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Not My Fault: In praise of the not-so-lowly stromatolite

Lori Dengler/For the Times-Standard
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Summer vacation has taken me to winter on the other side of the globe. My husband and I are spending three weeks in Southern Africa. Travel gives a different perspective and a trip to the southern hemisphere where the sun is to the north, the stars are unfamiliar and they drive on the left is a good way to do that.

We are in Namibia because my undergraduate college roommate and her husband, Laurel and Time Osborne, run a 14,000-acre game farm and lodge in Northern Namibia and I wanted to visit before they retired. It took effort to get here - Arcata, San Francisco, Frankfurt, Johannesburg, Windhoek. Then a long drive (challenging driving on the left in a manual transmission truck, shifting with the left hand) and made two hours longer by my navigational error.

It's been worth the effort. My Humboldt cough has nearly disappeared in the dry air. I grew up in the desert and the arid landscape has a touch of familiarity. That vanishes quickly when an Oryx strolls past and a hornbill flies overhead. The flora and fauna have been wonderful but the highlight so far is the geology.

The rocks exposed at the surface of the farm give a glimpse into the world 550 to 750 million years ago. None of the present continents and oceans existed at that time. Several hundred million years would elapse before all the landmasses assembled into the supercontinent Pangaea. And at least another 100 million years would pass before Pangaea began to break up and the Eastern Atlantic coastline begin to form.

Everything we know about the world of 600+ million years ago has to be pulled out of the rocks that were formed at that time. The surface rocks exposed at the farm are all carbonates and carbonates form in water. Most carbonates contain fossils – from shells easy to see with the naked eye to tiny microfossils only observable under magnification. Fossils are an indicator of age and the environment the rock was formed in such as deep or shallow water, salty or fresh and so forth.

The problem here in Namibia is that these rocks are very old, before life had evolved to produce any hard parts that could be preserved as fossils. European and British geologists of the 18th century were the first to identify rock units based on relative age and develop the geologic time scale. One of the first major divisions they identified was to separate the time of life, beginning with the Cambrian and the time before life, or Precambrian.

In the 20th century, geologists and paleontologists found that the Precambrian was not so lifeless. New techniques revealed life appeared on the planet at least 3.8 billion years ago. These earliest life forms were single-celled primitive bacteria with no nucleus. There were many varieties and some of them survive to the present day, clustered near hydrothermal vents, getting their energy from temperature gradients in the water and fueled by chemical reactions from the mineral-rich hot spring environment.

Life might have remained isolated in these unique environments if it weren't for a great revolution in the bacterial world somewhere around 3.5 billion years or perhaps even earlier. Cyanobacteria (once called blue green algae) developed the ability to photosynthesize, using the energy from sunlight to convert carbon dioxide and water, producing carbohydrates for food and a very important waste product - oxygen.

With photosynthesis, life was free to colonize any area of the ocean or inland seas that were warm and where sufficient amounts of light could penetrate. Vast colonies of cyanobacteria formed in the near-equatorial regions creating slimy bacterial layers, extracting carbon dioxide from the water and causing precipitation carbonate minerals. Over and over again the process repeated – mats of bacteria covered by layers of minerals. Time has long since removed almost any trace of the bacteria but the distinctive mineral layers remain, sometimes forming domes, cones and columns called stromatolites, and considered by many to be the world's oldest fossils.

Tim and Laurel's farm is stromatolite heaven. Tim took us on a field trip to observe the cones, mounds and intricate forms left by the cyanobacterial mats of so long ago. Some of them looked like inverted egg cartons, others made intricate patterns that would rival any graphic designer. The opportunity to touch these outcrops was very special,

Stromatolites are not just an ancient fossil oddity. Most earth scientists agree that they triggered perhaps the most dramatic changes in earth history from the perspective of life. Earth's early atmosphere was very different from today. It likely consisted almost entirely of

carbon dioxide, similar to today's atmosphere on Venus and Mars, with only small traces of other constituents. Slowly stromatolites began to emit oxygen into the oceans. It would take well over a billion years before oxygen levels in the ocean began to affect the atmosphere. But by the time of the stromatolites I saw in Namibia were formed, the oxygen levels were likely close to modern levels, setting the stage for the explosion of life in the Cambrian.

Stromatolites are not just ancient. They aren't nearly so widespread now as they were in the Precambrian, but they continue to survive in a few areas on earth, making them one of the most long-lived of all earth's life forms. So a big thank you to the stromatolites – without them, you and I might not be here.

Note: I've gleaned much of the information above from a very readable book, "The Story of Earth and Life," by McCarthy and Rubidge. It is a Southern African perspective on both the geologic and biologic evolution of the planet but much of it applies anywhere.

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