After the Floods

Unraveling the mystery behind the Northwest's channeled scablands
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The view from State Route 281, a few miles south of Quincy, Wash., doesn't seem like one of the world's more dramatic landscapes. Not to me, anyway. This is country to be endured (better yet, slept through) on the way to other, more captivating environments. The topography here is mostly flat, and whatever isn't paved is russet or beige or an irrigated green. But Gary Kleinknecht is doing his best to show off the region's subtle charms.

"So where we're standing, we'd be under, oh," -- he takes his bearings -- "probably 800 feet of water."

We are in the midst of the Channeled Scablands, a braided maze of buttes and canyons scoured out by massive floods thousands of years ago, and now blended into the workaday scenery of eastern Washington. A few miles north of us are the Frenchman Hills; the Saddle Mountains are to the south. Kleinknecht explains that the area they bracket, the Quincy Basin, was at one time under a huge temporary lake, Lake Lewis, which also covered the nearby Pasco Basin and the Yakima Valley. The lake only existed for a week or so, but in places it was nearly 1,000 feet deep -- transforming today's mountains into small islands, or submerging them completely. Then it drained swiftly away, leaving behind raw earth.

"We're surrounded by some of the most fascinating geology on Earth," Kleinknecht says, as a semi rumbles past, followed by an antsy string of cars. He watches them go. "And the people who drive past this stuff every day, they just don't have a clue."

Kleinknecht's quest, as president of the Richland, Wash.-based Ice Age Floods Institute, is to give them a clue. Last March, Congress made his job easier when it passed the Omnibus Public Lands Management Act of 2009, which included a bill for the formal designation of the Ice Age Floods National Geologic Trail. Scheduled to be completed by 2016, the trail will lead amateur geologists and their longsuffering kin along nearly 1,000 miles of roads, from the floods' origins in Montana to their exit on the Oregon coast.

"Now we can really start getting the story out," Kleinknecht says. "And it's a helluva story."

But it's a story that presents unique challenges in the telling. Most geological parks focus on contained, stationary features. This trail, the first of its kind, will be something else -- an attempt to put rock in motion, to give it narrative, a start and a finish. All of which raises the question: How exactly do you get people to see movement in something as permanent-seeming as stone?

Here's the no-frills version: About 15,000 years ago near the end of the last ice age, a lobe of the Cordilleran Ice Sheet, which covered much of Alaska and western Canada, stretched south to what is now Sandpoint, Idaho, blocking the Clark Fork River with an ice dam over 2,000 feet tall and 2,200 feet thick. The backed-up river formed an enormous lake, called Glacial Lake Missoula, which held over 500 cubic miles of water -- more than is held by Lakes Erie and Ontario combined. Over the decades, the water wormed its way through minute cracks in the ice, probing and wearing away at the base of the dam as only water can until the entire structure became critically unstable. When at last it failed, it

did so spectacularly. A towering wall of water blasted out and rampaged across Idaho and eastern Washington at up to 80 miles per hour. Over 3,000 square miles of land were covered to a depth of 1,000 feet. The torrents peeled off columns of rock and boiled up at choke points along the Columbia Gorge, back-flooding so furiously that the Snake River ran in reverse. The waters rumbled on to present-day Portland, still hundreds of feet deep, backing up again at the narrows near Kalama, Ore., and forming another temporary lake in the Willamette Valley, before roaring on, past Astoria, another 100 miles or so to the edge of the Pleistocene coast, and then into the Pacific, spewing sediments out along the ocean floor as far south as California.

Glacial Lake Missoula took only two days to drain; the floods probably lasted two weeks. After they subsided, the ice dam started to re-form. Then, after 30 to 50 years, it failed again. The process repeated itself, perhaps more than 100 times over the next 3,000 years, before the Earth warmed and the Pleistocene Epoch ended. According to geologists, the Ice Age Floods, as they eventually became known, may have been the largest floods the Earth has ever experienced.

That the story of the floods is now accepted as fact is due to four decades of cantankerous persistence by a geologist named J Harlen Bretz -- "J" being his first name in its entirety. A Michigan native, Bretz moved to Seattle in 1907 to teach high school. Between classes on history and physiography, he liked to peruse topographical maps, and in 1909, he came across a recently published U.S. Geological Survey map of the Quincy Basin. What he saw perplexed him: large coulees, or dry canyons, some of them as much as five miles wide, without any clear indication of what forces formed them.

In the early 1900s, geology was governed by the principle of Uniformitarianism, which held that the processes observable today -- rivers eroding rock and so on -- were likely the same ones that operated in the past. Thus, dramatic landscapes -- canyons and gorges -- were understood to have been patiently etched into the Earth over eons. But what Bretz saw in eastern Washington wasn't consistent with that principle. No watercourses led to or away from those coulees, and they were the wrong shape to be glacial valleys. Something else seemed to be at work. To find out what, Bretz left teaching in 1913 to get his Ph.D. in geology at the University of Chicago. In 1922, as a member of the geology faculty there, he returned to the Northwest, trundling around the Quincy Basin and its environs in an old Dodge, studying curious landforms: the coulees, the dry cataracts, the hanging valleys, the deep potholes, and, sprinkled liberally around the landscape, the large granite boulders, known as erratics, that had no place among the local basalts left over from the lava flows that had coated the region 17 million years before.

Bretz proposed a daring hypothesis: The Channeled Scablands of the Columbia Plateau had been gouged out by an enormous flood. In two papers published in 1923, he outlined his theory, turning Uniformitarianism on its head. Slow, almost dignified processes did not explain the Channeled Scablands, he argued; the landforms had to be the result of some hitherto inconceivable catastrophe. "It was a debacle which swept the Columbia Plateau," he wrote, with special emphasis. But despite marshaling what he felt was compelling evidence, he failed to persuade his colleagues. Still bruised by their efforts to convince a skeptical public that the Earth was, in fact, much more than 6,000 years old, none of them were willing to cast aside the uniform in favor of Bretz's Catastrophism. To them, the theory reeked of the biblical. Why couldn't more acceptable mechanisms explain those features? they asked. And where did all that water come from in the first place? Bretz's attempts to answer these questions -- perhaps volcanic activity under the ice sheets caused them to melt rapidly, or the glaciers might have, well, done something -- weren't persuasive. His temperament didn't help, either. He was characterized by what he himself called "a recurrent earthiness," and he found the occasional feud bracing. Soft spots in his theories, while irksome, were hardly fatal. The landscape spoke for itself, he declared.

But apparently not loudly enough. On Jan. 12, 1927, Bretz was invited to speak to a gathering of distinguished geologists, many of whom worked for the U.S. Geological Survey, at the Cosmos Club in Washington, D.C. It didn't go well. "They were all loaded for me," Bretz later recalled, "and after letting me speak for two hours they opened fire."

Kleinknecht, 58, is not a geologist by training. He is head of the Social Studies Department at

Kamiakin High School in Kennewick. He did take one geology course in college, and he happily admits that he got a D. An eastern Washington native, he first became interested in geology when he moved back to the area from South Carolina in 1979. "It opened my eyes," he says. "There was a lot I'd taken for granted before." He started reading, started hanging out with geologists who had made a hobby of the floods, and in 2002 started the Wenatchee chapter of the Ice Age Floods Institute. He has been the Institute's president for the past five years. "We're an older bunch," he says of his constituents. Interest in the floods has increased over the years, and the organization now has around 700 members. "Now we need two buses for our field trips," he says.

We are at Trinidad, Wash., near the Trading Post and Shell Station, standing on a bluff above the Columbia River and the Crescent Bar Resort. Looming over the resort is a sheer basalt cliff, the top of which, planed flat by the floods, is called Babcock Bench. Below the Bench, boaters and waterskiers cut tracks across the Columbia. From our vantage, we can hear the mosquito whine of motors, and it's hard not to see this frenetic recreation as kind of silly and insignificant against the general attitude of lithic sternness. (Geology sometimes makes me dour.)

Kleinknecht has brought me here to see something else, though -- what counts in geology as a smoking gun. Across the river from the resort, the landscape rumples in a series of short, unremarkable hills. When Kleinknecht was younger, he and his father used to hunt among them and ride motorcycles over them. In his current capacity, he appreciates those hills differently. "They were the crucial piece of evidence," he says.

Joseph T. Pardee, the USGS geologist who first recognized landforms of this kind for what they were, was sitting in the audience during Bretz's 1927 roast. He, too, had worked in the Scablands region, as well as in Montana. In 1910, he had found evidence in the Missoula hills of a large glacial lake; the high-water marks, known as strandlines, are still visible today. (At the meeting, while Bretz was hemming and hawing his way through possible, if unlikely, sources for the water, Pardee reputedly leaned over and whispered to a colleague, "I know where Bretz's flood came from." He never told Bretz this, however.)

Later, while surveying Camas Prairie, Mont., in the late 1930s, Pardee discovered some curious rolling hills in the former lake's bottom sediments. They were so big that he realized what they were only after he flew over them: From the air, the hills became giant ripples, 50 feet high and 500 feet apart, which could only have been shaped by powerful currents, which themselves were only likely to occur if, for instance, an ice dam holding back an enormous lake had burst and that lake drained very, very quickly.

Pardee presented his findings at a 1940 meeting of the American Association for the Advancement of Science in Seattle, and later published them after his retirement in 1942. Why he had not been more immediately forthcoming is not known. Vic Baker, a hydrology professor at the University of Arizona who has studied the Ice Age Floods and made a hobby of their history, thinks that Pardee's silence was partly political: His supervisor was one of Bretz's most prominent critics, and Pardee, a retiring personality, was probably discouraged by the contempt that rewarded Bretz's dogged iconoclasm. "I don't think it's a coincidence that he waited until he retired to release that paper," says Baker.

But here, at last, was a source of water large enough to support Bretz's hypothesis. With Pardee's work, the resistance to Bretz's catastrophic explanations steadily eroded, although broad acceptance would not come for some time. When, in 1979 at age 96, Bretz was awarded the American Geological Society's highest award, the Penrose Medal, it was something of an attritional victory, bringing to mind Max Planck's adage that new ideas don't necessarily triumph on their merits so much as the deaths of their opponents. Bretz himself was all too aware of this. "All my enemies are dead," he told his son after he had won, "so I have no one to gloat over."

Later in the afternoon, Kleinknecht takes me to Dry Falls, near Coulee City. A series of cliffs nearly 400 feet tall and three-and-a-half miles wide, Dry Falls is one of the floods' more spectacular leavings. It marks the middle of the largest channel in the scablands, the Grand Coulee, a canyon 50 miles long, five miles wide, and 900 feet from rim to floor in places. Here, floodwaters ran more than 250 feet deep, rushing over the basalt shelf and ripping out large chunks of it; at their peak, the falls would have been a small dip in a swift cascade. Now, they sit almost absurdly empty.

Sights like this are what tease the imagination, giving the floods their made-for-TV appeal. The Discovery Channel has run a couple of specials on them, and NOVA did an episode in 2005, Mysteries of the Megaflood, which is for sale at the Dry Falls interpretive center. The show happens to be playing on a small TV inside, and I watch, transfixed, as the announcer intones things like, "Few areas on Earth are as mysterious and controversial as the Channeled Scablands," and "No river in the world can form what you are about to see," as if I am about to be treated to something more titillating than odd landforms. The jump cuts and synthesizer music are weird, but it's also strangely riveting when, to a pounding beat, a cellophane CGI wave crashes down a valley and sweeps away all the trees.

I'm not sure how long I've been slack-jawed before I notice that Kleinknecht is behind me, watching me watch the show. He looks mildly disappointed.

"Too dramatic," he mutters, which seems to be my cue to leave.

Outside, I ask Kleinknecht what about the NOVA episode he doesn't like. "That stuff shouldn't be necessary," he says. "The floods don't need that kind of treatment to be interesting." He considers for a moment. "The thing for me about the floods is what they make you do with your mind if you want to understand what happened." How they mess with our idea of linear time. How we have, in recent years, become all too familiar with the idea of a planet that can undergo sudden, catastrophic shifts. How we have to look at the landscape in its apparent stasis and know that what we see is really layers of activity, different episodes -- not one flood but many. How some geologists think that floods may have roared millions of years ago, during even more ancient ice ages. How the Earth has its own long rhythms, warm and cool, and the planet may be warming now, but someday it will cool again, and the floods will return.

This is the roar which lies on the other side of silence. The Earth certainly doesn't lack for stunning tableaus, like the Grand Canyon, or the Himalayas. But they are byproducts of age, spectacles born of the dull plod of time -- persistent trickles, or tectonic plates that move an inch per year. The Ice Age Floods are the reverse: the waters' hyperbolic thunder (Ten times the flow of all rivers! Two trillion tons of water! Blasting like a fire hose!) is gone, and much of what remains is remarkable, true, but it is also still and silent, concealed if not buried outright by roads and highways and towns, or fields, or the Grand Coulee Dam. To comprehend the Ice Age Floods is like realizing that when your parents were young, they had wild, rollicking lives, before you showed up and bent them to your will.

Sunday morning, before I leave for Seattle, Kleinknecht has one last thing for me to see. "I want to show you a rock," he says. It's an isolated erratic that probably rafted in from Idaho, and it's among the largest in the area -- an enormous granodiorite boulder that is almost 10 feet tall and weighs more than 100 tons. It sits at about 850 feet in elevation on the southeastern face of a hill near Badger Coulee, in the Tri-Cities area.

Soon, we're wending through one of Kennewick's upscale neighborhoods. I look around but don't see anything approaching a 10-foot-tall rock, and still haven't when Kleinknecht stops his car and gets out.

"There it is," he says. I can't immediately tell what he's referring to. "It's over there," he says, pointing. "Above that gray house, past the garage, a little bit up the hill."

I follow his arm, and what I see, about a quarter mile away, is a large gray spot. Half-hidden by the hill on which it rests, the erratic doesn't look much bigger than the decorative stones some of the residents have used to bracket their driveways and mailboxes.

Kleinknecht seems chagrined at the anticlimax. This rock has a special significance for him. He tells me later that, after his father's funeral, he visited it, and was comforted by its connection with distant time. He used to be able walk right up to it, but now a recently retired NHL player owns the land, and he isn't so keen to have people traipsing around his property.

"I wrote to him a few times and have sent him plenty of literature," Kleinknecht says. "He never responded. So now we have to content ourselves with looking from here." He shrugs, and we stare at the rock for a moment more, then head back to our cars. Just before we go our separate ways,

Kleinknecht nods at nearby Badger Mountain. "By the way," he says, "those houses up there are only at about 1,200 feet. You know what that means." He grins a little impishly. "But the top of the hill is around 1,400 feet or so. The people who live up there, they're the smart ones. They'll be safe. You know, the next time."

I look at the small, nondescript mountain and follow its modest slope upwards. Through the waves of afternoon heat, its summit shimmers like water.

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For more information, visit:

The Ice Age Floods Institute

Nova's Mystery of the Megaflood

The National Park Service's assessment of the Ice Age Floods National Geologic Trail