Travertine Stone at the Getty Center

By Eric Doehne

As a geologist and conservation scientist, I am often asked about the remarkable travertine stone exterior of the Getty Center. What kind of stone is travertine? Why are there fossils in it? How will it look in 20 years?

A Getty Center exterior wall faced with travertine stone. Photo: Vladimir Lange.

Travertine is a product of the earth's water and carbon cycles. As carbon dioxide-rich rainwater percolates through soil and stone, it slowly dissolves tremendous quantities of limestone along underground fissures. Reemerging at the surface as a spring (now saturated with dissolved limestone), this water releases carbon dioxide gas into the atmosphere—much like carbonated mineral water. Because of this "Perrier effect," the limestone can no longer remain in solution. It recrystallizes, typically as the water cascades over organic films made of bacteria, algae, and mosses. A dense, banded carbonate stone is built up over time as new material covers older layers.

Calcite and gypsum, the minerals that make up about 99 percent of travertine stone, are colorless. The beautiful honey color of the Getty Center travertine actually has its origin in the other 1 percent of the stone: traces of yellow sulfur, brown iron compounds, and organic pigments. The intricate "Swiss cheese" texture of travertine is partly the result of gas bubbles, which are often trapped between layers of stone, creating spherical voids. Minerals crystallizing on the ever-present bacteria in travertine deposits—like granular snow blanketing a miniature landscape—preserve organic growth forms, called "shrubs," and produce much of the rugged relief evident across the stone's surface. In some cases, travertine layers are similar to tree rings, with lighter and darker laminations representing seasons of growth.

Travertine is found in greatest abundance where hot and cold springs have been active for tens of thousands of years. The most famous travertine location, and the source of the stone used for the Getty Center, is Bagni di Tivoli, 20 kilometers east of Rome, where travertine deposits over 90 meters thick have been quarried for over two thousand years.

A view of the Italian quarry that is the source of the travertine stone used at the Getty Center. Photo: Jim Mawson.

Because travertine is plentiful, weighs less than marble or granite, and is relatively easy to quarry, it was the stone most commonly used by the ancient Romans. Famous structures constructed with Tivoli travertine include the Colosseum, the Trevi Fountain, the colonnade of Saint Peter's Basilica, and many Roman aqueducts. In our century, Lincoln Center in New York and the ABC Entertainment Center in Los Angeles are faced with travertine from the same Tivoli quarries.

While the age of the stone used for the Getty Center is unknown, it probably dates from about 8,000 to 80,000 years ago. The Center's travertine is split with the grain of the stone, making visible many more fossils than are seen in the more common banded travertine, which is cross-sectioned and polished. At least two species of fossilized leaves are fairly common at the Center—evidence of a lakeside environment at the time of the stone's formation. The impression of a feather is preserved in stone at the foot of the curved East Building wall; an unusual bone embedded in a travertine block has also been discovered. The rapid deposition of the travertine layers acts as a natural preservative for these traces of evanescent prehistoric life. Paleontologists at the George C. Page Museum in Los Angeles are working with Getty scientists to identify these fossils.

Over 108,000 square meters of Roman Classic travertine from the Lippiello family quarry at Bagni di Tivoli were used at the Getty Center. In order to remove the travertine from the vertical quarry face, workers drill holes into the stone, outlining a block 6 meters high, 12 meters wide, and 2 meters deep. A diamond-studded cable is then threaded through the holes, lubricated, and pulled against the stone with a set of pulleys. A large cut may take a day and a half, but eventually diamond wins out over the softer travertine. When the cuts are completed, the slab is pushed away from the quarry wall and falls onto mounds of earth, which help cushion the fall. The slab is then broken up into more manageable cubes, which are taken to the Carlo Mariotti factory for honing and splitting. An automated guillotine was created by Mariotti to split the stone along its natural bedding plane. On the average, each block at the Getty Center is 76 x 76 centimeters and weighs 115 kilograms, with a typical thickness of 8 centimeters. About three hundred thousand pieces of stone were used for facades and paving.

The travertine floor surfaces are anticipated to last at least 50 years before replacement in high-traffic areas is needed. High-quality travertine is very durable, since it is formed at the earth's surface in relative equilibrium with the environment. Most other building stones are formed under different conditions, deep underground.

Fossilized imprints of a feather and leaves in two of the Center's travertine stone blocks. Photos: Dusan Stulik.

Accelerated aging tests of the travertine stone were undertaken by two consulting firms and the GCI to determine the suitability of the stone, the mounting system, and the chemical treatments. Each stone block at the Getty Center has been treated with a silicon-based water repellent that is expected to ease cleaning. Paving stone and walls in public areas up to a height of 2.1 meters have also been treated with an oil-resistant coating to reduce soiling. The frequency and methods used to remove dust and soot from the cleft-cut stone will depend on soiling and weathering rates that have yet to be studied fully. Over time, the honey color of the fresh travertine on the Getty Center will change as the stone weathers and a natural patina forms.

An electron micrograph of calcite crystals in a block of travertine stone. Photo: Eric Doehne.

In short, the beautifully colored and textured travertine at the Getty Center will offer visitors a wonderful opportunity to appreciate the structure, genesis, and natural history of the stone.