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The Present is the Key to the Past

A Monday Morning Musing from Mickey the Mercenary Geologist

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In my opinion, geology is a fascinating subject for anyone with inkling for the out-of-doors. Of course I am biased having grown up in the woods exploring, fishing, and hunting. I have also been a professional geologist for four decades and view the natural world with a trained and observant eye.

My world is a room with a different view. As a geologist who practices both the science and the art, I work to understand the Earth in all its dimensions (**Mercenary Musing, April 28, 2008**).

Time, i.e., the fourth dimension, is fundamental to geology. Observation and interpretation are based on the principle of *uniformitarianism*, a 17-letter word that could be an answer on *Jeopardy*. It means *the present is the key to the past*.

This idea was formulated in the late 18th Century by a group of British naturalists that included the giants of scientific thinking: Whewell, Hutton, Playfair, and Hall. Charles Lyell expanded and elucidated the concept in his seminal work, *The Principles of Geology* (1830-1833). Stephen Gould simplified Lyell's ideas and presented a modern view in 1965.

Today, I present a lesson on the first principle of geology and provide a working example from my home state of New Mexico.

I have always liked to explore mines. My grandfather was a mule driver in the zinc mines of Aurora, Missouri. One of my prize boyhood memories was going with my dad during the dead of winter to those old mines. Carefully avoiding the water-filled sinkholes formed by collapse of old workings, we would venture onto the waste dumps (called "chat piles"), and dig maple saplings for transplant to our orchard 20 km away. Some of those trees still provide cool shade at the old homestead.

But I digress.

One of the mines I have visited repeatedly is a small travertine operation on the flanks of Mesa Aparejo west of Belen, New Mexico.

Travertine is a type of limestone generally formed by hot or cold spring waters that are saturated in calcium carbonate. Aquatic plants, grasses, bacteria, algae, and other microbes often grow on the surface

and give the rock its characteristic concretions, pits, rods, vugs, and rhythmic layering or banding. Although mostly shades of white, iron minerals and other impurities can impart tan, gray, cream, pink, brown, yellow, and rusty colors.

Commercial-grade travertine takes a polish to a smooth, shiny finish. It is a common building stone in both historic and modern architecture, and today is widely-used for facades, cladding, and flooring. Italy, Turkey, Mexico, Peru, and Iran are major sources. The mine in central New Mexico is one of only two or three active operations in the United States.

My first trip to the quarries of New Mexico Travertine, Inc was in winter 1985. I was accompanied by a fellow geologist who had done field work on the deposit and told me of the operation and its spectacular rocks. We went on a sunny Sunday afternoon to examine the geology and methods of extracting large blocks of travertine and also to collect a few rock garden-size samples of the beautiful decorative stone.

Quarry at New Mexico Travertine Inc

My second visit was again on a Sunday in May 2009; this time it was with my friend Tim who is referenced in the musing link above. This cut block illustrates some of the textures and colors common in the travertine quarries:

On those two trips, we specifically went on Sundays to avoid any active mining operations.

In the summer of 2012, I proposed a visit to a local video producer. We were afforded a formal tour with owner Scott Lardner of New Mexico Travertine Inc and Rocky Mountain Stone as our guide and visited the travertine mine, processing plant in Belen, and finishing and retail operations in Albuquerque. This photo from a previous visit is near the plant entrance and shows a diamond-impregnated saw blade used to cut large blocks of travertine into thin slabs:

Now please permit me to digress again to Thanksgiving of 1977. At that time, I was in graduate school at the University of New Mexico.

A group of friends that included fellow grad students, my brother, a cowboy roommate, and my geologist girlfriend drove southwest of Belen to hike around the desert and visit some large, rapidly-flowing cold springs on the east flank of Lucero Mesa. These springs are valuable sources of surface water in one of the driest parts of the dry State of New Mexico, and they are actively depositing large quantities of travertine. At this particular locale, travertine beds are forming along the western fault boundary of the Rio Grande Rift.

Now let's jump forward to that first visit to the aforementioned travertine mine in 1985, which germinated an idea. A recent trek to an arroyo three km to the north confirmed my working hypothesis from that time 31 years ago.

The mine exploits five types of laminated and variegated travertine of various hues and colors and also a variety of altered limestone. I have often wondered why this particular deposit produces such beautiful travertine with high commercial demand.

Travertine is a very common rock type in central New Mexico. There are over 50 discrete deposits known in the state and many others occur within limestone terranes. However, only three other deposits have been commercially exploited and those were small-scale operations over short time periods. Could it be that few other occurrences are of dimension stone quality?

And if so, why is this deposit unique?

At the mine site, the geological processes that produced the beds are long extinct so there is no direct evidence for their formation. Knowledge gained from the geological literature indicates they must have been formed by fossil spring waters localized along a fault zone.

Clues to the historical processes can be found in an arroyo about three km north of the quarries. The arroyo is fed by present-day cold springs that come to the surface intermittently from seeps along the streambed. These springs are actively depositing travertine.

Thinly-bedded to laminated, concretionary, porous, and vuggy textures are easily discerned in the travertine at this locale. Note the abundant salt grasses on the banks that attest to the high mineral-content of the waters:

The stream gradient is low with water that flows slowly and gently enough for various tabular travertine bodies with small mushroom-shaped columns to be preserved underwater. It seems likely they alternatively grow and dissolve as water levels fluctuate:

There is an algal mat growing on the currently wet portion of the tiny waterfall below. It seems reasonable to surmise that the tan organic matter, the olive-green algae in the above photo, and the salt grass will influence both color and texture *if* this rock is preserved for the future:

The bedrock in the hills and arroyos north of the quarries consists of Paleozoic-age gray limestone and red sandstone overlain by Quaternary gravels and travertine. The calcium carbonate-rich waters that form the travertine deposits are sourced from the limestone.

In the photo below, redbeds crop out on the hill with massive white travertine and gypsum in the center and vuggy bedded travertine in the foreground:

These red sandstones, siltstones, and shales are the likely source of iron oxide minerals that color three types of travertine mined at Mesa Aparejo with variegated shades of pink, red, yellow, brown, and rust.

In this Geology 101 lesson, I have illustrated the fundamental principle of uniformitarianism, i.e., *the present is the key to the past*.

- I first examined the travertine quarried at Mesa Aparejo and observed its various textures and colors.
- I noted that the geological processes that formed the quarried travertine are now extinct. I know from the literature that travertine deposits are often formed by surface spring waters but there are no present-day surface waters in the mine area.
- Given the large areal and volumetric extent of the travertine at Mesa Aparejo, I surmised that the beds must have been deposited by big springs issuing along a major fault system.
- I observed present-day cold springs actively depositing travertine in an arroyo three kilometers to the north of the mine. Those observations allowed me to deduce the processes that deposited older travertine beds in the geological past.
- Plants and microbes growing in and around the active cold springs and the redbed outcrops nearby are likely analogues to conditions responsible for the textures and colors observed in the travertine rock mined to the south.
- My exam of the recent springs in the arroyo accounted for the internal features of the rock mined in the quarries. However, it did not answer the main question. What are the qualities that make this particular travertine especially suited for exploitation as dimension stone?

Geologists use the present as a key to interpret the environment, conditions, and processes active in the past.

Oftentimes however, a geologist's research raises as many questions as it answers. I am still uncertain why this deposit is apparently unique in a region with many travertine occurrences.

Why has the Mesa Aparejo travertine been successfully mined for dimension stone for several decades while other deposits remain undeveloped or attempts at mining them have failed?

Remember that "ore" is a rock or mineral that can be mined, processed, and sold at a profit (**Mercenary Musing, August 25, 2008**). Instead of the geological setting and rock characteristics, I think the reasons are likely economic.

These economic factors at Mesa Aparejo could include:

- A very large deposit on ground with favorable surface and mineral ownership.
- Proximity to infrastructure including roads and power.
- A local source of water for drilling and mining.

- Sufficient initial and sustaining capital to finance the mine and plant and maintain competitive and profitable operations.

- A committed and effective marketing effort by the owners of the mine, plant, and the retail store in Albuquerque.

Folks, it all begins with the rocks. That said, the operations of New Mexico Travertine Inc and Rocky Mountain Stone serve as a reminder that there is much more to the mining business than geology.

If you have further interest in this unusual decorative stone, please check out the website of **New Mexico Travertine Inc**.

Finally, check out this cerulean view to the south from near the travertine quarries; that's Sierra Ladron in the distance:

Ciao for now,

Mickey Fulp
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The **Mercenary Geologist Michael S. "Mickey" Fulp** is a Certified Professional Geologist with a B.Sc. Earth Sciences with honor from the University of Tulsa, and M.Sc. Geology from the University of New Mexico. Mickey has 35 years experience as an exploration geologist and analyst searching for economic deposits of base and precious metals, industrial minerals, uranium, coal, oil and gas, and water in North and South America, Europe, and Asia.

Mickey worked for junior explorers, major mining companies, private companies, and investors as a consulting economic geologist for over 20 years, specializing in geological mapping, property evaluation, and business development. In addition to Mickey's professional credentials and experience, he is high-altitude proficient, and is bilingual in English and Spanish. From 2003 to 2006, he made four outcrop ore discoveries in Peru, Nevada, Chile, and British Columbia.

Mickey is well-known and highly respected throughout the mining and exploration community due to his ongoing work as an analyst, writer, and speaker.

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