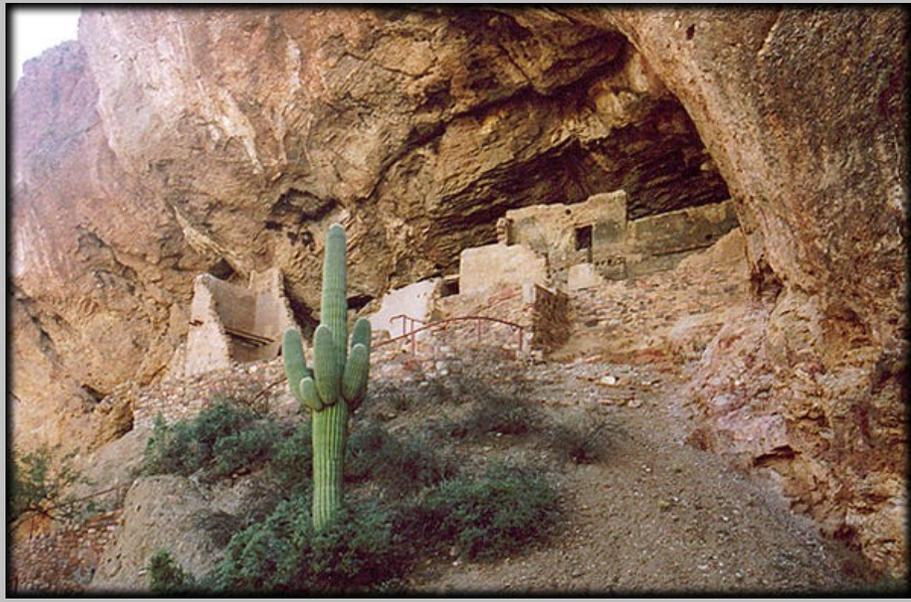


“Gimme Shelter”



Lower Cliff Dwellings at Tonto National Monument, Arizona.

To the ancients who inhabited the myriad canyons of the Colorado Plateau, they must have seemed like gifts bestowed from above, or maybe their presence was a portent of things to come. Looking up from the narrow river and creek bottoms where life was easy, at least for that moment, the Indians took note of the immense hollows seemingly carved in numerous places into the sheer canyon walls above them.

Did they know all along that the cavernous openings would one day be their sanctuaries? That those very caves would shelter and protect them from whatever menace was to eventually creep up the maze-like gorges?

When invasion did arise, they hauled their lives up into those rocks, and built walled villages and storehouses that still stand today, though now silent. Nature always had ruled their lives, and in this case nature would turn out to be their savior. Throughout the canyon country of the Southwest are countless such caverns, and they weren't shaped that way by humans.

For nature had evolved to perfect what later on took humans centuries or millennia to arrive at: the principle of the *arch*, and the structural protection it offers.

When you look at the abodes of those magnificent cliff dwellings that are now the centerpieces of places like *Navajo National Monument*, *Canyon de Chelly*, and *Mesa Verde*, what you see are not man-made excavations. The towering cavities, now lined with the remnants of civilizations lost (and many more that are not home to ruins), are the product of nature's engineering, and a process called *wall collapse*. (It should be pointed out that not all cliff dwellings are in such places.)

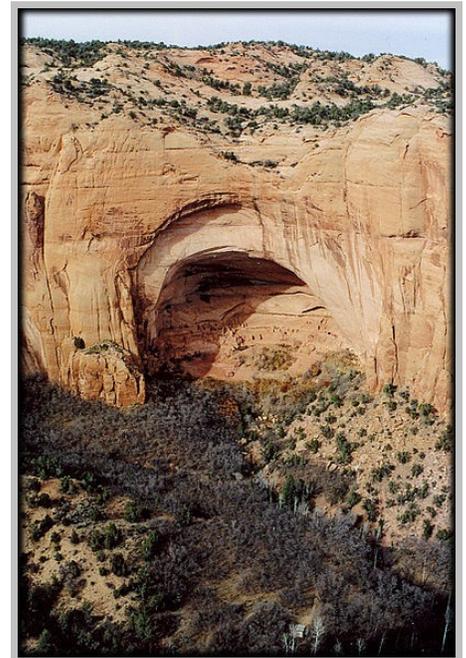
The vertical walls into which the cliff houses are built are usually made of *sandstone*, but also sometimes a baked and hardened version of sandstone called *quartzite*. These rocks consist of grains of sand (usually *quartz*) that is either cemented or fused together into the massive layers that we see in many places in the plateau country.

The higher the cliff, the more pressure is exerted on the grains of sand lower down, simply because of the force of gravity. Seasonally, and even daily, the entire cliff face is subject to expansion when the temperature gets hot, and contraction when it gets colder.

Near the top of the cliff, the rock can flex in all directions, but at the base, due to the confining forces exerted from above, the rock can only flex outward or inward. Hence, it begins to spall off there, more at the base, and less farther up the face.

This removal of grains takes on the shape of an arch, or more precisely, the inside of an apse, and it is a mostly gentle process. Sure, occasionally a large piece of stone breaks loose from the ceiling, but for the most part, the erosion is slow, grain by grain.

Eventually the sand particles blow away from the base of the opening, or are washed away by the stream in the canyon bottom. That is why there is surprisingly little rubble on the floor of such caverns.



Ancestral Puebloan Betatakin Ruins, in Navajo National Monument, Arizona.

If the same process were to occur on both sides of a narrow wall – one cave hollowing into one side of the wall, and one forming on exactly the other side of it – a natural arch would eventually develop (visit *Arches National Park*, in Utah, and see for yourself).

The ancient peoples of the canyon country, usually called the *Anasazi*, but now more correctly called *Ancestral Puebloans*, realized the safety of such one-sided places, and chose them for their refuges. They were safe from above, and because the caverns were usually situated somewhat above the valley floors, with cliff faces below too, they were also safe from attackers moving in. If they chose a south facing wall in which to locate, they had the additional advantage of climate conditioning. The overhanging ceiling above sheltered them from the intense heat of the summer sun, and yet, in the winter, when the sun was lower in the sky, the opening allowed in its rays and warmth.

Would I feel uneasy about living in such a place? Not very. Could I sleep there at night? Certainly. I would, of course, do a “once over”, to make certain that there were no loose-looking chunks of rock hanging overhead, and then I would move right in. Under an arch is one of the safest places you can be if you are worried about something collapsing onto you. I’ll take the serenity and security of nature any day over the danger and unpredictability of humanity and all of its consequences.

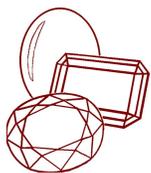
To learn more about Arizona’s fascinating geology and archaeology, visit www.gemland.com. There you will find interactive maps, where you can click on any name to initiate a series of images, together with geologic explanations. You can even send any picture you like to your friends as an E-postcard for FREE!

----- *Richard Allen*

February 2007

Text and images © Richard Allen 2007.

This article may be reprinted for NON-COMMERCIAL use only.



gemland

PRECIOUS GEMSTONES • CUSTOM JEWELRY

*At right: natural Arizona Peridot and 22K Gold
gent's ring by GemLand © 2007*



by Richard Allen

The geology section of our website and these articles are financed in part by our gemstone and jewelry sales. So please don't forget, we offer only the finest in custom-made jewelry. No pretentiousness. No hype. No inflated prices. Now in our 20th year, we work in gold or platinum, and can set our stones, or yours.

info@gemland.com

Phone/FAX 602-294-6775

www.gemland.com