



## MONTEZUMA WELL

## Prehistory

Montezuma Well, located in the Verde Valley of north-central Arizona, is a natural sinkhole that formed some 11,000 years ago when the limestone roof above collapsed. The Well was long the home of first Hohokam, Sinagua, and later, Yavapai and Apache people, and remains a source of irrigation water for the Verde Valley to this day. The Well is also a unique habitat in which several species are endemic (found nowhere else in the world), having adapted to the Well's distinctive water chemistry.

## Environment

The water in Montezuma Well has unusually high levels of dissolved carbon dioxide (nearly 100 times higher than most aquatic environments) and arsenic, as well as calcium and other chemicals. This combination prevents fish from living within the Well, but is also responsible for the evolution of the five endemic species found within the Well: a diatom (*Gomphonema montezumense*), an amphipod (side-swimmers; *Hy-*



The outlet of Montezuma Well.

## OVERVIEW



USGS/R.H. JOHNSON

Looking south across Montezuma Well.

*allela montezuma*), a leech (*Motobdella montezuma*), a water scorpion (*Ranatra montezuma*), and a spring snail (*Pyrgulopsis montezuma*), as well as several other species suspected of being endemic, but not yet formally described as such.

Phytoplankton serve as the base of the Well's simple food chain. These are eaten by the amphipods, which in turn, are eaten by the leeches. Each day at sunset, the amphipods rise to the surface to feed on algae, and the leeches follow, hunting the amphipods in the dark of the night (Govindich and Bain 2005). Sonoran mud turtles are also native to the Well, and along with other resources, provided prehistoric people a ready food source.

The Well is fed by two powerful underwater vents and maintains a constant temperature year round. Water exits the Well at the southern edge, traveling through a swallet (a dissolved channel in the stone that drains the surface water) some 300 feet through the limestone surrounding the Well and exiting into a prehistoric irrigation canal on the other side, near Beaver Creek. Roughly 1.5 million of gallons, 74 degrees in temperature regardless of the time of year, flow out of the Well every day.

Inside Montezuma Well and along Beaver Creek, the Well supports a variety of riparian floral species, including Arizona sycamore, while up on the rim of the Well, yucca, other cacti, saltbush, cliffrose, and a variety of other desert species are present. These combined resources provided prehistoric peo-



Tuzigoot Red olla or storage jar. Courtesy of the American Southwest Virtual Museum ([swvvirtualmuseum.nau.edu](http://swvvirtualmuseum.nau.edu)).

ple a rich environment with a variety of plant foods and game, as well as an environment in which abundant water and consistent summer temperatures allowed for maize, bean, squash, and cotton crops.

## Prehistory

The earliest people to live in the Verde Valley were hunters and gatherers that were surely present by eight or nine thousand years ago. Initially semi-nomads, these people and their descendants came to rely more heavily on plant foods over time, and ultimately, shifted to more sedentary lifestyles focused on food cultivation and later, agricultural production. By A.D. 650, a small population of sedentary agriculturalists — known archeologically as the early Sinagua — were living in the Verde Valley (Pilles 1996).

Over the next 200 years or so, Hohokam cultural influences, if not the people themselves, began to appear in the Verde Valley. In Montezuma Well, the earliest of these Hohokam-like features appeared sometime in the seventh or eighth century A.D., including the original irrigation canal used to transfer water from the Well's outlet to small agricultural fields. The large publicly-accessible pithouse near the Montezuma Well picnic area is also Hohokam in style, but was built and used later.

By A.D. 1125, the population of the Verde Valley had begun to grow and peak, and it was at this time that the large well-known communities such as Tuzigoot and Montezuma Castle were built. These communities were built by the Sinagua, some of whom had always lived in the Verde Valley, and others that may have migrated from the northern Sinagua communities around Flagstaff.

One of the first Sinagua villages in the Montezuma Well area was Swallet Cave, located within the Well itself. Swallet Cave, though relatively small at only nine rooms, completely enclosed the swallet, thereby controlling the place at which the water began to drain from the Well interior.

Based on the absence of Tuzigoot Red pottery (dating roughly between A.D. 1150 and 1400), Swallet Cave was not occupied for long. Its wooden elements, and possibly the building stones as well, were likely removed for use in building new structures in the alcoves just below the rim of the Well, as well as on top of the rim (Ladd 1960). Like the previous residents of Montezuma Well, the Sinagua used the outlet water from the Well to irrigate fields totaling perhaps 60-140 acres in all. Agricultural staples included maize, squash, beans, and cotton, the latter of which was an important trade item, along with salt mined near Camp Verde and local argillite. The Sinagua traded great distances, acquiring both shell from the south and pottery from the north.

The Sinagua living at Montezuma Well maintained fieldhouses from which they guarded and worked their agricultural fields. These, however, fell out of use increasingly in the 1300s, as people began to consolidate their living spaces into the large pueblos on the rim of the Well. The population of the area also



Swallet Cave Ruin.

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Prehistoric wall framing a room in front of the Montezuma Cave swallet.

peaked at about the same time, with perhaps 150-200 people living in the Montezuma Well area.

By A.D. 1400, people had begun to move out of the Verde Valley, and by A.D. 1425, the Sinagua had left their homes at Montezuma Well and other Verde Valley sites. Why they left remains a mystery, but it was probably the result of a combination of environmental and social conditions. It may be, for example, that when the prehistoric population peaked in the area, the fields became overworked, game scarce, and wood resources depleted, which could have resulted in not only food shortages, but conflict between villages. The arrival of the Yavapai may also have contributed to the Sinagua migrations, as may have religious factors.

Another fascinating possibility remains — one having to do with the high arsenic content within the Well's water. The level of arsenic found in Montezuma Well is about 100 micrograms per liter (Compton-O'Brien et al. 2002), far above modern standards for safe drinking water. Long-term consumption of the water, and more specifically, native Well species, such as turtles, may have led to black foot disease (gangrene) and goiter (Senanayake 2005), skin rashes, seizures, a variety of other physiological conditions, psychosis, and death. Even at doses low enough to not cause immediately noticeable effects, multi-generational exposure could also have led to birth defects.

Regardless of the reasons — be it disease, famine, conflict, religious reasons, or a combination of these factors — the Sinagua slowly left Montezuma Well and the surrounding region, moving northeast and joining the ancestors of the Hopi, with whom they already had ties (Jeddito Yellow Ware pottery, for example). Some may also have gone south towards Phoenix and west toward Prescott, and others still may have stayed, joining the Yavapai, and possibly Apache people, as well.

The Yavapai people continued to live in the Verde Valley, and were present when Spanish explorers passed through the area in the late 1500s. Apache oral traditions suggest Apache presence in the Valley at the same time, and archeological evidence indicates Apache people living at Montezuma Well specifically during the 1800s (Schroeder and Hastings 1958). Both tribes — now the Yavapai-Apache Nation — continue to live in the Verde Valley to this day.

## Oral Tradition

Montezuma Well is an important place in Native American oral traditions. The Hopi remember their ancestors living at the Well, from which they migrated because corruption had led a great serpent to destroy the village (NPS Montezuma Well brochure 2007). Navajo people also consider the Well sacred, and the Well features in Yavapai and Apache origin stories. According to Yavapai tradition, for example, Montezuma Well (*Ahakaskyaywa*) is the place at which all beings entered the world, climbing a maize plant from the underground world below (Khera and Mariella 1983). The Well then filled with water, becoming as it is today.

## Archeology and Preservation

Montezuma Well, an unfortunate victim of nineteenth and twentieth century curiosity hunters and looters, was not studied archeologically until after it was acquired by the National Park Service from former owner William Back in 1947.

In the late 1950s, the National Park Service excavated the large Hohokam pithouse along the entrance road to Montezuma



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A Jeddito Black-on-yellow bowl, a Hopi pottery type found in the Montezuma Well region. Courtesy of the American Southwest Virtual Museum ([swvirtualmuseum.nau.edu](http://swvirtualmuseum.nau.edu)).

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The ruins of the rim-top pueblo above Montezuma Well.

Well. This pithouse, which dates to the early twelfth century A.D., is one of the largest known in the Verde Valley, and likely served as a community structure.

In 1960, the National Park Service excavated seven of the nine rooms comprising the Swallet Cave ruin at the base of the Well interior (Ladd 1960), and in 1968, the National Park Service embarked on the first underwater archeology survey ever conducted within a National Park, recovering hundreds of artifacts from the bottom of the well that had been thrown from the rim-top pueblos prehistorically.

The excavated structures have been stabilized by the Park Service to prevent collapse and deterioration of exposed features, but many of the prehistoric structures in the Montezuma Well area remain relatively untouched, preserved for future generations.

Today, visitors can picnic near the Hohokam pithouse and walk the National Park Service trail along the rim of the Well, down into the Well itself to see the Swallet Cave ruin, observe the cliff dwellings built just under the rim of the Well, the ruins of the pueblos above, and visit the outlet of Montezuma Well, where the irrigation ditch built, in part, more than 1,000 years ago, still funnels the Well water to modern Verde Valley residents.

*Montezuma Well acquired its name during an 1864 expedition against the Apache people. Members of the expedition encountered the Well and thought the dwellings to have been built by the Aztecs* (The first published account of the name appears in "The Woolsey Expedition," *Arizona Miner*, 25 May 1864, by Henry Clifton).

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Looking up at the cliff dwellings below the rim of the Well. Riparian vegetation grows below, but desert plants dominate the landscape above.