
Timefulness: A Geologist's Story—Interview with Marcia Bjornerud

ANJA CLAUS

Geologist Marcia Bjornerud's latest book, *Timefulness: How Thinking Like a Geologist Can Help Save the World*, can easily capture your inner philosopher, scientist, activist, and writer. When I received this book from Princeton University Press, I was immediately intrigued by the book's cover. I've always been fascinated by ideas that necessarily mix up life's ingredients into creative nature stories, and this book does just that. The choice of title and cover design (with its elegant series of mineralogy lithographs) offers clues to the layered Earth-story within: unwrapping the scientific ways of knowing our home's deep planetary history; how we humans have come to discover these stories; how knowing them can re-educate us and thus drive us to become better citizens as part of the whole community of life.

Bjornerud's title, *Timefulness*, intrigued me as a grander understanding of our current temporal limitations. The subtitle, "Thinking Like a Geologist Can Help Save the World," shares how looking into the deep time of Earth's rocks breaks open an opportunity for us to become more aware of the damage we have done while concurrently offering hope. Bjornerud offers tips on re-imagining how we can comprehend our humanness on this planet by coming to re-know ourselves as Earthlings. Marcia Bjornerud's Earth story elaborates this interweaving of a deep past with a deeper future and explores how we might expand our human sense of temporal directions in order to arrive at some meaningful place of resilience.



Anja Claus (AC): In *Timefulness*, you breathed great life into this magical story of rocks; that's a big feat in our flashy, fast-paced, capitalist culture.

Marcia Bjornerud (MB): In most people's minds rocks are dumb, mute, and dull perhaps. So I tried to bring them back to life and share the stories that they have to tell us.

AC: In a way, your book is a storytelling of Earth—Earth's past but also its now. You say in your book, "The dramatic narratives of the geologic past are perfectly suited to the human appetite for storytelling." Why do you think that? What is it that makes for such good storytelling?

The Earth is always changing



And we are changing Earth

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"The Earth is Always Changing" by Sofia Jain-Schlaepfer

MB: I'm positioning the idea of storytelling in contrast to the physical, pure sciences of physics and chemistry, which are of course important fields—and I am partly trained myself as a physicist. But what's lacking in them is this sense of narrative arc. The triumph of physics is that it has distilled out these universal, timeless laws and rules. But if something is timeless, there's no story to really tell. There's no character development.

Earth as a whole system has had a very interesting series of personalities, in a sense. It's had a childhood, an adolescence, a middle-age. It's seen cataclysm and wonderful, bountiful times as well. So that's what I mean. That there are stories in the natural world, and they match our appetite for seeing how things unfold. I think that's the way to draw people in: Tell these Earth stories, develop some kind of relationship with the protagonist, and they're hooked.

AC: You used wonderful linguistic expressions of analogies, metaphors, and similes quite a bit throughout your book. For example, you share a metaphor within a larger analogy, highlighting the essentialness of time in life's symphony:

Timefulness includes a feeling for distances and proximities in the geography of deep time. Focusing simply on the age of the Earth is like describing a symphony in terms of its total measure count. Without time, a symphony is a heap of sounds; the duration of notes and re-occurrence of themes gives it shape. Similarly, the grandeur of

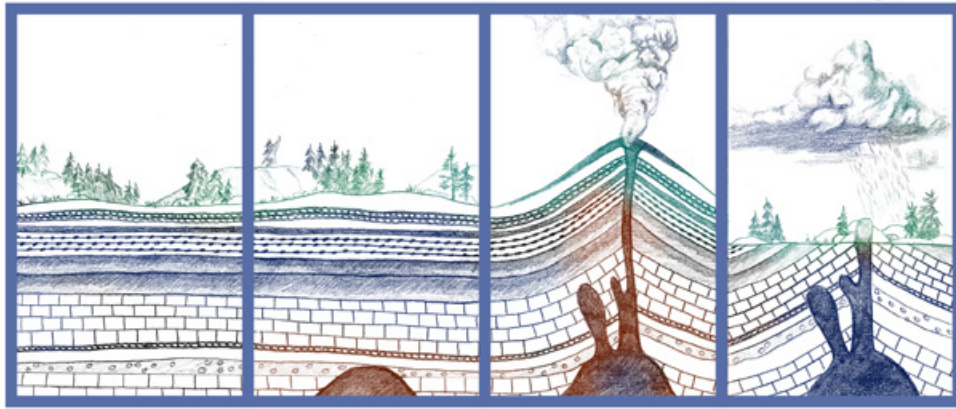
Earth's story lies in the gradually unfolding, interwoven, rhythms of its many movements, with short motifs scampering over tones that resonate across the entire span of the planet's history. We are learning that the tempo of many geologic processes is not quite as *larghissimo* as once thought; mountains grow at rates that can now be measured in real time, and the quickening pace of the climate system is surprising even for those have studied it for decades.

Where do all these beautiful, luscious expressions come from—are you a writer as well as a geographer?

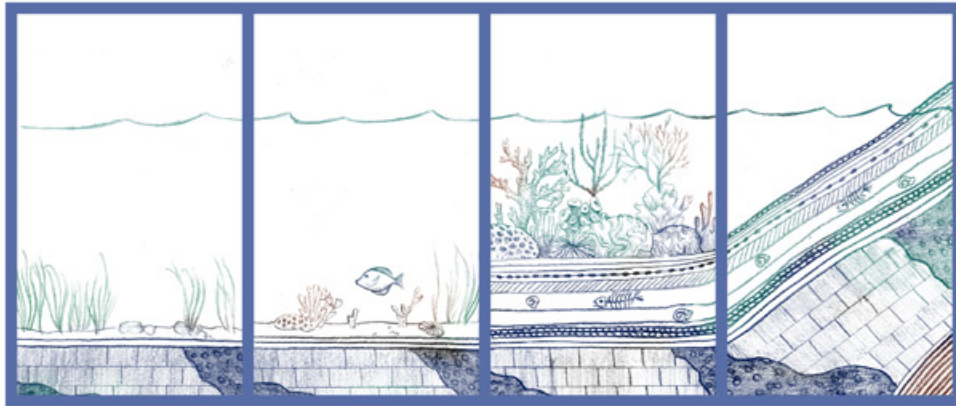
MB: Well, for the musical ones, I have to partly give credit to Lawrence University itself. We have a Conservatory of Music here, so music is in the air all the time. We have music students coming into our geology classes and so some of the metaphors I use were consciously developed in my teaching, to try to show connections between music and science. And then in other cases, it's just desperation. "How do I explain this rather complicated, arcane thing in a way that students can grasp?"

And I do believe that almost anything—even very complex, subtle ideas—can be explained at some more accessible level, usually through metaphor. And although the metaphor may not be perfect, it can get people on board, provide a framework for understanding that can then be built upon. So I'm pretty shameless, especially with anthropomorphic metaphors.

Granite as a verb - an act, occurrence or mode of being



Limestone as a verb - an act, occurrence or mode of being



Geologic Time Scale

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"Rocks as Verbs" by Sofia Jain-Schlaepfer

We're often told as scientists not to anthropomorphize nature, but we are part of nature—so why wouldn't we see ourselves reflected in the natural world? Not everything is like us, but we came from the natural world, so of course we see echoes of ourselves in everything. And I think it's okay, at least to initially get people engaged in the topic. We have no option. We're deeply embedded in nature.

AC: Another interesting grammatical tool you use is turning the verb/noun relationship on its head. You understand rocks as verbs and not as nouns.

Early in an introductory geology course, one begins to understand that rocks are not nouns but verbs—visible evidence of processes: a volcanic eruption, the accretion of a coral reef, the growth of a mountain belt. Everywhere one looks, rocks bear witness to events that unfold over long stretches of time.

Little by little, over more than two centuries, the local stories told by rocks in all parts of the world have been stitched together in a great global tapestry—the geologic timescale.

What do you mean by this?

MB: People think that rocks just are. But every rock had to come into being in some way. And so very literally geologists see rocks as emerging, as changing. When I see limestone, I see a coral reef that grew over time. Or when I see a granitic rock, I see a volcanic system that formed as plates moved, melting happened, and magmas formed. So that really is at the essence of geologic thinking. Recognizing these seemingly inert objects as records of events. So they really *are* verbs, I would assert.

AC: I have been lucky enough to get to know member of the Citizen Potawatomi Nation and botanist Robin Kimmerer,

who wrote *Braiding Sweetgrass* among other things. Robin highlights the use of verbs versus nouns when speaking of nature in the Potawatomi language. I think the entire language is very much a verb-based language. So it was interesting to see a similar understanding and use of language coming from a Western science perspective. I think using *grammar of animacy* is the right way of understanding and referring to the whole community of life.

MB: Well, I think it gets to the heart of part of our problems with interacting with nature. We treat nature as if it's this passive backdrop for us, when in fact it's doing all kinds of things all the time at different time scales. And our ignorance of that underlies so many environmental problems.

AC: I'm curious about your own sense of time, partly because you seem to have been quite captivated by understanding time when you were young. You start the book with a story of being able to miss school because of the snowfall, and how the snow accumulation had halted the human, day-to-day concept of time.

MB: A snow day offers a kind of unexpected exemption from everyday routine. It's a moment for stepping outside your own life and looking in. Yes, I do vividly remember one particular snow day when I paged through our family's world atlas and discovered a time zone map showing an Arctic Archipelago, Svalbard, that supposedly had "no official time."

I was in the eighth grade then, an age where you're kind of aware that childhood is ending, adulthood is before you, and standing uncertainly in the threshold between them. As I thought about how to frame the book, that strong memory seemed a natural entry point into a broader discussion of time. In this book, I wanted to establish my credibility as a human being and not just a scientist – as someone who personally struggles with the passage of time like everybody else, and not someone who's somehow just taking a purely scientific point of view.

AC: Can you give us an annotated definition of "timefulness"? How might this concept help improve our understanding of ourselves and nature and our interconnections?

MB: It's meant as a counterpoint to two things: First, timefulness sort of rhymes with "mindfulness," the idea of being present in the moment. This may be good practice for individuals in times of stress, but not so good for society. We are too myopically focused on the Now, ignorant of history and blind to the future.

I also meant it as a counterpoint to "timelessness," which we think of as this kind of ideal aspiration. We would like to think that things could be timeless and never-changing, when in fact that's a completely unrealizable goal and arguably a sterile concept anyway. Everything in Nature is full of the work of time. Everything is evolving and changing, and our failure to embrace that causes all kinds of ills, ranging from neuroses about our own aging process to environmental problems that could have been avoided if people just had had the capacity to think on decadal time scales and recognize the potential implications of our actions.

So the call for timefulness is to acknowledge that we are temporal creatures, to learn something about the history of the Earth and the environment in which we are deeply embedded and with which we have evolved. And to learn to anticipate the ways that our actions as humans, who are increasingly numerous, will interact with the unfolding natural processes in ways that may not be what we would like them to be.

AC: You also speak of chronophobia: the idea that humans have a fear of longer senses of time, both in the past and the future.

While we humans may never completely stop worrying about time and learn to love it..., perhaps we can find a middle ground between chronophobia and chronophilia, and develop a habit of timefulness—a clear-eyed view of our place in Time, both the past that came long before us and the future that will elapse without us.

MB: I think this fear has a number of origins. It's rooted in our own fear of mortality at a very personal level. It's certainly fueled by the demands of the capitalistic world we live in, where short-term profit is the motive force for everything. And there's just very little incentive—certainly in the economic sector, and increasingly in the political sector, either—for people to speak and think on time scales of more than a couple of years. We are so focused on immediate crises and political arguments that we have lost the capacity to step back and take the long view. And so that's a kind of chronophobia, or time-avoidance that has become endemic in our discourse—unfortunately.

And there's no excuse for it. At this point we have the tools to anticipate the consequences of our actions, but we are not taking them seriously. Or we're not taking action fast enough.

AC: You mentioned that in your day-to-day life, you have more of a polytemporal way of thinking. Please tell us more about this.

MB: What I meant by "polytemporality" is more of a geological point of view. I walk into work every day, and I truly do see the

landscape in four dimensions. I see rock outcrops and think of the shallow seas that were here 400 million years ago. I see the river valley that is carved into clay left by a giant lake at the end of the Ice Age. My walk to campus is a walk through time as I sense the lingering presence of the many different landscapes that have existed at this place.

And that's at the heart of geologic thinking. Recognizing that every landscape has been written over many times. Another metaphor I often use in teaching is that of a "palimpsest" manuscript. It's a term that's used by medieval scholars to describe a parchment that was written on and then—because parchment was an expensive thing to produce—often scraped and then re-inked with a more recent text. But there would always be vestigial remnants of the earlier text that were still there. These days these older texts can be seen by x-ray and reconstructed. So that idea of a palimpsest text that's been written and erased many times over is the perfect way of describing how a geologist sees the landscape. And in many cases, there are many, many re-inkings that we can track.

So that polytemporal point of view is the habit of mind that I would call geologic thinking. But I think also many of us do this in everyday life. As parents we can see our children as they are today, but also remember vividly how they were when they were younger, and at the same time imagine who they may become. And I think that kind of thinking would be helpful to adopt as a society. To understand where we've been, where we are now, where we are going is a mindset that might do us good.

AC: One aspect I especially appreciate about your book is how you dive into different themes that are impacted by polytemporal thinking—even governance and citizenship. What might citizenship look like if we begin to think this way? And what might be the policy and planning implications of a more polytemporal decision-making process?

MB: Yes. I ventured there with some trepidation into social and political realms because I am just a geologist. I have no experience in the public sector, but as a citizen I feel it's urgently necessary for those of us who do have the scientific training to try to share what the essential messages are, and the facts that are just not getting through in our policy conversations. It's really disheartening how few members of Congress have any scientific background. I don't think they all need to be scientists, but I think at last count, there were maybe ten members who could be considered scientists, and most of them are in the medical profession. Very few people with scientific backgrounds are making a lot of decisions that require a pretty good

working knowledge of the natural world. With luck they will have surrounded themselves with good advisors. But that's a little bit scary to me.

And so what we need is just a more broadly science-literate citizenry, and a higher priority placed on Earth education. As I mention in the book, it's frustrating and confounding to me how geology just doesn't get the attention or the prestige that's afforded to the other sciences. I think that it is arguable that if there is any science that every single child should be well-versed in, it would be Earth science, because they're all going to be Earthlings for their entire lives and will be very much affected by all kinds of Earth phenomena ranging from groundwater to earthquakes and volcanic eruptions to climate change to soil degradation.

But somehow these topics don't quite have the cachet that the purer sciences do—and then that's reflected in our curricula and the kinds of programs that we encourage our best and brightest students to go into. It's really a shocking failure of our educational system to prepare citizens who urgently need to know about these things.

AC: This brings me back to this sense of aliveness about the Earth that you present in the book. You speak of all these changing processes over the last—I think it was 4.5 billion years—of Earth's story. And you speak to the change in chemical structures of the rocks, of the air, the tectonic plate movements, and the overall pace of the planet; you speak of how the pace has changed and how it keeps changing. And sometimes it's a very slow process. Sometimes it's a very fast process. And most importantly these processes are interconnected and continually influence each other. Through these planetary stories you show just how unique planet Earth truly is—especially when compared to the other planets within our solar system. What came to my mind as I read through your chapters is the somewhat still popular Gaia theory that argues the Earth is very much alive. Do you see a connection between this theory and your understanding of Earth and timefulness?

MB: I think the Gaia hypothesis is a really useful lens through which to see the Earth. I've been in geology for more than thirty years at this point and remember quite well when James Lovelock introduced the idea of Gaia. I think William Golding, the novelist, who was a neighbor of Lovelock, was the one who suggested the name. And maybe it was too poetic for science at the time.

Interestingly though, in the subsequent decades since Gaia was first posited, geologists have adopted some of the philosophy

underlying it in terms of thinking of the Earth as a great bio-geochemical system, that is to some extent able to self-regulate itself. For example, over geologic time it has kept ocean chemistry and the planetary temperature within certain bounds, in a way similar to an organism maintaining its internal biochemistry or body temperature. We can be out in the 15 below weather today and still be at 98.6 degrees inside our bodies.

So Gaia has crept into geology in the guise of what people sometimes call bio-geochemistry or sometimes even geo-physiology. People rarely use the term “Gaia” in the scientific literature. But it certainly is true that Earth is a system of many sub-systems that operate at many different scales, both spatial and temporal, and that’s the challenge of studying the Earth. It’s a giant big old complex thing. And the more we look, the more complex it is, and the more awe-inspiring I would say it is, as well.

So although we don’t often use the word “Gaia”—the idea that the Earth is in some sense a superorganism or at least something that’s more than the sum of its parts in being a complicated system of interacting systems has entered mainstream geological thinking.

Regarding your comment about some geologic processes happening very slowly and others very fast: There’s an irony that for years and years geologists have had to be vigilant about Young-Earthers and creationists—and so we’ve flogged people over the head with the idea that the Earth is old and geological processes are slow. Now we’re trying to change the narrative to say, “Yes, mainly geological processes are slow, and yes, the Earth is old, but sometimes things—like climate change—can happen really fast as well.”

And that’s always been true, but I think we’ve been too emphatic about the slow part, and now we’re trying to turn public perceptions around, but that’s what is hard for people to swallow. It’s comforting to think that the Earth is old and never-changing, and I think that’s part of the reason that some people are slow to accept the idea of climate change. “Well, how could we possibly affect something as big and old and slow as the Earth,” is their skeptical response. We geologists have to claim some responsibility for this public skepticism.

AC: Yes. Climate change. You touch on this subject in the chapter on air, the changes in the air. What is the job of humans at this point in the climate change process?

MB: I think it’s mainly to save our own skins. I mean, I am an ardent environmentalist, and I think nature is something to try

to protect in its own right. But I’m also a realist, and I think the real message, and the one that’s going to leverage change, is that climate change is putting our own civilization at risk. And I’m not thinking that there’s some single cataclysm, but it’s going to be a slow and exorable grind as we face more and more unexpectedly extreme weather events: longer and longer drought periods, dwindling water supplies in places that rely on either glacier melt or snow melt for water, decreasing predictability of crop yields. All these things will be stresses on our economic and social systems. And we’ll spend more and more of our time and our collective investments mopping up after disasters and bad crop years and have fewer resources to invest in positive, constructive things.

Increasingly, when I speak to different groups, I emphasize how economic systems really are averse to uncertainty. And that’s really what climate change presents to us. We’re not exactly sure what’s going to happen, but we know that we’re going to be less and less able to predict what will happen because we’re entering territory we’ve never been in as human beings.

The Earth has seen very large climate fluctuations over time, but for most of that time, we weren’t around. As a society we count on things like sea level or weather patterns staying constant. Our infrastructure is built on that assumption.

So I think, as much as I do think nature has its own rights and should be protected for a variety of reasons, it may be the case that the most potent arguments that we can advance are going to be the economic ones. And as so often happens, whenever there are stresses imposed on societies, it’s the poorest people and the already marginalized ones who are going to bear the brunt of those disruptive events. So it will only exacerbate the inequalities we have in our society as well. That’s pretty gloomy.

AC: I would like to end this interview by sharing a hopeful note that Marcia shares in the last pages of *Timefulness*:

If widely adopted, an attitude of timefulness could transform our relationships with nature, our fellow humans, and ourselves. Recognizing that our personal and cultural stories have always been embedded in larger, and longer—and still elapsing—Earth stories might save us from environmental hubris. We might learn to place less value on novelty and disruption, and develop respect for durability and resilience. Understanding how historical happenstance is written into each of our personal lives might cause us to treat each other with more empathy. And a timeful, polytemporal worldview might even make us less neurotic about the fact of our own mortality by shifting our

focus from the finite length of our life to the rich anthology of experiences that a lifetime represents.

Thank you so much, Marcia. Thank you for this book, for this interview, and for taking the time to share your experiences and thinking behind *Timefulness*; the book rocks.



The Center for Humans and Nature would like to thank our partners at Princeton University Press for connecting us with Marcia Bjornerud and her book *Timefulness: How Thinking Like a Geologist Can Help Save the World*.

Princeton University Press, an independent publisher that brings scholarly ideas to the world and connects authors and readers across spheres of knowledge to advance and enrich the global conversation.

As Senior Editor of *Minding Nature*, Anja Claus manages the publication of the journal. She also writes and searches out stories that help us reimagine our relationship to each other and to planet Earth as a whole. These stories range from deeper philosophical concepts, to reflections of wider-ranging historical perspectives, to the personal story within local places. Anja engages storytellers to share their perspectives via the written word and through the arts.

Marcia Bjornerud is Professor of Geology and Environmental Studies at Lawrence University in Appleton, Wisconsin. Bjornerud's research focuses on the physics of earthquakes and mountain-building, and she combines field-based studies of bedrock geology with quantitative models of rock mechanics. She is a Fellow of the Geological Society of America and was a Fulbright Senior Scholar in Norway (2000–01) and New Zealand (2009). She is the author of *Timefulness: How Thinking Like a Geologist Can Help Save the World* as well as *Reading the Rocks: The Autobiography of the Earth*.