NSS NEWS
AMERICA'S CAVING MAGAZINE

PAULST-MILWAUKEE
Below the surface of the Earth.

BOHEMIAN BEER.

Tourist Party in Mammoth Cave, Ky.
NSS NEWS
AMERICA’S CAVING MAGAZINE

THIS MONTH

This Month’s Cover

Lithograph advertising folder for Pabst Beer - Courtesy of National Cave Museum, Park City, KY

To accompany the article about the 1893 Chicago World’s Fair, on page 20. Research by Bob Thompson.

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CALENDAR OF EVENTS

Aug. 29 to Sept. 2, 2024
The 73rd annual Old Timers Reunion, themed caves, cavers and caving will be held in Dailey, West Virginia. Website at: https://www.otr.org

September 9 to 14, 2024

September 19 to 22, 2024

September 19 to 22, 2024
Mississippi Valley Ozark Regional, Seminary Picnic Grounds, Perry County, Missouri. Hosted by SEMO Grotto. For more information, see: http://tiny.cc/y54yyz.

September 27 to 29, 2024
Fall VAR 2024 will be held at Hungry Mother Lutheran Retreat, Marion, VA. Sponsored by Out of Bounds Grotto. Reg. and info to be posted at: https://outofboundsgrotto.org/var/

Sept. 29 to Oct. 3, 2024
International Show Caves Association Conference at Mulu National Park, Malaysia

October 7 to 10, 2024
Annual Convention of the National Caves Association, Niagara Cave, Harmony, MN

October 10 to 13, 2024
Texas Cavers Reunion, Johnson City, Texas

November 7 to 10, 2024
Karst Waters Institute & West Virginia Cave Conservancy are sponsoring the 4th Appalachian Karst Symposium in Lewisburg at the WV School of Osteopathic Medicine’s Roland P. Sharp Alumni Center. Reg. includes entry to annual WVCC Banquet on Sat. https://karstwaters.org/conferences/appalachian-karst-symposium-2024/

December 14, 2024
The annual Cumberland Caverns Caver’s Christmas Party, a private party for cavers from across the country to come enjoy a nice dinner, pre & post caving trips, Caver Carols and more! Reservations are required, for more information email: Nicole@cumberlandcaverns.com

October 6 to 10, 2025
National Cave and Karst Management Symposium in Ely, Nevada, and hosted by the Western Cave Conservancy. See: https://ely2025.nckms.org/

January 21 to 25, 2025
85th Anniversary of the Speleological Society of Cuba, International Congress. At Playa Los Bajos Gibara, Holguín, Cuba. See more details at: https://www.fealc.org/index.html
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BACK COVER

Ben Hutchins enjoying Te Puta Cave’s many flowstone pools, from the article on page 6. photo by Shane Fryer
There I was, starting to climb out of a gorgeous vertical cave. But when I looked down, something quite dangerous had occurred. I had inadvertently removed my upper ascender from the rope with my breasts. I had ‘boobed’ the cam.

Since I was very concerned by this on-rope event, like any good scientist, I decided to go back to the lab and replicate it. So, I rigged a rope, and successfully boobed the cam multiple times. Below is a report of my findings and my analysis of the phenomenon, including the experience in the cave and above ground. Please note that the motion that removes the cam from the rope is not a common occurrence when ascending.

Who Should Care

Cavers with sufficient breast tissue need to be aware that their mammary tissue can remove an unloaded upper ascender (of a frog system) from the rope. Though this mainly applies to female cavers, please be aware that this can also be an issue with men (whether they have gynecomastia or not). The breast size necessary for this phenomenon to occur has not been ascertained. I’ve noted my own size below for reference. For future research, please reach out if you have experienced this phenomenon yourself. My email address is below.

The Problem

When ascending using the frog system, there is a point at which the caver stands upright, against the rope (Figures 1 and 2). As the caver sits back down, their breast tissue travels downward, sometimes bringing the upper ascender cam trigger along with it (the down motion used to open a cam). With a simple turn of one’s shoulders, the breasts can push the cam trigger to the side (the ‘out motion used to fully open a cam). By simply sitting down and slightly turning, they have removed the upper ascender from the rope, or “boobed the cam.” This means that they are only attached to the rope at one point being their chest ascender.

Mitigation

The good news is, this maneuver is only possible when the foot loop is unweighted. When the foot loop is weighted, the cam is pushed against the rope and cannot open. So, a caver needs to be climbing a slope or a shelf for this to be a problem. Such as somewhere where you have at least one good foothold to the point where the foot loop is not used and the upper ascender is not weighted. A caver’s boobs need to be pressed against the rope and the ascender, and as they sit, their boobs push against the cam and sweep the handle down. Then, moving their shoulders right (for right-handed ascenders) or left (for left-handed ascenders) completes the ‘down and out’ motion with the handle, detaching the ascender from the rope.

However, clipping a carabiner through the holes in the top of the ascender and around the rope prevents the ascender from coming completely off the rope (Figure 3). The boobing the cam maneuver may still occur with a carabiner safety, however to recover all a caver would need to do is reengage the cam onto the rope. Alternatively, keeping the foot loop loaded would prevent cam removal.

Other considerations

Breast shape may impact the degree of ascender interaction. Differently shaped breasts of the same size may have varying levels of projection and surface area near the ascender. Breasts that sit lower on the chest may interact less with the ascender. No observational research was completed to determine these interactions; I can only speak for myself. Though bras and clothing will affect the silhouette, the distribution of mass as well as density (compressed or not) will still affect the degree of applied force to the cam. This is an avenue for future research – stay tuned!

It is unknown how much breast tissue is required to boob the cam; the author of this article wears bra size 36E or 34G. I am curious to know if anyone else has experienced this issue. And thoughts on this subject are welcome, too. I can be reached at nelsonallisone@gmail.com.
**Story Time**

Howdy all, I am Ken Moore co-chair for the NSS 2025 Convention in Cobleskill, New York, and this is an invitation for lifetime cavers to have a part in it. The theme of 2025 is “A Lifetime of Caving.” We all know that once you go caving, it changes you on some level. What I am looking for is how caving affected, changed or inspired your life. These stories can be funny, sad, inspirational, insightful or just plain silly.

What is going to happen with these stories? They are going to be compiled into a little book that will be part of our convention, so all your caving family can appreciate what you have to say. I am not looking for perfect writing skills, but instead I encourage you to write like you are talking to a caving buddy. Keep it real. There will be very little to no editing.

Here are the rules:

- No longer than a page and a half, single spaced.
- A minimum of 25 years of caving. I figure that if you have been caving for 25 years, you are in it for life.
- If it is a story that you cannot put your name on, please do not send it.
- Stories are due by December 1st 2024.
- Please include your NSS number.

Send you stories to caverken@gmail.com. I am excited to read everybody’s stories, and to see how this experiment goes!

**President Xi Goes Caving**

*Adapted from a story by Radio Free Asia.*

In late June, Chinese President Xi Jinping led top military leaders on a trip to caves that were important bases during the Chinese revolution led by the late Chinese leader, Mao Zedong from 1936 through 1947. Mao spent these years in the cave complex of Yan’an, in Shaanxi Province, and it was here that he and others formed the Chinese Communist Party during the war with Japan. These caves have become a symbol of Chinese communist ideology, and have been described as one of the “holy sites,” of the Chinese Revolution.

The Yan’an conference marks “a return to the roots of the military,” state news agency Xinhua paraphrased Xi as saying.

Revolutionary troops and communist leaders arrived in Shaanxi and the caves in 1935. The area is a loess plateau north of the Yellow River. It was a poor region and revolutionaries ate millet gruel every day for years until they began to win the civil war in 1948.

The Yan’an period of Chinese history is an important symbol, because it came before the infighting, political struggles and violent campaigns launched by Mao against his political opponents and the Chinese people causing turmoil and costing millions of lives. The caves are reported to still be a symbol of hope for many Chinese people.

Caves have been used as bases and for storage for multiple communist revolutions in the past including the Cuban Revolution where the attack on Havana was launched from caves in Pinar del Rio Province, and in Vietnam during the US Vietnam War in the 1960s and early 1970s.

**Oldest Art Found in an Indonesian Cave**

A figurative painting showing a pig and three human figures is at least 51,200 years old, 5,000 years older than any other known art produced by humans. The painting was found in Leang Cave in Karampuang Hill on the island of Sulawesi and in South Sulawesi district in Indonesia. The painting is significantly older than the famous cave paintings found in France and Spain. The painting seems to be depicting a pig hunt using spears. The story was reported on July 3rd and 4th by multiple new outlets.
Early History

At first, the life of a caving project is energetic and heady. After never-ending flights, car rides on bumpy roads and some meetings with local people, you are led through overgrowth to a yawning entrance, barrage down a borehole, do a short climb and make a quick discovery. There are perhaps a few years of exciting articles and dramatic grotto slideshows, followed by a few mediocre trips and some bad news. Then the trips stop, and in the end it all feels fleeting. Ben Hutchins had helped run such a project in central Guatemala that yielded a number of amazing caves (see NSS News 2020 78 (3); 2019 77 (5); 2016 74 (7)), but ultimately the political situation made trips untenable. And so Ben turned his Google Earth sights elsewhere, to Mozambique, Bolivia, and eventually to 15 lonely rocks set in the vastness of the Pacific Ocean, the Cook Islands.

On the surface, it seemed unlikely that New Zealand cavers would have overlooked something in their backyard, a mere 4.5 hour flight from Auckland. But after some positive online research it seemed that there were some caves on the tiny island of Mangaia (mah-nya-ee-ah), the most southern of the island chain. And soon he had secured permission from the King of the island, Te Ariki Numangatini Tangi Tereapii. And then there was the prescribed pandemic delay, after which eight of us were willing to go.

Ben had found a single substantial report on the caves of Mangaia written by an Australian geologist, Johanna Ellison. Though not a caver, her paper Geology and Speleogenesis of Mangaia, Cook Islands, contained the bulk of the information that we found on the caves in advance. She was not a caver, though she had mapped multiple caves during her time on Mangaia and produced multiple Grade 5 maps. The snake-like maps were drawn in an older, more basic style and many of them ended with enticing text like “pitch down, way on not explored.” Caver bait if ever there was: We hoped to resurvey and extend the lengths of known caves and, hopefully, find new ones.

But we had important questions! Would the local people be receptive to us? Would they let us cave at all? Were there actually more caves? Would we have to settle for a handful of short sea caves? Our conversations were practically quilted out of red flags, but we were committed. We had to accept the risk that we could fly to a rock in the middle of the Pacific and be doomed to days of Mai Tais. We all salivate over expedition photos of exotic places, but there are certainly adventures that fall flat on their face and nary a headlamp is needed. Optimism would have to carry us to the shores, and then hopefully things would work out. All of these worries and fears became the grist on our emails and texts, as duffels zipped closed, and we boarded flights. If there was an award for most flights to get to anywhere, we would have been contenders. Mangaia, at about 50km2 (about half the size of Disney World), is visited so infrequently that in order to get enough seats in our timeframe we had to charter a 12-seat turboprop. We all met up in Rarotonga, the main Cook island where the government seat is, and after a brief meeting with the King, we flew to Mangaia, around 100 km southeast of Raro. As our plane approached the island, we got our first glimpse of a verdant, low island ringed by a white, fringing reef and the endless dark Pacific. We swooped lower and the dirt airstrip came into view adjacent to the ocean. The plane whirled up to a small, green, concrete building and came to a stop. The mechanical sounds of flight stopped and the quiet sounds of ocean waves lapping rested on our ears. A Toyota 4 x 4 drove down the runway and stopped next to the plane and began to accept luggage.

We had a meeting with five of the six district chiefs and a few sub chiefs. There was certainly tension in the air: We were there by the king’s permission, but that meant little to the families that traced land ownership far back beyond 1777, when British explorer James Cook first laid eyes on the island. Then, locals used the caves extensively and subsequent visitors - archaeologists or
looters perhaps - had disturbed and extracted numberless artifacts. Emily found a closed Sotheby’s auction, for example, of a Cook Island grind- er. Putting myself in their shoes, outsiders came in with smiles and opaque intentions and flew off with bags full of ancestral heritage headed for museums and university basements to gather dust. It doesn’t take a forensic account- ant to understand that islanders were getting the short end of that stick. Our intentions were understandably murky, as we can agree that survey- ing and measuring things in the dark is an odd hobby. We cavers knew that we had to bring value to the island and make the chiefs look good in the pro- cess. They sat, noncommitally in plastic chairs. We were two dozen or more - making the chiefs look good in the pro- cess. In retrospect what we said mat- terness and tone likely mattered as much or more. Their concerns partially eased, we reported to the tourism office the next day at 10 am to start relationship building in earnest.

**Mangaia Cave Development**

A coral reef had sat in shallow wa- ter surrounding a volcanic island and when the whole mess was uplifted a donut of limestone known as the Makatea, with a basaltic volcano core, emerged. The Makatea has a unique cliff facing the inside of the island, and the outer rim is a cliff or steep, broken slope that drops off into the ocean. The rock is like white skeletons of hard cor- al in places and gray blades of rock in others. Any fall onto it would be instant stiches, and likely, a trip to the hospital (if there were one on the island), but the upside is that there are generally plenty of natural anchors points everywhere. There are a few basic models of cave creation, and the Makatea combines as many as three, which likely increased the number of caves on the tiny island. First are flank-margin caves formed under the island at the intersection of a lens of fresh water and saline water from the ocean due to the chemical differences in the two different water sources. Second are sea caves formed as tides and waves physically erode rock at the ocean margin at sea level, which is classicly how sea caves are formed.

*Photo Page 6: Andrea Futrell looks over a valley from a cliffside entrance in Te Anu Puta. photo by Shane Fryer Overlay Map Below by Mike Futrell.*
This process accounts for entrances on the outside of the donut, sometimes at multiple levels. Thirdly, rainwater falls on the basalt core and runs towards the coast, forming six swamps at the base of that inland Makatea cliff. The swamps drain through the limestone as water finds its way to the ocean potentially making fluvial or stream caves. The water is slightly acidic and dissolves out caves at the inner edge of the donut and creates a few insurgences. Of course reality is complex, and many caves involve two or all three processes. With this many ways to form caves working on the quite pure and incredibly porous limestone, an incredible number of caves have formed on this remote island.

Tuatini Cave

The following day, the head of tourism, Taoi Nooroa, and his coworker, Moekapiti Tangatakino, gave us a prayer, sang us a song and showed us a 3D model of the island to help orient us. We met our island guides, Harris Ngai and Ina Pokino, and set out for Tuatini Cave.

Tuatini was mapped to 800m by Ellison during her research and has been used for tourism. At the entrance we divided up into three teams to resurvey and explore it. Cyndie Walck, Charley Savvas, and Harris Ngai formed a team, Mike and Andrea Futrell played their normal surveying game, and Ben Hutchins, Emily P Davis and I formed a third team. Shane Fryer, our photographer, floated among teams taking pictures and documenting the cave. Inside the broad entrance a large passage extended before the first junction. The Futrells started mapping a stooing passage on the right, Cyndie started in the main entrance and Ben's team went to the back. The goal was to conduct a leapfrog survey so there weren't any hanging segments. Most of the passage was borehole with an occasional short crawl. Into the afternoon Ben noticed a crack ascending and Emily climbed up it tenuously. She finally emerged at the top and called us up, after which we named Emily's Climb. Ultimately this ended up being a key connection that extended the cave from 800 m to more than 2.5 km. At the end of the first day, we returned to camp extremely elated. Our initial fears that we would be denied access or that the caves had been fully explored were relieved, and we found the passage to be large, always a dream. We went to bed that night looking forward to continuing the relationship building with the people of Mangaia.

Over the next few days we returned to Tuatini, each time passing a taro swamp with a large entrance at water level. We assumed it connected, the question was where? Charley and Cyndie continued to survey in known passage and the Futrells went to the front of exploration beyond the Ellison map, where they eventually discovered a dry sump and a few climbs. Shane photographed large fossils and other passages, while Ben, Emily and I continued in the passage above Emily's climb, which ultimately led to an entirely new section of the cave. A traverse was rigged, and we continued in an extremely well decorated passage with beautiful white flowstone, low rimstone pools and large purple crabs. The passage appeared to end, and we free climbed up to a skylight we were unable to fit out. Later in the day I rappelled into a collapsed portion of the passage and through a surprisingly windy, crusted shaft that led down to the muddy bank in a river passage.

The next day Cyndie, Shane, Emily, Ben and I brought inflatable tubes and surveyed the river. Ben, Emily and I went upstream and Shane and Cyndie downstream. There was no flow in the brown water and the mud was over the top of my wellies. Cyndie and Shane ultimately discovered a downstream sump with lots of mud, which Cyndie was challenged to escape. Upstream the passage ended in a sump, but a dry bypass was located, and we were able to continue. At the day's conclusion I swam ahead 100 m or so and looked out a large entrance onto a taro field. We had just connected the cave to the taro swamp entrance! The following day Charley, Emily and I were directed to some unused boats at the edge of the taro swamp in front of Tuatini. We dragged them, wading through floating mats of grasses. Giant grass spiders lumbered around and freshwater prawns squirted through our legs. We hand paddled towards the giant water entrance that I had peeked out of on the previous day. We got our longest shot of the trip just inside the entrance at 63 m, while Emily sketched hurriedly from her dinghy.

Every morning we reported to the tourism office and the trust continued to build. A week in, locals were return
returning our waves and the atmosphere was very warm. Harris had been surveying with us daily and surely his neighbors asked about us and set the rumor mill going in a positive direction. We were making friends on the island, holding their babies and talking to them when we passed them on the road. There were only three commercial buildings on the island, including the airport and a gas station with no gas, but the 500 people that live there are tight-knit and word spreads fast. The initial meeting with the chiefs had been a litmus test, and so far we were passing. We saw the chiefs occasionally during our traverses of the island, and as we interacted with the islanders their comfort with us grew. They knew their artifacts and legends were safe.

More Caves and Caving

One day Tuara George led us past a passel of pigs to the entrance Te Rura Rere Cave, which he had helped Ellison map in 1991. Her map showed 791m of passage and noted a ‘tight hole in floor,’ which we took to be an undescended pit that piqued our interest. The Polynesians are arguably the greatest nautical explorers the world has ever known. Apparently they were bold cavers as well: we found that most of the caves on Mangaia were originally explored with candlenut torches, and virgin passage was rare. We again divided into the same trio of survey teams and started surveying the borehole. The passage was less decorated than Tuatini, but its size and features were still generous and stunning. As survey teams leap-frogged, we went deeper into the cave, passing large formations and multiple skylights. The caves were hot, and looking to shed clothing I stopped wearing knee pads. I rigged the undescended pit and Ben and Emily carried the survey down into it. It was lined with sharp popcorn. The pit and the ~100 m of passage below were virgin, and though air was churning around we couldn’t follow it. Beyond the pit, the main passage continued as well, eventually leading to a second entrance. We finished surveying Te Rura Rere Cave, proud of the 1.1km of passage we had mapped in a single day.

Everyday was chock full of mapping and fun exploration. One day while Emily, Charley and I were in Tuatini, Harris led the rest of the group to Ruanae Cave a short walk from the huts we were staying in. Another day while the Futrells, Charley, Ben and Harris started surveying Te Ana Puta, which included a dramatic view over a valley, Emily, Cyndie and I entered Te Puta. We rappelled down a short 4m pit alongside a large water pipe to a series of abandoned pumps and switches installed on the edge of a Belize-blue pool of water. A dive line extended into the depths. The pumps were once used to provide the island with freshwater until they started pumping brackish. As Emily and Cyndie surveyed down to the water I scouted ahead for the way on. It was clear that we would have to enter the pool, but it was unclear if the passage continued beyond. Not wanting to get everything wet for a lead that might not go, I stripped down and jumped into the crystal blue water and swam across the 25m pool. Emerging, I climbed up a long flowstone slope barefoot and stared into going borehole. Soon the three of us carried the survey across the pool and up into the well decorated and spacious passage. By the day’s end we had a few hundred meters of passage and a number of leads in Cyndie’s book.

A few days later we returned to Te Puta with everyone. We met a neighbor, Victoria, and after reassuring her we were treating the cave and its contents with respect, we descended into a dry pit entrance we had observed as a skylight from below. Inside the new entrance, we broke into what was becoming our common teams. Charley and Cyndie followed a handline down into a borehole while the Futrells headed to a walking lead. Ben and Shane surveyed into a short but well-decorated passage while Emily and I rigged down a blind pit and later up a dead end climb. As far as we saw, Te Puta was the only cave with substantial-looking, diveable sumps. Everyone played a role, and we finished exploring the exceedingly well...
Ana Tuatini
“The Labyrinth”
Te Puna Veitātei, Mangaia, Kūki 'Airani
Veitātei District, Mangaia, Cook Islands
Roa: 2,533 mita 'Ō'onu: 44 mita
Length: 2,533 m  Depth: 44 m
Map by: Ben Hutchins
decorated 669 m long cave. Everything was working out.

Mangaia is a devoutly Christian, so on Sundays, not much happens on the island beyond church and family-time. And frankly, we were worn down from days underground. In the afternoon we trundled down to the ocean and surveyed Ana o Vai Nga Tara, to 67 m. After the tide went out, we realized that the cave was also a freshwater spring. It was becoming clear that brown water from the inland swamps was draining through caves and emerging in the ocean as clear springs.

In the evenings we ate hearty meals and Mike led the charge entering survey data from the day’s efforts. In the silence was the ‘woosh-pffffff’ of waves as they broke on the reef. We walked a short distance and watched humpback whales breach and slap the water and roared our approval. Although we were in the wrong season for the giant coconut crabs, nights were filled with the constant sound of smaller crabs scurrying around in leaf litter searching through the leftover flotsam from the day’s events.

Part of what was interesting about Mangaia was not what it had but what it lacked. There is a limited diversity of species as the island emerged from the ocean 18 or so million years ago as a volcanic hot spot. Example: there are no amphibians and fewer than 10 species of lizards: all of which are skinks and geckos that likely hitched a ride with early Polynesians. The Ophidio- phobians in the room can relax - there are no snakes. We only observed a handful of species of birds. Everything - seeds, animals, bugs, planaria - even cave dwelling pseudoscorpions - were either blown in on the wind, delivered by the sea, carried on animals or brought by humans. The island served as an agricultural hub growing oranges, pineapples, coffee and more recently taro, tomatoes and coconuts. After the pineapple industry collapsed in the late 70’s, pine trees were introduced to control erosion. We wondered if any of the species that we saw were native or if there was such a thing.

The Wow Goes On

After a pile of flights took us home, we all traded ocean sounds for car alarms, perhaps the most jarring return ever. The caves still felt tangible and the ocean’s sounds were still in our ears. At home, we reminisced and found new articles on Mangaia that helped us understand how the caves were used over time. In some caves we had observed rampant vandalism, some even beyond daring free climbs and through small passages that had been hammered open, which we found puzzling. We learned that Mangaians had traditionally mined stalactites to make cylindrical tools, including pounders for food, which we saw in the Rarotonga airport. To make a round thing it helps to start with a round thing, which stalactites are. We found evidence that hard basalt tools used to carve the formations into pounders came from distant islands, showing how far trade routes in the ancient South Pacific extended. That changed our minds on the formation mining - mea culpa - and helped us bet...
ter understand Mangaian culture.

In the southeast US, Native Americans explored caves lighting their way with river cane torches. Previous generations of Mangaian burned candlenuts, which look like Brazil nuts, for light underground. Locals strung nuts together on a palm leaf midrib and they burned them one by one sliding them down into the flame like an abacus to control light output. Our guide, Harris, even demonstrated the warm glow of candlenut light underground one day. It was similar to carbide’s light.

But perhaps the main use of caves was for hiding and protection. An 1894 tome, by British missionary, Reverend William W. Gill, which is surprisingly easy to read, includes a history of pre-Christian Mangaia. It outlines no fewer than 42 coups extending back to the mid 16th century and indicates multiple cases in which the losers “went to rock,” or “escaped to caves.” For example, Ruanae Cave is named after a man that housed his clan in the cave after his defeat, which occurred just before Captain Cook’s brief visit in 1777. Ruanae lost the battle, but the core of his clan survived, and to avoid further chase, “used the sharp pointed rocks” for their escape, meaning they moved across the Makatea limestone, whose razor edges would be a poor choice for a chase. Also of interest were bird bones that paleontologists found in caves that may represent an ancient bird that was hunted to extinction.

Though Mangaia is a small place, it seems to have a high density of lovely caves and an amazing history. The Polynesian use of caves is incredible, and we look forward to returning to map more caves, learn more and continue to build a tighter relationship with Mangaian.

Like any great adventure we are indebted to a great number of people and organizations. Permission was granted by Numangatini Ariki Tangi Tereapii and the Aronga Mana. Staff at Ara Moana (Jan Kristensson, Shane Warren, and Iona Warren) provided friendship, support, counseling and great food. Tangi Kaiou catered several delicious meals, and entertained us with beautiful singing. Harris Ngai, Ina Pokino and Tuara George served as guides, friends and team members. Linda Alleluiah Zoll (Centre for Pacific Languages) has agreed to advise on Mangaian language for cave maps. Wendy Tuara provided lodging, advice and support while on Rarotonga. Victoria Tuaengata Leeder allowed access to family property in Ivirua. We thank all family landowners on Mangaia for allowing visitation to their caves. Foremost, Tāo Nooroa and Moekapiti Tangatakino (Mangaia Tourism and Information Centre) helped with access to multiple caves, arranged for guides and accompanied us, provided historical information, prayed for our safety, sang wonderful songs, gave us a tour and counseled us on natural and cultural considerations. Anthony Whyte (Island Administration) conducted filming and interviewing and provided general support. On Rarotonga, Mum Wendy provided advice and assistance with lodging at Maire’s Avarua AirBnB and River View Manea on Muri. Shirley Herman, proprietor of Muri Beach Haven and 1AAA Taxi Rarotonga, assisted with lodging and transportation. Financial support was provided by an International Exploration Grant from the National Speleological Society ($1,500 USD).

Finally, I would like to dedicate this article to my long-time caving team mate, mentor, hero and best friend, Charley Savvas. Charley was among the most skilled cavers I have ever known with his ‘fingertip only’ caving style and his optimism that knew no bounds. I will be thinking of him everytime I click on my headlamp in a new place.
Ana o Vai Nga Tara
Cave of the Water of Nga Tara

Ivirua District, Mangaia, Cook Islands
Length: 67.1m  Depth: 1m

Surveyed 13 August, 2023 using DistoX2 by Ben Hutchins (Sketch), Mike Futrell, Cyndie Walck, Charley Savvas, Shane Fryer.

Cartography by Shane Fryer, 2023
Images by Shane Fryer, 2023

Emily Davis out the entrance (A') and into the pacific.

Charley Savvas swimming through the passage

Cyndie Walck careful in the razor sharp limestone

Legend

- entrance
- drip line
- drop in ceiling
- rocks
- bedrock
- sediment
- water/flow
- ocean
- ceiling height/water depth (m)
- t.t. too tight

Magnetic declination = 14.5°
13 August, 2023

Profile (viewed from 90°)
Springer publishing has released Australian Caves and Karst Systems, the latest in their series of books on cave and karst systems of the World. This is an amazing book about a fascinating country with a huge diversity of karst. Although some NSS cavers got a taste of Australia during the 17th International Congress of Speleology held in Sydney in 2017, this book is the first comprehensive treatment of the topic and will be a hot read for anyone interested in karst from this part of the world.

Australia is a large country, with many types of karst. Traditional limestone karst, both epigene and hypogene are covered, but there are also sections on vulcanospeleology, coastal karst, and even caves in quartz sandstone. The book is heavily illustrated with full color throughout and excellent maps and photos.

It begins with four general chapters that cover humans and their use of caves, diving, and conservation. After this are seven chapters, geographically arranged, covering karst development in “hard-rock” (older) limestones. This is followed by five chapters of “soft rock” (younger) limestone regions, including caves of the famous Nullarbor Plain. Rounding out the cave-centric part of the book are three chapters on non-carbonate caves including lava, talus, fissure, piping and sea caves. The final five chapters deal with things in the caves such as minerals and speleothems, sediments, fossils and present-day fauna. A glossary and three indexes (general, cave, and stratigraphic) allow the volume to serve as an important reference.

As a reader, I was impressed by the overall quality of the work. The editors have organized and seamlessly melded together contributions from many talented Australian speleologists, both scientists and explorers. Taken together with the stunning photographs of amazing speleothems and passages, the reader is given a compelling tour of fantastic karst landscapes. I particularly liked the cave history sections where the authors explain the evolution of important cave systems and their connections to the overlying landscapes.

The book is not limited to underground features; Australia also boasts fantastic surface karst features, such as towers and karren fields. Although the volume is designed to be documentary and scientific, it would also serve well as a coffee-table book. Overall, this book is highly recommended: You will pick up this book, read through it, and wonder when you can plan a trip of your own to this fascinating place.

The Cave Conservancy Foundation provides funding to promote and facilitate the conservation, management and knowledge of cave and karst resources. The CCF grants program places an emphasis on research, education and the development of conservation partnerships.

The Charles W. Maus Fellowships in Karst Studies provides funding for selected degree seeking student applicants to pursue cave and/or karst-related graduate or undergraduate research.

Information on how to apply for grants or academic fellowships may be found at www.caveconservancyfoundation.org

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Introduction

Cuciulata Pit in the Bihor Mountains is a deep cavern in Romania. It is a unique and stunning network developed up to nearly 200 m of depth. The cavern formed between soluble and insoluble rock formations. The contact between limestone and quartzite rocks is the distinct path of the running water that made the cave.

History of Exploration

In the sixties, geologist Gheorghe Man-tea found the big entrance of Cuciulata Pit. Then, the discovery fell into oblivion. In the summer of 1977, Speleological Club Z organized two expeditions in the upper valley of the Someşul Cald River, and Liviu Vălenaş and Horia Mitrofan re-discovered the pit. They started the exploration and reached an open sump at 141 m depth. Liviu passed solitary through it and stopped at a second open sump at -182.5 m. The next day, Liviu, along with Dorel Pop, passed through the second sump and stopped at an impenetrable sump at 186.6 m depth.

Between July 21 and 24 the team mapped the cave. Ponorul din Cuciulata was discovered in July 1977 also by Club Z. The exploration and survey was made by Liviu, Horia, Dorel and Nicolae Sasu, Nicolae Paul, Eva Győrfi and Angela Stugăreanu. In September 1977, the explorers were joined by a team of the Speleological Club of Dabrowa Górnicza, Poland. Also, Ponorul Mare from Pârâul Vacii Cave was discovered in July 1977.

Description of Cuciulata Pit (Avenul din Cuciulata)

Cuciulata Pit has its entrance at 1,400 m elevation in the upper Cow Creek (Pârâul Vacii) watershed. It lies in a typical valley of the Someşul Cald River basin, in a forested area, with large- and medium-sized sinkholes. It is one of the highest altitude cave entrances in the Bihor Mountains. The temperature inside the Cuciulata Pit is between zero and 4.8 degrees Celsius with a humidity over 90%.

The pit entrance is 16 m long and four m wide. A pillar at 14.5 m depth divides the entrance shaft into two branches, P 37 and P 33. Both shafts overhang in the lower part with the entrance shaft being bell shaped. At the bottom, it continues into the largest room of the cave, which is 35 m by 25 m and 20 m tall. Perennial snow covers the high angled floor of the room.

After some narrow passages at -41.7 m and -49.0 m, the cave descends a small 4 m vertical step among boulders to enter the Great Corridor (Marele Culor) at -63.5 m. The Great Corridor is sloped at angle of 30 to 35 degrees and is a large gallery 12 m wide and five m average height. Small verticals, between two m and 5.5 m, created due to the accumulations of stone blocks, fragment the slope. A very tortuous loop in a side of the gallery can help to avoid a low section. At -141.5 m the ceiling suddenly falls to 15 cm from the water surface, and the width of the passage is only two m. The water passing through a small limestone layer creates the First Sump.

Beyond the First Sump, the cave passage meets the lithological contact with the Liassic quartz bed again. After three spectacular waterfalls, the highest being 6 m, it reaches the Hall of Waterfalls (Sala Cascadelor), which is 31 m long, 9 m wide and 8 m tall. After this hall, the water flows on a relatively horizontal course. At -174.0 m, through a 2.5 m waterfall, the gallery receives a major tributary of an unknown origin since the passage quickly becomes impenetrable. A new sump (Intermediary Sump) opens at -184.5 m, and a relatively large
gallery continues forward for 20 m ending in a closed sump (Final Sump) at -186.6 m depth.

The Cuciulata Pit is 925 m long and extends 230 m. The length of the cave is due to the rock pillars that split the cavern into several descending and parallel branches up to a depth of 141.5 m.

**Geology and Tectonic influences on Cave Development**

Lithologically, Cuciulata Pit begins on the contact between layers of limestone of Malm (J1) age and quartzite of Werfenian (T1) age. The quartzite is from an old thrust fault and has been faulted into place over the limestone. Moreover, the water partially eroded one gallery under the quartzite unit. At -40 m, the cavity intercepts another quartzite layer of Lower Liassic age (Hettangian – J1) in a normal stratigraphic relationship with the limestone of Malm (J3) age. The watercourse follows the lithological contact to -174 m and then passes through the limestone of Malm (J3) age up to the last sump at -186.6 m. The quartzite is a sandstone made of quartz granules and other elements as plagioclase crystals, biotite and opaque minerals. It lacks components of the Upper and Middle Liassic layers, especially the Toarcian marlstone. This situation is common to the Bihor Mountains. As for the limestone of Malm (J3) age, the main cavern developed on obvious lithological diastems and joints. The proximity of the Cuciulata Pit to the banatites massif of Vlădeasa (200 m) supports the idea of crystallization of limestone of Malm age (J3).

**Cave Hydrology**

The profile of the underground network shows an angled cave. The sole particularity of this slope is the entrance shaft (P 37). The cave has its origins in a deep phreatic pattern, including the entrance shaft. Later, the watercourse changed to vadose flow. The underground river in Cuciulata Pit originates from rainfall into the sinkholes near the entrance pit.

As a result of water tracing in the area, we have realized that the karstic water drainage is more complicated than the scheme we first imagined in 1978. The subterranean course in Ponorul din Cuciulata leads to the Izbucul Moloh resurgence, situated at 700 m air distance from the final sump of Ponorul din Cuciulata and with a vertical variation of 125 m. The dye appeared after 35 hours for an average flowing speed of 20 m/hour.

The dye trace in 1994 in Cuciulata Pit demonstrated, surprisingly, that this great descending cave had another resurgence, Izbucul cu Cascadă in the canyon of the Someşul Cald, situated at 500 m distance and at a vertical difference of only 13.4 m. Fluorescein appeared in the resurgence in only two hours and 15 minutes, showing an extremely high flowing speed of 256.6 m/hour.

Izbucul cu Cascadă is also joined by the important ponor and cave, Pârâul Vacii, the final sump in the cave being 450 m distance from the spring and only 10 m lower. Here the colorant traveled for 12 hours for an average flowing speed of 37.5 m/hour. We suspect the origin of the important tributary at -174.0 m in Cuciulata Pit comes from a swallow hole located 200 m northwest of the pit. In conclusion, here we have two different systems of drainage with no connection between Ponorul din Cuciulata and Cuciulata Pit. The proximity of these ponors and caves to the Someşul Cald canyon did not create a single drainage system.
Description of Ponorul din Cuciulata

In the immediate vicinity of Cuciulata Pit there are two more steeply descending slope-caves: Ponorul din Cuciulata and Ponorul Mare from Pârâul Vacii. They do not make a unique morphological and hydrogeological system, belonging to two different resurgences: Izbucul Moloh and Izbucul cu Cascadă. Ponorul din Cuciulata is situated at 350 m southwest of Cuciulata Pit also on Cuciulata Mountain and at the same altitude, 1400 m. Ponorul din Cuciulata is a continuously descending cave, developed generally on two levels. Here and there, a small intermediate floor appears, complicating the system of galleries. It is one of the most mazy caves in Romania. The 3,140 m of galleries fit in a rectangle of only 200 × 150 m! The cave is continuously descending, having a final river with quite a big flow. It is not known where this course of water comes from, but there are only two possibilities: It comes either from the river, which is lost at the entrance or from a nearby slope. In the middle sector, the cave presents a network of galleries, relatively horizontal, narrow, low and mazy. In this sector, there is also the only large hall in the cave, 57 m long, 16 m wide and 12 m high.

The passages formed along fracture lines with bedding in the rock playing a very minor role. The entrance is at the end of a small blind valley, 10 m wide and five m high. Right under the entrance portal, a short gallery climbs up to +10 m. From the end of the entrance hall, the cave branches out in a T shape. The northeast branch ends after 40 m. The southern branch is narrow and meandering. After a three m pitch, there is a larger 6.6 m drop. At its base, there is a hall 14 m long and 14 m wide called Intersection Hall. From here, a complex of extremely branching maze galleries go northeast and are called the CSER Galleries with 1,500 m of passage. From Intersection Hall, the Main Gallery continues southeast and is meandering, relatively narrow and with several verticals up to eight m. There is an active stream, which comes from the infiltration water from the CSER Galleries. Here, some sumps are avoided through fossil passage loops. In the terminal portion, you get to the main stream, which makes a surprisingly sudden bend to the northeast. At 350 m from the entrance, a gravel clogged final sump, at -75 m, stops any advancement. In this portion, several very narrow fossil galleries have the tendency to pass over the sump but they also end.

The sudden bend of the main stream to the northeast in 1977, set forth the hypothesis that Ponorul Cuciulata could be a side network of Cuciulata Pit. But the dye trace, made in 1994, showed that the final drainage of the cave leads to Izbucul Moloh. In other words, the idea that Ponorul din Cuciulata and Avenul din Cuciulata would form a single morphologic and hydrologic system proved to be wrong. The provenance of the final course from Ponorul din Cuciulata (average flow 15 l/second) is unknown. It probably gathers the waters from the slope at the entrance and from the dolines to the south. We do not see another possible source for the water. In the CSER Galleries there is one more subterranean water course, 50 m long.
which gets lost separately, through a whirlpool. It probably confluences with the main stream after the final sump.

Description of Ponorul Mare

Ponorul Mare from Pârâul Vâci (1,371 m in length, and 117 m deep) is situated only 230 m west northwest of the entrance of Cuciulata Pit at 1305 m altitude. It is also a mazy cave and contains some large halls and several siphons. The cave stream resurges at Izbucul cu Cascadă. It lies at the end of a small blind valley and has three entrances including an eight m pothole. The entrances lead to a narrow gallery in bare rock, fragmented by several short pitches of three, 5.5 and 4.5 m. At a depth of 33 m in 1977 the passage was totally clogged with river deposits. After 1980, the Speleological Club Politehnica of Cluj-Napoca, dug this terminus and explored a complex of mazy galleries that descended with a length of 179 m. This cave forms only one hydrogeologic and morphologic unit with Cuciulată Pit.

Conclusions

Cuciulata Pit developed first as a deep phreatic system and then was reworked by a vadose flow. The water is flowing along the rock fractures, and the main direction is the contact between the soluble and insoluble beds of limestone and quartzite. This contact determined the direction and the slope of the water-course. The resurgence in the Someșul Cald gorge and the primary water flow is a consequence of lithological contact. Ninety five% of the cavern has developed in limestone while the entrance shaft, and the terminal area downward of -184.5 m, developed between the soluble and insoluble rock layers. It demonstrates that chemical reactions are more important than mechanical erosion in the development of the cave. Also, it demonstrates the flowing water erosion mechanisms on quartzite. Cuciulata Pit is a top natural laboratory for caves and karst.

References

Silvestru, E., Tâmaș, T., Frățilă, G. 1995 - Preliminary data on the hydrogeology of karst terrains around the springs of Someșul Cald River (Bihor-Vlădeasa Mountains, Romania), Theoretical and Applied Karstology, vol. 8, 81-89.
Introduction

The 1893 Chicago World’s Columbian Exposition was a landmark event in American history and culture. Named in honor of Christopher Columbus, the Fair was a means of celebrating the 400th anniversary of Columbus’ discovery of the New World and progress in science, industry and culture, since that historic event. However, instead of opening in 1892 (the actual anniversary) the fair opened one year later. It ran for six months from May 1 to October 31, 1893.

Countries from all over the world were represented at the fair. It was immensely popular and drew more than 27 million visitors. It was widely publicized, both nationally and internationally, and people traveled from all over the world to see the spectacle. The entrance admission was a steep 50 cents, about $12 in today’s American dollar. Visitors were so desperate to visit this once-in-a-lifetime event that some even mortgaged their homes. The admission covered almost all the major exhibits except for some of the many special exhibits like the reproduction of Mammoth Cave of Kentucky and the Mammoth Crystal Cave of South Dakota, which required an additional 10 cents to visit.

The major buildings included Administration Hall, Manufactures and Liberal Arts Building, Machinery Hall, Electricity Building, Agricultural Building, Horticultural Building, the Art Palace, Woman’s Building, United States Government Building, Fisheries Building, Transportation Building, and the Mines and Mining Building. Cave exhibits from all US states and other countries were represented within these buildings.

Countries from across the globe brought trade items as bragging symbols to show off their unique natural resources. It was the first time many people had seen items from another country, not to mention artifacts from different continents. The fair was a trade show, art gallery, lecture series and museum exhibit rolled into one. Nearly every item was for sale. Many of America’s popular show caves were represented at the fair with varied exhibits as well as miniature reproductions of the underground attractions. Representatives from the different caves were in attendance to show off artifacts and sell souvenirs.

Smithsonian Institution Exhibit

The Smithsonian Institution obtained and purchased the largest number of cave artifacts for the 1893
World’s Fair. In 1892, geologist and curator, Professor George P. Merrill, and his assistants, traveled to the many prominent show caves around the country in search of cave artifacts to be displayed in cases in the Smithsonian and National Museum section of the Government Building.

The exhibit occupied two wall-cases, each some 30 feet in length, with three special bases carrying relief maps and cave-sections. Artifacts included in the exhibit were: 1) Plans and sections of Howe’s Cave, New York, Luray Cave, Virginia; Mammoth Cave, Kentucky, and Wyandotte Cave, Indiana. 2) A series of photographs showing cave interiors from Howe’s Cave; Luray Cave; The Grottoes, Virginia; Mammoth Cave; Wyandotte and Marengo caves, Indiana. 3) Twenty five views in Howe’s Cave from photographer S. R. Stoddard. 4) Fifty nine views of Mammoth: Thirty four views of Wyandotte and 25 views of Marengo caves from Dr. Horace C. Hovey's photographer, Ben Hains. 5) Twenty six views of Mammoth Cave from photographer, Frances Benjamin Johnson. 6) Thirty five views of Luray Cave from photographer, Mr. C. H. James.

Also, a large series of cave deposits with many of the stalactites and stalagmites being cut and polished to show structure: 1) Stalactites and stalagmites from the Luray Cave and The Grottoes. 2) Gypsum rosettes and incrustations from Mammoth Cave. 3) Gypsum incrustations and rosettes, epsom salt, and stalactites and stalagmites, from Wyandotte Cave. 4) Stalactites and stalagmites from Marengo Cave. 5) Stalactites and stalagmites from the Percy and Robertson caves, near Springfield, Missouri. 6) Botryoidal stalactitic masses from caves in the Organ Mountains, New Mexico. 7) Stalactites from the Copper Queen Mines, Arizona. 8) Large translucent selenite crystals from a cave in Wayne County, Utah. And a section of a cave, some 2 by 4 feet, and 23 feet high, constructed from materials collected in Marengo Cave, the materials occupying their original positions as taken from the cave.

The possible economy of cave products, shown by cut, turned, and polished blocks of cave marble and stalagmites, and nitrous earth, from Mammoth Cave together with a small vial of calcium nitrate extracted from the same by leaching. A series of specimens in alcohol illustrating the fauna of caves. And a small series of photographs, bone breccia and flint chips, illustrating the occupancy of caves by human beings.

A large series of cave products from caves in Virginia, Tennessee, Kentucky,
Indiana and Missouri; also onyx marbles from Arizona and lower California. Donations and purchases from: 1) Ganter, H. C., cave materials from the Mammoth Cave, collected by George P. Merrill - three large and one small blind-fish, Imbylopsis spelacue. 2) Hay, W. P., salamander, Hemidactium scutatum, from Mount Vernon, Virginia; large conglomerate of clay-cells of the mud-wasp (Peloporus cementarius); alcoholic specimens of Cambarus pellucidus from Shiloh Cave, Indiana, and Cambarus pellucidus Testii from Mayfield’s Cave, Indiana. 3) Langdale, J. W., native sulphate of iron; stalactitic calcite and aragonite from Weyer’s Cave, Virginia. 4) McDonald, A. F., a collection of cave products from the Wind Cave, South Dakota including stalactitic and stalagmitic material. 5) Merrill, George P., specimens of cave-salamander, Spelerpes maculicandus, from Little Wyandotte Cave, Indiana. 6) Morrison, Prof. J. H., cave materials from Luray Caverns. 7) Ozark Onyx Company, through J. F. Leighton, President, slab of stalagmite. 8) Rothrock D. M., Stalactites from Wyandotte Cave. 9) The Grottoes Company, through J. W. Rumple, President, and E. C. Pechin, General Manager, collection of cave materials from grotto.

Mines and Mining Building, the Kentucky Pavilion and the Mammoth Cave Exhibit

The entrance to the Kentucky Pavilion exhibit itself consisted of an arch of polished coal twenty-five feet in height and twenty-three feet wide with a doorway twelve feet wide and twenty-two feet high. Immediately within the arch are displays of coal, iron ore, clays and stone on either side as well as a relief map of the State. The entire exhibit is enclosed by a wall at least eighteen feet high, which is used for hanging maps, and the colored photographs of Kentucky scenery. The roof is composed entirely of transparent photographs representing views of different products and scenes in every portion of the State.

At the further end of the Kentucky Pavilion space is a large image showing the entrance to Mammoth Cave. Below the image, is a reproduction of the cave going beneath the Pavilion Building accessed by a trap door. “A pair of winding stairs will lead down a depth of twelve or more feet to an iron gate, similar to the one at the cave, through which the visitor passes into a hall six feet wide and fifteen feet high. The walls and roof of the miniature cave consist principally of cave incrustations and stalactites. A series of seventy-five of the most prominent and interesting points in the cave has been photographed by Miss Frances B. Johnston, which was enlarged to 30 x 40 inches and finished in crayon by the Eastman Kodak Company and placed alternately on either wall. This hall, or gallery, is about 150 feet in length, and leads around the entire mineral space back to iron gate. At the central part of this hall there is a tank containing the various forms of aquatic life of the cave, such as blindfish, crawfish, etc.” At the representation of the “Bridal Chamber” the cave guide includes the story of the first wedding and the woman who promised her mother she would not marry a man on the face of the earth. There is also a reproduction of the “Starry Chamber.” An admission of 10 cents was charge at the “cave” entrance exhibit.
Ed Bishop, the Mammoth Cave guide, is mentioned in a newspaper article as the representative of the cave. “Underneath the Kentucky mineral exhibit is a Mammoth Cave in miniature and visitors are carried through by Bishop, the famous guide, from the original Mammoth Cave. Bishop explains every foot of the famous cave in a graphic and intelligent manner.”

In the last 50 years, different sources about the exhibit also mentioned Mammoth Cave guide, William Bransford, as one of the guides at the Fair. Many of the white gypsum flowers shown at the Fair were stripped from an area of Mammoth Cave known as Charlotte’s Grotto off of Cleveland Avenue by William and other guides at the request of hotel and cave manager Henry C. Ganter. This area is now known as Specimen Avenue. Mammoth Cave gypsum fragments were harvested to hand out as souvenirs at the Fair. Mammoth Cave guide John Nelson had a collection of unique onyx and gypsum formations of Mammoth Cave shown at the Fair.

Stories have been passed down over the years from the cave guides saying that because William Bransford had Caucasian features, he was more suited to travel to the Fair and represent the cave. Racism was an issue at the Fair. The Fair was known as the “White City” for its decor and its racist policies. One African-American woman “decided to prove the point by seeking admission to the Kentucky Pavilion. She was rudely rebuffed.”

William Bransford supposedly brought the Salt’s Cave mummy, Little Al, to the fair. The mummy may have been on exhibit but not at the Kentucky Pavilion. There was a mention in a newspaper article that someone “saw it at the World’s Fair in Chicago, but few people knew it was from Mammoth Cave.”

The Monon Railway circulated 100,000 copies of an artistic folder of the Kentucky and Mammoth Cave Pavilion exhibit during the fair, giving, on one page, the time of trains from Chicago to Mammoth Cave and return and two pages illustrating the entrance to the cave and Kentucky’s coal arch and forestry exhibit. These folders were the only advertising documents on Kentucky and Mammoth Cave distributed at the fair.
Geologist John R. Procter of Kentucky was a judge in the Department of Mines and Mining at the fair. Awards were given out, but the exhibit on Mammoth Cave did not receive one, "We do not observe on the list of nine World’s Fair awards to Kentucky exhibits any mention of that wonderful Mammoth Cave in the Mining building. We are pained at this. It ought to have been awarded at least ten years."

Visitor’s positive and negative comments of the Mammoth Cave, Kentucky Exhibit “A throng of people appeared entering the model of Mammoth Cave beneath the exhibit. I did not go into the cave at the exhibition,” said Prof. Bickmore, “but after leaving Chicago I went to the cave itself and walked into nearly all its nooks and crannies. I secured many pictures and a vast deal of information, which will be used in a lecture I am preparing on this cave in connection with the Luray Caverns of Virginia.”

“IThe ‘Bourbon News’, thinks that the ‘miniature’ of Mammoth Cave at the World’s Fair in the Kentucky display in the Mining Building possesses more interest to visitors than all our other exhibits and ‘whets the appetite for more.’ Has our contemporary gone through that ‘miniature,’ and has he watched the facial expressions and heard the comments of the visitors coming out of that miniature after having paid 10 cents to get into it? Colonel Crump of Kentucky has an interesting and exceedingly creditable exhibit, but let us draw the curtain over that ‘Mammoth Cave’ fake.”

Apparently the exhibit was not open during the duration of the Fair according to one visitor: “I sought in vain for the section of the Mammoth Cave fitted up with stalactites from that world famed cavern, and also the tank of blind fish and the genuine guide fresh from exhibiting its mysteries. Blind fish, and cave and guide had disappeared.”

Horticulture Building and the Mammoth Crystal Cave from Crystal and Bethlehem caves, South Dakota

The Mammoth Crystal Cave exhibit in the Horticulture Building was visually the most impressive of all the model caves exhibited at the Fair. The cave was constructed under a large “dome of a miniature tropical mountain. Several cascades are formed upon the sides of the mountain, and the sparkling waters leap from rock to rock under the foliage of the largest palms, tree ferns and other tropical plants that have ever been collected in a conservatory.”

The “miniature cave” in a sixty-by-eighty-foot space was constructed under the floor of the Horticultural Building and was divided into seven rooms connected by passages and electrically lighted with 100 bulbs. The cave was said to be decorated with "15 tons of stalactites, stalagmites, onyx, geodic crystals, dogtooth spar, and sparkling botryoidal masses, and of cave pearls, aragonite and drip-stone stained by oxidation in as many colors as the rainbow that was removed from the cave by owners Jacob G. Keith and Frank T. Allabaugh.” An admission of 10 cents was charged at the exhibit entrance.

Other US State Buildings with Cave Exhibits

California Building: “In the southwest corner of the building was a mound of mimic rocks set with patches of real moss and tufts of genuine ferns and native shrubbery. Beneath was a good sized cave.”

Colorado Cliff Dweller Exhibit: “For an additional fee, attendees could choose to walk across the top of the exhibit, or enter inside, where they would find a cave, paintings, mummies and further recreations of the cliff dwellings and their human architects.”

Kentucky Building: The Kentucky Building at the Fair had a “large picture of Mammoth Cave” displayed in one of the indoor exhibits.

Missouri Building: In the fall of 1892, the Truman Powell family hosted photographer C. E. DeGroff and two other men representing the Missouri World’s Fair Commission. DeGroff’s photos of Marble Cave (Marvel Cave) were displayed in the Missouri pavilion exhibit.

South Dakota Building: The first formal survey of Wind Cave, a ten-foot-square map, drawn by George S. Hopkins was displayed in the pavilion exhibit. Large assortments of cave products from Wind Cave including stalactitic and stalagmitic material were displayed in cases. Alvin McDonald assisted his father in the selling of cave specimens at the fair from June to August. Mammoth Crystal Cave owners, Jacob G. Keith and Frank T. Allabaugh, had an exhibit of cave specimens set up in the South Dakota pavilion.
Hardy Subterranean Theater Building at the Fair

The Hardy Subterranean Scenery Company was to build a novel subterranean theater, in which a skillful arrangement of moving walls gave the impression that they are being lowered to a great depth below the earth's surface.

The plans included the arrangement of, “five underground caverns, showing a coal mine, an ice cavern, a scene from Dante’s Inferno, a submarine view, and a reproduction on a smaller scale of the Mammoth Cave.” Unfortunately, Hardy’s attraction never was completed. “An exchange gravely announces that work on the Underground Theater in this city has been stopped, the builders in sinking the pit for the underground effect struck a quicksand, and it was found impracticable to cope with the problem this presented. No other suitable site was available.”

Cave Souvenirs at the Fair

The whole fair was set up as a trade show from which the exhibition items themselves were purchased as souvenirs. Of all the abundant souvenirs available at the fair, there were actually very few from caves, other than some written literature and small examples of specimens from the caves, not much else exists today.

Kentucky and Mammoth Cave Folder: 100,000 copies were printed and given out at the Kentucky Pavilion inside the Mines and Mining Building.

Pabst Beer Folder: Pabst beer was served on the fairgrounds and supposedly won a “Blue Ribbon.” Mammoth Cave was featured on one page of the advertising folder. Copies of the folder were given out to visitors at drinking establishments.

Mammoth Cave Souvenir Fibrous Gypsum Envelope: One inch pieces of gypsum in envelopes were sold at the Mammoth Cave model by cave guides at the Kentucky Pavilion. An example packet from a private collection is at the National Cave Museum and Library in Park City, Kentucky.

South Dakota Mammoth Crystal Cave specimens were sold by Keith and Allabaugh, and Wind Cave specimens by Alvin McDonald and his father at the Fair.

Conclusion

The world came to Chicago in 1893, to showcase cultures and homelands at the Columbian Exposition. When the World’s Fair closed, however, many chose to leave behind their artifacts. Many of the artifacts left behind became the beginning of the Field Museum of Natural History in Chicago. Shortly after the closing of the Fair, The Hall of Structural Geology at the Field Museum had a display case “illustrating cave formations and cave life, the cave formations being mounted in natural positions.”

Despite the destruction brought to the caves, the success of the World’s Fair provided much needed attention to the existing developed caves across the country. Cave exhibits were displayed in buildings across the fairgrounds to draw the attention of the general public in hopes that one day they will come and visit the caves in their travels across the country. Many of the same caves that exhibited in Chicago also participated at other World’s Fairs, including the 1904 St. Louis World’s Fair. It was a significant way of advertising the beauty of an underground attraction to the world.
How did you first get interested in caving?
Kayla: I actually didn’t enter a cave, not even a tour cave, until college. I had some friends that were going to a cave, and they invited me along. I liked to go hiking, go waterfall hunting, and things like that, but I had never been in a cave, so I went with them. I enjoyed the trip, and then decided that I wanted to do more, so I reached out to some people in the Park Service to ask where there were more caves. That’s not really the right question to ask, but they connected me with a Cave Research Foundation expedition that was going on. I showed up, and they later connected me with a local grotto. So, I showed up there as well. I would drive an hour and a half each way to attend grotto meetings once a month, and I got involved in a lot of projects.

Why caving?
Kayla: It’s the people — it’s a community and a family. It’s like a really special reunion of your most favorite family members. Sure, caving pushes physical limits and things like that, but that’s not the biggest thing for me. The people are why I kept coming back.

You’re President of the Cave Research Foundation — can you tell us more about that?
Kayla: The Cave Research Foundation (CRF) is a 501(c)(3) nonprofit organization that is geared toward cave research and conservation. It has projects across the country working with agencies and with some private entities, too. I do most of my work in the Ozarks, which includes Arkansas, Missouri and Oklahoma. There are two main areas that I’ve been working in — mapping and biological and cave inventories.

When I first got involved with the CRF, on that early trip, it was a mapping project. They let me hold the Suunto tandem, and I felt so special that I got to shoot the instruments. I was just some scrappy little girl who showed up, and they let me be involved, and from there I got involved with mapping in the Little Rock Grotto. I’ve always liked maps, so it just kind of clicked. Some maps are much more complicated to draw than others, but that’s a fun challenge. It’s neat to see that a cave gets the quality map it deserves.

In a turn of events that I still marvel at, I’m now President of CRF. I was on the board of directors for a decade, then took the vice president role, and now president. I’m truly honored to hold the position and hope to make a positive impact on the organization.

What kind of caver do you consider yourself?
Kayla: I’m a project caver — there’s something that really speaks to me about working on a project because you feel like what you’re doing is contributing towards something greater than you are. Over the years, I’ve learned a lot about organizing people and organizing expeditions. It’s a lot to think about, from following up with who’s going to be there, making sure there’s a place to stay available, making sure the food is right, making sure that the project objectives and the participants skill sets are matched appropriately. It’s something where I’ve improved a lot. You fall into a rhythm of organizing projects. Things shift and situations change, but you get better at being able to prepare to have a successful expedition. It’s also important to understand that the metrics of success for an expedition vary depending on the cave, the project and the people.

What are some of the secrets of success for project caving?
Kayla: Organization and planning ahead are key. But you also know that things are going to change — people are going to drop out, there might be a storm that leads to flooding, a pipe might burst at the facility where you’re staying, something unexpected. I think probably the biggest thing is just to do your best with the planning on the front end, and try to plan for any contingencies. But know that what you’re planning for is probably not going to be exactly how it happens — if it is, that’s great, but people are irrational and unpredictable beings. Communication also is critical. So things like having a good and open relationship with the landowner or the entity that you’re working for is also key. It’s important to communicate your plans to somebody who’s not going to be underground for safety, but also to communicate plans to each of the people on the trip so that they know what to expect. Because whether it’s a five-hour trip or a 10-hour trip affects how you plan.

I’ve noticed that there’s a lot more female presence on caving trips recently. I think probably having a female expedition leader makes a difference, but there are likely other factors, too. It’s probably also related to an overall societal shift of women being empowered to do things that women weren’t expected to be doing in the past. But we’ve recently had all-girl trips, which is kind of cool.

Do any caving-related memories stand out to you?
Kayla: I once got stuck in a cave for about eight extra hours or so. It was a pit that had a 150-ft-deep entrance. Although the weather forecast indicated there was hardly any chance of rain, it rained a lot, and the water funneled into the cave. The pit kind of funneled down in width in some places where you could touch the walls, so it was like Niagara Falls in the entrance. We decided we would wait because we knew that was the safest option rather than risk getting hit by debris or drowning on rope. No one got hurt, but, of course, folks up top were worried. We used our trash bags as vapor barriers, we had some tarps, we had each other, and we had food and water, so we were fine. But it ended up being about eight hours that we had to wait. We had already had a full day of survey in the water and mud, so we were already tired and ready to leave, but we decided to play it safe. You really have to balance the risk and return — getting out sooner would have been great, but it wasn’t worth that risk.

What tools and approaches do you use to navigate the unknown and risk in caving?
Kayla: Always let somebody know where you’re at, what your out of
obstacles you will encounter. Also, I always tell the people that I cave with, especially new folks, that you don’t need to do anything that you don’t feel comfortable doing. It’s not worth taking risks if you’re uncomfortable. Of course, caving is often physically uncomfortable, but you shouldn’t do something or feel pressured to do something that is outside of your acceptable comfort zone. I’ve been on trips where somebody didn’t feel like climbing up something or squeezing through a passage, and that’s okay. It’s important to monitor how everybody’s feeling.

As far as exploring the unknown, there’s always going to be associated risks, especially if it’s virgin passage, because nobody’s crawled through it. Make sure you know your team and you feel comfortable with them being the ones to help you if something does happen. I think that goes back to some of my NCRC training — I always think about these situations from a risk standpoint. As a project leader, that’s something that is always in my mind, maybe even a little too much. But I always want to be cautious, because really anything can happen.

If you could only give one piece of advice to a new caver, what would it be?

Kayla: Be persistent! That’s something that I think helped me — I sought out opportunities rather than waiting for them to come to me. I would ask, “What can I do? What trips can I go on?” And I would join trips from other grottos and travel to places. When I first started caving, I think I was underground just about every weekend. There were opportunities out there, but I had to seek them out. If someone is persistent, energetic and passionate about being involved, they’re noticed.

On the opposite side of that, we could probably do better as leaders in our grottos and in projects to make sure new people who are interested don’t fall off the radar. Because it’s possible that they were interested, but they just didn’t get the nurturing that they needed or maybe they needed somebody to make them feel more included. Be willing to help others and train others to pass on what you know. If somebody wants to get into sketching, help them with that. If somebody wants to get into vertical, maybe set up training in a safe place where they can learn. This is where the NSS comes in, and even at a more local level, grottos can help. Everybody can contribute. If somebody isn’t cut out to do 300-foot pits or 16-hour days of mapping, that’s okay. There are other ways they can be involved. If someone can’t do something physically, maybe they can help at camp or enter data. I think it’s important to be open to teaching people and helping people find where they can contribute. Having mentors and being mentors are both important.

Do you have a favorite piece of caving gear?

Kayla: It would probably be a tie between two pieces of gear. I like my Blackfathom Cave Gear survey pouch. It’s a purple and yellow bag that has a little state of Arkansas and a bat on it. My second piece of gear is my left-foot Pantin. I think it’s the best thing ever; I don’t want to climb without it. When it wears out, I’m going so sad, because the new ones are a little different.

Do you have a favorite place to cave and why?

Kayla: I have a favorite type of cave — I really like wet caving. I like having to wear a wetsuit and crawl or swim through water. That’s what I cut my teeth on with surveying in the Ozarks, where there are many water-carved caves with a lot of scalloping and active streams. Water is refreshing and life-giving.

If you were posting in an app to go on a date with a cave, how would you describe your ideal cave?

Kayla: I like a cave with an active stream. I don’t mind a hike to get there, as a little warm-up before I jump into the stream. Having some bats and salamanders are a plus. I like a cave where it is okay for me bring a few of my best friends. And I guess size and looks don’t matter that much.
American Caving Accidents

Report:

On October 10th at around 11:45 am, a ~55-year-old man accompanying a boy scout troop on a tour of the undeveloped section of Laurel Caverns was climbing down a 15 foot sandy slope when he collapsed and fell into the stream channel at the base. Initially fearing a heart attack, the LC staffer leading his group, Jeff Seabury, found another staffer, Dan Babyak, nearby and alerted him of the situation. By this point the patient had partially regained consciousness and scouts and staffers were able to make a confident diagnosis of a severe stroke based on several present symptoms: limited motor function, facial droop, reduced motor function on the right side of the body compared to the left, and poor communication. Babyak started out of the cave to initiate an emergency response while Seabury and an unknown number of scouts stayed with the patient.

At approximately 12:00 pm, a group of experienced cavers camping on the property (Ryan Maurer, Katey Bender, Hope Brooks, Nathan Roser, and Jason Zwick) were notified by LC staff that there was a severe accident in the cave, 911 had been called, and the staff needed assistance. When the cavers arrived at the visitor center (VC) at 12:04, they were notified that the accident was in fact a stroke. Maurer and Brooks assumed Incident Command and called Doug Moore, as the NCRC had not yet been contacted, while Bender and Roser prepared to enter the cave. Maurer and Brooks also called Cindy Barton and other nearby cavers familiar with the cave for further assistance.

Bender, who had the highest level of first aid training in the group, headed into the cave for an initial response with LC staffers Babyak and Maddie Lytle. They arrived at the patient at 12:15, about thirty minutes after the stroke. Bender confirmed the symptoms used for the initial assessment that the patient had had a stroke and assessed that he had no other major injuries that would affect the rescuers’ ability to carry him out of the cave. He was responsive with severe motor limitations but was able to communicate that he was getting cold. Bender and Babyak stayed with the patient, provided reassurance and communicated to him what to expect for the rescue while warming him up while Lytle was sent out with an update on the patient’s condition.

The first paramedics arrived in the VC by 12:10, at which point paramedics, cavers, and staffers gathered in a side room in the VC to begin strategizing. Shortly thereafter, eight firefighters from Hayden-town Volunteer Fire Department and three from Fairchance VFD arrived at the VC. The firefighters were initially not aware of the chain of command that had been set up and attempted to enter the cave at least once without even half of their group having a single light source on them. They were taken to a downstairs room where they were given helmets, lights, and an orientation to the situation. A Ferno basket kept on the premises by LC was brought in and associated gear was packed into several packs for the firefighters to help distribute weight. Roser led this group into the cave at 12:26 to manhandle the litter to the accident site.

While Roser and group hauled the Ferno into the cave, Brooks and Maurer began a series of conversations with cave management about the continuing tours in the developed section of the cave. At 12:30...
Maurer and Brooks began telling staffers to stop tours from entering the cave to clear the VC of all non-rescue personnel to remove obstacles for rescuers and reduce the possibility of exposing children and guests to a potential fatality. The cave owner issued directives to staff members and Brooks to continue tours. Eventually an agreement was reached between staff and Incident Command to continue tours on a very limited basis with all guests knowing they would be asked to leave once rescuers reached the commercial sections of the cave. Doug Moore arrived around this time and, after assessing the situation, left Incident Command to Brooks and began working with the arriving EMS, fire, and helicopter crews.

Although a series of phone lines run from the VC to the Ballroom (in the wild cave), they were largely out of commission at the time of this event. Maurer left the visitor center at 12:55 to check the phone lines in the Ballroom, but upon arrival at the base of the Flue, found a caver coming up with a report that the party had just reached the Ballroom.

Although the movement of firefighters, cavers, and the patient were slowed in constricted passages of the upper Flue, upon arrival in the commercial section of the cave they moved rapidly to the VC. Doug Moore and Tyler Anderson entered the cave around 13:20 to assess the in-cave situation, then Moore exited at 13:27 to prepare for the patient’s arrival topside.

Throughout the rescue Jason Zwick kept tabs on the rescue party to provide a 15 minute warning for the helicopter that had been placed on standby at the start of the emergency. The Incident Commander and LC staff stayed mostly aware of the situation, though the messengers began moving slower than the rescuers – with the five-minute warning being received only a minute before the patient arrived at the Main Entrance.

The patient was turtled through the narrow passages approaching the entrance and then without stopping, the patient was taken up and out of the cave, entering the VC at 13:36, the same time as the helicopter arrived. The patient was out of the VC and in the care of emergency services at the helicopter at 13:41, less than 2 hours after his injury occurred.

Emergency services took over life support and resuscitation efforts as the patient entered cardiac arrest shortly after being handed off. At 13:54 the helicopter left LC for Ruby Memorial Hospital in Morgantown, WV. Although the patient was alive when they departed, he died of his injuries several days later.

After the helicopter departed, entrance control notified Incident Command that one of the firefighters had not yet exited the cave. Four of the responding cavers swept the commercial section of the cave without finding him and were preparing to mount a further rescue when the missing firefighter reappeared. He had gotten winded and taken a break, then took his time exiting the cave.

Following these events, an OCR was held at Laurel Caverns to ensure that staff, firefighters, and local cavers were better prepared for future incidents at the cave.
BOOK REVIEW: CAVES OF THE NAKANAI
BUFORD C. PRUITT, JR


My first exposure to the caves of New Britain, Papua New Guinea, was a note from British Untamed River Expedition cavers who flew over the Whitman Range back in 1985, relating that they saw giant sinkholes. A French expedition that year also explored a series of caves there containing a “huge river.” New Britain then dropped off my radar until the 2017 Dachstein Expedition (Austria), when I met the book’s editor Jean-Paul Sounier. He told me that to get to New Britain they must first fly from Paris to Singapore, then take a shorter flight back to the island of New Guinea, then charter a helicopter to ferry kit and crew to a beach on New Britain, then schlepp their gear inland through tropical rainforest to a base camp. Weeks or months later, they packed it all back to the beach or a temporary “helipad” for the return hop to New Guinea, altogether costing several thousand Euros per person.

The first book on the caves of the Nakanai Mountains karst was Nakanai 1978-1998, 20 ans d’exploration (20 years of exploration), published in 2001. Caves of the Nakanai is the group’s second book on these caves, and is bilingual (French and English). Editor Sounier has attended 13 expeditions to Nakanai since 1980, including seven as their leader. Those who have read Europe’s historical caving books will appreciate that Sounier first became acquainted with caving through one of Norbert Casteret’s books. Co-author Florence Guillot took part in six Nakanai expeditions, acting as co-leader on three. David Gill attended three of the expeditions, leading two of them. Jennifer Gabriel is an anthropologist who has studied local customs on several trips to the Nakanai Mountains. Sounier conceived the book, chose the authors, and published the tome.

Sometime around the turn of the 19th to 20th Centuries, European mountaineers decided to organize as a group rather than remain a collection of independents. Shortly thereafter, French cavers took the hint and organized the world’s first caving organization. The rest of Europe soon followed, but it took almost another half-century for Americans to catch up. This student of caving history and caving expeditions appreciates that it is the French, the ‘inventors’ of modern speleology, who have led so well in the Nakanai.

The two books encompass a half-century of Nakanai speleology, showcasing more than 200 kilometers of galleries. In addition, research within New Britain caves has revealed the world’s largest known underground rivers, which can carry 5 to 20 cubic meters per second (cumecs), and at least in the case of Nare Cave have flood flows exceeding several hundred cumecs. It is no wonder that dissolution of the limestone has been estimated at appx 500 cubic meters per square kilometer per year! The speleological potential hints at another several thousand kilometers of passages awaiting discovery, as evidenced by hundreds of sinkholes and many small streams visible on satellite imagery through the dense tropical rainforest canopy.

These statistics can be attributed to the island’s strong uplift and the world’s strongest uplift, being whittled away by a hyper-humid equatorial climate having 5-10 meters of annual precipitation. Nonetheless, tectonic uplift easily outcompetes this extraordinary erosion, as evidenced by large resurgence perched high on canyon walls. “It is common for every expedition to the Nakanai to experience violent earthquakes” in this “most highly seismic area in the world.”

The book is divided into six sections: New Britain and the Nakanai Mountains, the people of the Nakanai, archaeology, expedition history, the caves themselves (largest section), and prospects. This coffee-table book is amply illustrated with color photographs, cave maps, geological formation sketches, images of petroglyphs, graphs, regional maps, and local topographic maps. Photographs include mega-dolines, off-raging clear-water epigean and in-cave streams, pools begging to be dived, cavers, villagers, flora, fauna, in-cave SRT, and base camps.

The book generously points out areas that have been little or not at all explored, but also advises future explorers not to neglect potentially rewarding exploration in already known caves to discover their extensions. For example, the known extent of Muruk (Cassowary) Cave was expanded from 4.5 kilometers surveyed in 1985 to 17.3 kilometers after two cave-diving expeditions, and in the process becoming the first cave in the Southern Hemisphere to exceed 1,000 meters in depth (currently the 2nd deepest at 1,178 meters). Cave diving and numerous climbs have also connected two “smaller” caves into the single Wowo Cave. So far, all the Nakanai cave diving has been done to pass sumps and siphons using open-circuit scuba, but there is also “huge phreatic potential.”
EDITORS’ NOTE

After the July 2024 NSS News went to print, we received some additional photo captions/credits for the great diving photos in that issue:

Cover: Cartographer Jason Richards scooters through the entrance tunnels enroute to sketch the cave, Station 17. Photo: Christina Richards

Page 6: Diver Jef Frank decompressing in the entrance room after returning from a photo dive. Photo: Christina Richards

Page 7: Jef Frank stands in the rapid flowing downstream passage, Station PCDD2. Photo: Christina Richards

Page 8: Diver Ryan Hoffman inspect the new safety line rigging leading into the downstream siphon, Station PCDD6. Photo: Christina Richards

Page 9: Divers Ryan Hoffman (front) and Liz Hoffman (back) swim down the downstream siphon, Station PCDD5. Photo: Christina Richards

Page 11: Diver Ryan Hoffman swims upstream to the main cave, station PCDD1. Photo: Christina Richards

There are opportunities for biological and human sciences. Gill points out that, although exploration is the main goal of their expeditions, two more important objectives must be kept in mind. First, the expedition must be sensitive to the well-being and needs of the local populace, which in this case is typically composed of isolated subsistence farming villages. The second is conservation of the karst and caves in consultation with the local community and relevant government entities. The book makes a strong case that Nakanai Mountains karst is a natural environment that warrants protection from timbering and palm oil plantations through proposed UNESCO World Heritage listing.

Authors eschew bombastics, grandstanding, and inappropriate cave naming, in so doing showing respect for the Nakanai ecosystem, its people, and its karst. As you peruse this book, you will no doubt become aware that its speleologists are as good as it gets. This book is a wonderful example of how long-term, recurrent international expeditions should be done. Buying a copy directly from Sounier will further support their endeavors in the Nakanai.

https://nakanai.speleo.com/index.html

CLASSIFIEDS


West Virginia Cave Books www.WVASS.org

If your grotto or region is looking for great caves to explore in the Virginia area - look no further! RASS Grotto can offer a complimentary place to camp in Bath County, VA - where more than 100 caves are located within an hour’s drive. We support cave conservation and education. Some COVID restrictions still apply. Contact Richie Ellison at relisson1120@gmail.com

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


WVASS, 13 Sleepy Creek Rd, Barrackville, Hurricane, WV 25526 andrew.schaer@frontier.com

I repurpose retired rope, webbing, harnesses for pack straps. I pick up donations in mid-Atlantic/Northeast. Abbe, 6035620754, abbethh@gmail.com

Ennis Cave Coffee Table Book: History, Biology, Speleogenesis and Passageways. Stone County, Arkansas, by Randal W. Rose. 11 x 12 x 1.75 inch, 6.6 pounds, 437 pgs, 576 photos. $100 plus $10 shipping. Satisfaction guaranteed. If you don’t like it, simply send it back. Contact randal.rose@jacobs.com

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The Central Appalachian Cave Rescue Team is forming as a volunteer, fully trained and equipped, 501(c)(3) organization with 7,000 caves in six states. We need insurance, equipment, an alerting app and more. We are hard at work and would greatly appreciate your donations. See our website at https://www.easterncaverescue.org/home. Or by PayPal. Questions? Earl Suitor, 703-431-2661. Thank you!

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