Derek Bristol being belayed by Aria Mildice on the Higher Education dome climb above the PhD Room. An article on this technically challenging ascent begins on page 23. Photo: James Hunter.
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The shelfstone lake beyond Lake Castrovalva in Lechuguilla Cave is one of the more exceptional locales in a cave known for exceptional things. Photo by Max Wisshak.

VIEW THE COVERSREAD as a single image. Click here.

CALENDAR

USA

November 20-22, 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@abcglobal.net for more information.
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., April 1 for the May issue).
Red Lakes (Dan Austin)

When someone hears the words ‘Lechuguilla Cave,’ the images that come to mind are of grandiose formations, borehole passage, and new discoveries. While there is no shortage of spectacular formations and booming passages, the breakthrough discoveries are happening with less and less frequency. To make big discoveries today, cavers need to look at the obscure, too-tight holes or the less accessible shadows in the ceiling; the leads that may have been forgotten over the decades. Such was the case when I entered Lechuguilla in May 2013 for my first multi-day camp trip. I had no idea that on this particular trip, I would find myself at one of those places that had been forgotten, and that it would be another three years before its true potential would be learned.

I was one of twelve team members on an 8-day expedition led by Derek Bristol, and eager to get involved. A new area of the cave called Oz had just been discovered the year before, at the top of the Kansas Twister: a 410-foot dome climb led by Derek and James Hunter. Many leads remained to be surveyed, and there was tremendous excitement to see what Oz would do.

The journey to Deep Seas Camp in the western branch of the cave consisted of much enthusiasm for the coming survey. After a night’s rest at camp, most of the expedition members traveled to Kansas Twister to begin the long ascent. I however, found myself in a different place entirely. The Red Lakes area needed resurveying, and I was given the task of inventory on a survey team with Stan Allison, Jason Ballensky, and Rene Ohms.

Located at the end of the Western Borehole, just before Oasis, Red Lakes was used for years by cavers as a water source for the now closed Far West Camp. Since Red Lakes was considered a “closed” area, the expedition had been granted special approval to conduct the resurvey. The old map of Red Lakes was less than interesting, and I had little hope for anything exciting that day. I was pleasantly surprised, however, to find that the Red Lakes area was heavily decorated, making for enjoyable survey and inventory.

Donning Aqua socks and clean cave gear, the four of us surveyed across pristine flowstone cascades and around shallow pools. Eventually, we found ourselves climbing a steep wall of flowstone to a heavily decorated series of rooms that were punctuated by a deep blue pool of water which hadn’t even been shown on the old map. Climbing around the pool, Stan and Jason reported that the passage ended in a formation choke, but that they could see walking passage beyond, and feel slight air movement.

After several more days of surveying, and a few eventful trips up to Oz with the rest of the team, I once again found myself back on the desert surface of New Mexico, hiking back to the vehicle from the cave entrance. Everyone was talking about Oz and the two miles we had surveyed over the course of the 8-day trip. But it wasn’t Oz that I was thinking about. It was that blowing lead in Red Lakes.

A Red Tide (Dan Austin)

After arriving back home in South Dakota, I began studying maps of the areas we had been to on the 2013 expedition. Much to my surprise, Red Lakes jutted south of the end of the Western Borehole, and there was nothing but blank space on the map beyond. The tantalizing wind that had been felt was coming from unknown cave—and even more exciting, because the airlock at the entrance of Lechuguilla prevents massive air during pressure changes, the fact that we felt air movement at all was significant. The fact that we felt it at the end of the cave was even more exciting. To me, the Red Lakes passage almost felt like a big borehole that had been plugged with formations in the middle, and the only way to get to the other side was to find our way over the top. I resolved to give it a try.

There was a problem, though. The lead at the end of Red Lakes was a formation choke, and it would require some delicate formation removal to get through. I wasn’t sure if the park was going to be too interested in making these modifications for the sake of exploration but decided to put in a proposal anyway.

I submitted proposals to work on the dig in 2014 and again in 2015. Both times the proposals were denied. Before I gave up entirely, I submitted one final time for 2016. Expecting another denial, I was quite surprised when the dig was approved. I immediately began making plans for a November expedition. Because we didn’t have enough objectives for a camp trip, I opted to go to the Red Lakes area and back to the entrance in a single day. I knew it would be a long, hard trip, but was determined to see where the dig went.

November 2016 approached rapidly, and our team solidified. Rene Ohms and Chris Pelczarski joined me in driving from South Dakota. We met up at the park some 15 hours later with three of our other participants: Jen Foote, Kelly Mathis, and Ellen Trautner, the new Physical Science Technician at Carlsbad Caverns National Park.

The following morning we got a later-than-anticipated start to the cave. It was cold and windy, and everyone was anxious to spend the day underground. Chris, an experienced Jewel caver, had never been to Lech before, and was amazed at the warmth
after entering the airlock. “It feels like Jewel Cave, only something’s wrong with it!” he exclaimed after just a few minutes. We continued into the cave at a steady pace, eventually arriving at the entrance to Red Lakes after about four hours. Here we changed into the necessary clean gear, to prevent damage to the multitude of formations in the area. We split into two teams, with Rene, Chris and Jen continuing the resurvey from where we had left off in 2013. I took Kelly and Ellen, and climbed back up the flowstone wall to the decorated room at the top where the dig was located.

The first challenge was figuring out an easy way to climb around the deep pool that Stan and Jason had skirted three years before. A wall of draperies, terminating in a thick shelfstone ledge only a few inches wide was the only option. We were forced to stuff our hands into the fluting of the draperies, and step gingerly across the narrow ledge to the other side of the pool. Here there was barely enough room for the three of us, and only one at a time could get to the dig face. I was encouraged, though, when Ellen took the first look and reported that she could almost make it through without any modification. In the end, though, we did remove two stalactites, which were the ends of a large drapery plugging the passage. This was necessary to make the two 90-degree bends into the tight spot and out the other side. Since Ellen was the smallest of us, we opted to let her go first and see what was on the other side.

Ellen was able to make the squeeze without too much difficulty and reported back that there was a room on the other side with leads to survey. After following her with the survey, we discovered that we had emerged from the tight spot into the bottom of a dry pool basin. There were multiple ways out of the room, but one very promising direction, to the southwest, up a large flowstone slope. It was as I’d hoped: a formation plug in a larger passage. At the top of the slope, we descended the other side to a room 114 feet in diameter, with a 40-foot ceiling. Even more astonishing were the formations. Several columns up to 6 feet in diameter and 40 feet tall dotted the room, along with a multitude of larger stalagnites and stalactites. A huge, mostly-dry pool basin with brilliant red coloration around the edge covered one entire section of the floor.

We gleefully surveyed into the huge room, and my brain subsequently overloaded on sketching formations. We called the room Rising Tides, after the recent national election and for the brilliant red shelfstone around the pool. Unfortunately, our excitement was short-lived. The room came to a screeching halt at a 70-foot tall flowstone cascade pouring from a tall dome at its far end. We had no climbing equipment with us, and we were almost out of time. The air had to be coming from somewhere, and I guessed that it was coming from passages at the top of the flowstone cascade. Kelly and I both analyzed the potential climb with differing opinions: Kelly thought the climb looked easy; with a nearby column to stem across to the wall, it would be a simple matter to make it to the top. But, he thought, the lead didn’t look all that great and he wasn’t encouraged. I thought that the lead looked good, but that the climb looked difficult, especially at the lip where the nearby column couldn’t be used to stem across, and the flowstone became steep. It was difficult to see what happened above this point.

Disappointed that the new passage had ended for us, but relieved that we had made such a phenomenal discovery, we met up with the other team and began making our way back out. While we had been busy with Red Tides, the other team had surveyed in well-decorated passage down to a pool with a beautiful golden calcite deposit coating white formations. They called it Goldmember Pool, and left a going lead on the far side to return to.

We emerged from Lechuguilla around 5 am, after being in the cave for 18 hours. As we hiked back to the car, the sun was just starting to peek over the horizon. It had been an epic day, and the sunrise was a perfect way to end it.

After plotting up our survey, we were astonished to see Red Tides sticking out quite some distance from the main trend of the Western Borehole. I kept thinking back to the climbing lead at the end. The air had to be going there. There was nowhere else for it to go. That was the way forward, to unknown territory. And it wouldn’t be long before we found out what was at the top.

**Rising Tides (Derek Bristol)**

It was thrilling to hear of the new discoveries beyond Red Lakes, and that a potential climbing lead at the far end was left to be explored, but this news came late in the expedition planning process for 2017. Proposals were due by December 1 for exploration trips the following calendar year, and the new handful of leads in Red Lakes and Red Tides were added to other existing objectives in Oz and the Far West, but they were initially a low priority, and several members of the Red Tides discovery team had indicated they probably couldn’t afford the time off to make the trip. The proposal, for a team of 10 working out of the Deep Seas Camp, was approved in early January. The expedition was scheduled for late February of 2017 and there was heavy emphasis on technical climbs spread across very different areas of the cave. James Hunter and I would do most of the lead climbing, but we were supported by many other cavers with significant climbing experience. Just prior to going into the cave we decided to change the priority of some of these climbing leads. As a general strategy on week-long expeditions, many groups try to visit especially clean or decorated areas early in the week when their clothes, packs and other gear are cleaner. The Red Tides climbing lead was moved up from Day 5 to Day 2 of the expedition. We would go there first and use it as a warm-up for some of the bigger and more technically challenging climbing leads in Oz. This decision would eventually derail our plans for the entire week, but we would be glad to have this distraction.

After spending a day of travel to reach the Deep Seas camp, I headed out to Red Lakes with Kevin Manley, Ian Chechet and Ellen Whittle, where we found the route back up to Red Tides by going through the tight squeeze that Dan later called Jellyfish Bones. Ian and Ellen went to survey a few tight crawls in the area while Kevin and I geared up for the climb. The climb fit the description and expectation set by both Dan and Kelly. The first 40 feet was easy free-climbing between a large column and the main wall of flowstone, but the final 20 feet required moving onto an overhanging flowstone bulge and placing a series of bat hooks in shallow hand-drilled holes - a difficult and strenuous series of direct-aid placements. The final 10 feet went up a low-angle flowstone slope to level ground where there was an excellent natural anchor. As I was making my way up the initial chimney moves and eventually transitioned to etriers, it struck me how unique it was to be doing a technical climb up flowstone in full clean gear, including Five-Fingers on my feet. As with many of the technical climbs we do in Lechuguilla Cave, virtually no trace of the climb was left after completing it: Cams, nuts and hooks were all removed. We decided to call it Rising Tides to continue the naming theme for the area and to describe the vertical nature.

Ian and Ellen joined us as we surveyed the horizontal passage that continued southwest from the top of the climb. The passage continued to be lined with draperies and the floor covered with flowstone, but we soon reached a very dirty corrosion residue-covered free-climb that had to be passed to reach a small passage continuing beyond. We had left all our dirty caving gear back at the entry to the Red Lakes area, which was a considerable distance below us now, so we surveyed a short side passage before returning to camp.

The following day we returned to the dirty lead at the top of Rising Tides but this time we carried all our dirty caving gear with us. At the top of the short free-
Photos, clockwise from top left:
1. Rising Tides (Dan Austin photo).
2. Red Lakes (Dan Austin photo).
3. Chris Pelczarski on rope in a climb south of Zion (Dan Austin photo).
4. Rising Tides (Jean Krejca photo).
Lechuguilla Cave
Zion

Surveyed from 2013-2019 by: Dan Austin, Rene Ohms, Kelly Mathis, Chris Pelczarski, Derek Bristol, Kevin Manley, Ian Chechet, Ellen Whittle, Pete Johnson, Jean Krejca, James Hunter, Beth Cortright, Stan Allison, Jason Ballensky, Garrett Jorgensen, Ellen Trautner, Jen Foote, Blase Lasala, Hazel Barton, Aria Midice, Adam Weaver

Cartography by Derek Bristol, 2020
climb a flowstone floor forced us back into clean gear and we pushed on into a narrow fissure. Due to how delicate and confined the passage was, we sent Ian ahead of the survey team to scout the route and rig any vertical obstacles. Within just a few hundred feet he was stopped by a formation choke, but a small black hole was evident in the floor of the fissure. He worked on rigging this and then checked with the rest of the team before rappelling through the hole and over a flowstone bulge where things really opened up.

Zion (Derek Bristol)

Ian hooted and screamed something incoherent about a huge room and borehole disappearing in the distance. He was soon on the bottom and the rope was free. We had to restrain ourselves from acting on the urge to follow Ian without surveying to see what all the yelling was about. We controlled our emotions and continued to set stations and take measurements as one-by-one we descended the rope to reach a small flowstone-covered pedestal that was perched against the side of a massive slope with another 60 feet of exposure below us. Ian’s excitement was not misplaced. Surrounding us were giant drapery-covered columns 60 to 80 feet high in a room that is well over 100 feet wide, and looking to the south our lights could not see the end of a giant passage that continued up the slope for several hundred feet. Looking back up at our rope, it dropped through an inconspicuous 2-foot diameter hole in the ceiling between giant draperies and dropped us into the middle of a massive flowstone-covered room. The pedestal we were standing on would later be named Angel’s Landing and it appeared that the only way on was to continue rappelling further down the flowstone.

After a bout of celebration that included lots of yelling to hear our echoes, and many high-fives, we decided that we needed to find a wall in order to anchor the survey and give some foundation to the sketch. Ian rigged a belay to a huge stalagmite and continued rappelling towards the bottom of the room. We did eventually reach a wall on the north side of the room and started a perimeter survey that circled clockwise and back to the south. The passage steadily gained elevation, though nothing was so steep that it required technical climbing or rigging, which was fortunate since we had exhausted all our rope. After several hundred feet of survey we reached a high point that is a sort of saddle, much like a mountain pass, with a massive wall of flowstone on our left that cascades from a ceiling that is too high to see. We shot the Disto into this and got readings of around 200 feet. But even more amazing was the huge borehole passage continuing down a steep slope ahead of us to the south. More giant columns soared above us and the passage got even bigger with a width of about 150 feet. We surveyed down the slope in front of us in a direction that was clearly heading away from known cave. We had to navigate several very steep climbs down breakdown that were covered with aragonite, and eventually we reached the edge of the clean flowstone where the floor transitioned to corrosion residue (Lechuguilla Cave’s version of mud). It was growing late, and we decided to end the survey here in passage that was more than 100 feet wide and 80 feet high.

We returned to the rope at Angel’s Landing and took turns climbing out of the huge room. I am not usually very expressive, and I try to suppress my emotions, but I was overwhelmed with excitement and pride over this discovery. All of this erupted when I offered Ian a fist bump as we started the long trip back to camp. He reciprocated, and it was obvious he fully understood the significance of this gesture. We had done well.

We excitedly told the rest of the team back at Deep Seas camp about what we had found, and made plans to take everyone out to the new area the next day to continue the exploration and survey. We discussed possible names and I suggested “Zion”. Zion can mean a “high point”, or the “promised land”, and the area had soaring red walls that were somewhat reminiscent of those found in Utah’s Zion National Park. There was a consensus that this should be the name.

Space Shot (Derek Bristol)

Teams made several return trips to Zion during the remaining days of the expedition. We explored the main borehole passage, which ended very abruptly as the ceiling dropped to nearly meet the floor and form a 2-foot high crawl with a mix of flowstone and corrosion residue that was not pushed. The most interesting lead was the 200+ foot high dome above the high point of the main room. We had already climbed about 300 vertical feet above the elevation of the Western Borehole, and the Disto told us there was much more elevation to be gained. Since James Hunter and I were both present, and we had a 250-foot static rope and aid climbing gear, we decided to tackle this formidable climb. We managed the climb over three days with James leading the first long pitch up to a perch under a spectacular display of flowstone curtains. I led the next couple of pitches that included one of the most perverse sections of climbing I’ve ever encountered. To get past the steeply overhanging section of curtains demanded doing a chimney traverse where my feet were against the flowstone wall and my back was pressed against thick draperies with nothing but 100 feet of exposure underneath. The draperies were thick enough to support the counter-pressure from chimneying, and cans were placed between folds in the draperies for protection. James led the final pitch of climbing, which led to a spectacularly decorated room with helictites and shields, though the room was blind. The climbing route was about 400-feet long and measured to be 260 vertical feet above the floor of Zion.

The expedition added over 6,000 feet of new survey to Lechuguilla Cave and made for one of the most significant new discoveries in many years.

Epilogue (Dan Austin and Derek Bristol)

Most of the Red Tides discovery team from 2016 and the Zion discovery team from 2017 returned to the west branch of Lechuguilla Cave in 2019 to continue project work in various areas in the Far West, including Zion. Several technical climbs were made that reached passages that eventually ended. The small lead at the very southern tip of Zion continued through a mix of dirty and clean zones and opened back up into large passage that branched but each lead eventually ended. About half a mile of additional survey was added to this area. Zion appears to be shutting down on us, though there are 4-5 difficult leads remaining. In hypogenic caves like Lechuguilla all it takes is one obscure miserable hole to make the next major discovery. We will be returning soon to find that elusive lead.
Photos, clockwise from top left:

1. The team in 2019: Aria Mildice, Hazel Barton, Kevin Manley, Derek Bristol, Pete Johnson, Chris Pelczarski, Adam Weaver, Dan Austin and Garrett Jorgensen (Dan Austin photo).
2. Angels Landing (James Hunter photo).
3. Zion (James Hunter photo).
4. Zion (James Hunter photo).
5. Zion (Jean Krejca photo).
Years after the initial and quite ecstatic wave of major discoveries in Lechuguilla Cave, exploration has slowed down and given way to a consolidation phase. That is, only a few meticulously planned expeditions with international teams of expert cavers are allowed entry, with a focus on high-end cartography combined with thorough mop-up of known areas. This process leads to a steady increase in survey, by now comprising around 40,000 survey stations, including more than 3,000 loops, and supporting just over 150 miles of mapped passage at 1,614 feet total depth of the labyrinthine system. Major breakthroughs, however, became a rare event. They are nevertheless achieved, by two quite contrasting strategies of exploration, either by tackling technically demanding climbs (the discovery of Oz at the top of the 535-foot dome climb Kansas Twister is the prime example), or by thorough compilation and assessment of survey notes identifying areas that demand re-survey and leads to be (re-)checked, in a quest to produce detailed area maps. The present article gives an example of a combination of the two strategies and showcases a significant breakthrough into an area now dubbed Neuland, from the perspective of one of the protagonists of that discovery, Colorado caver Derek Bristol:

My first expedition to Lechuguilla Cave, in late 2011, was an eight-day camping trip in the West branch, where a team of seven pushed mostly small mop-up leads in the very farthest areas of that branch. A small breakthrough was made in a well decorated borehole named Promised Land by pushing small holes in breakdown in an area where no leads had been indicated by prior survey teams. This led to a walking-sized passage that extended off the edge of the known cave but ended abruptly after only a few hundred feet. Nevertheless, this experience helped solidify the notion that in three-dimensional hypogene caves like Lechuguilla, it’s important to push every lead, and look under every rock in order to find the next major discovery.

Over the following several years I have been fortunate to be involved in several expeditions to the West and East branches of the cave where some of the most important discoveries in recent years have been made. In December, 2013 I joined a West branch expedition led by the legendary Peter Bosted, who has surveyed more and spent more time in Lechuguilla Cave than anyone (50 expeditions in total!). It was during this expedition that I first met and had the pleasure of working with Max Wisshak. Max is one of the best cave photographers in the world, and has been actively involved in Lechuguilla Cave exploration as the cartographer for several map sheets in the West and South branches. During Peter’s expedition the team spent several days working on leads and other cartographic objectives for Max in the Southern Climes area in the Far West. During the trip Max mentioned that he and another Lechuguilla cartographer, Hazel Barton, were intending to submit a joint proposal to work in the South branch of Lechuguilla in 2014, in order to continue their resurvey and mop-up campaign of the Lebarge and Voids areas. These proposals must be submitted by the end of the calendar year for work the following year, so soon after the end of Peter’s expedition I emailed both Max and Hazel to lobby for a spot on their roster. Unfortunately, I was too late, and they had already identified a team, but I emphasized that I would be available on short notice if circumstances changed and they found themselves in need of an alternate.

Lechuguilla Cave is notorious for its restricted access and less than a handful of permitted expeditions a year. It is also perhaps the most desirable cave destination for many cavers. This creates a situation where a lot of cavers who wish to visit the cave do not have the opportunity. To complicate matters, it is one of the world’s longest caves, and the longest with a single entrance, it is extremely warm, it requires a higher level of vertical expertise than most US caves, and the delicate and unique resources require a heightened level of concern for conservation and following rules designed to protect

Derek and Beth presenting an old flag saying “No leads ahead and above!!!” after returning from the breakthrough squeeze just a few tens of feet behind (photo: James Hunter).

Derek worming his way up the tight breakthrough squeeze (photo: James Hunter).

Pristine tunnel covered in gypsum snow in Quiet Crisis in the upper level of Neuland (photo: Max Wisshak).
the cave and keep cavers safe. The need for cavers who can handle the heat, deal with vertical challenges, carry a heavy pack, travel safely with minimum impact, survey efficiently and in top quality, and navigate the complex maze of passages to locate project objectives, tends to favor teams with previous experience in Lechuguilla Cave. This gives the appearance of favoritism since a relatively small number of cavers get repeated opportunities to visit the cave; however, team selection is a decision that is left to the private groups who submit proposals, and teams made up of more experienced and proven team members are more likely to be approved by the Carlsbad Caverns National Park Cave Resources Office (CRO), who follow a set of pre-defined quality criteria for ranking the submitted proposals. So the truth is that access to the cave is partly merit based, and partly a matter of knowing the right people.

In the summer of 2014, after Max and Hazel's proposal had been successful, I decided to send another email just to remind them of my willingness and ability to fill any unexpected voids in the roster. Sometimes in life getting the things you want requires finding a balance between waiting for the phone to ring and being an annoying pest. This is probably true for most things including finding a mate and career advancement, but I have had an unfair amount of success by bothering people about interesting caving projects. Initially Hazel thought she might need to back out due to a foot injury, but in the end she recovered and Max in turn ended up bowing out due to an unresolved medical issue of significant pain in his heel. I certainly had mixed feelings. I was glad to have an opportunity to join the trip, but felt terrible for Max regarding the circumstances. Four days after getting the call I was rappelling down the entrance pit with Beth Cortright and James Hunter on our way to Big Sky Camp in the South branch.

The Big Sky Camp is relatively small and our international team of seven included Artur Hofmann, Rainer Straub, Phil Cunningham, Hazel, Beth, James, and me. Max sent along detailed objectives with working maps that made it very easy to understand what needed to be done on
one of his map areas near Lake Lebarge, which is at the very beginning of the South branch. This area was originally discovered and explored in 1987, just a year after the entrance dig broke through. On the second day of the expedition we elected to work on one of Max’s objectives—a resurvey of a passage above Lake Lebarge that had been explored in 1988. There were no leads indicated from the quite poor original survey notes that lacked detail and had not been drawn to scale. Its location along the west edge of the South branch, and the fact that it had been explored during the early days, when open leads were commonplace, suggested to Max that there was some potential for missed leads. In addition, air flow had been reported from that passage and the location along a major tectonic lineament led Max to sense the chance for a breakout in this area. Accessing the area requires climbing a nearly vertical fissure for 80 feet using delicate aragonite and popcorn knobs for hand and foot holds. At the top is a wide inclined area with several intersecting pancake fissures. A tie-in station for starting our resurvey was quickly located and we set about the job of finishing off the first objective on Max’s list. Within a few stations we entered a narrow but tall room where the map indicated a low and high route. Both branches were originally surveyed to terminations within about 10 stations. A long strip of vinyl flagging tape was draped across a breakdown block with the message “NO GOING LEADS ABOVE OR AHEAD!!!”. We joked about how such prophecies are often proven to be wrong, but we had no idea at that point in time exactly how wrong! James, on point, elected to finish the survey of the lower level since the upper level required a difficult climb and had not been permanently rigged. As we progressed, the walking sized passage became narrower and fragmented until we found ourselves in passage that alternated between hands-and-knees crawling and belly crawling. The walls through the final few survey stations were lined with a 4-inch thick layer of gypsum. James crawled to the very end and verified that there was no continuation. As I was finishing up the sketch, James worked his way back to the previous station, where Beth was catching up on resource inventory. The second-to-last survey station was at a slight bend in the crawl and James spotted a narrow crack in the north wall that was only evident when he returned. He stuck his head through and saw a narrow vertical fissure ascending a slope at 45 degrees that only widened slightly. The opening was only about 8 inches wide and 20 inches high, but James felt airflow. James squirmed through the narrow opening and struggled up the steep and slick slope beyond. After only 25 feet he reached an intersection and was able to stand in large passage going both west and east with dimensions that quickly increased to about 15 feet high by 10 feet wide. We surveyed on through the crack into this larger passage and found that the west branch went a very short distance before dropping down a 20-foot pit that would require rope to descend. Without rope there was nothing more we could explore in this new section, so we returned to the resurvey area and mopped up a few more objectives before returning to camp.

Fortunately previous expeditions had left nearly 600 feet of rope cached at Big Sky Camp, and we would end up using most of this as the exploration progressed throughout the week. The next day James, Beth, Phil and I returned to the short pit lead and James...
rigged to some large but soft gypsum blocks. We hadn’t brought a bolt kit into the cave so we had to rely entirely on natural anchors for rigging. Once he had descended we could hear exclamations and echoes that indicated big passage below. We surveyed down the drop until we all rejoined at a short down-climb where the floor dropped away and the ceiling soared above. We were staring into a giant descending borehole with no end in sight! The passage here was at least 60 feet high by 30 feet wide. Another vertical pitch was rigged to gypsum blocks and James descended 60 feet to a silt-floored room with another pit at its far side. The next pit was rigged to an erosional pocket in the floor that allowed webbing to be threaded through. An exposed traverse was necessary to reach this anchor, and the last piece of rope was lowered down and over the edge of a 30-foot diameter vertical shaft, allowing us to descend. This series of pits has walls and floors that are coated with thick layers of gypsum that is visually reminiscent of glacial ice. Additionally, Lake Lebarge is named after a location in the Yukon Territory of Canada. This was the inspiration for the borrowing of names from landmarks in the Canadian Rockies. This first pit series was borrowing of names from landmarks in the Canada. This was the inspiration for the after a location in the Yukon Territory of gypsum that is visually reminiscent of glacial and floors that are coated with thick layers of

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was another 15 feet up a loose and exposed free climb. The first move was tricky and committing, but the rest of the climb was straightforward. Near the top is a perfect natural anchor and the static rope was fixed for the rest of the team to ascend. I climbed up one more short and awkward move to a corrosion-residue lined crawlway. I scouted ahead about 60 feet where the crawl opens into a 15-foot diameter passage heading west with side leads going off in multiple directions. This appeared to be exactly what Hazel wanted us to leave as a reward for all of Max’s hard work and the climb was consequently dubbed Diplomacy Dome. At the prime lead, we left a message written on flagging for Max to find later.

Meanwhile, on the gypsum glacier of the Columbia Icefield, the other team surveyed through large trunk passage with a floor that is littered with gypsum blocks. After just a few shots they came around a corner to see a slope heading up into a massive black void. Along the walls of the passage were well developed and slightly orange gypsum chandeliers that are maybe the best examples outside of the Chandelier Graveyard and Chandelier Ballroom. This passage was thus named the Chandelier Wallroom. The climbing team rejoined Hazel’s survey team just as they entered the enormous room above the chandeliers. This room is more than 150 feet long and over 100 feet wide. At first it appeared to be a major intersection with passages heading off in every direction, but after methodically surveying, every one of these “passages” ended as an alcove with just a few shots. At the far side of the room is a monster dome that is 30 feet in diameter and appeared to twist up and out of sight at a height of over 200 feet. This dome would later be named Polar Circus after the famous ice climb in the Canadian Rockies.

We were not equipped to even begin such a daunting climb, but James and I scouted it...
and discussed plans for a return trip. Some effort was spent pushing short side passages throughout Neuland, but nothing went more than a few stations before ending. Besides the good lead at the top of Diplomacy Dome that was being held for Max’s return, and several interesting technical climbing leads, the area was completed with close to 3000 feet of new survey in the book. Plotting of the data showed that the large lead at the top of Diplomacy Dome was less than 100 feet from the upper reaches of Polar Circus, and there was optimism that first exploring this area might circumvent the need for a long and potentially dangerous aid climb. Artur and Rainer took some time to capture high quality photographs of these new discoveries, but additional survey and exploration would have to wait for the next expedition.

Max was very excited to learn of the new discoveries after we exited the cave—even though the news for sure induced some ambivalence between feeling happy for us and being angry with his heel that had spoiled that first-hand discovery experience for him. Further ambivalence arose from the fact that by that time he had already worked out a 2015 expedition proposal, and assembled a team, to continue mopping up South Winds and Southern Climes, but was now facing the desire and potential to continue exploring Neuland! After fruitful discussion with Stan Allison at the CRO, the plan was made to propose bringing a team of nine instead of seven cavers (now including the entire Neuland breakthrough team) that would be based out of the Deep Seas Camp in the West branch, so that objectives in Southern Climes and Deep Seas could be combined with a couple of trips to Neuland. This meant, however, that teams visiting Neuland would have to ascend back up the Great White Way to EF Junction and descend to the South branch in order to work in this area. Fortunately the Deep Seas Camp isn’t very far out the West branch of the cave, and this trip turned out to take less than two hours of one-way travel with a day pack, a trip that is possibly shorter and easier than getting to Southern Climes. In addition to the climbing leads in Neuland, Max had several technical climbing leads in Southern Climes, so a dynamic rope, additional static rope, an aid climbing rack, and bolt kit were all brought along. By the end of the expedition this gear would be used to complete an impressive number of 11 technical climbing leads.

Luckily, Max’s proposal was approved for 2015, with a team including Tim Williams, Andy Armstrong, Thomas Schneider, John Lyles, Garrett Jorgensen, James, Beth, Max, and me. Our first objective in Neuland was the 15-foot diameter lead heading away from known cave at the top of Diplomacy Dome. James took point while I read instruments and Max sketched. The passage got even bigger and went up a couple of free-climbable pitches for a couple of hundred meters before intersecting a large room that is about 60 feet in diameter and 30 feet high. Unfortunately, as often happens in hypogene caves, the cave suddenly ends here in a room that was dubbed Quiet Crisis. A good side passage was surveyed until we heard the team of Beth, Garrett and Tim arriving to help with the survey. We divided up the remaining leads and spent the rest of the day surveying dead-ends and loops back to previously surveyed passage. By the end of the day everything above Diplomacy Dome had been completed with no connection to Polar Circus in sight. We returned to camp with a lot of survey in the book, but disappointed at having killed another area, and increasingly nervous about the prospect of needing to climb Polar Circus the hard way.

James, Andy, and I returned to Neuland the next day with the goal of climbing some of the shorter and easier climbs in the Icefields Parkway and Chandelier Wallroom passages. We were a little too successful in that all of these climbs were accomplished relatively quickly and they either led to terminal constrictions or looped back into known passage through other climbing leads. By mid-day we found ourselves staring up the steep blank wall at the base of Polar Circus. James and I had
been swapping climbing leads and it was my turn. I didn’t mind because the first pitch of 15 m followed a corner that had some features and became low angle near the top. The second pitch however, was quite forbidding with a series of overhanging roofs up blank limestone. Much of the wall on the second pitch was covered with thick beds of gypsum that could not be safely climbed, which forced one to follow the steeper and more featureless section of the face. By my calculations this would be James’ lead, and I was more than happy to be in the role of the belayer. I started up the first pitch and found a few good natural placements before reaching an insecure stretch that meant a potential ground-fall if something were to go wrong. I decided to place a short 3/8-inch bolt here. All bolts placed in Lechuguilla Cave must follow the guidelines in the management plan, which requires that they be stainless steel, and that they be hand drilled. Tim would tell us later that he could hear the tap-tap-tap-tap rhythm as the hole was being drilled, and it sounded as though we were just around the corner from him, even though he was two hours travel away. It’s amazing how efficiently the sound of hammer blows can travel through bedrock. After placing

the bolt it was possible to begin free climbing up a corner that was mostly composed of poorly consolidated gypsum. I joked later that my strategy was to maintain a body position that placed exactly 25% of my weight on each limb in order to minimize the potential for breaking holds. Soon the angle lessened and I climbed up to a wide and relatively flat gypsum ledge where a good natural anchor was used to rig the rope. We scouted the next pitch and then headed for camp.

The following morning, James was sent to work on objectives in the West branch and left me as the sole climber returning to Polar Circus, which meant that I would need to tackle the dreaded second pitch if we were going to make progress. I received a delay from Thomas as I started up in full direct-aid mode. The pitch required meandering back and forth to find features and rock quality suitable for supporting body weight. A mix of hand-drilled wedge bolts, Tricams, natural threads, and several bat hook placements were required. A bat hook, for those unfamiliar, is the smallest hook in the quiver, and is generally placed into a shallow 1/4-inch diameter hole. It can support little more than body weight, but only as long as you pull straight down. Any outward pull will dislodge it from the wall. One hook placement failed in this manner while trying to step up in airders, but fortunately there was a good cam just a few feet below that, which along with an attentive belay, caught the fall. The climbing was slow and strenuous, but the final roof was crossed and a wide and deep ledge was reached at the 100-foot level where a good natural anchor was located. The next 60 feet were easy free-climbing and I soloed up to find a final 20-foot exposed section that would require a belay to reach the top of the dome, and what appeared to be horizontal passage above. We decided to call it a day with almost certain success expected for the next day.

The next morning James free-climbed the final pitch to find deep and slick corro-

sion residue and what we had thought was a nice-looking horizontal passage ended almost immediately. An alcove was pushed, but no continuing passage could be seen at any level of the dome. We were satisfied and relieved to have completed the climb, but obviously disappointed that it didn’t provide access to the next big breakthrough. We surveyed back down as we descended and left a rope rigged in case researchers might want to return. At the base we rejoined with Max and Beth who had worked on further photo documentation of the area. The last few short climbing leads in Neuland were climbed but no going passage was discovered. By the end of the expedition all potential leads were eliminated and the area is now considered to be completed.

While the Neuland area is now fully explored, it was a fantastic and unexpected discovery while it lasted. There are certainly many more such discoveries waiting for future teams of explorers. The small hole that James pushed that led to this discovery might be viewed by some as luck or by others as the well-deserved reward for a skilled team of cavers with relentless curiosity and drive. I see it as the result of a culture that has developed amongst those now exploring and surveying Lechuguilla Cave, where tedious resurvey and lead double-checks are on the agenda, and where no potential lead is disregarded no matter how tight, miserable, remote, or technically challenging!

(This article is an updated version of the feature article Neuland published in DESCENT magazine 251 in 2016. This and other back issues of DESCENT can be ordered at www.wildplaces.co.uk)
Twenty-five Years Mapping the Mazes of Lechuguilla Cave

Hazel A. Barton

The first cave I ever surveyed was a 2,000-foot long talus cave in Colorado. I found project caving to be a lot of fun—it was a big motivation to go caving, despite the cold and wet and scary climbs, and also spend quality time with many of my favorite people. When I entered the map in the NSS Cartography Salon in 1995, I won a merit award and my hero, Pat Kambesis, came up to congratulate me. The experience firmly cemented my desire to map more caves. I followed up my first map with a series of increasingly difficult projects, and went on to win a fistful of ribbons at other NSS Conventions. Eventually I would win the “best in show” medal—twice—and went on to chair the Salon, instigating a number of changes to the way maps are judged. In addition to awards, mapping caves produced plenty of in-cave encouragement; meticulously pushing every lead often yielded new discoveries, sometimes dramatically extending the length of what were previously considered fully explored caves. Despite a time-consuming academic career, I still continue to do cave cartography on a regular basis. Yet I’ve only produced a handful of maps in the last 20 years, primarily because I have one project that consumes almost all my time—mapping the deep, complex mazes of Lechuguilla Cave.

As a novice caver in the UK during the 1980s, I was aware of Lechuguilla Cave (Lech). Even after I’d moved to Colorado in 1993, I never imagined I’d actually have the opportunity to see it. My first interaction with the cave was in 1995, in the living room of Steve Reames, one of the co-authors of Deep Secrets: The Discovery and Exploration of Lechuguilla Cave. Steve and I were good friends and he knew that with all the positive feedback I’d had for my cartography, I was looking for increasingly difficult challenges. It was Steve who suggested that I take on the Chandelier Graveyard Quadrangle.

In 1995, Lech was rapidly approaching 80 miles in length. The map of the cave was already too long to fit on a single piece of paper, and had been divided up into 26 different quadrangles, each at 36” x 24” (the average size of architectural size D paper, which could be copied in a large format photocopier), and at a scale of 1” = 50’, each of these quads covered an area of the cave 1,500’ x 1,000’. The Chandelier Graveyard (Graveyard for short) is in the western branch of the cave and named after the enormous gypsum chandeliers littering the floor in this area. It had been discovered in 1988 (see Higher Education article) and contained over 10 miles of surveyed passage stacked into a vertical maze, approximately 1,000 feet wide and extending over 800 vertical feet. When I saw the Lech line plot for the first time, I thought “Wow, that looks difficult. This will be great.” I didn’t think it would be easy, but I also didn’t think I’d still be working on the same map twenty-five years later.

The Chandelier Graveyard

The ceremony to anoint me as a Lech cartographer took place in Steve’s living room in Colorado Springs and involved him plopping the foot high stack of Graveyard survey notes into my arms. I also took possession of the Lech data file on a 3.5” floppy disk. There was no cloud, no file-transferring email, and the internet still involved a lot of digital screeching over phone lines. If you wanted the data, it had to be entered into Compass at Carlsbad Caverns, and make its way to you, file by shared file, disk to copied disk. It was not unusual to receive the Lech data a year after an expedition had taken place. While that may feel Medieval by today’s digital expectations, it was nothing compared to the issues I had with the survey notes. Even by 1995 standards, these survey notes were questionable. A lot of the sketches dated back to the 1980s before specific data and sketching standards had been adopted (today, the Lech surveying standards are some of the most stringent in the world). Of the notes I was given, some lacked back sights or had questionable (tape-bending and extending) 104 foot shots. Many contained barely readable, photocopy-of-a-photocopy-of-a-photocopy sketches, while others had no sketch at all (apparently someone had forgotten to tell the Swiss that sketching was a standard expectation). Nonetheless, I was ecstatic. I had been asked to become one of the cartographers of this remarkable cave and I clutched this treasure trove of data to my heart.

That evening I drove back home to Denver, stopping off at an office products store to buy a cardboard banker’s box and a colorful display of hanging files to organize the sketches. At home I excitedly sat down and sorted through everything, ordering them based on quality: good, OK, poor, and ‘needs a complete re-do’. The re-do folder was the thickest and ultimately over 40% of those original notes would be resurveyed/sketched to create the current map. The bankers box went on to travel more than 5,000 miles with me, through five different jobs in five different states, from being a lowly PhD student to becoming a PhD program director. I was still dragging that box of notes around in 2018 when Ron Miller took on the momentous task of systematically moving electronic copies of all of the Lech survey notes into shared Cloud storage, allowing them to be remotely accessed. In 2019, when it became apparent that I no longer needed hard copies of the notes, with much separation anxiety I unceremoniously dropped that box into the recycling bin and slammed the lid.

When trying to describe the Graveyard maze to people, I tell them to imagine...
Lechuguilla Cave 150 Mile Line Plot
The location of Higher Education, Never Never Land, Neuland, Oz, Zion and the Graveyard and Voids mazes are shown.

To view the complete map, use View > Page display > Two-Page View

Development of the Voids map

2008. The initial line plot for the Voids, which has been sliced vertically with some anticipated upper and lower boundaries for a level in this area. 2014 from above, how much of the original line plot has been removed in the initial map of this area. 2015. The skeleton map marked-up after a trip into the cave. Following an expedition, enough re-survey has been carried out, allowing additional passages to be added, including pulling up a survey from below, highlighted in blue. 2018. A complex connection has been mapped after a visit during an expedition (in red), with a field-check indicated. Additional surveys work on future expeditions. As the level is nearly finished, a shadow indicating the relative position of the next level below is added (in light gray).
The initial line plot for the Voids, which has been sliced vertically with some anticipated upper and lower passages. The first skeleton map of a section of maze just above lake Castrovalva in the Voids, annotated based on the survey notes, with some leads already marked. Its obvious how much of the original line plot has been removed in the initial map of this area.

2015. The skeleton map has been pushed to an end, while the map has been marked up with the issues that need to be fixed on the next expedition. The marked leads have been pushed to an end, while the map has been marked up with the issues that need to be fixed on the next expedition. 2018. Following an expedition, enough re-survey has been carried out, allowing additional passages to be added, including pulling from below, highlighted in blue. 2019. After another expedition, part of the map has been dropped down to a lower level (the missing passage is highlighted in yellow). The lower level initially included in 2018 (in blue) has been mapped and offset, and an area that needed re-survey has been included (highlighted in green). With the map nearing completion, a background fill is included. The map is marked up with dotted red lines in areas that need a visit to see how they connect. 2020. A complex connection has been mapped after a visit during an expedition (in red), with an area that needs work on future expeditions.
dumping a bowl of spaghetti on the ground (Centerfold). There are lots of dense, maze caves, but not many where navigating requires you to peer down through so many overlying levels—it is actually impossible to read the survey station labels for about 30% of the line plot with so many passages laying on top of each other. To simplify the task cartographers often use offsets to move underlaying passages to one side (challenging when the offset is essentially the entire map), or split the cave into separate, mapped vertical levels. I decided to go with separate vertical levels.

The Western Borehole around the Three Amigos is the most significant cave passage on my quad, winding its way west with a series of ropes that provide access to the Graveyard, 50 feet above. Using this vertical offset as a guide, I sliced the Graveyard maze into 50 vertical foot increments. This was a terrible idea. The Graveyard is rich in brecciated rock—small pieces of rock that are cemented together to form the greater part of the bedrock in this area. Initially, this breccia was thought to be due to pieces of rock breaking off of the ancient reef and rolling down the front (the forereef), where it was cemented back together. More modern interpretations are that it formed during ancient speleogenetic processes that started to erode the reef, even while it was still underwater. Whatever the process, the bedrock looks like a bag of cemented-together marbles. Those cements are really easy to dissolve, and when aggressive sulfuric acid created Lechuguilla it left behind an Escher-like maze, which looks like the inside of bone (we call these type of caves boneyards). Lech contains three such mazes, the Graveyard, Voids, and Chandelier (Figure 2), which together represent some of the most dense and complex cave passages anywhere in the world. They also represent some fairly significant mapping challenges.

When I initially sliced the Graveyard into 50-foot increments, it was the cartographic equivalent of slicing a sponge—there is cave everywhere, but depending on how slices intersect the passage, you either obtain contiguous passage or create a bunch of unconnected, random holes. By slicing the Graveyard entirely based on depth, I created a lot of holes. I moved my slices up and down and fussed about with the data until I realized that the levels of the cave are more like the curved layers in an onion than flat stacked pancakes, and tilting the slices could string together enough passage to produce a usable map. I printed out these line plots from Compass and laboriously transferred the survey stations to gridded mylar paper by hand (this was still in the era before Illustrator and SVG Exporter). It was also pre-Photoshop, so I would sneak into the photocopier room at work in the dead of night and shrink the sketches to the desired 1” = 50’ scale (one of the few perks of working into the night as a graduate student). Back at home, I had to align these re-sized photocopies to the Compass line plot and transfer the sketch via pencil (the final map would be inked onto velum paper). I spent the next three years taking the sketches and drafting them into five separate levels to make the first map of the Graveyard. Steve had told me that if I was able to generate a map, he would take me into Lechuguilla to field-check it and true to his word, in 1999, he invited me on my first Lech expedition.

Due to its reputation as a deep, complex and vertical cave, everyone is intimidated the first time they go into Lech; sleeping and waking in the dark certainly takes a bit of getting used to, as does the heat, the stiff ropes, and the complete lack of hygiene. But any nerves or discomfort were offset by my desire to field-check the map. I brought in photocopies of all my maps, along with an inch-high stack of survey notes from the ‘re-do’ pile that I naively thought we’d have time to check. I still bring the full size maps with me today, which allow me to mark-up the map in real-time; however, the notes were a bad idea. Regular paper adsorbs water in the high humidity of the cave, becoming damp and significantly heavier. An inch-high stake of dry notes weighs about 16 ounces, which might not seem like a lot, but when you add the same volume as damp paper to an already over-burdened pack, carrying it out of the cave is miserable. These days I bring a Windows tablet, which contains the survey notes for the whole cave and allows me to run Compass. It weighs the same as a stack of notes, but doesn’t get damp, and being able to surf the data in the cave makes it out of the ‘redo’ pile that I naively thought we’d have time to check. I still bring the full size maps with me today, which allow me to mark-up the map in real-time; however, the notes were a bad idea. Regular paper adsorbs water in the high humidity of the cave, becoming damp and significantly heavier. An inch-high stake of dry notes weighs about 16 ounces, which might not seem like a lot, but when you add the same volume as damp paper to an already over-burdened pack, carrying it out of the cave is miserable. These days I bring a Windows tablet, which contains the survey notes for the whole cave and allows me to run Compass. It weighs the same as a stack of notes, but doesn’t get damp, and being able to surf the data in the cave makes the additional weight worth it.

Back in 1999, I was really excited as I walked down the Western Borehole for the first time. As we reached the handline traverse—the first landmark on the Graveyard Quad—this excitement gave way to confu-
The cave didn’t really look the same as my map. The passages were the wrong size and shape, and there was an 80-foot deep pit that wasn’t on the map. When we got to the Three Amigos, my map showed a passage that ranged from 25-150 wide with smooth walls and no passages heading off. Yet when we pulled out the laser rangefinder to measure distances, it suggested that the borehole actually intersected a large room, 341 feet in diameter with pillars that broke the room into a complex structure, with passage in all directions, including up into the Graveyard. We checked the line plot against the stations. We were in the right place, the map just did not look like the cave we were standing in.

The original sketches of the Western Borehole had been done during exhausting, 24-hour-long day trips from the entrance using carbide for lighting, and it was not uncommon for the sketchers to miss important details, which was understandable. But there were ten different surveys heading off of this passage and more recent sketchers, who had had the advantages of camping and better lights, had neglected to sketch these connections around the Three Amigos. If they had, I might have had enough information to piece them all together into a cohesive map. Instead, I spent the first two days of my Lech expedition re-surveying the cave around just four stations (EY46-50), for a sketch that, prior to entering the cave, I hadn’t considered bad enough to make it into the re-do pile. Nonetheless, we had the advantage of knowing where all the stations were located, so it was possible to tie-in every survey into a complete sketch. This process, identifying the main areas that tie passages together and surveying everything together into one sketch, seems to be the key to creating maps of such complex areas—as does walking through the most complex connections to understand the three-dimensional nature of connections based on two-dimensional survey notes.

During that first expedition, I never got up the ropes into the Chandelier Graveyard—we spent the entire time re-surveying the most obvious errors in the Borehole. And of that heavy pile of survey notes I’d bought into the cave, we were only able to re-sketch two surveys. The mapping of the Graveyard suddenly began to look like a monumental task.

In 2000, expeditions into Lech were put on hold for the new entrance culvert to be installed. I waited two years to return to the Graveyard, when John Lyles and Peter Bosted invited me on their expedition. This time, rather than allowing myself to be distracted by the first map error I saw in the cave, I identified the critical surveys needed for the map prior to the expedition. This allows me to maximize the impact of our activities in the cave, and I continue to prioritize all my expeditions this way. In 2002, as I headed up the main 50’ rope into the Graveyard for the first time, the map looked good—I have since become good at recognizing which sketchers accurately represent the cave. But as we continued, it was apparent that a resurvey through the main level of the Graveyard was needed. During that expedition, we re-surveyed half-a-mile of cave, but more importantly produced sketches that connected dozens of other surveys into the map, while correcting major data errors. Finding these errors is critical to creating an accurate map, but by fixing some really bad loops, the whole structure of the line plot changes and with it so does the map. This is not a big deal nowadays, when whole sections of digitized maps can be electronically tweaked. But back in 2002 I was working with a pencil map and it meant that the whole thing had to be redone. It was enough to nudge me to digitizing the map and I have only ever drafted in Adobe Illustrator since.

In 2003, with encouragement from the Park staff, I applied for my own expedition permit, which launched nearly continuous annual week-long mapping expeditions in Lech ever since. In 2006 I invited Max
Having all three of the most active cartographers cave together likely reflects a common set of values in our approach to project caving and solving the problem of how to explore and map such a complex cave. It has also led to us exchanging information, approaches, and liberally stealing each other’s best ideas. Given that each of us has developed similar workflows and leadership styles suggests that this approach is ideally suited to mapping this type of cave.

The Voids

In 2008, I’d exclusively surveyed in the western branch of Lechuguilla and had yet to see any other part of the cave. The Graveyard map was coming together well and Paul Burger, a fellow cartographer who was working as a hydrologist in the Park, asked me if I was interested in taking on another quad —the Voids maze)—an even more convoluted series of twisting, interconnected passages, with a vertical profile of almost 1,200 feet. I was getting burned out on returning to map the west over and over again, and with my increased understanding of how to tackle a maze I was looking forward to taking on a more complex task, even though the Voids were a notoriously gritty, tight, and confusing area that had resisted a series of attempts by various cartographers for almost 30 years. In retrospect I would say it has been a more enjoyable experience than mapping the Graveyard. For a start, I didn’t waste hundreds of hours of effort on pointless draft maps and near-useless sketches. I also had a better understanding of how to generate good sketches of complex passage connections, which are the key to understanding how to define levels and structure. Finally, digital cartography and large format printers has allowed us to dispense with the quad system, removing the additional effort of coordinating a large map across several smaller sheets.

The first step in mapping the Voids was acquiring the notes, and Paul was kind enough to compile all the Voids notes for me in PDF. No more cardboard boxes. Nonetheless, these notes still suffered from the same quality issues as those in the Graveyard—this time I just didn’t waste any effort trying to draft them (the 1988 sketch at the Three Amigos would immediately be added to the re-do list). Next, I pulled up the line plot and made rough vertical slices by following the main passages, with some obviously looping together before peeling outwards and down. I then printed out each draft level at 1” = 50’ (Centerfold: 2008). The relevant PDF notes are then opened and evaluated for quality. For the good notes, I take a sharpie and mark over the printed line plot (this also helps keep track of what surveys have made it onto the map). These identified line plots are then imported into Illustrator (via SVG Exporter) and the notes are drafted. This goes through a few more iterations, until I end up with a skeleton map for each estimated level (Centerfold: 2010). During this process, I make a list of all the problems with the data and potential leads, which can be quickly compiled into an expedition permit application. The skeleton map for each level then forms the basis of an expedition, where it is field-checked, marked up with descriptions of how passages tie together, and identify where re-survey will be required (Centerfold: 2014). After each expedition, new data is incorporated and I continue to draft and refine each level, either through a better understanding of how passages connect, or because it’s just getting too complicated to include all of that information on one level (Centerfold: 2018). As
Voids map may require six levels. I had no idea on the amount of effort in with >8,000 hours of in-cave volunteer time. expeditions, required 5.32 miles of re-survey completed three levels, which has taken eight work this takes, since 2009 we have almost the process. As an indication of how much move on to the next level down and repeat the amount of time we spend on resurvey or join my expeditions, they are surprised at different approaches. When new people find any new cave, although we have yet to make a significant breakthrough. Nonetheless, recent major discoveries have shown that there is still plenty of potential for significant cave to be found (see the Neuland article). In the last decade, the historical pattern of discovery has changed; many of the new discoveries have been made by climbers, rather than continuing to push down. The discovery of Oz in 2012 (3 miles of cave found at the top of a 535 foot technical aid climb) and Never Never Land in 2016 (1.5 miles of cave above an awkward, overhung flowstone climb of 80 feet; Centerfold), demonstrated that significant cave passage could be found in the Yates Formation, a sandy, punky backreef deposit that sits atop the main cave-forming Capitan Limestone. The geology of the Yates had suggested that it could not host significant cave, but Oz and Never Never Land changed that paradigm. Now explorers are increasingly turning their attention to climbs into the Yates, historically abandoned due to a perceived lack of potential. One of these climbs, in the ceiling of the enormous PhD Room, had been considered unclimbable for 30 years. During a 2018 expedition led by Hazel Barton, the 215 foot dome, Higher Education, was successfully climbed by James Hunter and Derek Bristol.

Conclusions
I’m not sure I could have written this article until now, given how many years it has taken to figure a successful workflow for mapping Lech. I also wasn’t entirely sure who I intended the target audience to be. Certainly, a lot of effort has been invested by the Lech cartographers in figuring out how to map such caves, and this information could be valuable to other cartographers trying to map similarly complex caves. But I think I really wanted to capture the huge amount of work and dedication that it has taken to map Lechuguilla.

As a fairly mature cave, with over 30 years of active exploration, it takes a lot of effort to find new cave and there are many different approaches. When new people join my expeditions, they are surprised at the amount of time we spend on resurvey or on our bellies, shoving ourselves through 7” squeezes just to confirm it doesn’t go; you haven’t really pushed a lead in Lech unless you return to camp sore and bloody. But this approach does pay off. In the Voids we have added 2.07 miles of new survey and 1.95 miles in the Graveyard, both areas where past expeditions have struggled to find any new cave, although we have yet to make a significant breakthrough (see Higher Education article). But perhaps beyond exploration, these efforts are allowing us to finally map this complex and remarkable cave.

**Higher Education, Lechuguilla Cave**

*Hazel Barton, Derek Bristol, James Hunter*

(This is an updated version of a feature article published in DESCENT magazine 269, August 2019. This and other back issues of DESCENT can be ordered at [www.wildplaces.co.uk](http://www.wildplaces.co.uk))

Following the massive expansion of Lechuguilla Cave through exploration in the 1990s, the cave settled down to a relatively quiet 2000s, with fewer expeditions producing limited breakthroughs. Nonetheless, the Cave has experienced a recent resurgence in exploration. In the last decade, the historical pattern of discovery has changed; many of the new discoveries have been made by climbers, rather than continuing to push down. The discovery of Oz in 2012 (3 miles of cave found at the top of a 535 foot technical aid climb) and Never Never Land in 2016 (1.5 miles of cave above an awkward, overhung flowstone climb of 80 feet; Centerfold), demonstrated that significant cave passage could be found in the Yates Formation, a sandy, punky backreef deposit that sits atop the main cave-forming Capitan Limestone. The geology of the Yates had suggested that it could not host significant cave, but Oz and Never Never Land changed that paradigm. Now explorers are increasingly turning their attention to climbs into the Yates, historically abandoned due to a perceived lack of potential. One of these climbs, in the ceiling of the enormous PhD Room, had been considered unclimbable for 30 years. During a 2018 expedition led by Hazel Barton, the 215 foot dome, Higher Education, was successfully climbed by James Hunter and Derek Bristol.

**Exploration History**
The Chandelier Graveyard, so-called because of the enormous gypsum chandeliers littering the floor, has a somewhat ignominious exploration history. Steve Davis discovered the Graveyard in 1988, after he left his team (and his pack) to check a crawlway. Beckoned on by darkness, Steve crawled and climbed for a thousand feet into a large room. When he turned around to retrace his steps, he was looking at a wall of Swiss cheese (this room is now called The Lost World). After six hours of pushing every hole in an attempt to find his way back, Steve gave up and walked deeper into the cave, climbing over fallen gypsum chandeliers as he traveled almost half-a-mile through virgin territory. Eventually Steve was stopped at the edge of a large balcony, looking into a hole 50 feet below. Luckily, this passage was the Western Borehole, the main route through this area of the cave, and a rescue team found Steve after he had been lost for approximately 24 hours. Luckier still, Steve was carrying a roll of flagging tape, which he was able to gingerly lower to the team below. A survey tape was attached, followed by a rope, and Steve was able to retreat to known cave without waiting for a technical
aid climb to reach him (a description of Steve’s epic adventure can be found in the book *Deep Secrets*). To this day, no one is really sure of the route Steve used to climb up into the Graveyard and this rope remains the main travel route into the Graveyard, a maze containing almost 10 miles of cave is packed within a box 1,000 by 700 feet, and ascending over 800 feet through a variety of geologic levels, making it the third-densest maze in Lechuguilla (and possibly the world). It was no wonder Steve Davis got lost.

**Discovery of the PhD Room**

In 1990, Lechuguilla Cave was the deepest cave in the US and was rapidly approaching 50 miles in length. A large expedition had been planned for over 100 cavers to celebrate this milestone; however, there was one small problem, the celebratory expedition had been planned before they had actually reached 50 miles, and they were still almost 4 miles short. In order to guarantee that 50 miles was actually passed during the planned expedition, a frantic six months of exploration took place beforehand, with every conceivable lead pushed. In
August 1990, three cavers made their way to the Graveyard to push, as they put it, "... anything we could find!" After ascending the 50 foot rope that Steve Davis had used to escape his entrapment, the team ascended the steep 120 foot ramp of gypsum and slippery ferromanganese deposits (FMD) to reach the main level of the Graveyard.

All three cavers were unfamiliar with this area, with only Pat Kambesis having visited before. They paused and looked around in disbelief at the dozen passages heading off in all directions—with no map it was impossible to determine what had already been pushed. In frustration, Ann Strait turned to the climber they’d been told to escort to the area, Dave Jones, and said, “Well, you’re the climber, climb something?”

Dave did the only reasonable thing a climber would do in this situation—he looked up. About 35 feet above them he saw a 6 foot wide and 3 foot high passage heading off. Dave pointed and said “What about that?” With that, the exploration goal was set.

Even 30 years later Dave remembers the climb as fairly terrifying. To begin with, neither Ann nor Pat had much experience belaying, so Dave had to teach them before he began, already sapping his confidence that a significant fall could be arrested quickly. In addition, there were limited natural anchors, with significant exposure into the main passage the entire way. Dave climbed the first 10 feet fairly easily, before hand-drilling a couple of bolts, and after that he relied on any sketchy natural anchor he could find. The climb continued up at about a 70-80° angle for 150 feet, and Dave felt that for most of it he was climbing without any real protection. At two points he was able to set permanent anchors, allowing Ann and Pat to follow, before finally reaching a flat ledge where the team could congregate. Above them a narrow, ascending rift continued upward. Dave was able to chimney up the rift, going 20 feet before it shifted direction and forced a commitment move into a higher-level rift. This rift continued to ascend, becoming smoother and wider as it did. About 70 feet above the ledge where Ann and Pat sat, Dave was flat out, with one leg on each wall, no handholds, no good protection, and only a few feet of rope remaining. He said, “I couldn’t figure out how to keep going up, but the thought of going back down was terrifying.”

Dave could see a ledge just over a meter above him, just out of reach. In a last desperate move, he tied his climbing rack on the end of the rope to give it weight. He then threw it up and over the ledge, where it caught just long enough for him to use the momentum to fling himself up, catching the ledge as his legs lost purchase below him. Dave was then able to mantle himself up onto the ledge, where he collapsed into a puff of soft rock flour, sinking like an egg dropped into cake mix.

When Ann and Pat joined Dave, their combined lights were able to reveal the vastness of the room they’d found, one of the biggest in Lechuguilla Cave. They didn’t know what the soft piles of rock flour and FMD were at the time—no one had quite seen anything like it before. It was years before geologists and microbiologists figured out what these deposits were: the rock flour is formed from condensation corrosion, where the aggressive activity of moisture in the atmosphere dissolves away the limestone, and the insoluble clays that remain fall like a fine snow onto the passages below; the FMD are the residue of microbial activity in the Yates Formation, where iron and manganese in the rock provides energy for microbial growth (the FMD is essentially a layer of brown/black microbial poop that sticks to your skin). The room was covered in a thick layer of these deposits piled higher and deeper: the PhD Room. The three cavers noticed that the roof of the cave continued up and out of sight. When we asked Dave why he didn’t continue to follow this lead at the time, he said “I was using carbide so I couldn’t see much, but it looked like a difficult climb, and it was in the Yates. Why bother? It wouldn’t go anywhere.”

The Graveyard Map
Hazel began mapping Lechuguilla Cave in 1995 by taking on the Graveyard maze, which included 234 separate surveys, 2,672 stations, and 321 survey loops. Hazel’s first trip up into the PhD Room was in 2005, to carry out research on the FMD deposits. By this stage, the dome lead in the ceiling of the PhD Room had gained legendary status; it ascended to one of the highest points of the
cave, in a wide twisting tube of blackness. There was a large step in the ceiling at about 70 feet above the floor, but it wasn’t possible to see if this was just a change in ceiling height, or the bottom of a wide balcony, with the potential for huge cave heading off. Despite being there for research, Hazel couldn’t forget how great the lead looked and took every climber that joined her Graveyard mapping expeditions to take a look. But they all said the same thing as Dave: “The rock is crap. It’s in the Yates, why bother?”

Given the obvious difficulty of the climb and the sandy and friable nature of the Yates, the PhD Room dome kept its reputation as unclimbable and everyone began to forget about its possibilities, until the massive passages of Oz were found in the Yates, at an elevation not far above. Three years later, in 2015, Hazel put in her first serious permit to send climbers into the PhD Room. At that time, Oz was still going, and the Park wanted to see if there was an easier route through existing passage; Oz had numerous leads and was certainly heading toward the PhD Room, but none of the passages quite made the turn to the south that was so needed. In 2016, Never Never Land was discovered, also heading toward both Oz and the PhD Room through the Yates. While it came within 45 feet of Oz, Never Never Land petered out before reaching the PhD Room. Both these discoveries left a large, blank area on the map at the same elevation as a Disto shot to the top of the PhD Room, suggesting that there was significant passage to be found. In early 2018, Hazel’s expedition permit was finally approved. It included the climbers that had found Oz, James Hunter and Derek Bristol, who had enthusiastically signed on to the project with the hope that it might lead to the next big breakthrough. So in December 2018, Hazel, James and Derek, along with a Aria Mildice, Katey Bender and Nick Sockey, assembled at Carlsbad Caverns National Park before heading to the Deep Seas camp of Lechuguilla Cave to begin tackling the PhD Room dome climb.

The PhD Room Climb

A significant quantity of static and dynamic rope, along with climbing hardware, were hauled through the cave, first to camp, and then the additional two hours of caving up to the PhD Room. James and Derek perhaps had a bit of naivete following successful climbs elsewhere in the Yates. Nonetheless, once they were actually in the cave and looking at the climb, the initial enthusiasm gave way to the same apprehension that the other climbers had felt in the PhD Room; the climb would require negotiating steep overhanging walls covered in a mixture of clays, FMD and gypsum. The FMD deposits would coat the climbers on every pitch, making them look like they’d spent the day in a coal mine when they returned to camp. With no water to wash and only baby wipes for hygiene, the FMDs became increasing more miserable as the expedition continued.

The Yates also lacked anything resembling bedrock to support a climbing anchor, which was further complicated by the unusual rules for climbing in Lechuguilla Cave; Carlsbad Caverns National Park was designated as part of the US Wilderness Preservation System in 1978. As such, the park (including its caves) is governed by the rules of the 1964 Wilderness Act (https://bit.ly/3dfbcnD). This prevents the use of ‘motorized or mechanical equipment’ and protects the cave from exploratory oil and gas drilling, but it also prevents the use of drills. While this policy was enacted to limit anchor placement by bolted sport climbing in sensitive areas, it also impacts caves; a straightforward bolt ladder is not practical due to the need to hand-drill. Therefore, in addition to the complexities of the climb, the dirt, and the rock, climbers in Lechuguilla are forced to take more time, and compensate for slow hand-bolting with more creative tools for anchor placement; various types of pitons, cams, tricams, hooks, threads and slings, combined with rope tossing tricks and occasionally bold free-climbing are required to get to the top of climbs.

Despite all of these obstacles, the steep and crumbly walls of the PhD Room appeared to be comprised of a series of ascending ledges that might be linked together. The climbers decided to begin in the southeast corner of the room, aiming for two upper ledges that would bring them to the north and under the main dome of the room. The first pitch, as always, was tough; it is the most dangerous for the climbers, who need to mentally adjust to the focus and routines needed for safe climbing. It also means you are climbing just a few pieces of gear from hitting the ground. James took the lead, placing a bolt before reaching the first ledge safely. At the top, James was able to throw some webbing through an arch as a belay, followed by a hard free-climb that even he was impressed with, to reach a second ledge.

Derek led the third pitch, which required a series of hand-drilled bolts followed by some exposed and strenuous free-climbing, which then brought them to a chimney that looked like it might provide a bypass to the overhanging walls of the main room. This unfortunately proved to be a distraction, causing them to climb away from the main route for about 45 vertical feet, only to reach a blind alcove, and forcing them to retreat to the previous belay ledge and give up some hard-fought elevation gain. James began the fourth pitch by rapping to a series of connecting ledges on the opposite side of the room from where they began. The entire fourth pitch could be free-climbed, and the final 20 feet followed a crack system from one large ledge to another, utilizing a series of good natural features that actually made for enjoyable climbing.

Derek drew the short straw, finding that both his turns at lead placed him on the most difficult of the pitches. The fifth pitch was the hardest of the entire expedition, and took more time to complete than any other by a big margin… about 7 hours to climb 40 feet. Derek spent more than an hour standing on a ledge about 10 feet above the belay anchor looking for something... anything... to use for a gear placement. Every bit of the wall around him shattered or sounded hollow when struck with the hammer. At least two attempts to hand-drill a bolt had to be abandoned when the bit punched through to a clay layer underneath. Derek stood there, after a long series of failed placements, staring at a gypsum seam that he needed to ascend and wondered whether this climb might in fact be better left for the ‘next generation’. Eventually he was able to clean away enough surface deposits to find some solid limestone and get in a shallow 8 mm removable bolt. The climbers didn’t have much experience with these new Petzl bolts and the instructions clearly warned against using either hand-drilling or chisel-tipped bits, but the bolt passed the bounce test so he went.

The next pitch took several hours, including the need to overcome a great deal of doubt and frustration. At one point, following a significant lead-fall from a failed hook, Derek could be heard whimpering by the team below:

“Remember, you said you’d do this... you chose to do this. You could have been on a beach in Cancun for your birthday, but instead you chose to do this!”

The next day at camp, the team decided to cheer him up with a birthday surprise: everyone was hungry and filthy, but they collected together some extra cheese, beef jerky and clean baby wipes for his birthday. These were presented to Derek wrapped in a large survey flagging bow. He appeared to enjoy the wipes the most.

Despite the difficulty and setbacks, the next belay ledge was eventually reached and the prospects above looked good. It appeared as though a short, overhanging ceiling might lead to easier climbing to the top of the room, and possibly a series of passages. Nonetheless, after successfully climbing the next couple of pitches, they did not find the booming horizontal borehole they had envisioned, and as with many phreatic domes in Lechuguilla Cave, as soon as
they got to what they thought was the top, the dome twisted and turned and vaulted even higher.

The eighth pitch was difficult - guarded by a 10 foot overhanging bulge with no visible placements for climbing hardware. It took James well over an hour of scraping and testing to find a few good piton placements. Hanging on a dubious sling at the top of this bulge he was faced with a ledge covered in a foot or more of corrosion residue, which he had to sweep clean by leaning out and reaching as high as he could. Partway through, James realized swept a huge pile of FMD all over himself and down his trousers. As he realized this, he thought to himself: “Don’t worry about the dirt and focus. I am hanging above a 200 foot drop on a shitty piece of gear [admittedly backed up by several good pitons] and the priority is making this move, not worrying about getting a bit dirty.” Once past this obstacle, they reached a spacious ledge at the very top of the PhD Room, which presented them with two options: another short climb and a horizontal crawl. Taking the easiest option, they pushed the horizontal crawl, which became a small phreatic tube that continued to steadily ascend. The entire tube was coated in a thick layer of FMD, a good sign of airflow, and it reminded the climbers of the passages leading away from the top of the Kansas Twister dome, an area that led to the miles of large passage found in Oz in the same geologic area they were currently exploring. The small tube continued to climb, although ropes and gear were not needed, and in total it ascended an additional 130 feet from the last belay ledge. Finally the passage went through a tight hole, took an abrupt horizontal turn, and narrowed to a mud dig less than 6 inches high. At this point, their elevation was exactly the same as the main passages in both Oz and Never Never Land, but with no way on and no air. In frustration, they retreated back to the rope, double-checking for hidden passages behind every rock and in every alcove, but nothing was left.

On the last day of the expedition, the only thing left was the dubious-looking climb above the last belay ledge. It didn’t look very promising, appearing to end in a blind alcove, but from their vantage point they couldn’t be 100% sure, and Lechuguilla is notorious for breakthroughs in areas where people had confidently said that it didn’t go [see Neuland article]. Rather than the embarrasment of a missed lead, it was climbed with great difficulty, only to confirm that it was in fact a blind alcove. And so ended both the PhD Room climb and the expedition. The team named the climb Higher Education in honor of the PhD Room, using the EDU designation in the survey.

The main rope was anchored to a good natural anchor on the final ledge, with a belay 20 feet below, to produce a free 180 foot rappel through the center of the PhD Room—with the bonus of landing directly on the flagged trail. Free, straight drops are rare in Lechuguilla, and with the rope hanging at least 50 feet from the nearest wall, it was one of the best. While James was rappelling down for the last time, he felt that they had accomplished something unique; despite spending a week climbing to the top of the dome, from his vantage point rappelling past the pitches, the PhD Room still looked unclimbable.

It took 6 days to climb the PhD Room in 9 pitches, where 16 bolts were placed by hand, 11 of which were removed. The total climb height was 220 feet, although the route the climbers needed to follow was perhaps twice that. Yet, with so much hype over the past 30 years, and so much promise in terms of direction and geology, it was disappointing not to make the much hoped-for breakthrough. But breakthroughs in Lechuguilla Cave are a numbers game, with maybe only one in eight technical climbs leads to an important discovery, and there are a lot more climbs to be done in the cave. The team left the cave and washed away their sorrows with significant quantities of tequila and rum, ready for the next discovery.

Thanks:

The authors would like to thank Pat Kambesis and Dave Jones for helping us describe the exploration history of the PhD Room, and Art Fortini for providing data on Never Never Land.
During the August 1990 expedition, the surveyed length of Lechuguilla Cave passed 50 miles. Anticipating that this would occur, a celebration was planned at that time. The expedition ended on September 1990, with a celebration at Camp Washington Ranch, just outside of Carlsbad Caverns National Park, which included a cook-out, T-shirts, and a big cake that the bakery had mistakenly decorated with a “Congratulations on 50 Years”. Lechuguilla reached 100 surveying miles in December of 1998 without much funfare, outside of written reports that appeared in the NSS News and presentations at caving events. In October 2019, Lechuguilla surpassed 150 miles in length (see Max Wisshak’s article in the 2020 NSS News). With celebrations in 2019 marking 200 surveyed miles at Jewel Cave and 150 miles at Wind Cave, Carlsbad Caverns National Park staff thought a similar event was in order to commemorate this major milestone for Lechuguilla.

Similar to 1990, a Lechuguilla celebration was planned for April 2020 at Camp Washington Ranch, which included presentations, a cook-out and field trips. Then came COVID, stay-at-home orders, and shutdowns. Rather than let the celebration of 150 miles end on a sad note, with remote meetings becoming so common, we decided to hold a virtual two-day symposium/celebration in November, 2020. This symposium will feature an Exploration Session on Saturday, November 14th, and a Science Session on Sunday, November 15th. Both will begin at 8:30 AM (Mountain Time). The complete schedule is included below.

While a virtual event at first seemed less than ideal, it does allow us to invite an international group of speakers, and makes it possible for people to participate from across the globe. Registration for the event is required to filter out some who have disrupted real-time NSS events in the past. There is however, a limit of 500 participants, with 200 already registered as of October 1. If you would like to attend either or both days, please register beforehand using the following links:

Saturday, Nov 14 – Exploration

When: Nov 14, 2020 08:30 AM Mountain Time (US and Canada)
To register, go to: https://bit.ly/3SS1W7k

Sunday, Nov 15 – Science

When: Nov 15, 2020 08:30 AM Mountain Time (US and Canada)
To register, go to: https://bit.ly/33KSRub

The Zoom meetings are only half of the celebration. We hope to actually see you, in person, at the 2021 NSS Convention in Weed, CA. Arrangements have been made to celebrate Lechuguilla’s most recent milestone with a celebration bash coinciding with the campground party. Stay tuned for details and Convention updates at http://nss2021.caves.org/.

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<tr>
<th>Time</th>
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<tr>
<td>8:30 AM</td>
<td>Doug Neighbor</td>
<td>Superintendent, Carlsbad Caverns National Park: Introduction</td>
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<tr>
<td>8:45 AM</td>
<td>Pat Kambesis</td>
<td>In the Beginning: The first fifty miles.</td>
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<td>9:15 AM</td>
<td>Peter Bolt</td>
<td>Lake of the White Roses</td>
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<td>9:45 AM</td>
<td>Paul Burger</td>
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<td>John Lyles</td>
<td>Peeling the Onion after 100 Miles, Through Crawls, Climbs and Resurveys</td>
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<td>11:30 PM</td>
<td>James Hunter</td>
<td>Lechuguilla - Climbing in an Underground Wilderness</td>
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<td>12:00 PM</td>
<td>Max Wisshak</td>
<td>Neuland, Mythbuster, Barite Boulevard, and other recent discoveries</td>
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<td>Lunch</td>
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<td>1:30 PM</td>
<td>Emily Davis</td>
<td>Emily’s Spring Break: The Logistics of a Carry Out.</td>
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<td>2:00 PM</td>
<td>Andy Armstrong</td>
<td>Lechuguilla Exploration Special Challenges: Adaptations and Mitigations</td>
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<td>2:30 PM</td>
<td>Art Fortini</td>
<td>Changing Your Clothes in Awkward Locations—The Exploration of The Promised Land and Never Never Land.</td>
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<td>3:00 PM</td>
<td>Hazel Barton</td>
<td>The Mazes of Lechuguilla Cave: Chandelier Graveyard and Voids</td>
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<td>3:45 PM</td>
<td>Beth Corrigan</td>
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<td>Derek Bristol</td>
<td>Recent Discoveries in the West Branch: Oz and Zion</td>
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<td>Ron Miller</td>
<td>An Oasis in the Desert: Discovery and Exploration of the Coral Sea.</td>
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<td>Aria Mildice</td>
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<td>6:00 PM</td>
<td>Dale Pate</td>
<td>Keynote: Lechuguilla Cave - Helping to Shape Modern Worldwide Cave Management</td>
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<td>Ed LaRock</td>
<td>Remembrance of Kim Cunningham</td>
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<td>Max Wisshak</td>
<td>The barite conundrum – active BaSO_{4} precipitation in Lechuguilla Cave</td>
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<td>Andreas Pliltsch</td>
<td>How can climatologic research help to estimate the dimensions of Lechuguilla Cave - a short overview.</td>
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<td>10:45 AM</td>
<td>Jim Goodbar</td>
<td>The Lechuguilla Helium Study</td>
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<td>Jake Turin</td>
<td>Isotopic Indicators of Recharge Processes in Lechuguilla Cave Pools</td>
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<td>12:00 PM</td>
<td>Sebastian Englehardt</td>
<td>Urine Volume Reduction during Long-Duration Cave Exploration</td>
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<td>Ron Miller</td>
<td>How Strong is that Rope? Preliminary Test Results of Fixed Ropes from Park Caves.</td>
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<td>2:00 PM</td>
<td>Derek Bristol</td>
<td>Herding Cats - Drafting One of the Longest and Most Complex Caves in the World with Volunteers</td>
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<td>Harvey DuChene</td>
<td>Historical geology and mineralogy research in Lechuguilla Cave</td>
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<td>3:15 PM</td>
<td>Paul Burger</td>
<td>The Influence of Syndepositional Faulting and Brecchia Zones on Hypogene Cave Development and Morphology in the Guadalupe Mountains, New Mexico</td>
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<td>4:00 PM</td>
<td>Diana Northup</td>
<td>Life in Lechuguilla: Microscopic to Macroscopic: Intraterrestrial to Extraterrestrial</td>
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<td>4:30 PM</td>
<td>Hazel Barton</td>
<td>The Importance of Lechuguilla in our Fundamental Understanding of Microbial Processes</td>
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<tr>
<td>5:00 PM</td>
<td>Julie McGilvray</td>
<td>Program Manager, NPS Preservation Services: Concluding remarks</td>
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In the early days of Lechuguilla Cave exploration, the cave immediately yielded literally miles of passage oftentimes featuring incredible arrays of spectacular speleothems earning it the moniker “Jewel of the Underground”. But while most of Lech’s explorers were busy searching for the next virgin borehole or the next award-winning photo, caver and USGS scientist Kim Cunningham’s attention was captured by the cave’s strange mineral associations, curious wall coatings, and enigmatic floor deposits. His eyes saw a different potential than the caver status quo - he saw the critical link between cave exploration and the scientific research that was possible because of it. Kim made productive use of that link! After reviewing survey notes and trip reports, he sought out the cave explorers who were pushing the boundaries of the cave, many times right after (and sometimes during) an expedition. It was not uncommon to get a phone call from Kim asking for more details about new discoveries or clarifications of observations noted in trip reports. It was after some of those conversations that he gleaned insights into potential scientific questions.

Oftentimes Kim elicited the help of Lech explorers in bringing back samples from their areas of exploration (all with permission from the Park of course). Some of those samples provided the first evidence of the potential for microbial life in the cave. With a sulfur sample collected from the Southwest Branch of the cave, he illustrated the volatility of sulfur deposits. This resulted in the ban of carbide use at Lechuguilla because of some of the massive sulfur deposits found in various places in the system.

Kim once hijacked (in a good way) the August 1991 Lech expedition for a helium monitoring experiment. All survey teams were required to carry special stainless-steel cylinders (Kim called them “cylinders from hell”) for cave-air sampling at a set time at specific locations within the cave system. Kim then released 8.5-cubic meters of helium (Kim called them “cylinders from hell”) for cave-air sampling at a set time at specific locations within the cave system. Kim then released 8.5-cubic meters of helium (“inhaling” cycles in October 1989 and in February 1990 respectively and completed prior to the new air-lock gate. Radon concentrations throughout Lechuguilla Cave ranged from less-than 5 picoCuries per liter of air (pCi/L) to a maximum of 95 pCi/L from a sample collected in October 1989 in the Western Borehole. Radon in much of the cave is controlled by exchange with outside air, although some deeper, isolated areas maintained high radon during both sample events indicating less exchange with outside air. Suspected surface connections were identified in some deep areas by anomalous lower radon levels, CO2 concentrations and temperatures surrounded by higher values, such as in the Land of Awes where a ringtail cat skeleton was found.

Initially, Lechuguilla Cave was thought to be sterile of life beyond the Rift. Kim was the first to recognize the diverse, cave-wide microbiology of the cave including bacterial and fungal colonization on folia speleothems, ancient bacterial filaments in calcite speleothems (biothems), and suspected ‘rock-eating’ chemolithoautotrophic bacteria in corrosion residues. He observed the microbiology in scanning electron microscope photomicrographs on samples of folia and in the bedrock - corrosion residue interface where the bedrock substrate has been broken down and enmeshed by bacterial filaments. From these biological revelations Kim was realized that extremophiles in the cave could be possible analogs for extraterrestrial life. He helped take NASA scientists including Penny Boston and Chris McKay into the cave to study the microbiology as a possible Mars analog.

The Lechuguilla Cave mineral inventory, headed by Harvey Duchene and conducted between 1990-98 was Kim’s brainchild. The project resulted in a searchable database of geological and mineralogical features that is still in use at Carlsbad Caverns National Park.

Oil and gas operations adjacent to Carlsbad Caverns National Park posed a threat to local caves including Lechuguilla. Kim served on a multi-agency task force including Bureau of Land Management staff, National Park Service staff, Lechuguilla Cave Project directors, and industry representatives to prevent potential impacts to the cave from oil and gas wells on adjacent BLM lands.

As a strong advocate for caves and cave science, Kim gave many talks promoting science in Lechuguilla Cave. His work and ideas provided a foundation for many research projects by other cave scientists. He appeared in science-scenes in Lechuguilla Cave for the 1992 National Geographic Society television production “Mysteries Under groundwater”. Kim is credited as a Science Advisor on the 2001 IMAX film “Journey into Amazing Caves”.

The last research project Kim’s worked on was with Harve DuChene on the influence of paleo-tectonics and paleo-hydrology on speleogenesis in the Guadalupe Mountains. Unfortunately Kim would not see that project to published completion because of his untimely death. Shortly before his passing, Kim made Harvey promise that he would finish the paper which he did. It was published in a 2006 New Mexico Geological Society Guidebook.

So notable were Kim’s contributions to cave science in Lechuguilla Cave that MacGillivray-Freeman Films, who produced “Journey into Amazing Caves”, placed a special credit at the end of the film that reads, “In remembrance of caving and research pioneer Kim Cunningham.” Ultimately, Kim Cunningham (NSS
Kim 22063) is best known in the caving community for his scientific research in Lechuguilla Cave. He first entered the cave in 1989 and it became his cave research focus until his death in 2000. During that time, Kim participated in many science trips into Lechuguilla and authored or co-authored over 15 scientific publications on Lechuguilla Cave and the Guadalupe Mountains.

The cave explorers who worked with Kim have sorely missed his impromptu phone calls that mixed inquires about the latest discovery, Kim’s scientific insights, and enthusiastic encouragement that we all together, keep pushing the limits of exploration and science.

Kim captured this scanning electron microscope photomicrograph of the Capitan Limestone – corrosion residue interface showing suspected hemolithoautotrophic bacteria. The corrosion process can be observed in the center of the scene where the bedrock substrate has been broken down and enmeshed by the bacterial filaments. Sample from The Far East in Lechuguilla Cave. 10-μm (micron) scale bar at lower left of scene.

**Hawai'i Underground**

**Hawai'i Speleological Survey of the NSS Spring 2020, Number 48**

Rick Hazlett reports on the surprising lack of lava tube development in the 2018 lower Puna eruption. The massive volcanic event poured out enormous volumes of lava covering 13 square miles of land and creating 1.4 square miles of new land. Rick hypothesizes that the lack of new cave development was likely due to the large flow fluxes and a rapid rate of flow, which generated too much instability and didn’t provide adequate time for surface hardening.

Heavily covered in vegetation, the entrances to Keokea Cave sit in the south Kona district of the Big Island. Unknown to the Hawaii Speleological Survey until recently, Keokea has now been mapped to a length of over 7,700 feet. Leading the survey expedition was Perter Bosted, who recruited several local cavers to help him map the cave’s relatively spacious and mostly straightforward passages.

Survey of the 1.74-mile long LinRigger Cave began in 2015, with Veda Hackell and Tomislav Gracanin doing the bulk of the mapping. Filled with mostly walking passage, the cave has numerous entrances, several of which Veda was able to coordinate the purchase of, in turn donating the land to the Cave Conservancy of Hawai’i.

Over 17,000 feet of passage in Catacomb Cave are depicted in Doug Medville’s recently published map. The cave is the second longest in the historic Mauna Loa lava flow, but is sadly no longer accessible as it now lies behind a United States Army training compound fence.

**The Northeastern Caver**

**Northeast Regional Organization of the NSS September 2020, Vol. 51, Number 3**

After conducting some dye tracing work in the Hollow Brook Karst area, Christian DeCelle and Alex Fischer decided to begin a dig project. Excavating a 14-foot entrance shaft the two broke into a tight, sporty, unstable cave. Surveyed to 105 feet, Quarantine Cave is mostly filled with belly crawls which terminate in difficult digs and loose breakdown.

**The Carbide Dump**

**Blue Ridge Grotto September 2020, Vol. 55, Number 8**

Cavers used the historic entrance of McClungs Cave to travel to a lead in the Great Savannah Cave System that comes very close to connecting into Ludington Cave. Unfortunately, the digging team found the dig face to be relatively unstable and difficult to dig through. While a small amount of progress was made, it will require a more technical approach to stabilize and remove breakdown for cavers to gain access to the 9-mile long Ludington Cave.

Cavers have been working to connect Newberry-Banes and Buddy Penley’s cave systems into one large system since 2017. After an initial breakthrough, a pesky sump on the Newberry side has been restricting cavers from accessing some of their best leads. However, in early September Jason Delafield, Eric Landgraf and Paul Walko, using the Buddy Penley’s entrance, managed to press through piles of unstable breakdown, eventually coming out in Newberry-Banes passage. The combined system is now over 9 miles long.

**West Virginia Caver**

**West Virginia Grottos October 2020, Vol. 38, Number 5**

Returning to Lambert Air Blower, cavers set bolts and descended a 13-foot pit to explore the virgin cave below. Unfortunately, the passages ended after a short distance with most of the air being sucked down a small drain in the floor. Additional digging will be required should the cave be extended any further.

An overnight camp in the Maxwelton section of the Great Savannah Cave System turned into a mop up survey trip as several leads died or ended up widening their way back into known passage. The cavers surveyed 421 feet of passage and multiple Covert Creek leads were crossed off the list.

Pressing forward in the Bobcat Creek section of Dry Cave, cavers have been very successful. Over 2,000 feet of new passage has been added to the books, although much of it may not be virgin. Following strong wind upstream the creek has broken out into a complex multilevel set of passages. Somewhat surprisingly, older-looking artifacts of human visitation have been found in the far reaches of this new section of cave. Given the abundance of bobcat tracks and scat it is possible this old-time caver entered through a yet undiscovered entrance. Several promising, windy leads remain in Bobcat canyon, and with any luck cavers may just find one that takes them to a new backdoor entrance to Dry Cave.
We are now in the 8th month of the Covid-19 pandemic. I hope that everyone has been able to weather the pandemic and maintain their physical and mental health. I’ve been trying to improve my physical fitness by doing yoga using a virtual training program. This has worked out very well and helped me to also maintain what semblance of mental health I have left. I’ve improved my endurance, flexibility, lost some much-needed weight and hopefully, slowed down the aging process some. I think my bald spot is even getting smaller, but this may be more an effect of not having a haircut in months. (Anyway, one can hope).

An exercise program will help to give you a head start when we return to our normal caving schedule after the pandemic lifts. In the meantime, I recommend continuing to follow public health guidelines to minimize your risks of contacting Covid-19. It has had a severe and devastating impact on some of our members. Please be careful out there and keep our friends and family in our thoughts.

NSS Board Special Meeting (September 30, 2020)

A special meeting of the NSS Board of Directors was held on Wednesday, September 30, 2020. The purpose of the meeting was to address some business items associated with our Small Business Administration Loan and to approve a new and exciting program that has been proposed by Adam Weaver, NSS Administrative Vice President.

The board created an NSS Cave Preservation Network (CPN). This is a collaboration between the NSS, the National Caves Association (NCA), and numerous private show cave owners. The program will generate income from a “round up” sales program from show caves. The program will be used to create new NSS nature preserves, maintain existing NSS preserves, support cave conservancies and conservation efforts, production and distribution of educational materials, fund cave related research objectives, and cover operational costs of the NSS Cave Preservation Network program.

The program has already enlisted seven show caves in our pilot program. The NSS will place banners in the show cave visitors’ centers that will have links to our web page and educational material. This program will continue to grow as we add more show caves to the program. More about this program is detailed on page 34.

The board also allocated funding to cover the estimated costs to be used for special publications. We have a number of new books that are in the works including On Rope. The board also allocated funds for improvements in our web site development. The board also approved Michael Cicherski (NSS 36668 FE) as the chair of the Insurance Committee. Ted Keyes has stepped down after many years of service to the society. Thanks to both Ted and Michael for serving.

Headquarters Mortgage Status

At the end of November 2020, we will owe $83,855 on the mortgage of the NSS Headquarters and conference center and have 18 more payments before we own the facility free and clear. Our loan is from the NSS Life Member fund, so we are paying ourselves back. Our monthly mortgage payment is $4,959.16. Stay tuned for a push to help burn the mortgage. We’re scheduled to make our last mortgage payment on May 2022.

Estate Planning and End of Year Donations

I wanted to also say thank you to everyone that has included the NSS in their estate planning. Estate giving has helped the society with numerous programs throughout the years. For more information on this program, please feel free to contact me.

As the end of the year approaches, I also want to thank everyone that has remembered the NSS during these trying times.

Membership data.

Membership was relatively steady with a slight decline of 50 members through September with a total of 7350 members. Highest NSS number in the file was 70,642. Many people will join or renew at the NSS Convention and the pandemic has limited in-person grotto meeting attendance. Please consider renewing your membership in the NSS.

Fall BOG Meeting

The Fall BOG meeting will be held virtually on Saturday, November 7th at 9 am CDT. One of the advantages of virtual meetings is it allows members to observe and participate in the governance of the society and all members are welcome to attend.

Geary Schindel
NSS President

Logo of the new cooperative program between the NSS and show caves

BUY-A-BOOK GET-A-BOOK
A Bookstore Promotion for NSS Members

The NSS Bookstore is offering NSS Members the opportunity to buy one book from the Bookstore and get another FOR FREE!

That’s right! You have the chance to get two (2) caving resources for the price of one! The only cost to you is the one (1) full-price book and shipping and handling.

PROMOTION DETAILS

To participate in this great offer, put your desired book in your bookstore cart (https://members.caves.org/store/) along with one of these “free” books:

- Caves and Karst of the USA
- Adventure of Caving
- Visions Underground
- American Caving Accidents 50th Anniversary
- On Caves and Cameras (Hardbound)
- On Call (Hardbound)
- Cave Minerals of the World (Hardbound)
- [Surname] Jubilee of the National Speleological Society’s 75th Anniv (Hardbound)

After your two (2) books are in your cart (one (1) full-price book and one (1) from the list above) use the promo code Getabook at checkout.

Call the NSS Office Should you have any questions: (256) 852-1300

NSS News, November 2020 31
Johanna Kovarik

Q. How did your sense of adventure develop?
A. I have always been drawn to the outdoors. My earliest memories are of my mom being frustrated with me getting nice dresses torn from climbing trees or somehow getting completely covered in mud. There was a ravine across from our house where we used to run off and make mud pits, climb trees, and explore. My dad was sick with polycystic kidney disease (PKD) from the time I was really young and was unable to go out on adventures with us as kids the way he would have liked. He would tell us stories about travelling, climbing mountains, and seeking out adventure when he was younger. I had an old collection of National Geographic magazines that I would devour. The maps were my favorite part. While we couldn’t travel or adventure, I could travel the world by hanging the maps around my room. My dad passed away seven years ago and he loved hearing stories of my early days caving and working for the Forest Service. I wish I could share my adventures with him now.

Q. Please share some information about your background.
A. I grew up in the Midwest of the United States, in an area sadly devoid of caves but full of wonderful rocks along the shoreline of Lake Michigan. I used to collect the rocks by the bucketful and bring them back home. That interest ultimately led me to a Master’s degree in Geoscience from Western Kentucky University and a PhD in Geography and Environmental Science and Policy from the University of South Florida. I got my first job with the National Park Service at Carlsbad Caverns National Park with the Student Conservation Association, and that led me to a career with the federal government, including over 15 years with the US Forest Service where I’m currently a Pacific Northwest District Ranger.

Q. Where do you currently reside, and are you in a NSS Grotto?
A. I live in Oregon, and am in several grottos, at least in spirit if not current in dues, ha! The grotto of my heart will always be the Glacier Grotto in Alaska, and I’m current with them. Some of my early days caving were with the Green River Grotto during my time at Western Kentucky University. We had such an incredible community of cavers living in Bowling Green during that time and I learned so much from that bunch.

I was in Colorado the longest recently, and attended the Front Range Grotto meetings the most consistently. I have been to a couple of Oregon High Desert Grotto meetings but that sort of got thrown out the window with Covid.

Q. Please tell the story of your first cave trip.
A. Oh man. My first time in a cave was walking in to the natural entrance of Carlsbad Caverns—it blew my mind. The best part was walking around in the Big Room. My eyes had to have been like saucers and all my senses just felt ‘blown.’ From the sight of the formations to the cool, humid air, to the smells as you come back to the surface, I was hooked instantly. I had a few other shorter trips as well as some longer trips in Mammoth Cave with the Cave Research Foundation in my first year or two. But my mind always recalls to a trip I did in China with the Hoffman Institute, with some of my best caving partners even to this day, Andrea Croskrey, Ben Tobin, and Mike Futrell. Pat Kambesis and Kevin Downey also were on that expedition but weren’t on that particular cave trip. It was my first trip over eight hours, and it was like 17 hours of watery craziness. I felt excited, the trip felt epic, like I had no idea what I was doing (I didn’t), and then incredibly exhausted for the last couple of hours. We got out of the cave at 2 or 3 a.m. and I felt like a train had hit me, but in such a good way, if that makes sense.

Q. What is the priority of caving in your life when considered with other activities?
A. Caving has eaten up most of my time for the past 17 years or so. I’ve just been a little bit obsessive, and have spent a lot of time on expeditions, surveying, drawing maps, and in meetings about cave management and conservation. Caving also has been woven inextricably into my schooling and career until just this last year, and learning all I can about geology and hydrogeology has kept me busy. Enjoying simply moving around and needing to work out for expeditions finds me running, climbing, fabric, doing yoga, or whatever to stay in...
expedition shape. I’ve always been driven to experience and learn as many things as I am able. It’s so delightful to be new and terrible at something, to experience something different. I started learning to play the fiddle last year and I am absolutely terrible at it, and it’s great! I also started mountain biking and I’m terrible at that, too. I love canyoneering. I learned to ski and got really into backcountry skiing while living in Colorado, and I enjoy longer distance hut-to-hut trips. I started rock climbing quite a bit more with the goal of improving my underground aid climbing, and have been doing more of that lately than anything else outdoors. I started diving again (thanks, Gilly) in hopeful prep for some post-Covid expeditions. In summary, I enjoy learning and exploring and experiencing whatever I can, preferably outdoors.

Q. What is it (in your mind and in your heart) that drives you to explore caves and to find out ‘what lies beyond’?
A. I love collecting the data, pulling it all together, and coming up with more questions about a particular system, seeing the big picture in a karst area come together, seeing things that are new. I love learning more from the rock and water, from the scientists with whom I work or cave, seeing more than I’d ever dreamed when I was staring at those Nat Geo maps as a kid. I enjoy the physical nature of caving as well—it’s pure joy to pull yourself through a muddy crawl and spin out into shaft, swinging through rebelays, and pencil rolling down belly crawls that are ‘just big enough.’

Q. What ‘professional’ (work-related) awards have you earned? Any NSS awards?
A. From the US Forest Service, I’ve received some certificates of merit and recognition. In 2015, I received the National ‘Rise to the Future-Friend of Fish and Watershed’ award for my work with karst watersheds and the National Cave and Karst Programs. From the NSS, I’ve received some grants for expeditions, and became a Fellow in 2014, which is a huge deal to me.

Q. What are some of your caving accomplishments, and of which you are proudest?
A. I think for me, any time someone asks me to join an expedition, that feels like an accomplishment. I’m always thankful to feel like I’m a helpful positive member of a team pushing exploration forward. Similarly, getting my NSS Fellow was probably my proudest moment. Receiving positive feedback from your community that you are contributing is such a warm feeling. Plus, my NSS Fellow ‘class’ was so impressive that year. It was such an honor to be part of the group. A smaller gratification is when my sketching mentors acted on an expedition as if I were on a level with them, or at least, I was part of the conversation in terms of who wanted to be the sketcher on the team that day. Their talent and quickness were so impressive, and to be at least at a competency level where they were OK with me taking on full book and running with it was such a great feeling. Also, I would like to point out I’ve been on several China caving expeditions and never threw up or soiled myself, at least, underground.

Q. What are your thoughts about women in caving?
A. I think it’s a much bigger question than just ‘women in caving,’ and it is a fraught one. The NSS is a community, and it takes work to build and maintain relationships in community in the long term. It’s important that we ‘do the work’ (have the difficult conversations) as a caving community to make sure that women and everyone else feel they can show up in caving and be their amazing fabulous unique selves without fear. It sounds easy in theory, but hard, messy, and really not fun to sort out in practice. We need to do that work to sort out what kind of stuff goes on during trips, conventions, etc. that might be acting as a barrier to folks joining us, and that shouldn’t be normalized. This involves some change out of all of us. We need to want to talk to each other and take care of each other in these hard conversations, but that’s tough because pride, shame, and vulnerability often get in the mix. We all lose when we approach people with anger, judgement, assumptions, and stereotypes instead of curiosity and humbleness. But these kinds of conversations trigger strong emotions in all of us. Every day I feel like I have to start again, in terms of my learned behaviors and how I’m showing up, where I’m inadvertently hurting others. I feel like I mess up all the time and get in my own way so often, and that’s tough right now. One of my favorite cavers has said, “The rules of the expedition are simple, man, don’t be an asshole.” The problem is, ‘asshole’ can be relative.

Q. Has the Covid pandemic affected your caving activities this year or for future planning?
A. Well, I recently finally finished another cave map! We had a couple expeditions planned for this fall to get excited about, but the border closing has really put a damper on our hopes of joining our Canadian friends. Honestly, having just gotten married last year, changing jobs, moving to a different state, buying a house, helping with wildland fire, and being new to a leadership role through a pandemic and large scale social unrest has kept my plate full. I could really use about a month underground.

Q. Are there other things about you we might be surprised or interested to find out?
A. I was in ballet for a really long time, teaching, choreographing, and performing into college. I continued to take class whenever I could through my graduate programs. I enjoyed the structure of it and the movement, the physicality and the challenge of it. But I destroyed my ankle when I was 18 (a partner dropped me during a lift sequence in dress rehearsal) and my foot hasn’t been the same since. I sprained it terribly again in a muskeg (swamp) in Alaska which caused some foot issues, and that made it difficult to dance after that. Also, I have a degree in playwriting and poetry, and that’s surprising to some folks.

Q. What are your remaining caving goals and plans for the future?
A. My remaining goals are to be helpful wherever I can, to deejay mid-expedition dance parties, to up my costume game, to
support the next generation of cavers and help open doors and opportunities for them, to survey as much as possible, to get all my maps drawn up, to become competent enough to start pushing sumps (that’s probably a good one), and to drag all my flashes out and start taking pictures again.

Q. What advice would you give young cavers?
  A. Some of the best advice I ever got was from a caver mentor of mine, who said if someone gives you an opportunity to go on an expedition, say yes and figure the rest out later. Basically, go caving! If you feel uncomfortable about something, speak up. Also, don’t take mini-fruits caving; as tempting as those tiny bananas in Asia are, they do not belong in your cave pack; the Wild West Chili and Beans dinner by Backpackers Pantry is not advised; never eat a Clif bar, or actually, never eat anything off the ground in China; always bring survey gear; and survey virgin passage as you go (don’t “scoop”).

Cave Preservation Network

This month I’m excited to formally announce the creation of the Cave Preservation Network (CPN). This is a new endeavor by the NSS to reach out directly to the public; with information about cave conservation, exploration, research, access, and the importance of cave preserves. To make this happen we have built a collaborative partnership with the National Caves Association (NCA) and a number of show cave owners.

It makes sense that by assembling folks who are proud stewards of caves along with those who devote their lives to studying and exploring caves, great things can be accomplished! We all have a common interest in protecting and conserving caves, and ensuring that people can visit them in perpetuity.

For many of us, our first caving experience took place in a show cave. These show caves have been sharing their underground wonders with millions of visitors across the United States for decades. So, it seems only fitting that we use these same venues to help educate the public on all things cave-related. This message, paired with the tenets of exploration, scientific breakthroughs, new preserve acquisitions, and partner-driven content will hopefully excite the public to seek new caves and caving opportunities.

These show cave owners and managers have become part of the bigger vision of nationwide cave preservation. They have agreed to help support the CPN and the NSS efforts through fundraising at their local venues. Often the best way to protect caves and access to caves is to own them as well as the land above them. The NSS National Preserve System will use money raised from this project to increase its number of NSS Nature Preserves and supported cave conservancy partners with the goal that these caves remain available for safe access by trained cavers and researchers. Preservation and access is truly a collaborative effort and by working together we will all share in the sense of accomplishment when we “save” a new cave or create a new preserve.

I would like to thank all of our volunteers and partners for helping me turn this “great idea” into a great new program: Nick Anderson, Tom Hagen, Dr. Sharon Weaver, Brad Wuest, Devra Heyer, Val Hildreth-Werker, Amanda Willis, Bob Holt and the NCA, Stark Caverns, Bluff Dwellers Cave, Natural Bridge Caverns, Rushmore Cave, Lincoln Caverns, Dave Bunnell, and of course the NSS Board of Governors.

For all the information on this new program be sure to check out LEARNMORE.CAVES.ORG

Adam Weaver
NSS, Administrative Vice President; Adam@caves.org

One of the more recent survey efforts of Hazel Barton’s teams was a resketch and lead push in the Lake Castrovalva area. Below, the full width view of Max Wisshak’s wraparound image of this area from our cover.
were never recovered. Between 1972 and
two missing divers in the cave, with rescuers
pupfish, finding 300 of them. A detailed
from SoCal Grotto spent four days and made
The next push was in 1954, when six divers
to 75 feet using a “cumbersome air hose”.
Halliday and Peter Neely did a breath-hold
dive to 25 feet. In June that same year, a
February 1950, when none other than Bill
segment of the park. The first entry is from
formed by faulting in a disjointed 40-acre
mountain parks like Yosemite. While much
of it focuses on archaeological resources
like wrecks, there is also rescue and body
recovery of sport divers. This book covers
the period from the earliest diving efforts
through the year 2000.

Of main interest to our readers though
are the accounts of cave diving in several
National Parks. The cave diving accounts
focus on 3 parks: Death Valley, Carlsbad
Caverns, and the Grand Canyon.

The Death Valley dive accounts focus
on Devil’s Hole, a submerged cave feature
formed by faulting in a disjointed 40-acre
segment of the park. The first entry is from
February 1950, when none other than Bill
Halliday and Peter Neely did a breath-hold
dive to 25 feet. In June that same year, a
3-man team from SoCal grotto descended
to 75 feet using a “cumbersome air hose”.
The next push was in 1954, when six divers
from SoCal Grotto spent four days and made
the first count of the endemic Devil’s Hole
pupfish, finding 300 of them. A detailed
report from 1965 recounts efforts to find
two missing divers in the cave, with rescuers
reaching a depth of 315 feet. The bodies
were never recovered. Between 1972 and
1986, numerous dives were done to count
the fish and monitor pumping activities from
a nearby ranch that threatened the cave.
In 1991 Sheck Exley, Paul DeLoach, and
Alan Riggs pushed the cave down to -437
feet, thought to be the deepest cave dive at
the time.

The Carlsbad Caverns accounts chroni-
cle a 1969 dive by Ron Kerbo in Chocolate
Drip, in the New Mexico Room, and four
dives in Lechuguilla Cave, three by myself
and one from Peter Bolt, most of which were
detailed in the August 1996 NSS News. My
dives were in Lake of the Blue Giants
(1989), Stud Lake (1990) and Castrovalva
(1995). The first two were solo and the third
partnered with Ron Simmons. I found some
submerged passage off the first two lakes,
but Ron and I found only a short segment in
our Castrovalva dive, a roofed over section
between two lakes. I provided some color
photos to the authors and they included four
of them in the book. Peter Bolt’s 1991 dive
was in Lake of the White Roses, which at
the time was the deepest point in the cave.
He reached a depth of -93 feet in the lake
and extended the cave’s depth to -1601 feet.
Talks about both these dives will be featured
in the upcoming Lechuguilla 150th celebra-
tion (see details in this issue).

The Grand Canyon entry concerns dives
in Blue Spring on the Little Colorado River
in 1986 by Sheck Exley, which was recently
dove by Adam Haydock as chronicled in the
NSS News, March 2020 edition and Exley’s
dive was noted in a followup letter in the
April 2020 edition.

Dave Bunnell

Re: Lechuguilla book authorship
claim

Larry Matthews’ review of Michael Ray
Taylor’s new Hidden Nature (NSS News,
Sept. 2020, p. 31) states that “Mike has
been writing book and magazine articles
about caves for a very long time. His other
books include...Lechuguilla: Jewel of the
Underground (1991).” I see this author-
ship claim also on several Web sites offering
copies of Jewel for sale. But it’s misleading.
Taylor was the text copy editor for the first
edition of Jewel, but did not create any of
the content, and wasn’t involved with the
expanded second edition. Jewel had text
by several authors, and graphics by many
photographers, topographers and an artist.
The master editor who organized the project,
and assembled and published the book, was
the late Urs Widmer of Switzerland, who
deserves the primary credit for Lechuguilla:
Jewel of the Underground’s existence.

Donald G. Davis

Speloebooks Private Collection - 50 Year Sale. https://speloebooks.secure-mall.com 518-255-7978 emily@speloebooks.com No convention this year so Speloebooks owner Emily Davis is offering her life long collection of rare cave books for sale. We look forward to seeing you at future caving events.

For Sale: Western Grove Arkansas. 3/4 mile cave on 31 acres. Cave in pristine condition. No vandalism. Has stalactites, stalagmites, helictites, rimstone pools. Culturally rich with Indian relics. Experienced spelunkers have called it extremely beautiful. $50,000. Contact Kathleen Norton, Trustee, 1953 E. Maple Rd., Birmingham, Michigan. 248-761-1731, kathleenorton45@yahoo.com

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