Beneath the Surface

AMK
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"More than 99% of the living matter (standing crop) on this planet …are represented by biofilms, microbial mats and biodictyons of the deep subsurface layers of the earth" W.E. Krumbein et al 2003

Scientific genius is a rare gift, both in the finding and the developing. For a lifetime, soil science never made sense to me. The chemical analytical system of rock, sand, silt, clay, particles composed of elemental materials made into compounds of silicon, calcium, iron, sulfur, aluminum, potassium, zinc, manganese lacked a certain reality but I couldn't quite put my finger on what was missing.

Then came molecular biology and the advances in looking at whole genomes of bacteria. With thousands of genes, bacteria were solved, resolved into functions, compared and catalogued. New views emerged challenging existing status-quo beliefs. And increasingly advances in understanding bacteria continue to transform our notions of reality.

Bacteria were studied by microbiologists for 150 years as free floating liquid dwellers. Now it becomes clear that most bacteria live in rooted communities wherever water flows, settles, pools, clusters, accumulates or just passes by. These communities are composites of various living components, ones that use sun or chemical energy to make organic compounds which are then shared with others that need them in exchange for metals like iron or molybdenum or for cofactors that stimulate genes for swimming towards the light or away from oxygen. Bacteria spend a lot of energy making inter-communication molecules. Signals pass back and forth between bacteria, rapidly and routinely, reminiscent of our cell phone and internet human communication facilities

Rather than living a free floating life, bacteria prefer to live in biofilms, microbial mats or bacteria laminates. When these laminates solidify, they make rocks. In 1528 Paracelsus stated that microbial communities found in water turned into rocks. The predominant bacterial lifestyle is sessile. Attached. Rarely free. Took the microbiologists a while to figure it out. More than half of the gene activities are enhanced in the stabile, composite, integrated communities.

I was raised on the sedimentary notion of rock formation, that inorganic material precipitated from the top down, following gravity, giving rise to sedimentary rocks. Wrong. Bacterial communities grow on rocks, in pools, which dry down, become solid, rocklike, then rock. Microorganisms make an extracellular polymeric matrix of sugars as an environment and adaptational milieu for the changing times which later turns into more rocks.

Times are always changing. Some changes are more profound than others.

The conversion of rock formation from abstract physico-chemical principals to the activities of tiny little creatures is a long climb after generations of ignorance. A scientist in the 16th century recognized the biological origin of sedimentary rocks. It took almost 500 years for current, modern science to come to the same conclusion.

Now a modern scientific genius in the biogeophysiology of the earth, W.E. Krumbein tells us that most all of life on earth is bacterial and that most of them live under the earth's surface, dozens to hundreds of miles into the world we live on. They are the foundation of our lives. We walk on them all the time.

Not only did the bacteria make many of the rocks on the surface of the earth, but they built enduring biofilm communities whose current incarnations include the surface of our teeth, the inside of our large intestine, many mineral ore deposits and the petroleum that fuels the current society.

Quote from Chapter 1 in Fossil and Recent Biofilms: W.E. Krumbein, D.M. Paterson and G.A. Zavarzin. Kluwer Academic Publishers 2003