In Search Of Deep Time

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Ha Strata
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IN SEARCH OF DEEP TIME

Time is tricky. It can move fast or slow. Time can heal. It can make the seemingly impossible into the possible. Here's proof. Go back, maybe 280 million years, to Wabaunsee County. Things would look very, very different.

Two hundred eighty million years ago, you wouldn't be standing in a pasture or see any of the animals around you today. You would, more than likely, be paddling on a shallow sea. The air would be warm, probably humid, more like today's Florida coast, because you'd be closer to the equator. The sea below you would teem with life: worms, clams, fish, sea urchins, corals, trilobites, and countless critters that flourished in that shallow, warm seawater.

That long-ago environment seems completely at odds with land-locked pasture today. But that ancient environment and the intervening pageant of time combined to produce the landscape around you now.

But what does 280 million years really mean? How do you envision a sweep of time so vast, so beyond our day-to-day thinking? At best, most of us experience only a few decades. And people have been recording history for only a few thousand years.

People who ponder much older events talk in terms of "geologic time" or "deep time," not decades or centuries. Deep time is the concept that William Least Heat-Moon considered in his big Flint Hills book, *PrairyErth*. He subtitled the book "a deep map," playing with the ideas of deep time, the deep subsurface, and deeply knowing a subject.

Deep time can change the inconceivable into reality. In deep time continents move, the way that the continental plate we're sitting atop has drifted from close to the equator to today's

location. Mountain ranges rise, the way the Rockies were uplifted to our west. Layers of sediments slowly accumulate on an ocean floor, then harden into limestones and shales, the way they have here.

Deep time lets species morph from one form to another or disappear, leaving their remains in the rocks around us. Over deep time erosion, mainly from falling water, can carve gullies, sculpting these hills.

Because deep time is so hard to apprehend, geologists have developed analogies that compare time to things we can understand. One analogy likens geologic time to a football field.

The earth is roughly 4.6 billion years old. If geologic time starts at one goal line, the first evidence of life shows up on the twenty-two-yard line (about 3.5 billion years ago). You must go sixty-six more yards, all the way to the twelve-yard line at the other end of the field, before shelled animals show up (at 570 million years). Fish appear at the eleven-yard line, amphibians on the eight, and reptiles on the seven-yard line. The rocks around us were deposited in a period called the Permian, which would fall between the seven- and six-yard lines. Dinosaurs show up at the five; mammals at the four; and the first humans, incredibly, just 1.5 inches from the goal line.

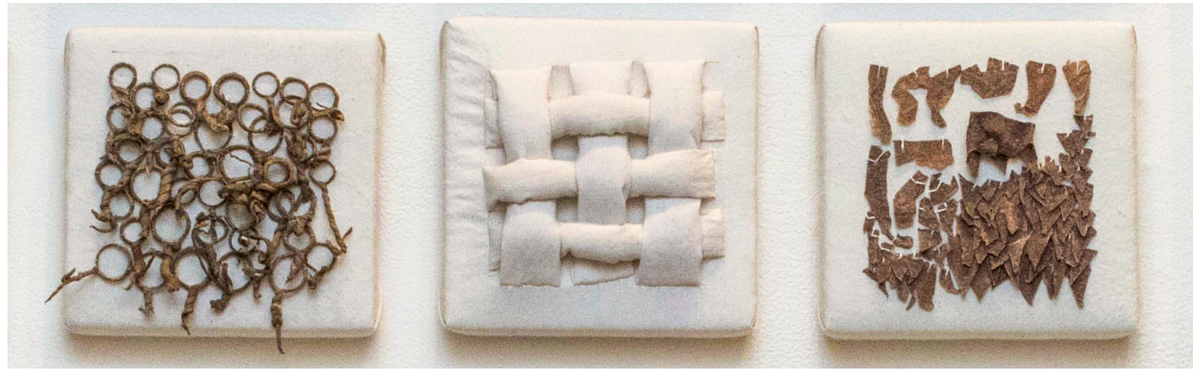
Analogies like this, and much of the information they are based on, were developed by geologists and paleontologists. It's sometimes said that earth scientists can envision deep time, think in those long periods, better than most people. In a famous essay, the ecologist Aldo Leopold wrote about "thinking like a mountain." He contemplated events that mountains witnessed, events that people weren't around to see. When geologists try to imagine geologic time, they're trying to "think like a mountain." Earth scientists, some people claim, can picture millions of years and billions of sunrises and sunsets.

I'm not so sure. I've worked with geologists for decades. In spite of analogies or fossils or the constant contemplation of Earth's whole history, many don't seem to comprehend a million years any better than most people.

But here's what they can do: geologists can picture worlds unseen.

They understand that this place would look very different, depending on when you were here. They know that a billion years ago, igneous and metamorphic rocks formed an ancient mountain range. Those mountains (still present only a few hundred feet below us) are now covered by sediments left behind by later oceans, like those Permian seas.

Geologists can picture those ancient oceans, and they know that even after the water receded, erosion and deposition continued inexorably on, washing small channels into the rocks here, channels that today conduct water to springs or even form caves. Geologists know that in



Ha Strata (detail)
Hannah Bennett

places erosion removed the softer rock, like limestone, and left behind harder, tougher stone, like the flint (or chert) that gives its name to these hills.

Geologists know that much more recently (a mere 600,000 years ago), thick layers of ice pushed down from the north. And although those glaciers didn't get this far south, they did rearrange the landscape, creating the Kansas River and leaving behind rocks and other debris they carried with them. Geologists know that big mammals, such as mammoths and camels and giant bison, bigger than the ones we see today, walked the ground of the Flint Hills.

Geologists know that in time, lots of things are possible. And geologists aren't the only ones.

William Least Heat-Moon wrote about that, too, in *PrairyErth*: "Before the children of Europe took these hills, the people who walked here believed stones to be alive because they carried heat, changed their forms, and moved if you watched long enough."

Here's a caveat. Even with long expanses of geologic time, not all geologic events happen slowly. Volcanoes, earthquakes, floods, maybe even climate change, all happen suddenly, sometimes catastrophically. Even evolution is not some long, smooth process. Paleontologists developed the idea of "punctuated equilibrium" (known as "punc eq" in some scientific circles), the notion that evolution occurs in fits and starts, sometimes quickly, and at other times hardly at all.

When humans arrive, they demonstrate again that things can change quickly, evolving, rearranging the earth. But only in that last 1.5 inches. For all the rest of

time, for all of the 99.9 other yards on the football field, no people were present. No human eyes watched the sun rise and set or saw the animals who lived here or watched those geologic conditions change. We might picture ourselves at the center of the universe, but for nearly all of geologic time, we were nowhere to be found.

In much the same way, people once pictured the Earth as the center of the universe. They thought that the sun and the other planets revolved around us. Then, with the realization that the Earth moved around the sun came the understanding that we were just another planet, not quite as special, not quite so central.

An appreciation for geologic time has something of the same effect, I think, on the people who ponder these things. They easily imagine a world with fantastic forms of life that come and go, mostly with no people present.

None of this makes geologists appreciate people any less. In fact, because people show up so late and play such a small role in geologic history, some geologists appreciate how rare and wondrous humans, and many other forms of plants and animals, really are.

In his book *Wonderful Life*, paleontologist Stephen Jay Gould analyzed the idea of historical contingency. That's the idea that history didn't have to unfold the way it did. With long periods of time to work in, all sorts of historical possibilities are out there.

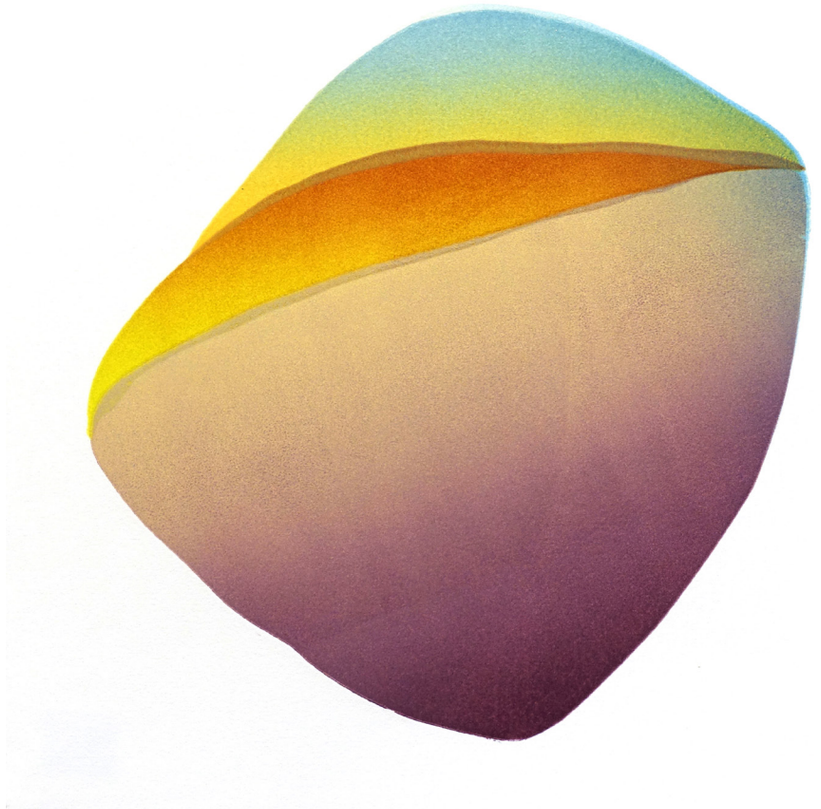
Like the movie that provided the book's title, Gould contemplates what might happen if the tape of time were rewound, played over again, with a change or two. And the cool thing about geologic time is this: it makes all sorts of things possible. A shallow sea becomes a pasture. Swimming animals give way to gently waving grass. People walk where camels once wandered.

At the end of the Permian Period, about 250 million years ago, a great extinction took place all over the world. About ninety-five percent of marine species disappeared, and about seventy percent of land-based species went away. It was a much more dramatic extinction than the one at the end of the Cretaceous Period that wiped out the dinosaurs.

And yet, after each of those extinctions, life recovered. Flourished even. All sorts of different plants and animals appeared, including, eventually, people.

All it takes is time.

Rex Buchanan is the Director Emeritus of the Kansas Geological Survey. He is the co-author of *Petroglyphs of the Kansas Smoky Hills* and *Roadside Kansas,* and editor of *Kansas Geology.* (University Press of Kansas)



Gem
Laura Berman