Photo Summary of Field Trip to Montezuma Well National Monument

April 22, 2023

On-Site Coordination by Sharon & Dennis DuBose, RCC President and RCC Treasurer;
General and Pre-trip Coordination by Brent Reed, RCC Board Member
Photos by RCC Members Diane Seago, Chris Tetzloff, & Dennis DuBose
Sponsored by Rim Country Chapter (RCC) of the Arizona Archaeological Society (AAS)
Guided by Archaeologists Matt Guebard and Lucas Hoedl of the National Parks Service.

All text and captions to these photos are by Dennis DuBose. Dennis DuBose is responsible for all inaccuracies and errors in text and captions. Unattributed Photos are by Dennis DuBose.

Montezuma Well Note the Cliff Dwellings at the Upper Left NPS Photo

On April 22 at 10:00 am thirteen participant Field Trippers assembled in the Picnic Area of the Montezuma Well National Monument and were met by Archaeologists Matt Guebard and Lucas Hoedl of the National Park Service (NPS).

Early Arrival Field Trippers at Montezuma Well National Monument Picnic Area

The Wooden Bridge in the foreground goes over the modern flow channel of the Irrigation Canal that carries the water exiting from the Well.

Modern Canal that Runs around the Picnic Area Carrying the Water that Exits the Well

Field Trippers Examining the Remains of the Prehistoric Canal about Forty yards from the Picnic Area

The Prehistoric Canal appears to be lined with rough concrete. Actually, it is precipitated Calcium Carbonate from the Montezuma Well water. The Well water is high in Calcium and Carbon Dioxide. Calcium Carbonate starts precipitating out when the water is exposed to the outside, making Travertine. So, the canal lining is actually Travertine, a kind of limestone.

Field Trippers decided to walk rather than drive to the first stop, a cover-protected large pithouse excavated in the 1950s by NPS Archaeologists.

Photo by Chris Tetzloff

Several smaller pithouses were also excavated nearby and backfilled afterwards. Matt Guebard said that recently they tried to locate them using Ground Penetrating Radar, without success. But they found a stone-lined plaza and a storage feature.

The original excavators wanted to have the large pithouse open for viewing by visitors, so, they temporarily covered it with newspaper to protect the surface and partially backfilled it. When they were ready to prepare the pithouse for exhibit, they dug out the backfill and removed the newspapers. But the newspaper was stuck to the surface, which was damaged by the removal. So, they did their best to restore it and painted it over with a compound called Durawell.

So, the pattern on the floor is preserved but it is not the original floor. Also, Durawell deteriorates over time and needs maintenance regularly.

The cover was built to provide additional protection.

The pithouse dates from perhaps around 1000 AD.

Photo by Diane Seago

The Field Trippers decided to walk on from the Pithouse to Montezuma's Well rather than drive. The distance was less than a mile and the parking at the base of the Well is limited.

Field Trippers Walking down the Road from the Pithouse to the Well Itself

The roof of the very small Visitor Center can be seen on the hillside right over the head of the column of Field trippers in the above Photo. The Well is centered in the hill just above the Visitor Center.

Field Trippers Heading up from the Visitor Center to the Well Rim

At the Rim of Montezuma Well

Field Trippers Looking Down into Montezuma Well

Field Trippers Taking in the View of Montezuma Well

Turning to their left, the Field trippers can see several Cliff Dwelling stone masonry structures built into the inner side of the well, hanging above the water.

One of the Prehistoric Stone Structures Built into the Inside Rim of the Well
Photo by Diane Seago

Photo by Diane Seago

Looking Down into Montezuma Well from its Rim

It is hard to capture the awesome feel of Montezuma Well in a single photo.

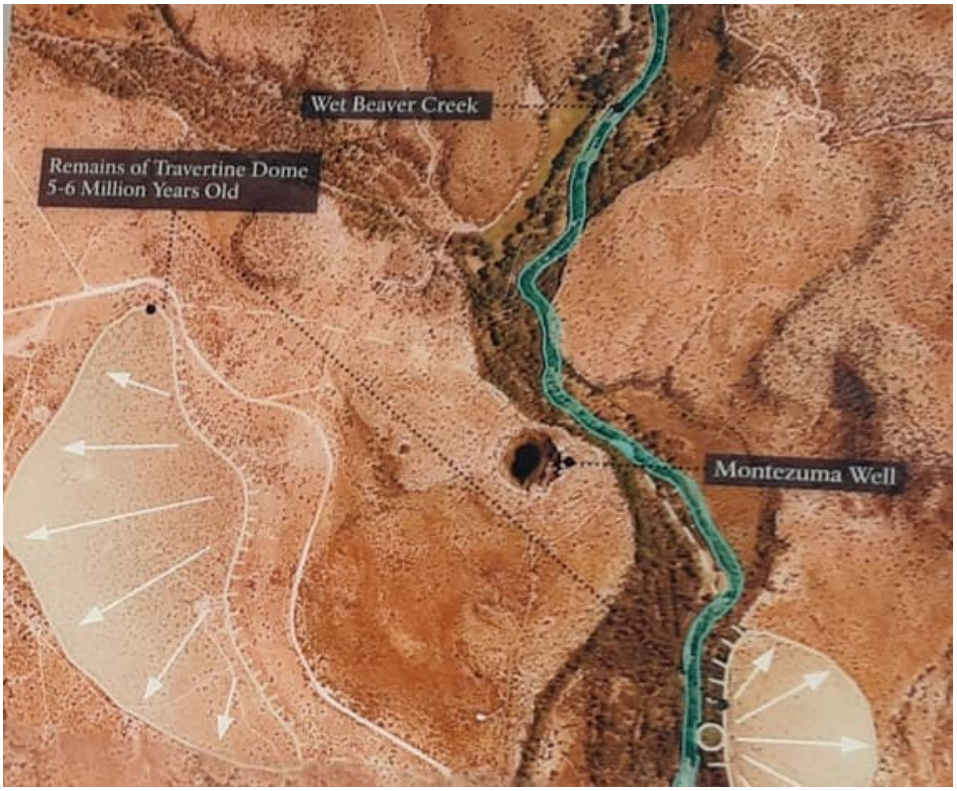
To the left, out of site, are a number of prehistoric stone masonry structures built into the inner wall of Montezuma Well, small Cliff Dwellings. The trail down into the Well leads around to the right, also out of view. After 105 steps down there is a shady grotto, with caves leading into the inner wall of the Well, dark and shady and cool. Once your eyes adjust to the light level, you can see prehistoric structures built inside the caves. Then turning around, through the trees, like standing on the bank, you can look out over the water in the bright sun. And the water escapes seeping through the rock just a few feet away.

It would flow into Beaver Creek except for a thousand years Prehistoric and Historic Americans have channeled the water to irrigate their nearby fields.

The outflow stream from Montezuma Well flows into Beaver Creek in an underground channel exiting from the Grotto in the clump of trees in the photo below. Beaver Creek is just beyond the rim of the Well.

At Montezuma Well Looking Down toward the Grotto

Note two hikers on the trail down, right center



A Map of the Montezuma Well Area from a National Parks Service Display

Field Trippers Beginning the Descent into Montezuma Well from the Travertine Deck at the Top, Going Down the 105 Steps to the Bottom Shore

Field Trippers Looking for Leaf Fossil Imprints in the Travertine Boulders along the Trail Down

Apparent Fossil Leaf Print in Travertine

Path to the Grotto

In the Grotto

There are caves down in the grotto penetrating the travertine sides of the well.

And in the caves are some prehistoric structures.

Some of the caves go far back …

Deep inside …

And as your eyes adjust to the darkness …

You can see dwellings deeper inside.

Bats live in the caves during the summer, so after May 1, the trail down to the Grotto is closed.

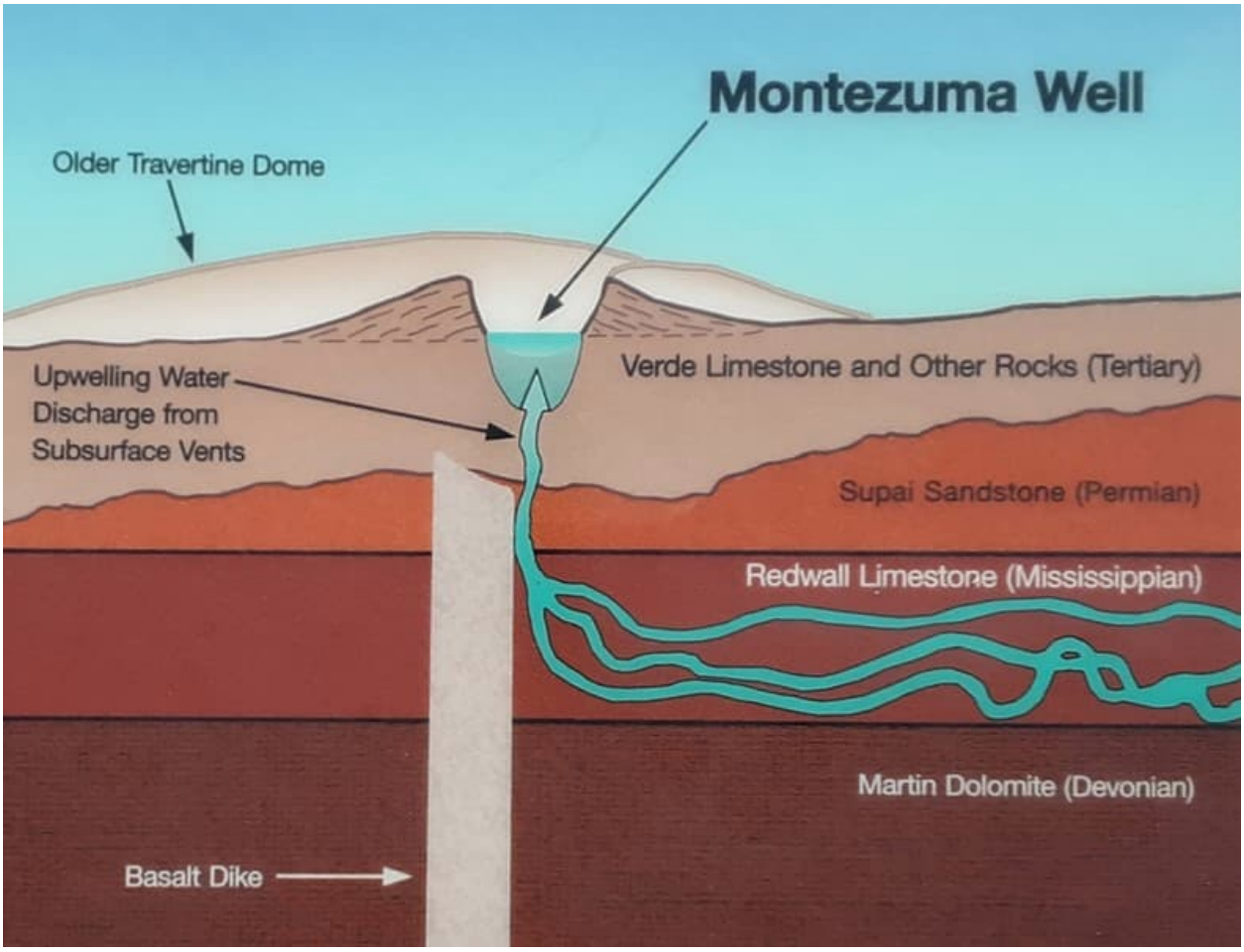


Diagram of a Cross Section of Montezuma Well

The water entering Montezuma Well today fell atop the Mogollon Rim some ten thousand or more years ago. It seeped down through hundreds of yards of various layers of rocks until it reached the relatively permeable Redwall Limestone layer. It trickled through this formation south towards Montezuma Well, where it runs into a prehistoric volcanic basalt dike which forces it to the surface.

Montezuma Well is structured sort of like a water volcano, as in the diagram above. Its sides are the remains of an older larger travertine dome that has since been much eroded down to its present size. The current exit spring keeps the Well from overflowing and continuing to grow. Also, perhaps the flow rate is lower than very long ago when the dome was forming.

Travertine is a sedimentary rock formed by the chemical precipitation of calcium carbonate minerals (limestone) from fresh water springs with a high carbon

dioxide concentration. Travertine includes both hot and cold spring deposits and also stalactites and stalagmites in caves.

Spring mounds are domes of travertine ranging in height from a few feet to over 300 feet surrounding a spring orifice. Because the spring orifice is above ground level, the formation of terrestrial mounds requires either an artesian spring or a geyser.

This exactly describes the situation at Montezuma Well, except for the now low-level water exit point, which keeps the Well from overflowing and growing anymore.

Down low in the Well face-to-face with the water surface, the question came up, "How deep is the water?" Our NPS guides said that is uncertain. There is a "false bottom" about 50 feet down. Divers have observed this false bottom. There is a constant upwelling of water from the springs below that keeps "sand" suspended to the point where it cannot be pushed higher. The water below this point is densely full of sand. It looks like a bottom, but a diver can stick his hand down into it and it passes into it like it is water, which it is, with a heavy load of suspended sand.

Looking Across the Water of Montezuma Well from near the Grotto
Note the prehistoric cliff dwellings in the opposite wall of the Well

Attempts to sound the depth by lowering weights to find the true bottom fail because the upward push of the water tends to suspend the weight at some point down. Long objects pushed down below the false bottom to probe it tend to be forced back up. One Internet site claimed the true bottom is about 50 feet below the false bottom.

Our guide Matt Guebard said that several times in past decades divers have gone down to investigate the water in the well. These dives were in the 1950s and 1960s, then in the early 2000s, the last in 2016. At least one of these dives was video recorded and can be viewed on the Internet. Matt said the video is well worth viewing.

A YouTube Video of Montezuma Well features including divers going into the Well can be found here …

https://www.youtube.com/watch?v=PM9tiz_Rp6k&ab_channel=LegendaryJim

The video is some 14 minutes long. The Dive into the well starts at about Minute 3:00 with the actual underwater part starting at about Minute 4:00.

Here below is a still photo of the false bottom.

In Montezuma Well, some 40-50 feet down, just above the "False Bottom" sandy water bubbling up, while Amphipods swim about

Almost 20 species of organisms worth noting live in the well.

The Well water is high in Calcium, Arsenic, and Carbon Dioxide. The water is definitely not healthy to drink. Most organisms cannot live in it. Consequently, several of the organisms found in Montezuma Well are unique, found only there and nowhere else in the world.

There are at least five species of organisms that are unique to Montezuma Well, found nowhere else in the world. That is more endemic species of any other spring in the southwestern United States.

These unique organisms are …

A diatom (a type of one-celled algae),
The Montezuma Well springsnail (a kind of snail that lives in springs with high carbon dioxide concentration),
A water scorpion,
The Hyalella montezuma amphipod (a crustacean, something like a shrimp),
The Motobdella montezuma leech (a blind, non-blood-sucking leech)

The leeches feed on the amphipods, which they detect with "hairs" around their mouths.

One would think that using arsenic-laden water for irrigation of food crops would be a problem. Our guide said that it was not dangerous at Montezuma Well because maize (corn) does not absorb the arsenic and there is no indication that Prehistoric or Historic Americans eating corn grown irrigated with Montezuma Well water suffered from it.

Out of curiosity I did an internet search on plants' uptake of arsenic. I sort of presumed that perhaps plants do not absorb arsenic from the soil. It turns out many plants do absorb arsenic. The species of plant is the major factor affecting how much and what parts of the plant accumulate it. Apparently, most plants that absorb arsenic keep it in the roots. It is said that few agricultural plants accumulate arsenic in their edible parts.

The main exception is rice. I found quite a few papers and articles about world-wide problems with rice absorbing arsenic into all parts of the plant, including the grain and its husk. One author said flooded rice paddies provided the ideal conditions for rice to absorb arsenic. Another said that rice has been described as a natural arsenic accumulator.

Initially, I did not see any technical papers that mentioned any other arsenic accumulator plant besides rice. I specifically searched for maize and found one paper that expressed some concern for maize. Apparently, there is little or no technical data on this for maize. The paper's authors' main point was that if maize does absorb arsenic into the grain, since it is the world's most widely grown grain, it "may" be a concern. Apparently, it was not a problem at Montezuma well.

Montezuma Well was previously owned by the Back Ranching Family. They operated it as a tourist attraction. The Backs attempted to introduce fish into the well. The fish died within minutes. It was not arsenic that killed them but instead the high concentration of carbon dioxide in the water.

The Field Trippers climbed back up the 105 steps and out of the Well then around the southeast side of the well.

Along the way there were ruins of pueblos in various states of repair or reconstruction. The former private ranch owners (the Back family) of Montezuma Well ran it as a tourist attraction before selling it to the national Park Service. They attempted to partially restore parts of some of the numerous ruins to make it more attractive.

One of these ruins had about ten rooms. They were occupied in the 1300s. At that time it appears that the Grotto was no longer a habitation.

Next, the Field Trippers descended to the base of the outer wall of the Well to along the canal and parallel to Beaver Creek to the water exit point.

Field Trippers Gathering just before the Well water Exit Point, Next to Canal

Archaeologist Matt Guebard talking about the Water Exiting from Montezuma Well Photo by Diane Seago

Over Matt's right shoulder is a glimpse of Beaver Creek. The rock face to the right is the Travertine base of the cone of the Well, which is up and over and then down to the right.

It is Perfectly Safe Down There So long as You Stay on Trail and Don't Drink the Water Note the sign.

The exiting water seeps through 150 feet of porous rock, taking seven-and-a-half minutes to break free. One of the NPS personnel said this had been determined with a dye test.

The Montezuma Well Water Exit Canal NPS Photo

The photo above is looking downstream in the canal, the modern visitor trail is to the right. The exit point from the Well is behind.

The modern canal at this point follows closely the prehistoric canal route. The canal has been used for about 1000 years. At times the canal was seven miles long and irrigated some 60 acres.

The earlier photos in this Summary of the modern canal by the Picnic Area and of the prehistoric canal segment about 40 yards away from that point are together about a mile from the Well Exit point.

The water level in Montezuma Well remains essentially constant, varying about an inch, regardless of rain or not, wet year or dry year. The flow out is essentially the same all year long, every year. It is a reliable source of irrigation water.

Where the Montezuma Water Seeps out into the Canal, 1.5 Million Gallons a Day
NPS Photo

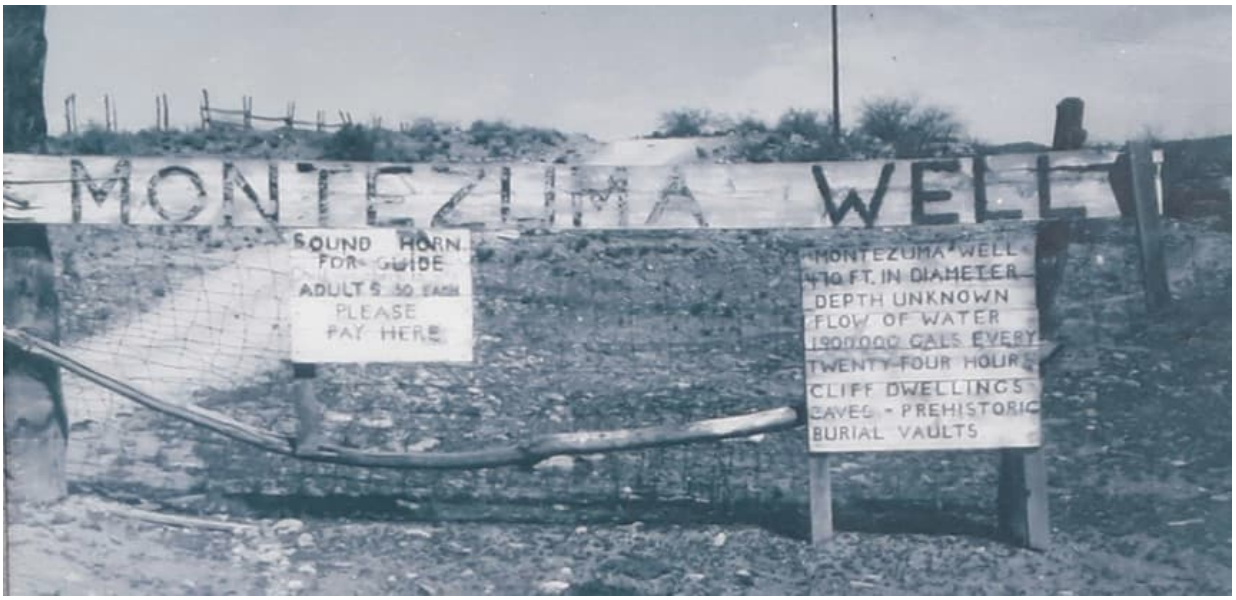
In the Montezuma Well YouTube video cited earlier, there is a good part about the water exit into Beaver Creek starting about Minute 11:25.

https://www.youtube.com/watch?v=PM9tiz_Rp6k&ab_channel=LegendaryJim

After observing where the water exits from the Well, the Field Trippers hiked back to just before the picnic area, where Matt and Lucas led the crew into a normally closed area where currently some NPS personnel live. Formerly, it was the Back Family Ranch headquarters. There had been at times a fortified adobe house with gun ports there due to conflicts with Apache raiders. And there had been a substantial house that somehow burned down. It was replaced by a simple home that may have been built from a "kit."

Behind the "kit" house is a very old Smokehouse, the modern canal, and a Rock Shelter.

The Back Ranch Family “Kit” House



The Back Family Ran Montezuma Well as a Tourist Attraction. This Signage was Present in 1947 when the national Park Service took Custody of the Site

Old Smokehouse from about 1885

The Smokehouse originally had a flat roof. Perhaps at one time it had been a living quarters. Now, inside it is all covered with soot, with meat hooks hanging from the ceiling.

Close-up Detail View of a Corner of the old Smoke House

Photo by Chris Tetzloff

Behind the Smokehouse and across the Montezuma Well Canal is a Rock Shelter. Probably it was used in prehistoric times. There are other cave or rock shelter features in the area that were used in prehistoric to historic times for habitations or other purposes by various peoples.

This particular rock shelter was used by the ranchers as part of an animal pen. It also appears that at some time it was used as a metal forge as well.

Field Trippers Taking Advantage of the Shade in the Rock Shelter Behind the Ranch House Area, and some Historic Metal Artifacts on its Floor Photos by Chris Tetzloff

Field Trippers Heading Out, Along the Montezuma Well Canal, with the old Smokehouse in the Distance, and the Picnic Area in the Trees Beyond

Old photos from the ranching era show there were no trees or mesquite bosque in the area, only open fields.

A Long Good Day at Montezuma Well