

What the Rocks Taught Me

By Marcia Glaze Wyatt

“Life is understood backwards, but must be lived forwards.”

By Danish philosopher Soren Kierkegaard

“History is unpredictable, but not unexplainable.”

By Danish physicist Per Bak

I first fell in love with rocks at age twelve. My dad had given me a huge chunk of mica. Not just any mica, mind you. This was a treasure rivaling any museum piece. Her foot-long, half-foot wide frame showcased an inch-thick stack of paper-thin, translucent sheets that lay parallel to one another, each one melded to its neighbor with pliable tenacity. I was smitten!

My mica had been a “late arrival” in her mountain-building neighborhood, back when upheavals were remodeling the landscape in what is now the Mid-Atlantic-States region. She owed her deep-seated birth to a residual water-rich brew that coaxed her atomic architecture into statuesque dimensions. This inevitability came from her circumstance. She had started out as one-of-the-crowd moving into new territory, but as most in her mix rushed to their destinies, she stood back and waited. Her late blooming was her making. Her durability, she owed to what happened to her post-arrival. Following her rather smooth entry, she found herself amidst a regional reconstruction event. She was “baked” a bit in the belly of the North Carolina mountains. It toughened her. Her original fragility was lost. Scattered crystals of deep red garnet seeded her soft green surface; white crystals of plagioclase capped her base. These ornamental touches were gifts from her struggle. She was grown, but not yet done. Her middle years were spent cocooned at depth. Internal changes had slowed within her, but surrounding her, the situation was anything but stagnant. Tectonic forces competed with erosion processes, slowly excavating her from burial, ultimately delivering her to earth’s surface. She survived.

Hundreds of millions of years passed from birth to debut. She is breathtaking. At the time she entered my life, I did not understand why she made my heart jump. She engaged my soul in a way nothing else ever had. I sensed that there was more to her beauty than her exterior.

My mica is a show-stopper. But so much more. One might overlook the hardships she endured to earn her beauty. External beauty can do that – blind others to what lies beneath. On the other hand, to the unseeing eye, some rocks and minerals can appear somewhat ordinary. They attract little attention. But beautiful or plain, all rocks and minerals have a story worth knowing. Those in the rock world don’t shout their wisdom. They wait until we are ready to “hear”. Children intuit this. They tend to know instinctively that a rock is not just a rock. Perhaps they sense common roots. But somewhere along the way to adulthood, most of us divert our attention to more modern distractions. Lost in the distraction is a message that we continue to seek our entire lives.

Rocks have much to say regarding that message; it just takes a bit of patience to learn the language.

At age 16, my fate was sealed. It was summer. I was on a trip with my school. We were studying earth sciences from the Carolinas to Canada. It was in Cape Cod that something shifted. While my classmates were off inspecting the surf zone, I was combing the beaches for rocks. Being from North Carolina, where beaches are sandy and white, I was not familiar with the terminal-moraine glacial deposits that pave these New England peninsulas. The beach was like a general store of rocks – every imaginable kind of stone had been imported to this end-destination from diverse and vast expanses of land, across unfathomable distances. Rocks of varied compositions, and from assorted backgrounds and life histories, mingled cozily together, creating a new tapestry in their collectively adopted home, creating land unlike what had previously existed, and together, as a unit, influencing its own unique destiny. I was hooked. From that day forward, I knew I would study the message that rocks had to share.

California's coast drew me westward. Here, the land was young. Signs of youth were everywhere. One could see it in its vertical contrasts, its sharp edges. Here, the land does not sleep; nor does one's soul. There is too much to absorb to allow the senses to slumber. Nothing seems gradual. Restlessness dominates. Land is pushed up and sideways; reconfigurations abrupt. Restive internal forces sculpt masterpieces, their edits seemingly executed by whim. Upheaval and shifting positions etch signatures into the landscape. Hills are built, and the ocean tears them down. No, the land does not sleep.

There is raw majesty in witnessing the ocean's relentless taming of the land. Yet, with the taming, messages vanish; memories fade and blur. Vestiges of virgin sea floor; the implied consumption of old; and signatures of oceans advancing and retreating over time - these are peeled away, piece by piece from these hills by the unrelenting forces of wind, water, and gravity. Too late we come to realize what has been missed and lost forever. I know this to be true. North Carolina's coast was once young. Now it is old. Lost are its traces of nascent sea floor; of rising and falling sea levels; of cycles of life punctuating an evolutionary trend. It, too, was once a place of turbulent clashes between ocean and land. Time has changed that. Forces have given way to mostly quieter conflicts, punctuated by only infrequent turmoil. North Carolina beaches are no longer places of collapsing cliff sides. Instead, they are sanctuaries of shifting sands, that gradually, yet relentlessly, redraw coastal configurations. The softness of this rather nomadic lifestyle belies the torturous past that has been tamed. The calm comes only from enduring struggle. Youth must always precede old; thus turmoil must always precede calm.

Away from the coast, in the California desert, I found another story. Naked rocks enticed close inspection. No vegetation concealed their beauty. What had lain hidden beneath dense foliage in the North Carolina mountains, became an open book at my feet. This new-found easy access to outcroppings had me bursting at the seams! The summer of 1972 was a turning point. Given an opportunity to spend my summer hundreds of miles from civilization assisting graduate students in field work in the Owl'shead Mountains in the Mojave Desert was a dream job, bar none! Companions included a handful of

humans; the occasional lizard, rattlesnake, and Gila monster; a feral burro or two; and miles of exposed rock. What others might have seen as barren, I saw as undressed hills brimming with beauty. And more, they brimmed with rich history. It was in these hills that rocks taught me my place within earth's dimension. I viscerally grasped how small I was; yet how significant, at the same time. I embraced the palpable interconnectedness of all – in every direction, in every medium. An elegant marriage of the simple and complex emerged from every corner of my new universe. And its message was everywhere, revealing that from disorder, order evolves – a theme repeated throughout time, and through diverse manifestations.

In early 1975, my undergraduate years came to a close. They had embedded in me memories and gifts that forever would shape my path, and most notably, they accomplished their intended mission: to stir potential; arouse curiosity; and sharpen powers of observation and reason. What I had failed to learn was that I was not as “in-charge” of my future as I'd led myself to believe. A vacation to Colorado was the first clue. I stayed; it became home. Moving from California hadn't been in my plans.

Colorado's geology introduced new perspective. In contrast to the mellowed stages of North Carolina's mountains and coast, and the youthful impetuousness of California's, I had come to a place of middle age. The mountains still had stories in their flanks; yet the mountains were calm and their stories accessible. The pace was easy. Every kind of rock was here to explore, the collection of which was rich with tales of migrating ancient landmasses, onto which increasingly younger land was sutured, and upon which inland seas left traces, revealing life, mass extinctions, renewed life, and more extinction, and again, more life. With every step, I could read earth's biography. Her story of the Rockies, and the two mountain ranges that preceded her, cornered my affections¹.

Fast-forward decades: Circa 2002. More years now lay behind me than in front. Life had calmed from its earlier tumult: Family raised; demands on time few. I was not looking for change. With no hint of lurking adventure, an unplanned unfolding of events hijacked my leisurely pace.

This hijacking had a history. It started with a geology book that I had been writing off and on for years. I had begun this manuscript back when typewriters and life's itinerary ensured slow progress. During one of the “on” times, I began a chapter on sedimentary rocks. That chapter laid bare my ignorance. You see, sedimentary rocks are record keepers of past climate – a topic about which I knew little. I understood that one could infer ancient rising or falling sea levels from sequences of sedimentary rock. But I had not deeply embraced the climate patterns that were behind this choreography. Nor had I grasped the factors influencing those climate patterns, internal factors such as: land configuration, continental location, landmass topography, composition of exposed rock and ground cover; life processes; ocean and atmosphere circulation; ocean-atmosphere interactions; and atmospheric chemistry, from the surface through the stratosphere. In addition, I had not fully pondered the governance of climate patterns by external forcings – especially forcings related to solar variability, and whether the latter was due to

¹ Geology of Colorado and beyond: <http://www.earthrocks.net/> (user name: earth; pw: Rocks!!!)

fluctuating output of the star, itself, or due to how planetary gravitational interactions affected earth's orbital and axial parameters, which, per consequence, modified the sun's influence on climate. In turn, I had not appreciated the reciprocal relationship at play: climate's impact on the topography; surface and atmospheric chemistry; ocean circulation; ocean-atmosphere interactions; ice cover; and life. There was much to learn. And I did. Self-guided study morphed that modest sedimentary rock chapter into a 300-page tome on climate. The chapter had taken on a life of its own.

Unlikely opportunities stubbornly commanded my attention. Coincidences seemed in control, coaxing me out of my risk-averse nature. Emboldened, I submitted my "tome" to Cambridge University Press (CUP). To my utter surprise, they didn't reject me! At least not right away. The manuscript went to review. Reviewers commented favorably; yet, collectively, they questioned: "Who is Marcia Wyatt"! The publishing-house agent conceded that this was not the ideal response, but he offered that if I could find a co-author who was an expert in climate, and someone well-known, someone who could vouch for the text's validity, CUP would publish the manuscript. Despite the appeal of the offer, I knew no one of that ilk.

I'd reached a dead end. Or so I thought. That evening my husband directed me to a Wall Street Journal article. The Intergovernmental Panel on Climate Change (IPCC) had issued a summary for policy makers. The article included comments by Richard Lindzen² about the IPCC summary. My husband thought I'd be interested. To paraphrase Dr. Lindzen: a summary of the science is an interpretation of the science, not the science, itself. Powerful, simple logic! Without another thought, I went to the computer and emailed him. Who was this gutsy person I had become? Within hours, Dr. Lindzen wrote back: "Marcia, I know you." I was floored. He explained that he had been one of five anonymous reviewers on my climate manuscript. Coincidences; they were in charge!

For over a year, Dr. Lindzen and I collaborated remotely. The manuscript resisted; or perhaps I did. Dr. Lindzen gave me his all. Progress was made; yet deficiencies lingered. We shelved the manuscript. I asked for advice: Should I get my own credibility? Should I, then age 50, go back to school? No one said yes. Only my inner voice did.

Now I stand on the other side of that sedimentary-rock chapter, masters and doctorate in hand. Along the path of this unlikely and unplanned journey, obstacles were aplenty; yet none a match for determination. Survival-to-the-surface was the teacher; unveiling dormant potential, the lesson. At the end of this journey, a novel idea³ had come alive. Coincidence had put in my path opportunity after opportunity. A supportive collaboration of minds and efforts worked together to effect this auspicious outcome.

² Atmospheric physicist, well known for his work on dynamics of the atmosphere; lead author of "Physical Climate Processes and Feedbacks" - Chapter 7 of the IPCC's third assessment report on climate change; Alfred P. Sloan professor of meteorology at the Department of Earth, Atmospheric, and Planetary Sciences at MIT (1983 to retirement in 2013); professor emeritus status.

³ Stadium-wave hypothesis: www.wyattonearth.net

Through it all, this rocky planet had a message; it took a while for me to hear it: Nothing is separate. Big and small: All have a role. With time, all becomes interwoven. Systems self-organize into networks, which often evolve into loosely connected hierarchies. The overall collective behavior works to damp extremes and promote resilience of the whole. From a narrow view of time and place, this message easily is drowned out by noise. Seemingly random actions of individual phenomena obfuscate the eventual transformation of disorder to order. It is the broader view that brings to focus this ubiquitous outcome, one common in nature and in human constructs.

And now it seems that the long shelved book – the one that re-scripted my plans - hints at potential revival. It has resisted for many decades. It had resisted for a reason. It was not ready. It needed time to evolve. It was like my mica; it needed struggle. Had its debut been rushed, had its development been ordinary, it would have had no story. It would have been a book about earth. It would not have been a book about earth's message. Now it is about both – earth *and* earth's message.