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Not My Fault: A vacation should always include geology

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These limestone cliffs on the Lot River are where a towpath was built in the 1840s. Inset shows Daniel Monrnier's marine-themed bas-relief sculpture that he carved into the stone walls in the 1980s, evocative of the organisms that made the limestone over 100 million years ago.

One of the perks of being an earth scientist is that no matter where I travel, there is always a geologic story, and this year put us in the middle of limestone country. Our big 2026 vacation took us to southwestern France. It was was our fourth canalboat/river trip and a chance to explore the Lot region north of Toulouse at a very slow pace. Having two of our children and their partners along made it even more special, and they were spry enough to jump on and off to operate the locks.

The Lot Valley is a special place, featuring some of the oldest human artwork, chateaus that played a role in the hundred years war between the English and French (it actually lasted 116 years), and the added perk of being famous for Malbec wine. It's off the main tourist routes. The few other visitors were hikers walking the French Way, the most popular route of the Camino de Santiago pilgrimage to Spain. The terrain is old and people have lived here for a very long time. It's difficult to imagine that this region spent much of its history underwater.

You can learn a bit about the geology of France by its buildings. Paris is called the City of Light with good reason. Most of its distinctive four to five story buildings are faced with cream-

colored limestone. Toulouse and much of the south of France feature rusty red colors because of the sandstones and abundant ochre pigment from the oxidized iron within it. Pale yellow to gold colors predominate in the Lot Valley from the Quercy limestone from which most of them are built.

Limestone is not a rock North Coast folks encounter very often. Carbonates make up roughly 15% of the earth's crust but there are only tiny amounts in Humboldt County. Most of it is produced by the remains and excrement of an unimaginable number of creatures with body parts composed of calcium carbonate. What is now Europe spent much of its geologic history underwater, not deeply submerged but covered with seas that teemed with life.

Many marine organisms extract dissolved calcium and carbon ions from sea water, combining them to build hard parts out of calcium carbonate. They are carbonate factories when alive, constantly assembling shells and eliminating fecal pellets that rapidly descend to the sea floor, a primary driver of the biological carbon pump (an important story for another day). When they die, their carbonate remains are added to this ooze on the sea floor and over millions of years compress and fuse into the rock we call limestone.

Limestone is of great economic value. Limestone is the primary raw material of cement and concrete, is used in the manufacturing of steel, neutralizes acidic soils in agriculture, is an active ingredient in pharmaceuticals, has many high-tech applications, and figures prominently in emerging technologies to capture carbon dioxide. The buildings of France attest to its role in architecture. There is almost no sector of the economy where limestone does not play some role.

The Quercy limestone is part of the Causse, limestone platforms that cover much of south-western France. It was formed 170 to 200 million years ago when the region was submerged beneath a vast shallow sea. This deformation of the continent was a response to the opening of the Atlantic ocean as Pangaea began to break up. The tectonic stretching caused much of what is now Europe to thin and sink beneath the sea. There are fossils embedded in the rock, most requiring a trained eye or microscope to see, but large coiled ammonites, ancient corals, and bivalves are seen in some places, a reminder of those many ages under the sea.

A hundred million years after the Pangaea breakup, a new plate tectonic force comes into play as the African continent drifts north and begins to rumple the southern Europe coast. In the area of first contact about 65 million years ago, the Alps began to form. Deformation in southern France was not as extreme, but the entire region was uplifted, creating the land we see today.

Systematic mapping of European geology owes much to canals and river engineering for barge traffic. Canals are among the oldest of human construction projects, dating back 6000 years to Mesopotamian times. By the time of the Egyptian pharaohs, river transport by canal became essential for trade routes. Canal construction required both an understanding of the geology and rock properties and the mechanics of water transport processes, giving birth to both the disciplines of geology and engineering.

The mid 17th to 19th century is the age of canal building in Europe. More efficient ways of transporting raw materials and trade goods are needed for the growing towns and industries as

the industrial age is dawning. During "Canal Mania" in England, Parliament authorizes the construction of dozens of canals at the end of the 18th century. One of the people hired to survey rock types on proposed canal routes was William Smith, a man of little formal education but a keen eye and interest in geology. He was the first person to recognize the relation of rock strata from one region to another and display them graphically on a map.

William Smith received little recognition for his first geologic map, and it was only at the end of his life that the geologic establishment wholeheartedly adopted his methods and honored his achievement. Smith's geologic map today hangs in the British Museum where I had a chance to see it. It is not only a scientific accomplishment, but a thing of beauty with the different colored rock units creating an almost psychedelic pattern of swirls and lobes.

Our first canal trip was ten years ago and took us on one of France's oldest canals. The Canal du Midi is considered by many to be the second greatest engineering feat of France's Sun King, Louis XIV reign, surpassed only by the Palace of Versailles. The 150-mile-long canal connects Toulouse with the Mediterranean and was completed in 1681. Combined with the Canal de Garonne to the west, it provided a critical link between the Atlantic and the Mediterranean. An engineering marvel, it climbs up to an elevation of 650 feet before descending to sea level, accomplished without a single pumping station. The engineer Pierre-Paul Riquet had the ingenious idea of excavating a large reservoir on the summit, the water provided the pressure head needed to provide sufficient water to the canal on both sides.

Canals were not the only part of the river barge transportation network. Many rivers were harnessed into viable commerce corridors by constructing weirs and locks to provide level steps of elevation suitable for animals on the channel towpaths to haul the barges. By the peak of the canal era in the mid 19th century, France had 513 registered canals/engineered rivers. Railroads construction overtook canals and by the end of the century most were no longer economically competitive and fell into disrepair.

Some canals were filled in, but laws in many countries made it difficult to completely dismantle them. The former barge routes began a rebirth in the 1970s when tourism became popular. Cycling along the former towpaths and barge rentals to folks like us are now commonplace. It's like renting a large RV. There are several companies offering a variety of boats that can accommodate anywhere from two to a dozen people for several days or weeks. You are the captain and staff and travel as leisurely as you like.

After our trip on the Canal du Midi, we were hooked. Subsequent trips took us to the Yonne River in Burgandy, the Garonne, and this year's trip to the Lot. They have all been excellent, but the Lot just might be on the top. It's an engineered river, with modifications beginning in 1840 to construct weirs, locks and towpaths. A particularly tricky spot was near the town of Bouziès where a half mile-long open-sided tunnel had to be carved out of the limestone cliff to allow the haulage teams to pass. In 1926 after trains pushed water transport aside, the Lot was decommissioned as a navigable river, the locks and weirs fell into disrepair and the towpaths overgrown.

Rediscovery of the Lot as a tourist destination began in the 1980s when an artist Daniel Monnier stumbled upon the old towpath near Bouziès on a walking trip. He spent two years getting permission to carve bas relief sea-themed creatures into the limestone tunnel wall. Word

spread of this unusual art/nature walk destination at the same time as interest in renovating more of the former canal/barge routes spread and by 2001, much of the former Lot route had been reopened for recreational traffic.

No matter where you travel this summer, take a moment to learn a little about the rock around and beneath you. It's easy to do, just put 'geology destination' into your browser. Some highways even have detailed on-line geology road guides. We keep a number of the Roadside Geology series books in our library, and unlike many things in our world, the rocks never go out of date.

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