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Ice

NEIL MATHISON

Some say the world will end in fire,
Some say in ice. —Robert Frost

My Missouri-born Grandmother, Catherine Seybolt, widow of a Methodist clergyman, liked to confirm the Bible through geology—the Flood, the parting of the Red Sea, how Jesus could be seen to walk on water. Her agnostic son-in-law, my father, John Mathison, abetted Grandmother's interest, but for his own secular reasons, bringing forth account after account in which natural phenomena explained apparent miracles: fossils atop Mt. Ararat; how under certain meteorological conditions the Red Sea actually parted; or places in the Sea of Galilee so shallow that you might look as if you were walking on water.

Grandmother was less concerned with the reality of miracles than with how phenomena might be seen as miracle. She believed the Bible was metaphor, but metaphor based on actual events: what its authors saw and then struggled to interpret. Later I would recognize this as a sophisticated view. Back then, however, when I tried to do the same, I gave it up, concluding that what I saw in my native Northwest defied Biblical explanation. The ice-crowned Cascade and Olympics peaks, Puget Sound's deep channels with their racing tides, the volcanic fields and the flood-cut coulee canyons and petrified forests of central Washington, all represented a geological truth more potent and more ancient than anything in the Bible. Here tectonic plates clashed. Plate-borne continents rammed one another. Once-living mollusks deposed themselves in long-gone seas—and then actually turned to stone! Here a furious volcanism raised mountains and, much more recently, a mere blink of the eye by geological reckoning, continental ice laid flat the earth and then carved it up again.

In the face of such geology, how could you attribute mere miracles?

My home state's ice-shaped geography originated from the great continental glaciations, the Cordillera Ice Sheets that four times in the last two million years invaded Puget Sound. (Of course, the ice wasn't invading Puget Sound as much as it was making Puget Sound.) At the height of the most recent Fraser-Wisconsin Ice Age, 75,000 to 10,000 years past, three-fifths of all the ice in the world lay in North America. Its southernmost extensions were the Juan de Fuca and Vashon lobes, which reached into what is now Washington.

Looking at Puget Sound from the perspective of geographical foreknowledge, the effects of the ice seem obvious. But it wasn't until the nineteenth century that geologists began to appreciate how much ice had shaped the world, as John McPhee so cogently explains in his collection of essays, *Annals of a Former World,* which first appeared in *The New Yorker*, and which introduced to many non-geologists like me the newest ideas of contemporary geology.

In 1795, James Hutton, a Scot, speculated that certain gravels and boulders in the lower Swiss valleys might have been carried there by extensive ice (but he missed the evidence of ice that had shaped his own native Scotland—eskars, the long, serpent-like ridges of sand and gravel deposited by streams flowing under glaciers, drumlins, the thin ridges left in the wake of a moving glacier, and erratics, the boulders deposited by melting glaciers, all of which laid the groundwork for what would become the prototype landscape for the world's golf courses). I love these words—eskars, drumlins, erratics—that seem to hearken of Norse sagas. Some years later a Swiss, an initially skeptical Jean de Charpentier, also concluded that many geographical features in Switzerland could only be explained by ice. When in 1836 a young medical doctor, Jean Louis Rodolphe Agassiz, rented a cabin up the road from Charpentier in the alpine Rhone River Valley, Agassiz, under Charpentier's tutelage, soon recognized that ice had indeed shaped the valley. In 1837 he published his *Epoque Glacier,* a thesis of continental glaciation that was greeted with derision. Even Agassiz's mentor, the famed geologist Alexander von Humboldt, counseled his protégé that his obsession with ice might endanger his career: ". . . your ice," von Humbolt wrote, "frightens me."

It seems to me that ice-age glaciers grew in ways similar to how the scientific Zeitgeist sometimes evolves. Or perhaps Zeitgeist is too large a word. Theory is more like it. The accumulations of precipitation, lower temperatures, and the net winter-to-winter gain in snowfall that causes the ice to spread is akin to what happens when, little by little, an apostasy—an idea that challenges established dogma—transforms to dogma itself. The ice had an inevitability about it, a shifting restlessness, a self-reinforcing momentum.

The causes of ice ages are still speculative: the uplift of the Rockies and the Andes and the Himalayas and the Alps—the great orogenies of plate tectonics—may have cooled the climate for the last sixty million years; or volcanic ash may have reflected the sun's energy back into space; or the weathering of mountains may have brought on a chemical reaction that removes carbon dioxide from the atmosphere, a sort of reverse greenhouse effect; or the wobble of the earth's axis may have tilted in just such a way as to increase the cooling; or the sun may have reduced its energy output.

But, because, in the four-billion-year history of the planet, an ice-age phenomenon is so rare, it's likely a collusion of these.

At the maximum advance of the last great continental ice sheet, all of Canada lay below thousands of feet of ice. At Bellingham in Washington State, just south of the British Columbia border, where short-story writer Tobias Wolf sets his lovely snow-laced short story "Powder," the ice was over 6,000 feet deep. At Seattle, it was five times deeper than the six-hundred-foot Space Needle is high. At Tenino, south of the state capital Olympia, where the ice sheet terminated, a torrent of melt water coursed south and then west entering the Pacific Ocean at Grays Harbor and Willipa Bay. In the Olympic Mountains, ice deposited Canadian boulders at what is now 4,500 feet. It left sediment over a thousand feet deep on both sides of the fjord that demarks the Olympic Peninsula from Puget Sound and which is called Hood Canal. It left glacial kames, kettles, drumlins and bogs at Port Angeles. It left eskars and lateral moraines on Whidbey Island. It left the gravel that forms most Puget Sound beaches. When the ice began to melt, it released so much weight from the earth's crust that for the next thousand years the land rebounded until it had risen five hundred feet at Seattle and eight hundred feet at Whidbey Island, just thirty miles north of Seattle; the land rose faster than the sea, which was also rising from melting ice—you can still see the wave-cut traces of previous shorelines hundreds of feet above the present Whidbey Island beaches.

From Cape Flattery on the Pacific coast to Olympia to the British Columbia border, with the exception of the two great mountain ranges that frame Puget Sound (these shaped by their own alpine glacier systems), the geology we see today is a geography of ice.

Officially the ice age is still on, although we're in an inter-glacial hiatus, or an interstade, as geologists name it. The most recent advance ended only 10,000 to 12,000 years ago; the next, if the cycles are maintained, will return 50,000 to 100,000 years from now.

We fret about global warming. Should we really fret about the return of ice?

There are a dozen different molecular structures for ice but only two exist at the temperatures and pressures that support our terrestrial biosphere. Of these, only one is common. The common form is called ice-Ih. It is a kind of hexagon crystal. Imagine it as a Tinker-Toy with six planar sides, with wheels as the molecules and pins and spokes as links between molecules. The hexagon structure of ice is why snowflakes are hexagons. It's less dense than water in its liquid state; thus, ice floats. It's also surprisingly stable: it takes four times the energy to melt ice as it does to melt an equivalent amount of iron, seven times the energy to melt ice as it does to melt an equivalent amount of lead.

It was a joy as profound as partaking of a good meal or staying dry at night or having good sex.

Ice is mostly white. Since white reflects the sun's short-wave radiation, ice may help prolong ice ages.

Ice is an effective earth mover. It abrades rock by using the rock it already carries like sandpaper; it also fractures the rock when sub-glacial water seeps into fissures, freezes, and expands; then the ice plucks up the rock and transports it away, sometimes for hundreds of miles, explaining why the north side of the Olympic Mountains is laced with British Columbia rock, rock delivered and deposited there by ice.

Ice is slippery, although the mechanism of slipperiness is not fully understood—current theory suggests that slipperiness occurs because ice molecules in contact with air cannot remain in their crystalline state. At very low temperatures, however, as those you might encounter in Antarctica, ice loses its slipperiness. Pulling a sledge through Antarctic snow can be like pulling a sledge through sand.

Try to imagine a world without ice. No ice to chill our gin and tonics. No ice to give us Peggy Fleming. No Yosemite Valley. No Half Dome. No Lake Superior. No Apollo Ono. No ice hockey. No Red Wings. No Bruins. No glacial crevasses and no moraines. No eskars or drumlins or wandering erratic rocks. No snowflakes or hail or frost-whitened mornings. No snowmobiles and no skis. No horse-drawn sleighs. No island of Manhattan. No Puget Sound.

Try to imagine a world with a different kind of ice. What if ice didn't float? What if it wasn't white? What if it froze at a higher or lower temperature? What if it didn't sublimate into vapor? What if, in the biosphere as we experience it, there was more than one kind of common ice? What if ice was other than water? What if our ice was dry? What if ice wasn't slippery? What if ice wasn't cold? What if we had ice in our veins? What if when we wanted to stop a thing all we really had to do was put it on ice?

I find it interesting, perhaps profound, that wherever you go on the earth and, as far as we know, anywhere you go in the universe, ice, at the same temperature and pressure, observes the same rules. Ice is always ice.

The universe didn't have to be a universe of rules.

But it is.

One of the reasons ice remains so vivid to Puget Sounders is because it's still here. When I was a School Patrolman at McMicken Heights Elementary in the late 1950s, we had to ride our bikes down to Military Road where we posted ourselves as crossing guards. From Military Road we could see Mount Rainier. If you haven't seen "the Mountain," as we natives call it, its immensity is hard to appreciate. It rises from sea level to 14,000 feet. Its nearest neighbors are only 6,000 feet high. Thus, Rainier appears to stand alone. But it's not the mountain's height or its solitude that impresses. It's the mountain's massive snow-and-ice bulk that impresses.

My brother Charlie and I spent many summer weekends camping the mountain's campgrounds and hiking its trails and lolling in its alpine meadows: Klapatche Park, Van Trump Park, Summerland, Indian Henry's Hunting Ground. Often we skirted the glaciers, clambering around their dirt-gray snouts and over their powdery moraines and up into their U-shaped valleys. Glacial sounds became familiar to us: the hollow rockfalls, the roar of rivers, the whistle call of alpine-dwelling rodents called marmots. We had merely to pull our caps over our eyes and let our senses float out—to the sounds, to the breezes, to the cold-to-the-touch-and-ice-sculpted rock. Then we envisioned an icier day, a millennia of ice, an age of ice.

The mountain's glaciers have retreated during my lifetime and have grown

during my lifetime and some, like the Carbon River Glacier, are still growing, still carving out their valleys, throwing up their moraines, sending their silt-gray rivers into Puget Sound. There is something latent in them, something animate in their ice, something that hints at violence.

Does place shape how we see the world? Having grown up in the Puget Sound country, and having returned to live here much of my adult life, I like to believe that our geography shaped me and shaped my neighbors: the uplift of mountains signifying a world that always transforms to something new; the tidal refreshing of our bays and estuaries reminding us that so much in the world is renewable; the ice caps glistening on our mountaintops cautioning us that even on the hottest days we live in a world of seasons. I like to think my neighbors share this view although I know we live countless different lives: some watch professional wrestling when I prefer to read a book, others play softball on summer weekends where I will always be sailing, others are violinists in neighborhood orchestras—you may find me water-skiing behind a fast boat. Some scale Cascade peaks. Some kayak rivers. Some even weed their gardens. I wonder: with so much diversity, can my neighbors and I see anything in common?

The November Monday after JFK was assassinated was a National Day of Mourning. My father took us out on Puget Sound on the family's new, eighteen-foot, runabout. We launched the boat from a mainland boathouse at Redondo Beach, opposite Maury Island, one of Puget Sound's bread-loaf islands, "bread-loaf" because it looks like a bread loaf with its clay high-bank shores and its narrow gravel beaches that are characteristic of being shaped by ice. The day was cold and gray. We felt as if the assassination had irreversibly chilled everything. On that day it was easy to imagine what it had been like when the ice was here: cold and bleak and shaping, only this time, on this day, what was being shaped was us.

You mark the events of your life by the places you were when they happened. And the places mark you. You've felt their textures under your bare feet. You've lain on your back and stared at their clouds. You've let their rocks and sand and gravels run through your fingers. You've felt their grasses and seaweeds wrap your ankles. Their sun warmed you. Their rains dampened you. Their breezes chilled you. The places where you grow up are in your bones.

Puget Sound Country is only a little more than halfway from the equator to the North Pole. But it feels closer to the pole. Our winters may not be as bitterly cold as Boston or Minneapolis or Fairbanks, but even in the height of summer, you feel the kiss of winter. We're in an ice age, and it's only in abeyance. In a tick of the geological clock, the ice might return.

My grandmother, Catherine Seybolt, was a woman of faith. Faith in God. Faith in the Women's Christian Temperance Union. Faith in the Right of Women to Vote. Faith in the Methodist Church and the Doxology and the NAACP. Faith that when she died, she would spend the rest of eternity with her husband, William.

I envy Grandmother her eternity with Grandfather William.

But I don't have her faith.

There are times when I despair at the fleetingness of life. A life long enough to ask questions about creation but not long enough to find all the answers. But there are other times when I think that just being able to think about creation, to try to wrap our minds around it, may be enough. In many ways geology is the study of creation and creation is the study of time, a time so vast that bones become stone, sea-floors become the highest of mountain summits, continents sail the surface of the earth. I find this saga of creation astonishingly beautiful, and deeply reassuring, a creation far more satisfying than a Creationist's creation.

The late paleontologist, Stephen Jay Gould, wrote that sentient life is unlikely because it's the outcome of too many evolutionary accidents. The dinosaurs, Gould liked to point out, ruled the earth for 240 million years and never, as far as we know, evolved our kind of intelligence, an intelligence that cannot stop asking why, that cannot resist trying to explain why, that demands explanations whether by science or by miracles.

When I walked with my son, John, down a Puget Sound beach and we spotted shell fragments in a cliff or

found agates and jasper in the gravel my explaining to him why these rocks were here brought me much joy. It was a joy as profound as partaking of a good meal or staying dry at night or having good sex. Our desire to know, to explain things is what makes us different. It's what makes us human beings.

Some anthropologists speculate that without the ice age, humanity might never have honed its desire to know things. The cooler climate transforming the forests of southern Africa to savannas, forcing our ancestors out of their trees, demanding they live by wit rather than climbing skill to escape the predation of their carnivorous enemies.

We are not so much stewards of the world, as the Bible tells us, but stewards of ourselves. Perhaps this is our destiny, if there is such a thing as destiny: to keep the race alive so that the flame of curiosity will keep burning, burning here at least, if not elsewhere in the universe.

Maybe curiosity is as rare as Gould's sentience.

Maybe curiosity approaches the divine.

Maybe without the ice age humanity would never have been curious.

Maybe curiosity is the Divine.

There is a park on the shores of Puget Sound, south of Des Moines, north of Redondo, called Saltwater Park. As a boy I spent many summer afternoons there. It is a place my grandmother, Catherine Seybolt, loved. Even when Grandmother was well into her nineties, my mother brought her there for lunchtime picnics.

As Washington state parks go, the park isn't particularly spectacular. It lies in a ravine that opens onto a beach. The ravine has been shaped by a creek. The creek flows down from what was once a glacial lateral moraine—the sideways wake of gravel pushed up by the glacier's retreat. If you follow the creek to its source, it begins as a notch in the moraine-formed ridge amid vine maple, Oregon grape, wild blackberry, and Douglas fir, drops down through a campground. From the campground you can wade all the way to the beach. The water is so cold your ankles will turn red. You'll pass under a wooden bridge and then through a corrugated culvert that runs under the park access road. The culvert is dark, damp, and a little scary, just within the tide's reach. Snails crawl up its metal walls. There are periwinkles and crawdads. Streamers of algae and creek grass brush your bare legs. You enter one end in fresh water and you exit the other into saltwater. If you don't watch your step, the barnacles will cut your feet. The beach spreads out in a broad, shallow fan of glacial gravel. It smells of seaweed and mud and iodine. Sea squirts shoot water as high as your waist. If butter clams are in season, and if there's no red tide, you can dig them, although as a boy I never found many. You often will see children wading here (some might even be swimming here), despite the gravel, the cold, the crabs, the currents, and the barnacled rocks.

To the north, toward Des Moines, the beach narrows below a bluff pebbled with glacial till. The bluff is prone to slides. Park officials long ago cut stair-step shelves in an attempt to arrest the slides. 10,000 years ago the bluff was sediment in a pro-glacial lake that lined the side of the Vashon lobe of the Cordillera glacier. But the berm between the bluff and a rip-rap seawall is manmade, set with picnic tables and fire pits.

Beyond the seawall, a sandbar extends into Puget Sound.

Across the Sound, you can see Maury Island, with its high clay cliffs ("high-bank waterfront" is what real estate agents call it).

Beyond Maury Island, you can see the Olympic Mountains, a skein of peaks zigzagged like a lightning bolt—even in summer, snowfields and ice whiten their summits.

If you grew up in Maine or Ontario or Oslo, or in upper New York State where my grandmother Catherine spent her teen girlhood, these landforms would be familiar to you. The gravels and silts and rocky beaches. The cold water. The hint of winter that you feel even in August. I don't recall my grandmother mentioning ice in any particular way. But the shape of Puget Sound must have felt like home to her. These are high-latitude places. Places born of the ice. My grandmother grew up in a landscape of ice.

If the land shapes us, shapes how we see the world, shapes how our brains work, in a way, Grandmother was a child of the ice.

As perhaps are we all.

The human race.

Every one of us, a child of the ice. □