: International Cave Photographers Meeting in Carlsbad, NM
- APR 28-29: Sandia Grotto in Big Room, cable camouflage project



# Canyons & Caves

Newsletter of the Resources  
Stewardship & Science Division

Vol. 43, Issue 2      December 2017

## PARK SUPERINTENDENT

Douglas Neighbor

## EDITORIAL

Rod Horrocks *Editor*  
Ellen Trautner *Associate Editor*  
Cathryn Hoyt *Production Editor*

## CONTRIBUTING AUTHORS

Paul Burger  
Rod Horrocks  
Erin Lynch  
Tim Pine  
Megan Podolinksy  
Ken Stella  
Ellen Trautner

## PHOTOGRAPHERS & ARTWORK

Chris Amidon  
Peter Bosted  
Paul Burger  
Yvonne Droms  
Art Fortini  
Rod Horrocks  
Kelli Housley  
Cathryn Hoyt  
Kenneth Ingham  
Brian Kendrick  
Jean Krejca  
Daniel Leifheit  
Art Palmer  
Charlie Reed  
Robbie Shone  
Nick Socky  
Shawn Thomas

## EDITORIAL ENQUIRIES

Resources Stewardship &  
Sciences Division  
3225 National Parks Highway  
Carlsbad, NM 88220  
[rod\\_horrocks@nps.gov](mailto:rod_horrocks@nps.gov)  
[www.nps.gov/cave](http://www.nps.gov/cave)

*Image Front Cover:* Ron Miller ascending  
the rope into the Tree House. Photo by  
P. Bosted.

*Above right:* Decaying bat found in Mystery Room area. Photo by Y. Droms.

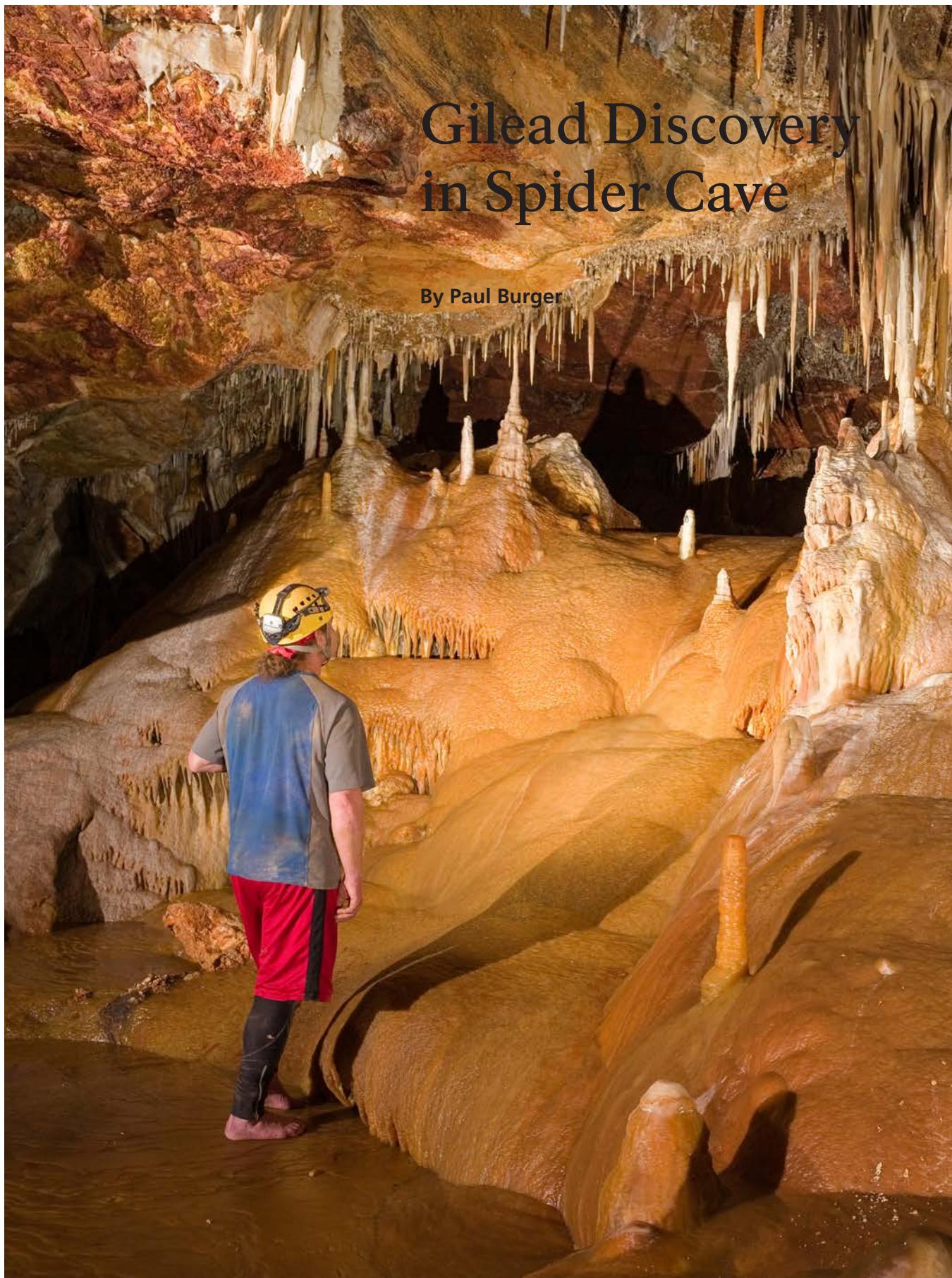


# Contents

Editor's Letter	2
Gilead Discovery in Spider Cave	4
The Squeeze: Resource Notes & News	12
<i>Physical Sciences</i>	
<i>Biology</i>	
Staff News	32
Recent Publications	34

# Gilead Discovery in Spider Cave

By Paul Burger



*Spider Cave has been known since at least the late 1920s. In 1933, Jim White, the principal explorer of Carlsbad Cavern, told Robert Nymeyer about Garden Grove Canyon Cave in a small tributary of Walnut Canyon. Nymeyer and a small group visited the cave on July 16, 1933 and documented the exploration in his book Carlsbad, Caves, and a Camera. He renamed the cave Spider Cave for all of the harvestman in the entrance crawl and it has been known by that name ever since.*

Numerous local explorers visited the cave until a flood covered the entrance in 1941. In 1958, a group—including future park superintendent—Bob Crisman, relocated the cave entrance and began digging it back open. On November 6, they worked their way through the entrance crawl series and into the larger cave passages beyond.

In April, 1967 explorers associated with the Guadalupe Cave Survey pushed into the maze beyond the Mace Room. This area had undoubtedly been looked at before, but no one had found the key climbdown into the low, mud and moonmilk-covered crawlway that leads to the back section of the cave. On May 20, 1967 Jerry Trout led a group back into the new discovery to begin mapping it. They pushed all the way into the Third Parallel and mapped most of the larger parts of that passage. At that time, they noted that the earlier map was not very good and suggested a complete resurvey of the historic cave. In 1971, the Guadalupe Cave Survey became part of the Cave Research Foundation and continued to conduct surveys in the cave through the early 1990s. Even though quite a bit of survey was completed, the map hadn't been updated since around 1978.

Rich Knapp, an active caver from the now-defunct Air Force Academy Student Grotto in Colorado, moved to Lubbock and participated on one of the CRF trips with Dave Belski, a local caver who had done many trips into the cave. On that trip, they realized that not only was there a lot of passage missing from the map, but that much

of the passage had been sketched with too little detail.

Starting in 1990, Rich spearheaded the systematic survey of the cave and resurveys of areas that either had poor data or poor sketches. I joined the project in 1993 during a time when the emphasis was on exploring and mapping the far southeast section of the cave where it was relatively close (~1,500 feet) to Chocolate High off of the New Mexico Room in Carlsbad Cavern. We pushed the southeast part of the cave pretty hard, including resurveying some poorly drawn older areas, but to no avail. Not only did we not find a way on, we never felt the kind of airflow that we had coming from the formation-choked passages in Chocolate High.

We continued resurveying and pushing into 1994, but after more than 70 surveys and 2.3 miles of cave resurveyed, Rich moved away and the mapping stopped. Rich had started drafting a new map of the cave even after he was no longer able to make trips, but he soon found a major survey bust that rotated the entire back section of the cave. This was before the era of digital cartography, so it would have taken a lot of effort to fix it. Disheartened, the working map was rolled up and stored away for many years.

From 1994 to 2003, the only surveys that took place were in support of scientific studies and no new exploration was going on. In 2006, while working on maps for the updated Cave and Karst Management Plan, we realized how inadequate the map was for accurately showing the trails and for scientific studies. So, I decided to take on the daunting task of drafting the map of Spider Cave.

◀ Paul Burger in the east end of Phoenix Hall—the new Gilead Section of Spider Cave. Photo by A. Palmer.



▲ Chris Amidon, leader of the Gilead discovery team. Photo by A. Palmer.

I began to work on the map and quickly realized that there was no way to do it right without fixing the bad loops first. When I started, there were more than 30 very bad loops, and many others too far off for an accurate map. So in 2006, I started with the worst loop and began knocking them off one by one. At the same time, I contacted Rich who dug out his old map and sent it to me so I could use as much of it as possible.

By the summer of 2007, the data was down to only a handful of minor bad loops and I re-registered Rich's map to the improved data and began drafting. From 2007 to 2010, with the help of volunteers and park staff on their off days, we had a good working map of the section beyond the Mace Room and had started adding detail and mapping passages that had been explored over the years but not surveyed. Chris Amidon, one of the Interpretive supervisors at the park, started to help me after getting bitten by the bug to explore Spider Cave.

In the fall of 2010, I took a new job in Alaska and during the winter offseason, I was able to put

together a working draft of the rest of the cave. Fortunately, Chris continued to run trips with the help of other park staff, fixing loops and resurveying areas where needed. Chris ran trips in October and December of 2010 and another in March, 2011. It was easy to add new survey to the areas beyond the Mace Room; most of the existing surveys had been fixed or redone. The Historic Section was a different matter entirely.

After much discussion with the park, we decided it would be best to redo the older surveys of the cave. So, in September 2011, Chris started from the entrance and began a new survey. Rather than repeat the old way of running a long baseline through the main route, Chris started to systematically survey the very crawlly area north and east of the entrance.

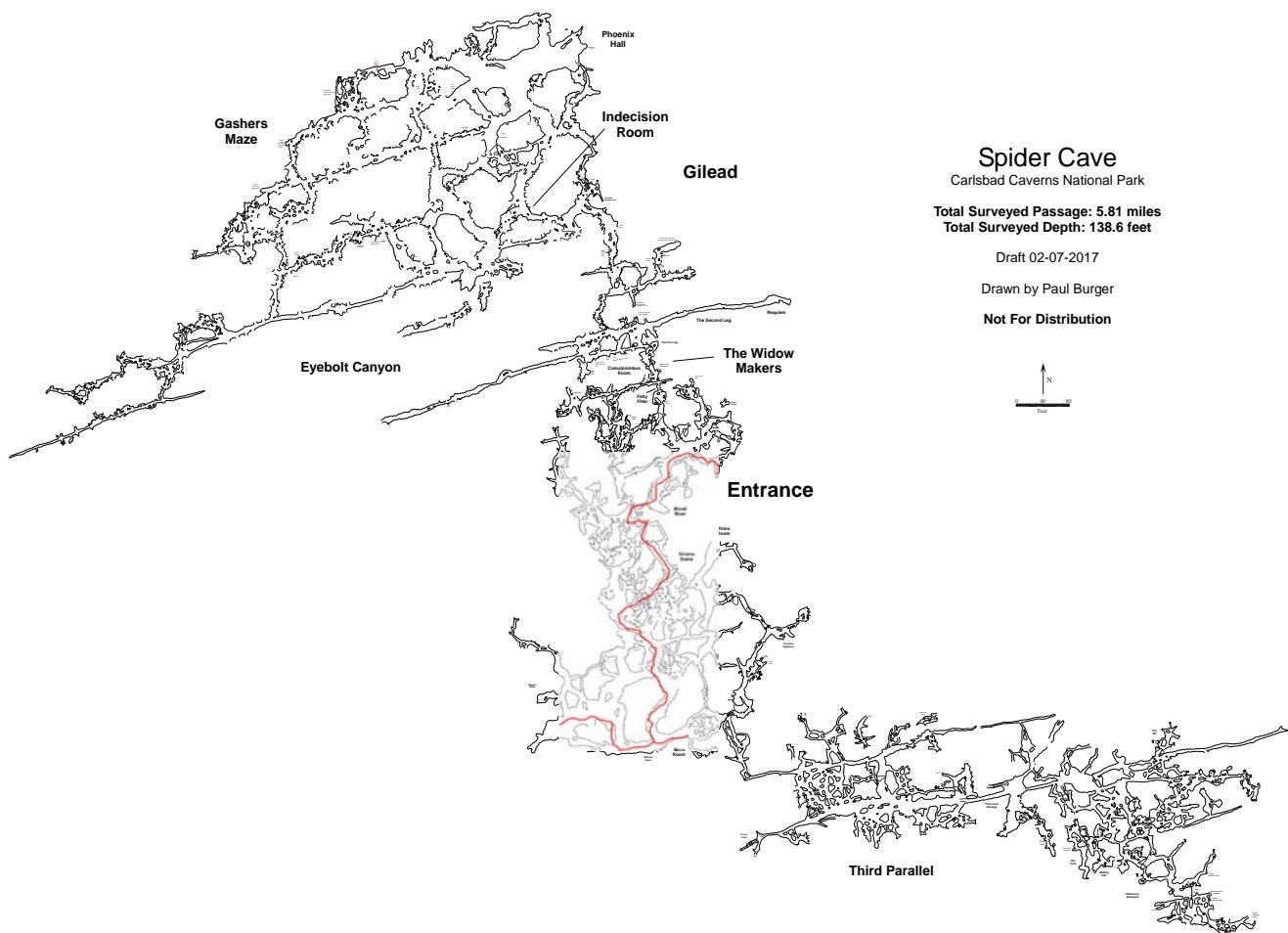
In early 2012, Chris accepted a job at Voyageurs National Park and wanted to get one last trip in before he left. On March 19, he led Erin Cubbon and Jen Evans to resurvey the NB/NC north of the entrance towards the Cumulonimbus Room, an

area of tight boneyard that Rich Knapp had initially surveyed in April, 1993. Ironically, I had been on a follow up survey to that area in May, 1993 where we pushed some tight boneyard northwest of the Cumulonimbus Room, the last trip to this area before Chris started the resurvey.

They followed the old NC survey, replacing it with the continuation of the B survey first through decent-sized stooping passage and then into difficult boneyard. They mopped up a good deal of boneyard and worked their way into a small room with gypsum and thick calcite crusts on the wall. This had to be the Cumulonimbus Room, the last named passage to the north, but the way on was not completely obvious.

While waiting for Erin to check a crawlway, Chris poked his head into a small hole a couple of feet off the floor. He momentarily debated whether it would be worth getting scraped up even more, especially since it had no airflow and did not look like it got bigger. As he was debating out loud whether or not to give the squeeze a try, Jen reminded him that this could be his last trip into the cave for a long time, so he pushed on.

Beyond three more constrictions (Widow Makers), he found a climb upward that led through a hands-and-knees crawl to an east-west fissure passage. They pushed east to a shallow pool and then only fifty feet to the west, enough to see that the cave continued.





▲ Paul Burger admires the gypsum flowers in Eyebolt Canyon in the Gilead Section of Spider Cave. Photo by C. Amidon.

## September 2012

We waited until Chris Amidon could escape his new duties at Voyageurs to continue exploring. On September 19, 2012 we mapped beyond the pool Chris had found and then started to map the main fissure to the west. The fissure ended after a few hundred feet, but we mopped up the majority of the side leads and netted almost 800 feet of new cave.

The next day, while Stan and I spent the first part of the trip photographing “The Requiem” flowstone area to the east, Chris followed a gritty crawl to the north into another parallel fissure. The east ended in dripstone formations and the western end went into gritty boneyard. Stan pushed through another north-trending passage, through

another tight squeeze, that opened up into more typical Spider Cave maze, but with more areas of dried pools and calcite rafts than is seen in other parts of the cave. The cave continued to get bigger with more obvious leads at multiple levels. We eventually had to stop at a major junction room to figure out where to go; it was no longer clear which way was best. We named this junction “The Indecision Room.” We opted to push west and began to encounter gypsum needles and other features that looked more like Lechuguilla Cave than what we expected from Spider. We stopped the survey in a 30-foot fissure passage (Eyebolt Canyon) with abundant tyuyamymite, and so many gypsum formations that it was nerve racking to move. We finished the day with over 800 feet of new cave.

The following day, we decided to push the north lead instead of returning to Eyebolt. The passage was much tighter and we descended into an old pool basin with thick, cracked calcite floors and walls. After much more squirreling around, the passage opened to stooping size and then broke open into a room 200-feet long, 40-feet wide, and 15 to 20 feet tall, which we named Phoenix Hall. On the east side of the chamber, active flowstone cascaded down a slope forming small pools. To the west, the passage continued into a large, walking fissure, but we were out of time even though we had only mapped a mere 700 feet of new cave. After much discussion, we decided to name the new area Gilead, after the fictional land of the Gunslinger from Stephen King's novels.

### **March 2013**

Chris, Stan, and I were able to return to Gilead in March, 2013 and we immediately headed to the walking lead in Phoenix Hall. The main passage ended in smaller maze passage so we backed up and mapped the next larger lead going to the south. This trend continued as we mapped west until the passage got small and we retreated to more comfortable maze cave. We surveyed three parallel western fissures with north-south connections and dozens of side leads. We established the structure of Gasher's Maze on that trip with dense maze passages on at least three levels, setting the stage for a lot of future mop up. We left the cave on the first day with nearly 1,100 feet of passage.

The following day, Shawn Thomas replaced Stan and we mapped westward from the Indecision Room into the maze once again. We mapped west until the passage got smaller and then mapped back to the north, picking up several east-west parallels as we went and eventually connecting into the Phoenix Hall area to the north. We mapped over 550 feet of nice maze passage.

The next day, I had to take care of a knee issue, but Stan, Chris, and Shawn returned to Gilead to continue the epic push. Heading west from the Indecision Room, they pushed into Eyebolt Canyon to continue following that trend. The passage went west for several hundred feet and a lack of side leads allowed for numerous 30-40 foot shots with ceiling heights in excess of 20 feet. The walls, ceiling, and floor were covered in gypsum needles, hair, and flowers, often several feet long that made for nerve-wracking survey. Eventually the fissure fizzled out with no obvious way on to the west. The team went back east to where the first decent lead was heading back north, and reconnected it to previous surveys in Gasher's Maze. They finished the day with over 800 feet.

Chris and I returned to Phoenix Hall the next day and mapped nearly 600 feet of cave in Gasher's Maze, including a shortcut that bypasses the old pool area on the discovery route, cutting off some travel time and allowing us to avoid some delicate aragonite.

On the final day of our spring trip, Stan, Chris, and I pushed the flowstone leads along the eastern edge of the cave, starting from Phoenix Hall and working our way back towards the Indecision Room. The passages were beautiful but delicate and we had to keep changing from regular caving suits to Tyvek and aquasocks to keep from tracking clay. We did not break out of the eastern edge, but still mapped nearly 700 feet of cave, bringing the total cave length to over 5 miles.

### **September 2013**

Stan Allison, Shawn Thomas and I spent three days pushing and mapping along the western fringe of Gilead hoping to find a breakout. We were unsuccessful. Nearly everything got too tight or reconnected to other surveys. Still, we mapped several hundred feet of passage.

## April 2014

For the first trip of the New Year, Shawn and I mapped more of the maze just north of Eyebolt Canyon, spending most of the day in passages less than 1-foot high. On the second trip Stan and I mapped some passage south of Eyebolt, into a parallel that ended solidly to the west and east, but still resulted in nearly 500 feet of new cave. On the last trip, Stan and I mopped up 350 feet more of the maze between Eyebolt and the Indecision Room.

## September 17, 2014

Stan, Stuart Marlatt, and I pushed the area near the end of Eyebolt and the area where we had found the parallel fissure to the south on the previous trip, but all of the passages got too tight.

## January 2016

After an unplanned hiatus from Spider and Gilead in 2015, Stan and I went to the upper level maze near the end of Eyebolt to see if we could find a way west. On the first trip, everything we pushed ended solidly or in unpromising chipping leads. In a pattern that continues to today, I began alternating trips between Gilead and the Historic Section in an effort to complete the survey of the older parts of the cave to modern standards.

Charlie Reed and Nathaniel Gilbert helped me remap the route from the entrance crawl to just

east of Blood River. We then tied the new survey into the old VB survey area just to the north. On the next trip Foz Trautner and John Davis joined me to remap from Blood River to just past the Rabbit Ears and the passage heading north out of the Decision Room.

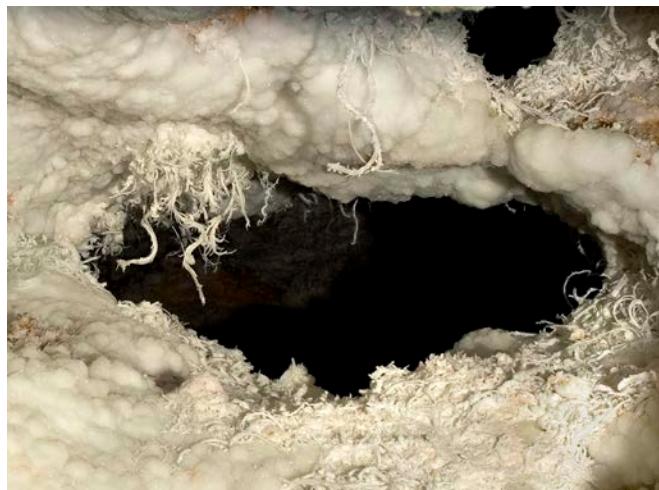
## April 2016

A fortuitous conference got me back to Carlsbad and allowed me to do some evening survey after the talks were over. On the first trip, Joel Despain and Ellen Trautner helped me resurvey from the Rabbit Ears to the Gnome Dome and then some of the side leads off the old VB (now E survey). Two days later, Joel and I went into Gilead to continue cleaning up leads in Gasher's Maze and mapped several hundred feet near Phoenix Hall. On the final day of this trip, Joel, Jon Mackey, and I continued to mop up side leads on the E survey, including the long, crawly connection between the E survey and the B survey just north of the entrance area.

## January 2017

In Gilead, Stan and I mapped more of the decorated areas east of the main route between the Indecision Room and Phoenix Hall. We did not make any breakthroughs, but did clean up a good number of leads.

In the historic section, we began mopping up the lower levels between the Gnome Dome and the Grand Canyon, including parts of the main trail. Josh Nelson, Toni Nelson, Brian Whitehead and I mopped up the last few leads in the passage between the E and B surveys and then headed to the parallel on the far side of the Fatty Filter, where Chris had made the discovery of the new area back in 2012. We mapped the main fissure but ran out of time before we could start mapping the maze



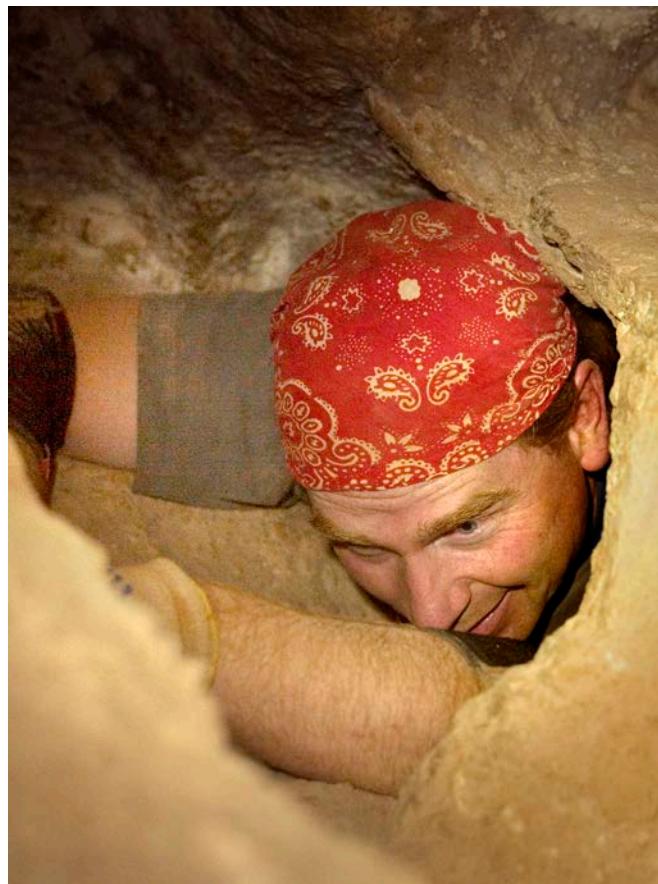
◀ Gypsum flowers in the Eyebolt Canyon area in the Gilead Section of Spider Cave. Photo by P. Burger.



▲ Paul Burger works his way through the Widow Makers.  
Photo by A. Palmer.

to the south back towards the historic section. On the final day of the trip, John Webber and I began mapping the maze area between the Grand Canyon and the Rhino Room where there is still a great deal to be done.

Spider Cave now stands at 5.81 miles (1.92 miles in Gilead) and we continue exploration on the frontier while balancing new exploration with the need to update the historic section and bring the overall map quality up to modern standards.



► Paul Burger in a Widow Maker squeeze. Photo by A. Palmer.



# THE SQUEEZE

Resource Notes & News

# Lechuguilla Cave Expedition Summaries, January to June, 2017

*Thirty-one years after a group of explorers dug their way through breakdown into Lechuguilla Cave, the cave still surprises us. Set aside for research, explorers continue to find new passages and researchers learn more about the diversity of life within this pristine cave system.*

## Hazel Barton Expedition to the Southwest Branch, January 21 to 27, 2017:

Hazel's team spent a week mapping and cleaning up areas in the Voids and Lake Castrovalva areas in the Southwest Branch of Lechuguilla Cave. During the course of the expedition, the group divided into two teams who remained relatively close together in the cave. This worked really well for the complicated areas, although it did reduce the overall footage that could have been obtained by two independent teams. They were able to completely resurvey Lake Castrovalva, which they were able to do by using a sterilized Pac-raft and sterilized string to pull the raft across the lake. They left a really good climbing lead for a future expedition. The totals for the week were 2,198.56 feet of resurvey, 988.32 feet of new survey, and 174.51 feet of redundant survey, for a total length of 3,361.39 feet of survey for the expedition.

## John Lyles Expedition to the Ghost Town area, February 25, 2017:

John Lyles led a team of three cavers to resurvey stations H1-H24 in the Ghost Town Chamber area. They reached the H survey after rediscovering and using a bypass route around S&M Crawl, which is off the level below the first (upper) rope of Apricot Pit. The approach was through climbdowns over flowstone, popcorn, and breakdown. They used new Disto X2 instruments owned by the cavers, which allowed high accuracy + high angle readings and faster throughput. The team moved through the H survey as it dropped down alongside the

◀ Paul Burger conducts typical Gashers Maze survey. Photo by S. Thomas.

Ghost Town Chamber and went into the wall, following a fissure that they climbed down. At that point they noted several unsurveyed boneyard leads, but continued resurveying the main route into a larger trunk that was decorated in light flowstone, pools, long soda straws and other formations. They found instances where the original 1989 survey had errors with inclinations. Azimuths were nominally within 1 degree in most cases, but the initial survey did have some redundant shots. The team reached H15 in the late evening and realized the resurvey work would require a second trip. A complete change to clean clothes, knee pads, packs and shoes would also be needed.

## David Levy Research Expedition to the Eastern Branch, March 13 to 15, 2017:

David led a hydrological sampling trip to the Near East and East Branch of Lechuguilla Cave. They collected water samples at the Nirvana drinking water source, Lost Pecos River drinking water source, and Lake of the White Roses. Unfortunately, they were unable to find the pressure transducer that has been recording the water table levels of the Capitan Aquifer at Lake of the White Roses. They theorized that the water level rose significantly, submerging the instrument.

## Derek Bristol Expedition to the Western Branch, February 25 to March 4, 2017:

Derek led a ten-person expedition to the western branch of Lechuguilla Cave. Most of the focus was survey objectives in Red Lakes/Oasis, Oz, Keel Hall/ Long Haul, and Wild Wild West areas. The general expectations for this expedition were

## THE SQUEEZE Physical Sciences



▲ Hazel Barton Expedition to the Southwest Branch. Top Left: Hazel Barton, expedition leader, traveling to Big Sky camp in Lechuguilla Cave. Top Right: Big Sky Camp during Barton's Lake Castrovalva expedition. Bottom: Hazel Barton collecting microbial samples at the Pearlsian Gulf in the Southwest Branch of Lechuguilla Cave. Photos by R. Shone.

that teams would spend most of the allocated time mopping up unpleasant and unpromising leads in mazy breakdown areas such as Keel Hall, Long Haul, Outpost Room and Sanctuary. However, a technical climb completed on the first day of

exploration, and the subsequent discovery of a large new room they named Zion, shifted much of the focus to this new area. Zion is a significant breakout on the southern edge of the west branch that also climbs nearly 500-feet above the Western

Borehole. The main room in Zion is 600-feet long, 175-feet wide, with spectacular 80-foot columns throughout. They left numerous leads for a future expedition. Additionally, a re-s sketch of Oasis on the first survey day revealed many previously undocumented leads that led to an extensive boneyard maze under this large room that occupied teams for several days with many leads left to explore. Progress was made in completing some of the remaining leads in Keel Hall, Long Hall and the Wild Wild West. The results of the expedition included 6,160.7 feet of total survey; with 5,887.5 feet of new survey, 230.7 feet of resurvey, and 42.5 feet of redundant survey. The expedition added 1.12 miles to the length of Lechuguilla Cave, raising the length of the Lechuguilla Cave survey to 141.94 miles.

#### **John Lyles Expedition to the Rift and North Rift areas, March 24 to 25, 2017:**

John Lyles led a team of four cavers on two day trips to the North Rift area in Lechuguilla Cave. During the first trip, they mapped leads off the Nautiloid Pass in the Lower Rift area. The leads included a 50' pit. They found more leads via resurvey than they started with, including a nice virgin pool with green minerals on the walls. There was air in the area and they left leads for a future trip. All the air seemed to be coming from the downward direction in the Rift, going up towards Sugarlands. During their second day trip, they investigated the North Rift route to the CG survey. They found a narrow popcorn lined slot blowing air, but it was very tight. After this, they went back to the D12 area to descend the pit below D11 in the Main Rift. James Hunter rigged to two flowstone-encased boulders on the floor with an 80' rope, which was sufficient. The pit could only be descended with clean shoes. Rick Bridges' notes from the original D survey showed a question mark on the profile down there. From this station,

they were able to shoot a 105 foot shot with a DistoX down to the lowest part of the fissure. Abundant white popcorn covered the entire walls and the whole floor was nice flowstone. The only way down was a too-tight popcorn slot that remained too tight for a long time, and it didn't move much air. James named this pit Tango Pit. They were able to survey 1,334 feet for the two-day expedition, which included 122 feet of resurvey and 1,112 feet of new survey.



▲ Garette Jorgensen and Jen Foote sketching during John Lyles Expedition to resurvey the H survey in the Ghost Town area in Lechuguilla Cave. Photo by B. Kendrick.

## THE SQUEEZE Physical Sciences

### Hazel Barton Expedition to the Chandelier Graveyard, May 20-27, 2017:

Hazel led five cavers—including Agusto Auler from Brazil—to the Deep Seas camp, cleaning up areas on the Chandelier Graveyard Quads, with a goal of completing quads H36/37 and I37/36. They surveyed 27 leads, many of which went farther than expected and completed most of the climbing leads that had been identified. One climb by Derek Bristol and Phil Cunnigham led to the PhD Room, providing a second access point, should that ever be needed. The expedition resurveyed 918.5 feet, 2,212.2 feet of new survey, and 95.0 feet of redundant survey, for a total of 3,130.6 feet of total survey for the expedition.



▲ Kathy Borer in the recently discovered Never Never Land on June 11, 2017. Photo by P. Bosted.

### Art Fortini's Expedition to the Never Never Land, June 11-17, 2017:

Art led a return expedition to his December 2016 discovery of Never Never Land, which is located at the top of the 500-foot high, multi-pitch climb known as the Treehouse in the Western Branch of Lechuguilla Cave. This unique area is unusually flat and dips slightly to the southeast at 9 degrees. The room and pillar maze, which is covered with

corrosion residue, averages 3 to 4 feet high and is 60 to 100 feet wide. Looking “up dip” at Never Never Land, you can see how much of the new discovery is confined within a very limited thickness of bedded back reef limestone. One station is now within 40 feet northwest of and essentially at the same elevation as, the eastern edge of Oz. Although, this is tantalizingly close and there is air in several too-tight holes, the notes show only one “too low” lead that heads towards Oz. The farthest west station in Never Never Land is still 366 feet to the northeast and 65 feet lower than the top of the PhD Room in Chandelier Graveyard, which makes the lead in the dome above the PhD Room one of the better climbing leads in the cave. The farthest east station in Never Never Land is a lead which certainly has potential for extending Never Never Land eastward. Using Disto X2’s, all loops in Never Never Land have very good to excellent loop closures, with deviation errors of 0.10 to 0.46 from the predicted error (anything less than 1 is considered “good”). The party surveyed 4,812.4 feet of new survey during the expedition. The vast majority of the survey during the expedition was in Never-Never Land, but they also surveyed about 200 feet in the FUBAR area. —ROD HORROCKS

► (Clockwise from top left):  
Derek Bristol, the Expedition Leader for the February trip to the Far West in the Western Borehole. Photo by J. Krejca.

David Lambert in the boneyard underneath the Western Borehole. Photo by J. Krejca.

Tammy Otten in the Red Tides Room ascending the rope climb that originally led to the Zion discovery. Photo by J. Krejca.

Zion, the large new room discovered off of Red Tides near the end of the Western Borehole of Lechuguilla Cave. Photo by J. Krejca.



© Jean Krejca

## What Are You Collecting? Volunteers Keep the Cave Clean

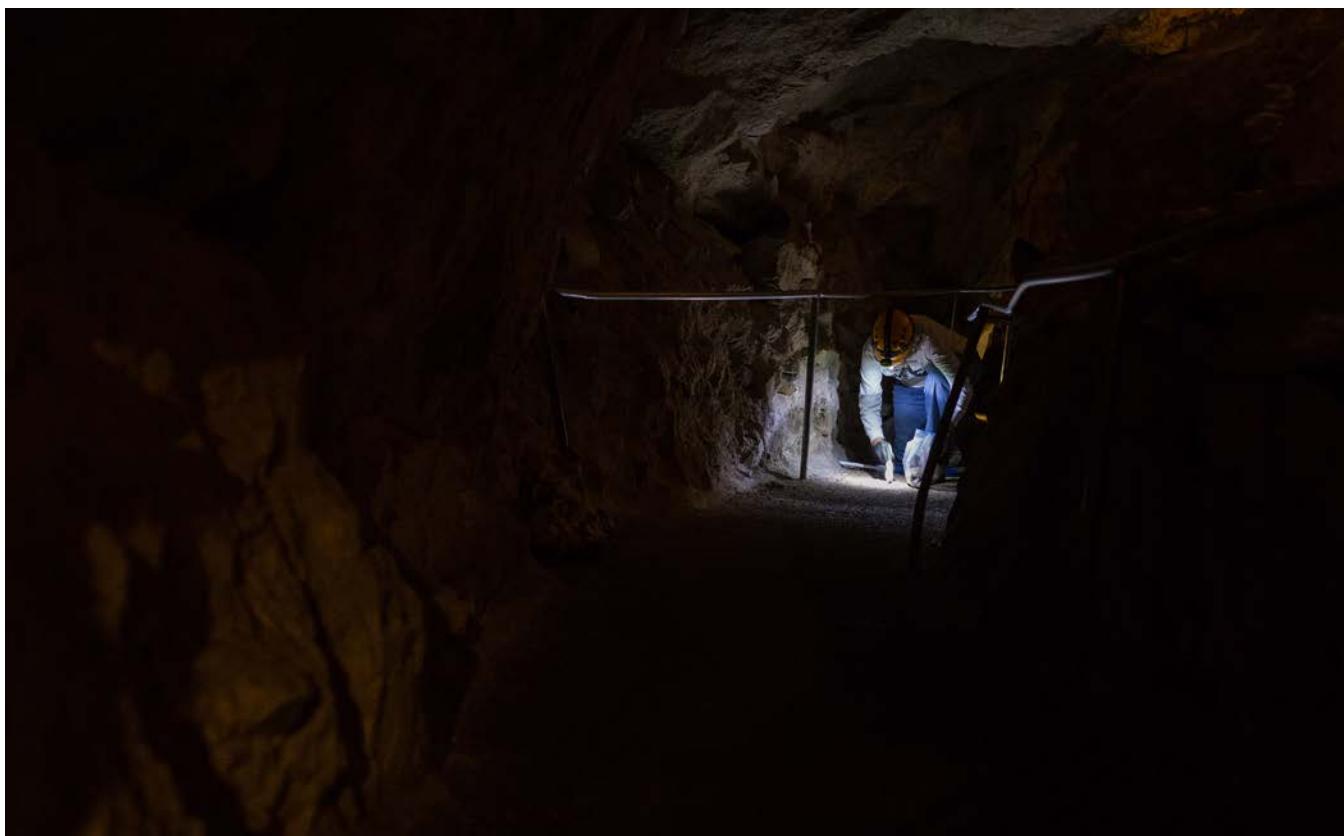
*Whenever someone asks me what I'm collecting, I respond with a cheerful "Lint!" I know I'll be met with a blank stare, so I'm prepared to explain.*

Since November 2016, we have had many groups volunteer to spend hours on their hands and knees, picking lint in the Main Corridor of Carlsbad Cavern. Our lint pickers include Boy and Girl Scout troops, youth conservation groups, local cavers, park employees, and families from Albuquerque—to name a few.

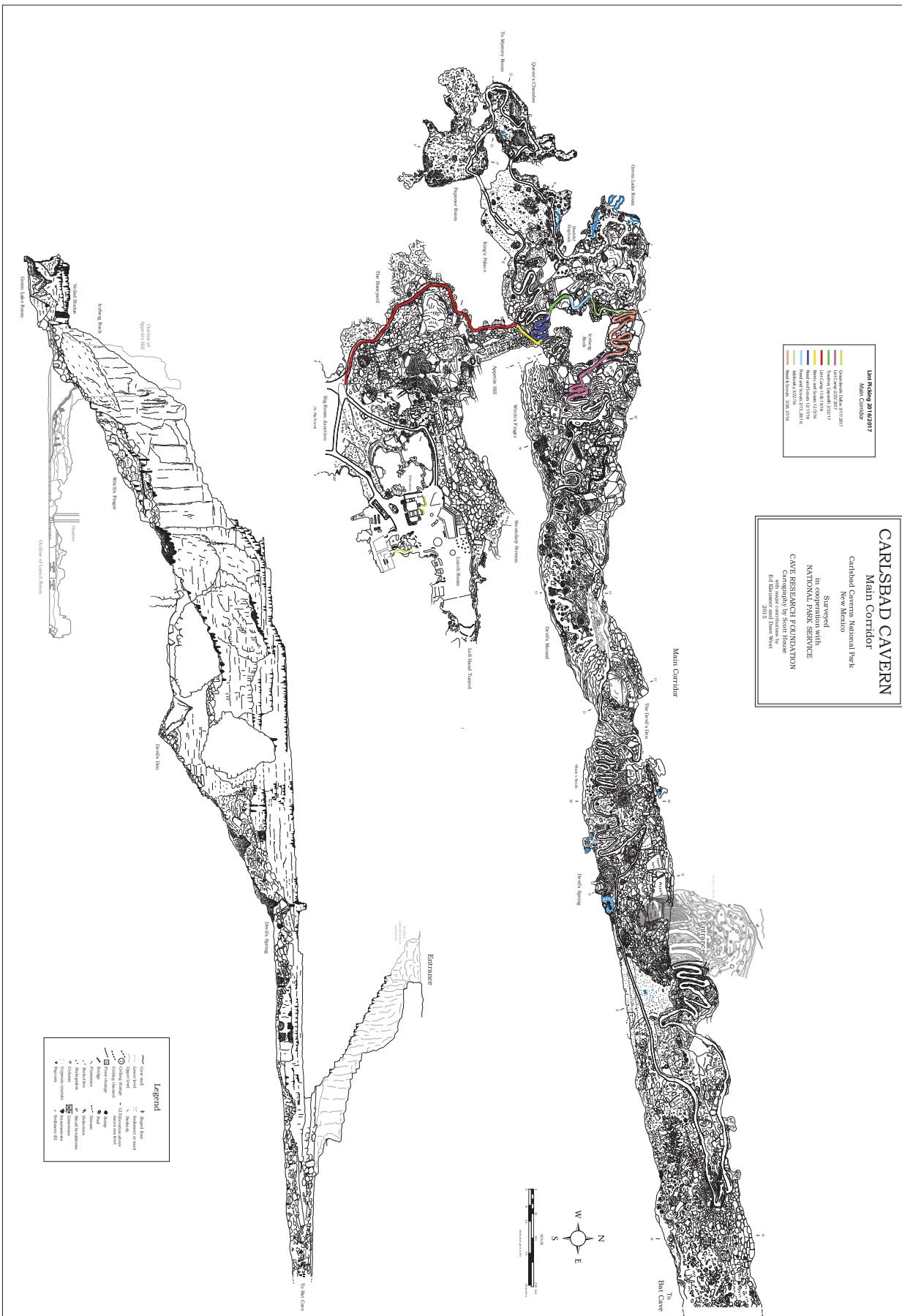
Almost 24 pounds of lint have been collected during close to 1000 hours of volunteer time. Most volunteers average about three hours of lint picking and collect 1 to 2 ounces of lint during

that time. Starting at the Big Room/Main Corridor junction, the groups have slowly worked their way up the Main Corridor. The goal is to have the trail finished by the end of 2017. In 2018, we'll focus on the Big Room.

Lint is a never-ending management concern. Imagine hundreds of thousands of people walking through your home and never vacuuming. Lint is the visible accumulation of clothing fibers (natural and synthetic), skin cells, hairs, and other small particles left behind unintentionally by cave visitors. Lint buildup is an aesthetic concern because it makes the cave look dingy, but it is also a resource issue. Lint can host nonnative micro-organisms that disrupt a cave's natural microbial



- ▲ A volunteer clears lint from the Main Corridor trail during Lint Camp. Photo by C.A. Hoyt.
- The colored trails show the sections of the Main Corridor where we have completed cleaning lint this year.



## THE SQUEEZE Physical Sciences

ecosystem. It can be an unnatural food source for cave crickets and other troglophiles. Lint is also a moisture trap that combines with carbon dioxide from the air, and the resulting carbonic acid slowly dissolves cave formations.

For these reasons, we try to mitigate lint accumulation in several ways. First, trail walls—often called lint curbs—were built to capture lint and keep it on the trail itself, making it easier to manage and protect the walls and formations near the trails. Ideally, the trails would then be vacuumed on an annual basis.

Without frequent vacuuming, however, foot traffic easily breaks the lint down into small

particles that can travel on air currents. Lint is wafted up and over the walls. These small lint particles land on the formations and cave walls near the trail. Vacuuming some cave formations is out of the question due to their fragile nature. Therefore, lint pickers with special tools are our final line of defense.

To everyone who has ever volunteered their valuable time to cleaning the cave of lint:  
Thank you! Please come again!

For more information on lint mitigation, see Jablonsky, Pat. 1994. Research Topic: Develop Preventive Measures for Future Accumulations of Cave Lint. Denver Museum of Natural History, Denver, CO., 74 p. —ELLEN TRAUTNER



## Carlsbad Cavern Survey Project

In June, Ed Klasner led a six-day CRF expedition to the Lower Cave in Carlsbad Cavern. They were able to mop up 37 leads for a total of 597 feet of new survey. Eighteen of their other leads ended immediately and just required a sketch update. Ed estimates that it will probably take two more expeditions to finish all leads that don't have to be bolted in Lower Cave.

In June, Dave West led a CRF expedition to the Music Room in Carlsbad Cavern to work on a section map of that area. They resurveyed 694 feet of problem surveys as well as 471 feet of new survey. They left numerous leads for a future expedition.

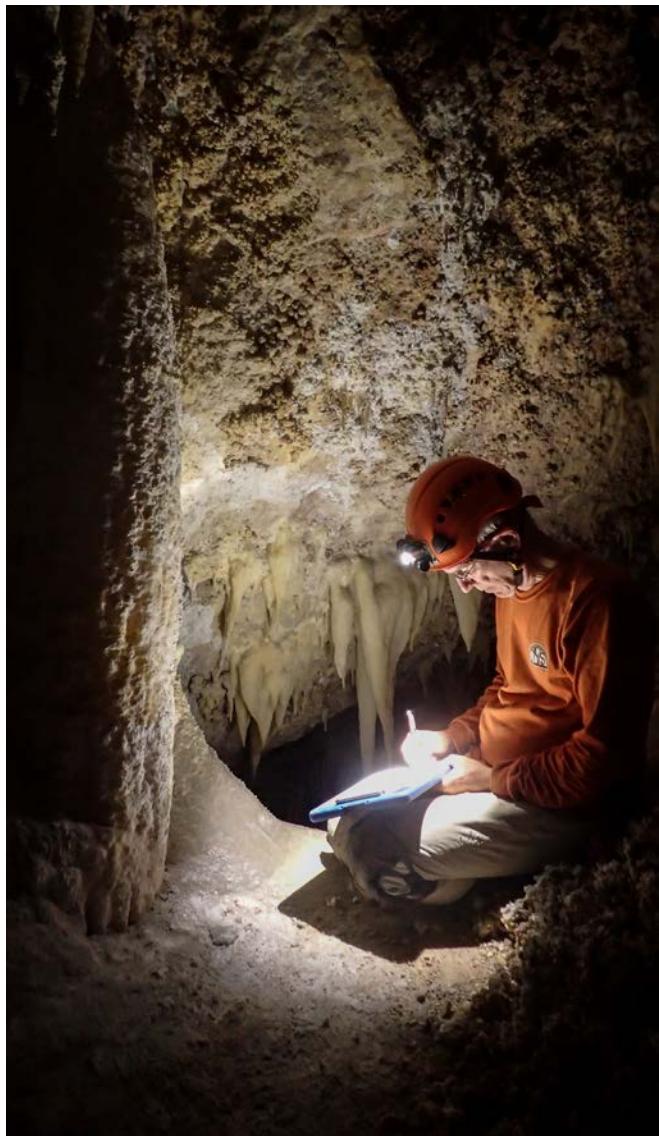
In June, Dwight Livingston led a CRF expedition to the Mystery Room in Carlsbad Cavern to work on the Mystery Room Section map. They resurveyed 2,258 feet of problem surveys and left a couple leads for a future expedition. —ROD HORROCKS

## NCRC—What Is It?

At the end of January, 2017 I attended a regional NCRC seminar in Bend, Texas. NCRC stands for National Cave Rescue Commission, chartered by the National Speleological Society (NSS) in 1979. It is a training organization run by volunteers, and affiliated with the Cave Rescue Section of the NSS.

As a training organization, its primary goal is to develop and maintain a national curriculum for cave rescue, based on current best practices. NCRC is divided into various regions, which frequently offer local trainings, as well as an annual national seminar. Its qualified cadre of instructors range across the U.S. and offer training in a variety

◀ **Volunteers use paint brushes to remove lint from the paths and lint walls along the Main Corridor Trail. Photo by C. Hoyt.**



▲ **Dwight Livingston sketching in the Mystery Room area.**  
Photo by N. Socky.

of formats. The most popular is the simple Orientation to Cave Rescue, or OCR, which was offered in Carlsbad last summer. This two-day course provides cavers and rescue professionals a chance to learn the fundamentals of cave rescue, ranging from communications underground to litter movement to map reading skills.

After OCR, there are a variety of other classes available. While in Texas, I took NCRC Level 1, which is an eight-day intensive course, teaching participants to be competent and confident members of a task force team underground. We spent a lot of time practicing litter movement, patient

## THE SQUEEZE Physical Sciences

packaging, rigging and rope skills, and communication strategies. Although tiring (most days went until 9:00 pm), it was also really fun. More importantly, it was valuable training that emphasized safety and skill mastery.

I encourage anyone interested in expanding their caving skill set to attend at least one NCRC class. OCR is a great place to start. There's also Small Party Assisted Rescue (SPAR), which focuses on groups self-rescuing with limited equipment. The weeklong classes range from Levels 1 to 3. For more information, visit [ncrc.info](http://ncrc.info).—ELLEN TRAUTNER

## Winter is the Season to Cave!

Carlsbad Caverns National Park has eight permitted back country caves. As part of my duties as Cave Technician at the park, I issue recreational permits to these caves, as well as monitor them for impact. I enjoy visiting these caves in the winter, as cooler surface temperatures make for more pleasant hikes.

This past winter, various volunteers assisted me in my back country cave monitoring duties. Some-



▲ Volunteers in Lake Cave. Bottom: Kelli Housley. Top row L to R: Christina Caparelli, Ellen Trautner, Travis Bishop, and Jaco Webber. Photo by K. Housley.

times, this involved reflagging routes through the cave, or flagging off delicate areas. It also included collecting trash, sometimes using tweezers to gather tiny pieces of old flagging tape. We also looked for signs of off-trail travel, use by animals, and vandalism. Thankfully, we don't usually find much vandalism to our caves! For the gated caves, I changed the lock combinations. For all caves, I pulled the oldest register pages and replaced them with new ones.

I enjoy taking volunteers with me to these caves, as they help me accomplish my goals quickly and safely. The volunteers get to see a cool cave—sometimes a cave they've never seen—in the bargain. Contact me if you are interested in helping with these projects.

Thanks to those that helped me last winter, including: Foz Trautner, Jaco Webber, Kelli Housley, Christina Caparelli, Toni Nelson, Josh Nelson, Charlie Reed, and Travis Bishop.—ELLEN TRAUTNER

---

## Largest Cave Chambers in the Western Hemisphere

A team of UK cavers, Tim and Jane Allen, Andy Eavis, and Richard “Roo” Walters, visited Carlsbad Cavern in order to make a detailed 3D map of the Big Room. They used the latest laser imaging instruments, so that the first accurate measurement of the volume of the chamber could be ascertained. Andy first went to Carlsbad Cavern in the 1970’s. At that time, the Big Room was considered to be the largest cave room in the world. Roo, who has been heavily involved in the current project, said, “We’re trying to find the true nature of the biggest caves in the world. They are enormous black spaces when you’re standing there with your ... scanner in the middle of the night. The only thing you can see around you is the floor... until you get results from a scan.” Roo is excited about laser scanning because the technology can capture what the human eye cannot see.

Roo used a Riegl VZ-400, which his team was the first to use in a cave. He said it is light enough to carry, at about 21 pounds, and has enough range (400 meters) for what they need to do. It also works with a range of software tools to process their information. “A man named Kevin Dixon introduced us to laser scanning in 2010,” Andy said. “He came with us on one of our trips

to Borneo with a scanner and we very slowly and laboriously scanned Deer Cave and Sarawak Chamber in Malaysia. That really got us on to the project of laser scanning. We’ve now embarked on an ongoing voluntary project to laser scan these chambers.” It is part of a 3-year project to visit all the world’s largest chambers so that the first detailed comparison can be made between them, not only to truly assess which is the largest chamber but also to find out more about their structure and how they were formed. Previously, large cave chambers were listed by their floor space. Roo, who is responsible for collating the data into 3D models from which measurements can be made, explained, “Previous estimates of size are largely informed guesswork... but this equipment allows us to measure down to each square centimeter of the cave walls ... which means a highly detailed and accurate model can be built.”

Their actual calculation for the Big Room was 0.93 million cubic meters, which is 10% larger than the chamber previously thought to be the largest in the Americas, the Belize Chamber in the Chiquibul Cave System in Belize. However, the team heard about another large chamber, this one in Mexico, that no one had been back to since it was first

## THE SQUEEZE Physical Sciences

discovered in 1989. When the team recently visited that chamber, which is called La Muneca and is in Sistema Tepepan Zaragosa, Puebla, Mexico, they were surprised to learn that that chamber was the largest in the whole western hemisphere, and by a significant margin. La Muneca turned out to be the fourth largest chamber in the world with a ceiling height over 600-feet tall.

Andy was asked how they determine the boundaries of the chambers they scan since caves are irregularly shaped. Andy said, “It can be difficult [to know] where to draw the boundary lines and what constitutes a cave chamber, but that is one of the issues that 3D scanning can help resolve.” Roo observed that, “The Big Room is a fascinating chamber and its complexity will test evolving ideas across the speleological world about what actually constitutes a cave chamber or passage and as yet there is no firm consensus, but the team hopes that this will be resolved by June 2017 at an international conference in Sydney [Australia].”

“What we discovered during this project,” Tim said, “is that until we measure it we just don’t know.”—ROD HORROCKS



▲ Visitors explore the Big Room—the second largest cave chamber in the Western hemisphere. Photo by C. Hoyt.

### Largest Cave Chambers in the Western Hemisphere

Chamber	Cave/State	Volume
1) La Muneca Chamber	Sistema Tepepan Zaragosa, Puebla, Mexico	5.9 million cubic meters
2) Big Room	Carlsbad Cavern, NM	0.93 million cubic meters
3) Belize Chamber	Chiquibul Cave System, Belize	~0.85 million cubic meters

### Springs Monitoring at CAVE

Since 2010, crews with the Chihuahuan Desert Inventory and Monitoring Network have been visiting springs around Carlsbad Caverns National Park. The initial inventory of springs was conducted in 2010. Various sources were found across the park ranging from small seeps to flowing springs to pooled tinajas. In total, over fifty sources were documented.

To continue monitoring the springs, a pilot monitoring protocol was inception in 2014 and is ongoing. The main objective of this monitoring is to determine the status and long term trends in

several parameters sampled at each spring. These include surface water dynamics (spring discharge and wetted extent), water persistence (number of wet vs. dry days), water quality (temperature, specific conductivity, pH, and dissolved oxygen), water chemistry, riparian and wetland vegetation, occurrence of non-native vegetation, and site disturbance (natural and anthropogenic). Springs are also documented using photographs, GPS units, and hand-drawn maps.

Thirteen sites were visited during the 2017 spring season, an increase of ten from 2016. Many of

- ▼ A Chihuahuan Desert Inventory and Monitoring Network crew member measures water quality during the spring monitoring project. NPS Photo.



## THE SQUEEZE Biological Resources

the sites visited this year had adequate water to support an abundance of wildlife including macroinvertebrates, frogs, and wetland vegetation, as well as deer, sheep, and mountain lions. Although the majority of the springs involve hiking over rough terrain into the backcountry of the park, it is always worth the effort to witness these oases emerging in the desert.—MEGAN PODOLINKSY,

CHIHUAHUA DESERT I&M NETWORK

- ▶ A water sample is dipped from a small seep spring in the park. NPS Photo.
- ▼ Cardinal-flower (*Lobelia cardinalis*) fringes the spring pool at Oak Spring in the late summer. Seeps and springs support species unexpected in the desert. Photo by C. Hoyt.





## Yucca Canyon Trail Rehabilitation

Throughout the first half of 2017, volunteer groups worked diligently to restore Yucca Canyon Trail for the enjoyment of our backcountry visitors. The project began in 2016, when an Eagle Scout approached the park staff, desiring to do his project in Carlsbad Caverns National Park. Charlie Reed, an interpreter and the park's resident Scout liaison, asked Resource Management for suggestions. Yucca Canyon Trail, in disrepair and overgrown, was overdue for rehabilitation. Scouts from El Paso Troop 10 arrived in February and spent two days removing overgrowth from the trail.

Once the beginning of the trail was cleared, other groups contacted the park, eager to volunteer. Groundwork Dallas, a youth conservation group from Texas, came during spring break and spent another two days working on the trail. Picking up where the Scouts left off, Groundwork Dallas continued work on overgrowth, as well as trail remediation at wash-out locations. Immediately following Groundwork Dallas, members of the New Mexico Wilderness Alliance spent a long day working on the mesa, clearing the trail and building better rock cairns.

Thanks to the efforts of these hard-working volunteers, the first two miles of Yucca Canyon Trail are in good shape. We look forward to more partnerships to continue this good work. In the meantime, explore and enjoy beautiful Yucca Canyon!—ELLEN TRAUTNER

- ◀ Yucca Canyon Trail drops across the drainage and winds up the canyon. Photo by C. Hoyt.
- ▼ Cairns built by New Mexico Wilderness Alliance define the trail along the mesa. Photo by C. Hoyt.
- ▼ El Paso Troop 10 clear overgrowth from the trail. Photo by C. Reed.



### Natural Defenses against White Nose Syndrome

Dr. Diana Northup and eight co-authors<sup>1</sup> recently published their final report<sup>2</sup> about the microbiota on bats at Carlsbad Caverns National Park. They wanted to determine if the bats had any natural defenses against the White-nose syndrome (WNS), which is caused by the fungus *Pseudogymnoascus destructans* (*Pd*). They used next generation sequencing and microbial culturing techniques to analyze bat microbiota on seven species of bats and then isolated Actinobacteria and tested their anti-fungal properties against *Pd*. They netted bats in Carlsbad Cavern, the Indian Shelter in Walnut Canyon, and Rattlesnake Springs. They swabbed each bat they netted, both for species likely to develop WNS and for species unlikely to develop WNS. Not surprisingly, they found that next gen sequencing performed on DNA collected from swabs suggested that there were different microbial communities on the bats caught on the surface versus those caught in the cave. They were able to sub-culture 648 species of purified isolates from the 147 parent cultural plates they generated. Nearly 57.5% belonged to the genus *Streptomyces*, a well-known antibiotic producer. Some species of bats had many Actinobacteria present. They were able to identify 18 isolates that showed significant inhibition of *P. destructans* and an additional five possible inhibitors, which were identified by Dr. Andrea Porras-Alfaro's lab at Western Illinois University. Additionally, one of these isolates appears to be a new species of *Streptomyces* and it is in the process of being formally described. In order to learn about the microclimate of the bats' roosts and if they were appropriate for the growth of *Pd*, they installed temperature/relative

humidity loggers to gather data in roosting areas of Carlsbad Cavern and three backcountry caves that previously tested positive for the presence of close relatives of *P. destructans*. Kenneth Ingham, from Science-in-Action Photography, was able to photodocument the whole study, producing some stunning images. —ROD HORROCKS

<sup>1</sup>Diana E. Northup, Ph.D., P.I.

Debbie Buecher, M.S., Buecher Biological Consulting

Nicole Caimi, B.S., UNM Masters' Student, UNM

Paris Hamm, B.S., Graduate Student, WIU

Kenneth L. Ingham, Ph.D., Kenneth Ingham Photography

Patrick Lewis, Senior, UNM

Andreas Pflitsch, Ph.D., Ruhr-Universität Bochum

Andrea Porras-Alfaro, Ph.D., WIU

Ara Winter, Ph.D., Postdoctoral Fellow, UNM

<sup>2</sup>Establishing a Baseline for Bat Microbiota and Discovering Clues to Natural Defenses against WNS in Bat Microbiota in Carlsbad Caverns National Park (CAVE) Period of Performance: 15 April 2015–31 December, 2016.

---

---

### New Butterfly Sighting at CAVE

On April 18, 2017, Interpretive Ranger Dan Leifheit spotted an unusual butterfly at the Natural Entrance shade structure. Dan noticed the butterfly nectaring at an Apache Plume flower and was able to take a quick photo with his cell phone. The butterfly turned out to be an Banded Orange Heliconian (*Dryadula phaetusa*).

This is the first time that this species of subtropical butterfly has been reported in the state of New Mexico. In fact, this is the first time this species has been observed north of the Rio Grande Valley in south Texas. Although this individual was classified as a stray, it may be evidence of species moving north due to warming trends in the climate. Steve Cary from Butterflies and Moths of North Amer-

ica (BAMONA) verified the first sighting record (#1114865). —ROD HORROCKS



- ▲ The first Banded Orange Heliconian (*Dryadula phaetusa*) documented in New Mexico was seen nectaring on Apache Plume near the natural entrance of the cavern. Photo by D. Leifheit.
- ▼ Chihuahuan Desert Inventory and Monitoring Network crew gather data from one of the 35 vegetation and soil plots established at Carlsbad Caverns National Park. NPS Photo.

## Vegetation Monitoring at CAVE

Over the past five years National Park Service employees with the Chihuahuan Desert Inventory and Monitoring Network (CHDN) have been monitoring vegetation and soils plot located throughout Carlsbad Caverns National Park. 2016 marked the last year of plot installations at CAVE, and all 35 plots were visited (seven per year) on a five year rotation. These intensive monitoring plots are designed to determine terrestrial vegetation cover for common species, terrestrial vegetation frequency for uncommon species, terrestrial soil cover by substrate class, terrestrial soil stability, and biological soil crust cover and frequency.

All CHDN vegetation and soils monitoring locations are 50 meters by 20 meters in size. Each plot takes a crew of four roughly 4 to 10 hours to complete. This variability is completely dependent



## THE SQUEEZE Biological Resources

on the complexity of the vegetation community and how difficult the plot is to access. At Carlsbad Caverns, the crew has observed as few as 35 plant species on a plot, and as many as 95 plant species on a single 50m x 20m plot.

The crews face many challenges while working at Carlsbad Caverns. The first challenge is navigating the remote backcountry. The second biggest challenge they consistently face is trying to identify the extreme diversity of plants observed at Carlsbad Caverns. However, all of their hard work is consistently rewarded by experiencing an incredible resource in the park that is rarely enjoyed by humans...the Wilderness areas of Carlsbad Cav-

erns. If you have any questions about the Chihuahuan Desert Network or the NPS Inventory and Monitoring Program please visit our website at: <https://science.nature.nps.gov/im/units/chdn/>—  
TIM PINE, CHDN

## Threatened Species: Lee's Pincushion Cactus

Lee's pincushion cactus (*Escobaria sneedii* var. *leei*) is endemic (restricted) to Eddy County, NM, where it is only found within the Carlsbad Caverns National Park area of the Guadalupe Mountains. The cactus is named after geologist Willis T. Lee



who collected it in the 1920s while assessing the area for national park status. The species was listed as threatened by the US Fish and Wildlife Service on October 25, 1979. The cactus was originally listed because of the threat from road construction and illegal collecting. It typically only grows on top of limestone ridges between 4,000-5,000 feet elevation, often growing in cracks in the exposed bedrock. The plants are identified by their profusely branching stems (200 to 250 stems in some individuals) and their conspicuously hairy spines. While the species has a very restricted distribution in southeastern New Mexico, it can be locally common. Currently, the species doesn't appear to be threatened by illegal collecting (as commercially-grown specimens are readily available), but fires and climate change (including drought) could be a threat to the species' survival. In late April, Daniela Roth from New Mexico's Energy, Minerals, and Natural Resources Department (EMNRD) came

- ◀ Lee's pincushion cactus (*Escobaria sneedii* var. *leei*) is a tiny cactus endemic to the limestone hills of Carlsbad Caverns National Park. NPS Photo.
- ▶ Wildfires could be a threat to the survival of the Lee's pincushion cactus. Photo by C. Hoyt.

to the park to monitor the 60 plots that she established in the burned and unburned areas within the 2011 Loop Fire. Daniela's monitoring will document the recovery of the population and it may document how long it will take the population to recover full reproductive capacity. —ROD HORROCKS



## Exotic Plant Treatment Project Completed

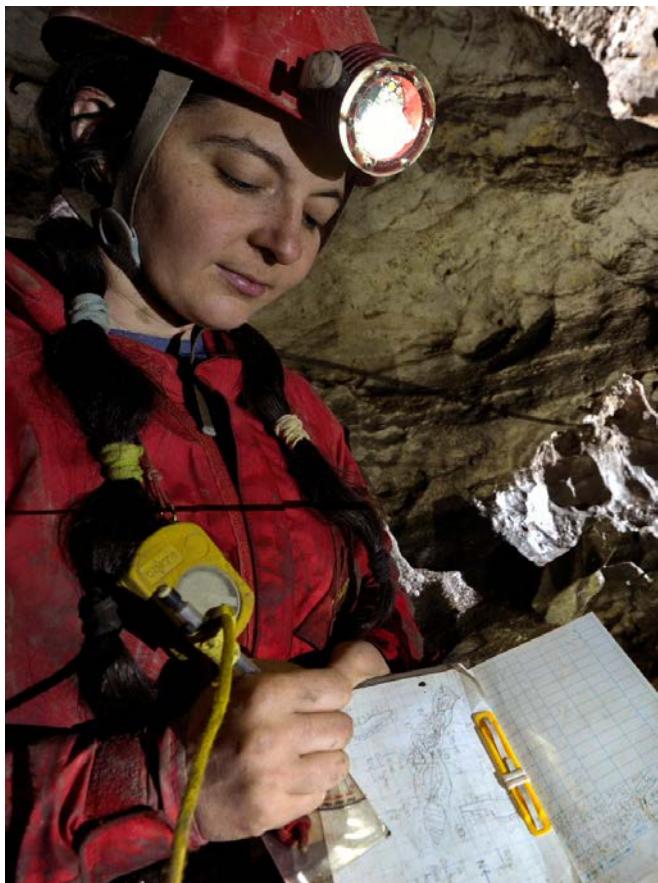
A 2011 to 2012 road improvement project impacted vegetation along the Walnut Canyon Desert Drive, the Visitor Center (VC), and the VC parking lots. The roadside along the Walnut Canyon Desert Drive and the VC parking lot islands were hydro-seeded with native genetically appropriate seed material. Following the seeding effort, several aggressive non-native species were identified in the project areas. Annually since 2013, a contractor has chemically treated the roadsides and VC parking lot islands to remove all non-native species. The final treatment occurred in 2017. The four most common species treated were:

Lehman Love grass (*Eragrostis lehmanniana*)  
Field Bindweed (*Convolvulus arvensis*)

Bermuda Grass (*Cynodon dactylon*)  
Malta starthistle (*Centaurea melitensis*)

—KEN STELLA, BIOLOGIST, DENVER SERVICE CENTER

# Staff News



## Erin Lynch Joins Resources Staff

Erin Lynch recently joined the Resources office as the Lead Physical Science Technician. Her specialties are cave cartography and data management, rigging, cave rescue, and GIS.

Erin started caving in the UK and can still occasionally be heard talking about “spanners” and “tackle sacks” when rigging. Prior to coming to Carlsbad, Erin spent 16 years in China. She worked at the Institute of Karst Geology in Guilin—a job that took her to karst World Heritage sites, National Geoparks, and show caves throughout southwest China. She also founded Hong Meigui Cave Exploration Society and led dozens of expeditions with cavers from around the world. Highlights include exploration of the 1,020m-deep Tianxing System, Miao Keng’s 500m vertical shaft,

two of the largest cave rooms in the world, and more than 400 km of passage. In 2015 she received the Lew Bicking Award from the National Speleological Society in recognition of her contributions to cave exploration.

Erin says that she is excited to be back in the U.S. and have the opportunity to be part of a world-class cave management team.

## Farewell and Best Wishes to Our Friend Luis Florez

The Resources Stewardship and Science Division is bidding a fond farewell to its biologist and compliance officer, Luis Florez. After thirty-seven years in federal service, Luis hung up his flat hat on March 31, 2017.

Luis first came to Carlsbad Caverns National Park in 2000 as the Chihuahuan Desert-Exotic Plant Management Team (CD-EPMT) coordinator. While based at Carlsbad, his team traveled to sixteen different parks in the Southwest to conduct treatments. Getting to visit those parks over the next two years was a special time in his career, he said.

After his time with the CD-EPMT, he went to the regional office as Director of the International Conservation Program. This job required him to travel to several border parks, where he met with folks on both sides of the border and enjoyed wonderfully scenic vistas. During his stint there, Luis remarked that he repeatedly thought, “Pinch me, I must be dreaming.” He was able to fund international projects ranging from bat and bear studies, to binational rock art documentation, to adobe structures restoration workshops.

Being from southeastern New Mexico originally, eventually he returned home and came to



▲ Luis Florez (left) accepts his NPS Arrowhead at his retirement party. Photo by R. Horrocks.

work again at Carlsbad Caverns National Park. His position as biologist and compliance officer enabled him to see this World Heritage Site up close. Luis mentioned the bat flights and darting swallows as particularly spectacular phenomena to study. He enjoyed spending many hours underground with fellow Resources staff, preparing for the new Cavern Lighting System, which protects the cave while showing off incredible formations. Luis also worked heavily on compliance for the Waterline Replacement project and supported that project in many ways. Now that the waterline is buried, it will be protected from the elements and will provide water to staff and visitors for hopefully the next 75 years. Finally, Luis reminds us of the special resource we have at Rattlesnake Springs. He loves its cultural resources as well as being a premiere migratory bird habitat.

When asked for any advice he can give to present and future employees, Luis offered this: "My

advice to folks just starting their career: Do something that you really, really enjoy doing or are good at. You will never have to worry about having the energy to go work every day. The pay will come with each year's experience and progress; just put in the time to learn, to share, and to volunteer. Leave the place just a little better than you found it. You will never regret it."

## Sam Denman Moves On

The Resources Stewardship and Science Division recently bid a fond farewell to its Museum Technician, Samuel Denman, who accepted a job at his dream park, Mesa Verde National Park. Sam first came to the park in 2008 as a law enforcement ranger. By 2010 his job duties changed and he became a museum technician. That job prepared him for his current job at Mesa Verde. The projects that Sam enjoyed the most while working here were guiding the archaeological technicians doing inventories of the Park's back country. Sam said he enjoyed his stay at Carlsbad Caverns National Park very much and especially enjoyed working with the great staff here.



▲ Monitoring rock art sites was one of Sam Denman's most enjoyable duties. Photo by C. Hoyt.

# Recent Publications

The following is a partial list of recently published articles that pertain to Carlsbad Caverns National Park.



Allen, C. 2017. A multi-proxy stalagmite reconstruction of the climate of southwestern North America from the Middle to Late Holocene. Thesis, Department of Earth and Planetary Sciences, University of New Mexico. [http://digitalrepository.unm.edu/eps\\_etds/188](http://digitalrepository.unm.edu/eps_etds/188).

Atwood, J.J. 2017. Notes on two species of *Frullania* subg. *Chonanthelia* (Frullaniaceae) from the southwestern United States. *Evansia* 34(3): 104–109.

Decker, D.D., V.J. Polyak, and Y. Asmerom. 2016. Depth and timing of calcite spar and “spar cave” genesis: Implications for landscape evolution studies. *Geological Society of America Special Papers*, 516: 103–111.

Decker, D.D., V.J. Polyak, Y. Asmerom, and M.S. Lachniet. 2017. U-Pb dating of cave spar: A new shallow crust landscape evolution tool. *Tectonics*, 36. <https://doi.org/10.1002/2017TC004675>.

DuChene, H.R., A.N. Palmer, M.V. Palmer, J.M. Queen, V.J. Polyak, D.D. Decker, C.A. Hill, M. Spilde, P.A. Burger, D.W. Kirkland, and P. Boston. 2017. Hypogene speleogenesis in the Guadalupe Mountains, New Mexico and Texas, USA. In: Klimchouk, A., N. Palmer A., De Waele, J., S. Auler A., Audra P. (eds) *Hypogene Karst Regions and Caves of the World*. Cave and Karst Systems of the World. Springer, Cham

Freeman, C.C. 2017. Nomenclatural novelties and notes in Penstemon (Plantaginaceae). *PhytoKeys* 80:33–39. <https://doi.org/10.3897/phytokeys.80.12962>.

Geluso, K.N., and T.L. Best. 2017. Selection of a remote maternity roost by fringed myotis (*Myotis thysanodes*) in Carlsbad Cavern, New Mexico. *The Southwestern Naturalist* 62(2):113–120.

Hamm, P.S., N.A. Caimi, D.E. Northup, E.W. Valdez, D.C. Buecher, C.A. Dunlap, D.P. Labeda, S. Lueschow, and A. Porras-Alfaro. 2017. Western bats as a reservoir of novel *Streptomyces* species with antifungal activity. *Applied and Environmental Microbiology* 83(5) e03057-16. <https://doi.org/10.1128/AEM.03057-16>.

- Jouves, J., S. Viseur, B. Arfib, C. Baudement, H. Camus, P. Collon, and Y. Guglielmi. 2017. Speleogenesis, geometry, and topology of caves: A quantitative study of 3D karst conduits. *Geomorphology*. 298:86–106.
- Kerans, C., C. Zahm, B. Garcia-Fresca, and P. Harris. 2017. Guadalupe Mountains, West Texas and New Mexico: Key Excursions. *AAPG Bulletin* 101(4):465–474.
- Kumar, H., S. Kumar, H. Ming Gan, M. Hua Tan, W. Wei Han Eng, H.A. Barton, A. O. Hudson, and M.A. Savka. 2017. Genomic characterization of eight *Ensifer* strains isolated from pristine cave and a whole genome phylogeny of *Ensifer* (*Sinorhizobium*). *Journal of Genomics* 5:12–15.
- Mali, I. 2017. Phase II: Demography of Western River Cooter (*Pseudemys gorzugi*) population within the Black River drainage. 2017 Interim Report. Submitted to Share with Wildlife Program, New Mexico Department of Game and Fish.
- Mali, I., and M.R.J. Forstner. 2017. Survey of Western River Cooter (*Pseudemys gorzugi*) in New Mexico within the Black River drainage. Final Report. Submitted to New Mexico Department of Game and Fish, 10 March 2017. [Bison-m.org/documents/48947\\_Mali2017\\_WesternRiverCooter.pdf](http://bison-m.org/documents/48947_Mali2017_WesternRiverCooter.pdf)
- Marino, E.B. 2017. Isolating lithologic controls on landscape morphology in the Guadalupe Mountains, New Mexico and Texas. Thesis, Department of Geological Sciences, University of Texas at Austin. <http://hdl.handle.net/2152/61568>.
- Medellin, R.A., R. Wiederholt, and L. Lopez-Hoffman. 2017. Conservation relevance of bat caves for biodiversity and ecosystem services. *Biological Conservation* 211(B):45–50.
- Muller, C.T., M.J. Moore, Z. Feder, H. Tiley, and R.E. Drenovsky. 2017. Phylogenetic patterns of foliar mineral nutrient accumulation among gypsophiles and their relatives in the Chihuahuan Desert. *American Journal of Botany*. 104(10):1442–1450.
- Pate, D.L., and R.C. Kerbo. 2017. Understanding and preserving caves and karst landscapes. *Earth Sciences History* 36(2):318–336.
- Polyak, V.J., Y. Asmerom, and M.S. Lachniet. 2017. Rapid speleothem  $\delta^{13}\text{C}$  change in southwestern North America coincident with Greenland stadial 20 and the Toba (Indonesia) supereruption. *Geology* 45(9):843–846.
- Powell, A.M., S.A. Powell, and Chris Jackson. 2017. Documented chromosome numbers 2017:1. Miscellaneous counts mostly from Western Texas (U.S.A.), one each from New Mexico (U.S.A.), and Mexico. *Journal of the Botanical Research Institute of Texas*. 11(1):143–146.
- Reynolds, J.W. 2017. Earthworms (Oligochaeta: Acanthodrilidae, Lumbricidae, and Sparganophilidae) in the Southwestern Tablelands Ecoregion (26), USA. *Megadrilogica* 21(11):225–230.
- Shear, W.A., and J.M. Reddell. 2017. Cave millipedes of the United States. XIV. Revalidation of the genus *Speorthus* Chamberlin, 1952 (Diplopoda, Polydesmida, Macrosternodesmidae), with a description of a new species from Texas and remarks on the families Polydesmidae and Macrosternodesmidae in North America. *Insecta Mundi* 0529:1–13.
- Winter, A.S., J.J.M. Hathaway, J.C. Kimble, D.C. Buecher, E.W. Valdez, A. Porras-Alfaro, J.M. Young, K.J.H. Read, and D.E. Northup. 2017. Skin and fur bacterial diversity and community structure on American southwestern bats: effects of habitat, geography, and bat traits. *PeerJ*: 5:33944. <https://doi.org/10.7717/peerj:3944>



▲ Western River Cooters (*Pseudemys gorzugi*) bask on a log during a warm winter day. Photo by C. Hoyt.



▲ Debbie Buecher weighs a bat during a study of microbiota on bats. Photo by K. Ingham, Science-In-Action Photography.

National Park Service  
U.S. Department of the Interior



Carlsbad Caverns National Park  
Resources Stewardship and Sciences Division  
3225 National Parks Hwy  
Carlsbad, NM 88220

EXPERIENCE YOUR AMERICA™