Western Cave Conservancy

Protecting the West's Last Frontier

Vol 14 No 1 Winter 2020

TRUSTEE TRIPS NOW AVAILABLE AT VANISHED RIVER CAVE

Mike Davies, SVR Project Manager

Vanished River Cave lies within San Vicente Redwoods in Santa Cruz County. Bay Area cavers have been visiting the cave since at least 1964 and likely years earlier. Many, or most, of these trips have been clandestine visits, often in the dead of night. The cave contains more than one mile of surveyed passages and it's a testament to many of those cavers that a detailed survey and map exists.

In 2011, POST and Sempervirens acquired the San Vicente property. Shortly thereafter, the Western Cave Conservancy signed an MOU with the new landowners to map and manage the caves and karst resources within on their behalf. One of the WCC's goals in signing this MOU was to introduce recreational caving to some of these caves in the form of trustee led trips. We pursued this goal in early 2018 and spent close to one year negotiating the details of such a program. We addressed concerns regarding legal liability, insurance, and appropriate protections for the cave with increased visitation. We finally signed a new MOU in April 2019 which included, within it's scope, trustee trips to the cave. The last hurdle was to set up photo monitoring of the main route through the cave to the sump, which for now is the only approved route for the initial phase of the program. The photos taken as part of this program provide a nice record of key decorations and locations along the route, which can be tracked over time.

We ran a successful initial trial trustee trip with SFBC cavers in late summer last year. We're ready to expand these trips to other NSS grottos both within and outside the SF Bay Area. We've reached out to numerous grottos and look forward to running additional trips before the MOU comes up for renewal in early April.

The trip into the cave takes 4-5 hours and is not a beginner trip, as there are numerous climbs and a modestly strenuous trip back out of the cave. It is well decorated and provides a good caving experience. Interested cavers can reach out to the WCC to be considered for upcoming trips.

IN THIS ISSUE

Vanished River Cave – Photo Monitoring

Mike Davies, SVR Project Manager

Site – PM16

Site Description:

Inside the 'Lunch Room' there are very nice intact stalactites above head height. Drips from these go into a small hole that has started to form of cave pearls.

Photo PM16a (February 24, 2019): Initial image of location with color card.

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P.O. Box 230
Newcastle, CA 95658

Telephone (831) 421-0485
Fax (831) 421-0485

Email
mail@westerncaves.org

Web site
www.westerncaves.org

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Photo PM16b (June 8, 2019): Closer image taken from below. Note that the flowstone comes down through a hole above.

Photo PM16c (June 8, 2019):

A broader context image shows additional flowstone in the foreground, but

this is higher off the floor and seems to be out of the reach of most helmets.

Site – PM33

Site Description:

'Formation Passage' is a parallel passage or loop to the main passage. Sites PM32 and PM33 have excellent decorations in this passage, but we will not pass through the passage on trustee trips, but instead look into it from either side.

Site PM33 is the initial, large opening into the route passage as a large hole on the left side of the main passage between sites PM22 and PM23. There is a long sawtooth or zebra-striped drapery that extends across the ceiling to about the mid-point of the righthand wall.

Photo PM33a (February 24, 2019): Initial image of one location with color card.

Photo PM33b (June 8, 2019): This photo is taken from a similar location looking into Formation Passage providing a good view of the extent of the drapery but also allowing a great view of additional decorations inside the passage. There are a lot of decorations on the walls and ceiling, earning the passage its name.

Photo PM33c (June 8, 2019): A third image is taken from the opposite side. From this perspective, you can now see that there are two separate draperies that start as flowstone coming from a hole in the ceiling before winding their way down the wall.

Letter from the President

Steven Johnson

I'd like to thank everyone for all the support you've given the Western Cave Conservancy during the past year. We've been working hard to continue being worthy of your support.

Over the past year, we've been excited to finally get some recreational, trustee-based trips going in certain caves that were previously off-limits. We were also happy to see the return of cavers to Avalanche Cave, with the blessings of the Forest Service (no trustee required).

Of course, the discovery of WNS in California has been an unfortunate development (both for the health of the bats and the convenience of cavers); the WCC continues to endorse a Clean Gear Policy, even for the areas of the state in which there is not yet any suspicion of WNS. We hope Western cavers will continue to set a good example by following all the best practices for minimizing the possibility of human-related WNS expansion.

We have interesting plans for 2020 that we hope to be sharing with you soon, including a new-and-improved website, and some other things that weren't quite ready at press time… which is as good an excuse as any to remind you that there is an email list for all things WCC-related. Just visit https://tinyurl.com/wcc-announce to join!

As always, we'd love to hear your thoughts on all things related to the conservation of caves, and how the WCC can help everyone succeed at this goal. Please feel free to share them with me at steven@westerncaves.org.

Cave softly!

REMEMBERING A PASSIONATE SUPPORTER OF THE WCC

By Marianne Russo

Historical research and photos provided by Bruce Rogers

Photos by Jane Laughlin and Bruce Rogers

This coming spring it will have been two years since we lost the company of Gale Beach (NSS # 6725). I was heartbroken to hear of her passing when I got call from Jim Lakner, another great supporter of the WCC and a wonderful friend to both Gale and Ray Beach. I first met Gale and her husband Ray back in the mid-1980's, probably at a fall Regional or perhaps at a spring Speleo-ed. As the years passed, I could always count on seeing them at local caver events and national conventions. At virtually every national convention I attended I could be sure to see Gale working hard at the registration desk. She was a quintessential "volunteer", always ready to get in and help out wherever she could be useful. She was always so friendly and welcoming and really made me feel like I was part of the big "caving family". She and Ray were life long cavers, learning their skills on many of the Mother Lode caves I experienced for the first time when I started caving in the early 80's.

Gale was so enthusiastic when she learned that a group of

Photo of Gale in her youth.

Gale perched on The Chockstone in the Scallop Room, Rippled Cave, Feb. 26, 1972.

Gale & Ray Beach outside Wildcat Cave at the 1972 White Salmon, WA, NSS convention.

2003 with Julia Graves (sis-in-law to Gale's younger brother Pat) & Ray — all supporting Beverage Appreciation Day…

cavers were starting a cave conservancy in the west. The Beach's, both Conservation Life members of the NSS, have been generous supporters of the NSS and its many worthwhile programs and projects. Seeing that a local conservancy could bring some of these same benefits to western caves and cavers, Gale encouraged us at every opportunity. She and Ray opened their home on several occasions when we needed a place for a board meeting and always showed up at annual public meetings and Regional presentations to lend their support.

Gale and Ray became founding members of the WCC in 2003, and always gave generous annual donations. However, Gale was especially fond of Rippled Cave having visited it many times during her early years of caving, and when we put out the call for donations and loans to help pay for what is now known as the Weller Preserve (15 acres plus Rippled Cave), she and Ray came through in a very big way. They gifted the WCC with $10,000 and loaned us another $10,000. They, along with several other very generous long-time cavers made it possible for us to acquire this much-loved Mother Lode cave, which sees frequent visitation by central California grottos throughout the year.

As if that wasn't enough, and this is a special memory for me, I would periodically get "post-cards" from Gale, bearing little notes asking if we needed anything for the Preserve. When I say post-cards, I mean old fashioned picture cards that you could buy at gas stations or variety stores, that had place on the back for a short note on one side, the address and postage stamp on the other. Before the advent of smart phones, I guess these could be considered the original "text messages". Anyway, as a result of one of these cards, Gale and Ray ended up giving to the WCC the money for the four folding tables and 20 stacking chairs we have in the Weller Fieldhouse. These are used for meetings and classes that are held from time to time. They do-

nated other materials when we needed them and were always encouraging us to make further improvements. I can say, truly, that we would have had a lot tougher time purchasing Rippled Cave and managing the preserve without the help of Gale and Ray.

And now, if you didn't have the opportunity to know Gale and Ray well, or actually go caving with them, here is a

Gale in Menlo Park, CA 2016.

brief history of their caving lives:

Gale first became acquainted with cavers and caving 1960 when she graduated from Stanford University . Her adventurous room-mate, Susan, discovered this interesting new club called the San Francisco Bay Chapter of the NSS. They attended a meeting and met a handsome young man, newly separated from the US Marine Corp. This fellow, one Ray Beach, was destined to play a major role in Gale's life. Apparently, in these early days, first time cavers such as Gale were blindfolded during the drive to their first cave. Until recent times, secrecy for cave locations was the mantra for all cavers. Today, of course, with GPS and the social networking, this is breaking down, although many hard-core cavers are still very circumspect with what they share.

She and Ray married in 1962, and she started her career in the Admissions Department of the San Francisco Children's Hospital. Gale was a very active caver between 1961 and the early 1980's, and along with Ray and other SFBC cavers did a remarkable amount of caving, many times under very tough conditions. In order to keep up with the "boys" and do all this caving, Gale quickly became vertically proficient. During this time, the standard rappel rig was double brake bars on two oval karabiners. A single steel chain link between them held the rig together. This was then attached to a seat harness with a locking karabiner. For most climbs back out Gale endured the tiring and wobbly thrill of climbing on cable ladders or the tried and true prusik knots (which are tied on to the rope using a loop of cord with a smaller diameter than the main rope). Later, when they became available, she switched to a set of Jumar ascenders, which were the standard when I started caving.

Besides going caving, she was active in grotto, region and national NSS activities. She was treasurer of the SFBC for decades, did a stint as the Western Region secretary/ treasurer, helped edit the Cal Caver (now called the Western Caver), served as a member of the NSS Board of Governors and was for many years an active member of the NSS awards committee. Early on, she assisted in the running of both the 1966 NSS Convention at Giant Forest in Sequoia N.P (the first truly western convention) and the later 1975 convention held at the Angels Camp, Frogtown fairgrounds in the California Mother Lode.

Gale and Ray participated in innumerable adventurous trips, not only to local California caves, but also exploring the great expanses of Nevada visiting caves and other features in the vast back country. The Beach's, along with Roger and Caroline Brown and our very own Bruce Rogers enjoyed amazing trips, usually associated around NSS Conventions, all around the U.S. Stories are filled with

The Latin scroll reads: "Life is short, memory long."

tales of un-

expected snow storms, flash floods, endless and confusing 4WD dirt roads, sodden tents and of course, fabulous camp dinners and adult beverages.

Gale was a very social person and for her the comradery of her fellow cavers was as important as the actual caving. She loved organizing gourmet meals on major trips and always appreciated a good party. Her social acumen and drive to organize and promote what she cared about led to her participation in "Speleo-politics," both on a local and national level, where she was very effective. Gale and Ray both had very successful careers which enabled them, in recent decades, to quietly be very generous donors to worthy caving projects such as the WCC and those associated with the NSS and affiliated organizations.

Project report for White Moon Cave, CA (a.k.a., Vanished River)

Cameron de Wet on behalf of the Oster Lab Group

Dept. of Earth and Environment Science

Vanderbilt University

We are using stalagmites collected from White Moon Cave to investigate climate changes in coastal California during the last ~10,000 years. Paleoclimatologists prefer to use stalagmites rather than other types of mineral cave deposits because of their simple, linear growth pattern. Variations in geochemical parameters of the calcite ($CaCO_3$) within a stalagmite track changes in climate during the time when the stalagmite grew that are transmitted through water that seeps from the surface into the cave. Thus, stalagmites can be used as records of what the climate was like in the past, in a similar way to how scientists study the chemistry of ice and air bubbles in ice cores. During the last few decades, stalagmites have become increasingly important records of paleoclimate changes in continental settings.

Stalagmites are particularly valuable records of paleoclimates because of our ability to extract data from individual layers within them with a high degree of precision using uranium-thorium (U-Th) disequilibrium dating techniques. This technique is based on the fact that, generally speaking, U ions are mobile in the soil and rock above the cave and can be transported to the stalagmite via seepage water, whereas Th ions are not. This means that any Th that we measure in the stalagmite layers is likely to have come from the radioactive decay of the uranium itself, which occurs at a known rate. These measurements allow us to generate an "age-model" that estimates the age versus depth relationship for the entire stalagmite and produce a record of chemical changes within the stalagmites with time.

We have collected U-Th ages for four stalagmites from White Moon Cave that indicate that these samples started growing in the cave between 10,000 and 6,000 years ago. Three of these stalagmites were found broken within the cave, possibly due to blast damage associated with quarrying efforts. One stalagmite was collected in situ by Oster and her students in consultation with Bruce Rogers in 2013. These samples allow us to assess how climate in drought-sensitive coastal California has varied since the beginning of the most recent geologic epoch known as the Holocene, which began roughly 11,000 years ago. The ratio of oxygen isotopes ($\delta^{18}O$) in the stalagmites provides information about the temperature of the atmosphere when rain droplets condensed and fell above the cave, as well as

Figure 1. Vanderbilt undergraduate student Monica Xu samples dripwater in White Moon Cave in June 2019.

the atmospheric circulation patterns that brought the rain to this region. The ratio of carbon isotopes ($\delta^{13}C$) tells us about the amount and types of vegetation that was growing above the cave in the past. Trace elements (e.g. magnesium or phosphorous) provide information about how wet the environment was and the rate at which rainwater infiltrated the ground above the cave. We also monitor these same geochemical signals in dripwater samples in the modern cave environment in order to better understand the system today. These cave monitoring efforts allow us to hone in on what aspects of climate system (e.g. temperature, annual rainfall, rainfall source) are driving the changes that we see preserved in the stalagmite. Together, these different geochemical proxies allow us to investigate specific questions about how California's climate has changed in the past, with an eye toward better understanding what to expect in the future.

Specifically, our lab has been using a speleothem from White Moon Cave that grew from ~8,600 until ~300 years ago (WMC1; fig. 2B) to investigate how rainfall rates in the region have changed in response to changes in global ocean and atmospheric circulation patterns. We have been

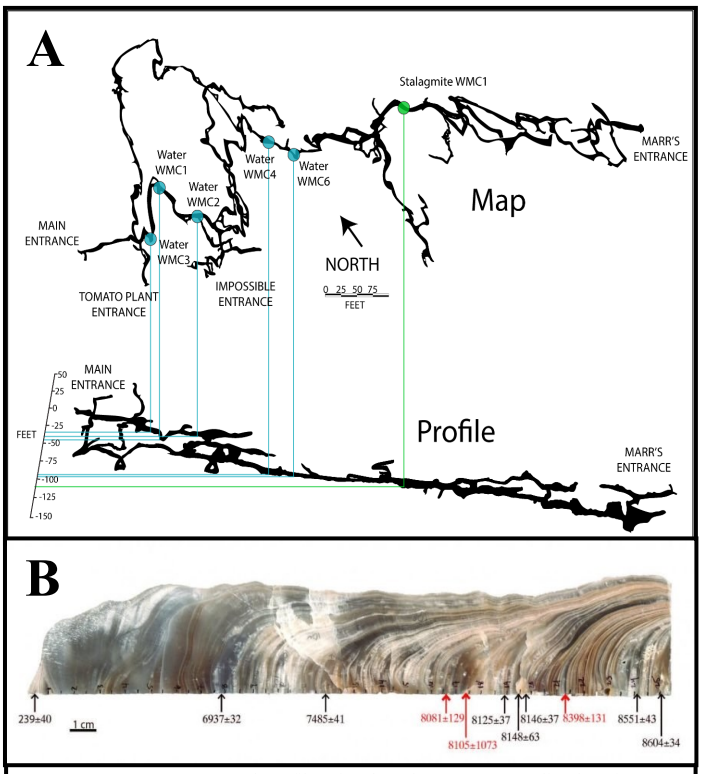

Figure 2. (A) WMC map and profile. Blue dots show water sampling locations from this study. Green dot shows approximate location of stalagmite WMC1 that was collected several years ago by a UCSC student. Main entrance is the modern entrance, which opens to the quarry wall. Map based on unpublished cartography by P. Bosted in 1986. **(B)** Quartered and polished stalagmite WMC1 with U/Th dates (cal. years before 1950) and 2 sigma errors from Oster et al. (2017). Dates colored red have high ^{232}Th and high measured uncertainties, and were not included in the age model.

focusing on an important climate event that occurred 8,200 years ago, known as the 8.2 ka event. The event is believed to have been caused by the catastrophic draining of large lakes of glacial meltwater that were situated near the present-day Great Lakes at the end of the last ice age. The drainage of this cold, fresh water into the North Atlantic appears to have caused a suppression of deep water formation that lasted for ~160 years. Paleoclimate records indicate that this suppression had ripple effects throughout the Earth's climate system resulted in colder temperatures in the northern hemisphere, and changes to precipitation patterns around the globe. Paleoclimatologists have been particularly interested in the 8.2 ka event because continued influx of large volumes of meltwater from the Greenland ice sheet to the North Atlantic could lead to a similar disruption to ocean circulation in the coming decades/centuries.

Importantly however the impacts of this significant climate event have not been well characterized in western North America. Our work at White Moon Cave has been changing this. Stable isotope and trace element data from the White Moon Cave stalagmite point toward increased wetness and storminess in coastal California during the 8.2 kyr event, suggesting rapid changes in atmospheric circulation over the Pacific Ocean in response to freshwater input and cooling in the North Atlantic. These data were published in the journal Scientific Reports by Dr. Jessica Oster and others in 2017 and have raised interesting questions about how winter storms in coastal California may be influenced by climate changes around the globe.

We are now applying a new geochemical measurement to this stalagmite to attempt to generate quantitative reconstructions of precipitation change across the 8.2 ka event. The calcium isotope ratio in stalagmites (δ44/40Ca) responds to how much calcite has precipitated from seepage waters in the rock above a cave, which is ultimately a function of the amount of local precipitation. Most interpretations of paleoclimate proxies are limited to qualitative changes (e.g. more vs. less annual rainfall), but the calcium isotope proxy has been interpreted as a quantitative metric for past rainfall (e.g. increase in annual rainfall by 300 mm). Calcium isotopes represent an exciting new method of investigating rainfall variability in California during the 8.2 kyr event and beyond with a high degree of detail. To complement the δ44/40Ca data and explore variations in host rock dissolution, we are also developing a strontium isotope (87Sr/86Sr) record for WMC1. Speleothem87Sr/86Sr is an established qualitative proxy for water-rock-soil interactions above a cave and will serve as a valuable comparison for the δ44/40Ca data.

Our ongoing work in White Moon Cave is aimed at continued monitoring of oxygen and carbon isotopes and trace elements in cave drip waters during the summer and winter at multiple drip sites within the cave (see fig. 1A). Additionally, in order to use calcium isotopes to estimate specific rainfall rates in the past we must compare our stalagmite data with data from calcite that grew in the modern environment. In order to achieve this, we installed small glass plates underneath drip sites and allow trace amounts of calcite to precipitate on them. We then return to the cave after ~6 months to collect these plates and analyze the modern calcite. Ultimately, it is the comparison of this modern calcite and calcite from the stalagmite that allows us to estimate average annual rainfall from thousands of years ago.

Our lab has also been using a different stalagmite from White Moon Cave that grew from ~7,500 until ~3,000 years ago (WMC2) to develop new techniques for determining the ages of stalagmite layers. As noted above, stalagmites can be accurately and precisely dated at high precision using uranium-thorium disequilibrium dating methods, but this precision can be markedly reduced if the analyzed calcite is contaminated by other U- or Th-bearing mineral phases. Such contaminants can be difficult or impossible to visually identify using conventional microscopic approaches when they are below the speleothem surface, and may be accidentally incorporated into sub-samples, leading to unexpectedly large dating uncertainties.

In collaboration with a high school student from the School for Science and Math at Vanderbilt (SSMV), a partnership between Vanderbilt and Metro Nashville Public Schools,

we have developed an approach to identify clean, dense calcite samples for U-Th dating using the micro-Computed Tomography (CT) machine at Vanderbilt that is minimally destructive to the stalagmite sample. Just like CAT scans in a doctor's office, the microCT machine uses X-rays to image density differences within a sample and construct a 3-D model of the internal structure of the stalagmite. We applied this new approach to WMC2, which contains mm-sized pockets of silicate detritus that greatly reduce the precision of U-Th ages. Because different minerals have different densities, this new approach allows us to detect these pockets of detritus below the surface of the stalagmite and then select volumes to sample for U-Th analyses that are free of contaminating minerals. Ultimately, we were able to improve the precision of the U-Th ages for WMC2 considerably. This method shows promise for optimizing the selection of material for U-Th or other proxy analysis and can thus improve paleoclimate records, especially in stalagmites with high concentrations of contaminating minerals.

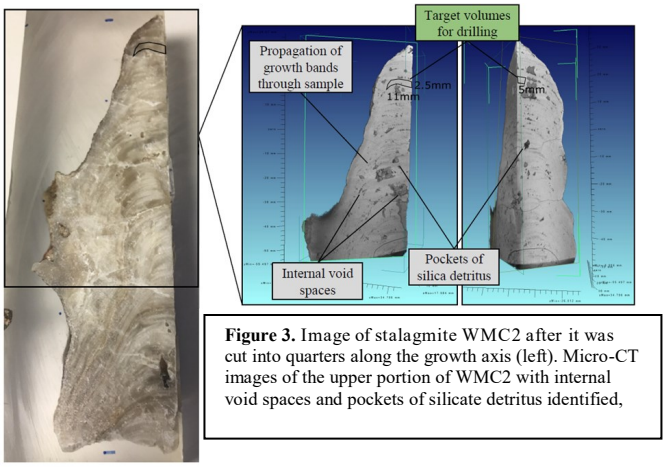

Figure 3. Image of stalagmite WMC2 after it was cut into quarters along the growth axis (left). Micro-CT images of the upper portion of WMC2 with internal void spaces and pockets of silicate detritus identified,

We hope to continue working in White Moon Cave in collaboration with the Western Cave Conservancy. Future goals include developing paleoclimate records that cover the entirety of the last 10,000 years using all of the stalagmites we have collected from the cave. The development of these records takes time, and involves many different sampling and analytical techniques. The field effort is central to this work because understanding how modern climate change influences the cave provides the framework for interpreting the past changes we see in stalagmite geochemical records. We greatly appreciate the collaboration of Mike Davies and Bruce Rogers in providing guidance and support in the field. This work has been financially supported by the National Geographic Society, the National Science Foundation, and the Karst Waters Institute.

White Moon Cave publications:

Paper:

Oster, J.L., J., Sharp, W.D., Covey*, A.K., Gibson*, J., Rogers, B., Mix, H. (2017) Climate response to the 8.2 kyr event in Coastal California. Scientific Reports 7:3886.

Conference Abstracts (* denotes student author):

de Wet*, C., Erhardt, A.M., Marks, N.E., Sharp, W.D., Xu*, Y., Oster, J.L. (2019) Toward quantitative records of rainfall using speleothem Ca and Sr isotopes. PP44B-07. AGU Fall Meeting, 9-13 December (upcoming).

de Wet*, C., Erhardt, A., Sharp, W.D., Oster, J.L. (2018) Application of the speleothem calcium isotope paleorainfall proxy to the 8.2 ka event in coastal California. PP43E-1968. AGU Fall Meeting, Washington DC, 10-14 December.

Neal*, K., de Wet*, C., Sharp, W.D., Oster, J.L. (2018) Using microCT to improve 230Th/U dating of speleothems. PP23D-1506. AGU Fall Meeting, Washington DC, 10-14 December.

Covey*, A.K., Oster, J.L., Sharp, W.D. (2014) Coastal California climate response to the 8.2 kyr event: A high-resolution multi-proxy speleothem study. GSA Abstracts with programs v. 46, no. 248070.

Oster, J.L., Covey*, A.K., Gibson*, J., Sharp, W.D. (2014) Speleothem-based evidence for the 8.2 kyr event on the California coast. Goldschmidt Conference, Sacramento, CA, 8-13 June.

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