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Speaking of Geothermal Myths—and We Are

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Geothermal myths are metaphors. Millennia later, we get to puzzle them out.

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ABSTRACT

For every geothermal myth found, recorded, and published, thousands are flat out ignored. This is a shame. A geothermal myth is a literary form, valuable in and of itself and as a cultural artifact. Some geothermal myths passed down for thousands of years have important geothermal and geological information. All myths reflect cultural values—helpful to geothermal developers establishing community relationships. Understanding the structures of myths, where they are found, and how they are interpreted are keys to understanding important aspects of our geothermal heritage.

1. INTRODUCTION

Geothermal myths are mostly old and short, a sentence long, maybe two or three. The sentences encapsulate the essence of an important moment and ignore the details. Lodged in the essence is a potent brew of emotion and power. The emotion is strong, like great love, fear, or need. The power usually involves invoking geothermal forces to strong-arm the universe into giving up what you want. Fortunately a geothermal myth-maker's arsenal is large, filled with volcanoes, volcanic eruptions and bombs, earthquakes, landslides, tsunamis, hot springs, fumaroles, and geysers. **Each essence of the following myths is typed in boldface.**

Because mythic essences are so potent, people remember them through millennia. You have only to ask in most geothermal areas. But plot twists exist. In one myth, the villains are mud volcanoes housing devils. The terrified people living nearby must rely on their own powers for protection.

Sure the older the myth, the harder it can be to understand. Sometimes we just lose the story. But sometimes we don't. Which means why not at least publish the myths as they are when you find them and perhaps someday someone will figure them out? And just as they are—short, enigmatic, often poetic, myths offer a geothermal document for a human moment that people can relate to.

Here is an Aymaran rain prayer from Northern Chile, a place full of volcanoes, with the essence of a mythical belief and no details. I translated the prayer from the1989 film, *Nubes de* Lluvia ("Rain Clouds"), by Patricia Moras.

Man volcano,

Woman volcano,

Make a rain cloud.

Why do geothermal myths exist at all? I think geothermal features fascinate us. They are so unique, complex, and changeful, so dangerous and awe-inspiring, so beautiful and impossible to ignore. Lured by the sight of water, rocks, and heat dancing to a different tune, we pause and mull the changes in our own lives.

Most people regard myths with disdain, and geothermal developers and scientists are no exception. A citation analysis in the journals *Nature* and *Science* for 1996 through 2005 shows not only was the word *myth* used infrequently, but except for two references it was used pejoratively, such as "time to bury misleading myth," "dispelling a myth," and "making reality fit the myth," write Piccardi and Masse.

They continued with a question: how did myths become pariahs? Between the time of Plato in the fourth century BC and the Renaissance of the 1300 to 1600s AD, much of the world replaced mythical beliefs with a rigorous adherence to biblical scriptures and text. Even as worldwide exploration grew, "The *Bible* remained the standard against which all myths from other cultures were weighed."

But here is the good news. In spite of everything, many geological and geothermal myths exist today—and most are undocumented. In the following myths, the essences were recorded long before someone worked out the details.

2. THE FENRIS WOLF IN THE NORDIC *ASA CREED* IN THE LIGHT OF PALAEOSEISMICS (MÖRNER, N.-A.)

In ancient Sweden, the god *Loke* had a son with the giantess *Angrboda* and the child took the form of a giant wolf—the Fenris Wolf—who became a threat even to the gods.

When the Fenris Wolf threatened to destroy the whole world, he was captured by magic and chained deep in the mountains. "Then when he howled, the ground and mountains trembled violently, deep fractures were formed, and the rock fragments were thrown around," Dr. Mörner wrote.

He added, “Today one might say: what a perfect metaphor for a high-magnitude earthquake. But until recently, earthquakes above magnitude 5 on the Richter scale were not known to have occurred in Sweden and no one proposed a seismic origin for the story of the Fenris Wolf.

“During the last three decades, it has become increasingly clear that Sweden was subjected to strong seismic activity at the time of deglaciation some 9,000 to 11,000 radiocarbon years ago,” writes the author. “Today an extensive palaeoseismic database includes 54 magnitude 5-8 events and several magnitude 6-7 or 7 events in Late Holocene time with the associated effects of faulting, fracturing, shaking, liquefaction, and tsunamis. These may have influenced not only Norse mythology but also ancient place names.”

Sweden’s oldest place names are said to originate in the Bronze Age and many refer to sounds, noise, or fractured rock. Examples are Pärve, “sound from the underground;” Marviken, “fractured rock;” Dunkern, “deep sound;” and Hjälmaren, “the sounding.”

3. OBSIDIAN: SACRED GLASS FROM THE CALIFORNIA SKY (HODGSON, S.F.)

California Indians used obsidian for projectile points, knives, scrapers, shamanic blades, and many other objects. Fashioned obsidian may be California’s first, widely marketed geothermal product.

Obsidian has played important roles in several California myths. One, from Northern California, involves an explanation by the Yuki Indians about the origin of obsidian, as told to anthropologist Alfred Kroeber in 1925. **The Indians spoke of a Great Spirit named *Mililí* “… who lives in the sky above the visible one, and owns an enormous block of obsidian of which all obsidians in the world are fragments that he has thrown down. He has the shape of an enormous eagle or condor and controls deer, *mil*, to which his name refers.”**

The idea of obsidian thrown down from the sky by a figure shaped like an enormous eagle or condor was confounding to interpret. I knew the myth might come from observations of the Yuki Indians watching Plinian volcanic eruptions in Northern California—several occurred in the last 1,100 years. But the puzzle remained until I finally saw the drawing of a Plinian eruption.

There it was, shooting straight up, a vast, paroxysmal, gas-charged emission of dark debris reaching heights of 45 km or more. And forming at the very top, the instant the emissions stopped rising, was a huge dark cloud. To someone on the ground, the cloud looked split in half like the wings of an enormous eagle or condor.

As for the obsidian, Plinian emissions include magma with partially molten or solid obsidian particles and hardened bits of obsidian pulled off from the volcanic walls. Once the emissions stop rising, the obsidian falls back to earth, raining down from the huge black wings. In this way, an Indian obsidian myth helps us to confirm and date a geological event when obsidian fell to the earth from the sky.

Figure 1. A Plinian volcanic eruption topped by a spreading dark cloud. From the ground, the cloud resembles the wings of a large black bird. Note the pieces of obsidian falling back down to earth. *Drawing by S. Hodgson.*

4. DEVILS IN THE SHAPE OF LARGE BLACK BIRDS—MYTH FROM THE MUD VOLCANOES OF SOUTHERN CALIFORNIA (HODGSON, S.F.)

“Mud volcanoes,” says Dr. Wilfred Elders, “are a lot of fun because they mimic so many different volcanic landforms. Some have steep, conical shapes like a miniature Mt. Fuji, others have a gentler slope like Mauna Loa, and sunken calderas are common, as well. Some cones have mud flows that mimic the geometry of lava flows.

“Mud volcanoes form in the soils of Southern California’s Imperial Valley and its many geothermal fields as CO_2 bubbles up through warm springs. Both the vigor of the CO_2 emissions and the ratio of water-to-mud control the morphology of the cone.” Dr. Elders said.

In 1850, Dr. John L. LeConte, led by Indian guides, visited the mud volcanoes in the Imperial Valley. Such an interesting account of a myth, in both essence and detail, is rarely discovered. A portion of his account follows.

“In October 1850 and being at Vallecitas, San Diego County, California,” Dr. LeConte wrote, “it was my good fortune to make a visit, in company with Major Heintzelman [of the US Army] and Mr. Matsell, to certain boiling springs, not similar to any which

have been noticed in our territory; and as the only account yet given of them has appeared in a newspaper, it seemed to me, that the rough notes taken while making the visit, might with slight changes be of interest to my scientific friends.

"Having secured as guides the interpreter from Santa Isabel, and the head chief of the 'Lleguina' Indians living near the Salt Lake, we left San Felipe a short time after the rising of the moon on the morning of the 28th of October."

One of the guides was "Heironimo Cherow," or Burning Fire, uncle to Heironimo [Geronomo] the powerful Apache chief who had many run-ins with the Mexican and U.S. armies.

Dr. LeConte continued, "We arrived at an Indian village situated on New River, which is here near its termination, and probably when the supply is abundant, sends a portion of its water to the nearby village …. The Indian village contained about fifty inhabitants, who received us in a very friendly manner, offering us melons, beans, and pumpkins, which they raise in abundance. Visiting the village were some Yuma Indians from the Colorado.

"After resting our horses, we started with an escort of seven or eight Indians, who used all the power of their eloquence to dissuade us from going. Nevertheless, on our exclaiming that we had come a long distance to see these volcanoes, and that we would seek them for ourselves if they were afraid to accompany us, the debate ceased and we rode on in a northwesterly direction. After going about eight miles, we reached a soft muddy plain bordering the Salt Lake: the salt in consequence of a recent shower had almost disappeared, only a few crusts about half an inch thick now remaining. The deposit is said to be sometimes a foot in thickness.

"North of the lake, and now distance from us six or eight miles, is a chain of rocky hills 800-1,000 feet high, portions of which have a volcanic appearance. Rising from the plain, where we now stand, are several volcanic mounds about 100-150 feet high; hastening to one of these, I found it composed of lava, and pumice: several of these mounds are arranged in an arc of a circle, but the general direction is a little west of south.

"Having arrived thus far, and given our horses in charge to some of the Indians, the interpreter again endeavored to dissuade us from further exploration. He said that **on approaching the springs, the steam from which was not distinctly seen, devils in the shape of large black birds rose from the ground, and descended with overwhelming force on the head of the rash adventurer: he stated that a tradition still existed among the Indians, of one Juan Lonquiss (Longecuisse? Perhaps a 'Crapaud' trader) who had met this dreadful fate, and asked us in a pathetic tone, how he could return to his town, if we too were sacrificed in this way.**

"We replied, in substance, that devils had no power over us, and that we were stronger than they, and that probably they were aware of that fact, and would not appear during our visit. This seemed very blasphemous to their ears, and the whole escort suddenly dropped behind, leaving us to our fate.

"Advancing toward the place, whence the steam issued, we found in the muddy plain numerous circular holes containing boiling mud, and exhaling a naphtha-like odor. Many of them are encrusted with inspissated mud, forming cones 3-4 feet high, from the apex of which proceed mingled vapors of water, sal-ammoniac and sulphur. Four of them eject steam and clear saline water with great violence, resembling in appearance the jet from the pipe of a high-pressure engine. The falling spray around these has formed a group of acicular stalagmites, composed of aragonite with a small quantity of silica and some saline matter: many of these stalagmites are tubular in form. Another spring was a large basin filled intermittingly to overflowing with foam and clear saline water: around the edge were botryoidal masses of aragonite, like that forming needles around the cones. Near the cones, in little fissures, were crusts of sal-ammoniac, some of which were colored red, possibly by sulphuret of selenium.

"The Indians, finding that the black devils did not assail us, ran up to us, with great exultation, and leaped about, and danced in such an extravagant manner, that we were obliged to caution them of the danger of breaking through; the solid crust was evidently very thin, as it bent and trembled under our weight in a very threatening manner.

"In returning we found on the most northern of the volcanic mounds before mentioned a quantity of scoria and obsidian, and distinctly traced the course of a lava stream down the side. The mounds all showed traces of aqueous action, in the terrace-like manner in which the pumice was arranged."

"*Author's Note:* By the kindness of Capt. Davidson, I learn that while he was stationed at Fort Yuma, in Dec., 1853, a violent earthquake occurred; the ground in the vicinity of the Fort opened, forming fissures, from which were thrown mud, sand and water: portions of the mountains several miles distant were seen to fall, and about forty miles SE of the Fort, in the direction of some springs, said to be similar to those here in described, was seen an immense column of steam. It is to be hoped that some of the officers then at the post will favor science with an account of the phenomena observed."

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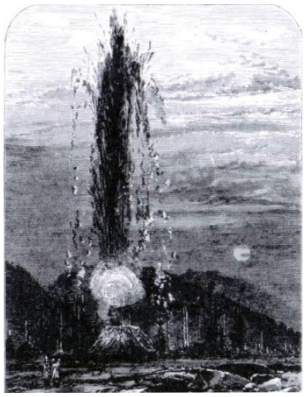

Figure 2. This drawing, by famed artist Thomas Moran, depicts a mud volcano erupting in Yellowstone National Park—and by analogy, a mud volcano erupting in the Imperial Valley in California. The splats of hot mud flying out of the volcano resemble "devils in the shape of large black birds." Clearly they would cause painful burns. Thomas Moran wrote in his diary on August 1, 1871, "Aug 1st photo & sketching at mud volcano. Left mud volcano at noon & reached the Yellowstone Lake where the whole party & escort were encamped."

5. GEO-MYTHOLOGY OF INDIA (CHANDRASEKHARAM, D.)

Sometimes when you look for a myth, you find more of a *semi-myth*: a statement with some mythic essence but not all. A good example is the following prognostication from ancient India where data replace emotion—but they are Hindu data. Prepare to be amazed.

According to Hindu Vedic cosmology, the age of the entire universe is divided into four *yugas* (eras): *Satyuga*, lasting for 1.728 million years; *Trethayuga* lasting for 1.296 million years; *Dwaparayuga* lasting for 0.864 million years, and *Kaliyuga*, the present era, so far completing 0.432 million years. These time divisions, writes the author, resemble the Precambrian, Paleozoic, Mesozoic, and Cenozoic Eras of geology.

Some scholars consider each yuga a "Maha Yuga", meaning each one should be multiplied by 1,000 years. In which case, the sum of these *yugas* amounts to the approximate age of the earth—*c.* 4.3 billion years, which constitutes one day for Lord Brahma, the creator of the universe.

Today scientists believe the earth is 4.54 billion years old, which isn't too far from 4.3 billion years. Note that during our own lives, the estimate has changed many times—while the numbers in Hindu Vedic cosmology have not.

6. MYTHS 101

Who can collect and publish geothermal myths? Everyone can. Are you working in geothermal somewhere around the world? Without exception, people living in geothermal areas know geothermal myths. Ask and write them down. At the same time, record the names of the people you speak with, the dates and the locations—and take pictures.

Sometimes the details and essences of geothermal myths are learned by speaking with people in geothermal areas. Sometimes they are found in first-hand accounts published by others in anthropology, archaeology, and engineering texts, or in EIR's and EIS's. Religious works and artistic pieces—like literature, painting, sculpture, and music—are great sources. Visit museums and look around at the art and architecture in the area. Talk to experts. Each situation is different.

Where can you read geothermal myths? Two books lead the pack: *Stories from a Heated Earth* and *Myth and Geology*. Now if you find a myth, preserve it in your own published documents. Or send it to me to place in geothermal publications.

Of what practical use are geothermal myths? First of all, they let us uncover and verify priceless geothermal and geological information available nowhere else. Secondly a developer's relationships with the people living in a geothermal area can make or break a geothermal project. Myths help everyone to understand community beliefs and form positive local relationships.

CONCLUSION

You ignore geothermal myths at your own risk. Myths are tiny time capsules of cultural and geological geothermal history shaped into metaphors. You never know what is hidden inside—until you look.

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