The **New Yorker**

January 7, 2002

SECTION: LETTER FROM GREENLAND; Pg. 30

LENGTH: 5641 words

HEADLINE: ICE MEMORY;
Does a glacier hold the secret of how civilization began-and how it may end?

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BODY:
Ice, like water, flows, and so the North Greenland Ice-core Project, or North GRIP, lies in the center of the island, along a line known as the ice divide. This is a desolate spot eight degrees north of the Arctic Circle, but, thanks to the New York Air National Guard, not actually all that difficult to reach. The research station is open from mid-May to mid-August, and every season the Guard provides some half-dozen flights to it, using specially ski-equipped LC-130s. The planes, also outfitted with small rockets, can land directly on the ice, which stretches for hundreds of miles in every direction. (To the extent that there is a military justification for the flights, it is to keep pilots in practice; however, the main purpose c practicing seems to be to make the flights-an arrangement whose logic I could never quite fathom.) This past June, I flew up to North GRIP on a plane that was carrying several thousand feet of drilling cable, a group of glaciologists, and Denmark's then minister of research, a stout, red-haired woman named Birthe Weiss. Like the rest of us, the Minister had to sit in the hold, wearing military-issue earplugs.

One of the station's field directors, J. P. Steffensen, greeted us when we disembarked. We were dressed in huge insulated boots and heavy snow gear. Steffensen had on a pair of old sneakers, a filthy parka tha was flapping open, and no gloves. Tiny icicles hung from his beard. First, he delivered a short lecture on the dangers of dehydration: "It sounds like a complete contradiction in terms-you're standing on three thousand metres of water but it's extremely dry, so make sure that you have to go and pee." Then he briefed us on camp protocol. North GRIP has two computerized toilets, from Sweden, but men were kindly requested to relieve themselves out on the ice, at a spot designated by a little red flag.

Steffensen, a Dane, runs North GRIP along with his wife, Dorthe Dahl-Jensen, whom he met on an earlier Greenland expedition. Together with a few dozen fellow-scientists-mostly Danes, but also Icelanders, Swedes, Germans, and Swiss, among others-they have spent the past six summers drilling a five-inch-wide hole from the top of the ice sheet down to the bedrock, ten thousand feet below. Their reason for wanting to do this is an interest in ancient climates. My reason for wanting to watch is perhaps best described as an interest-partly lurid, but also partly pragmatic-in apocalypse.

Over the past decade or so, there has been a shift-inevitably labelled a "paradigm shift"-in the way scientists regard the Earth's climate. The new view goes under the catchphrase "abrupt climate change," although it might more evocatively be called neo-catastrophism, after the old, Biblically inspired theories of flood and disaster. Behind it lies no particular theoretical insight-scientists have, in fact, been hard-pressed to come up with a theory to make sense of it-but it is supported by overwhelming empirical evidence, much of it gathered in Greenland. The Greenland ice cores have shown that it is a mistake to regard our own, relatively benign experience of the climate as the norm. By now, the adherents of neo-catastrophism include virtually every climatologist of any standing.

Abrupt climate changes occurred long before there was human technology, and therefore have nothing directly to do with what we refer to as global warming. Yet the discovery that for most of the past hundred thousand years the Earth's climate has been in flux, changing not gradually, or even incrementally, but violently and without warning, can't help but cast the global-warming debate in new terms. It is still possible to imagine that the Earth will slowly heat up, and that the landscape and the weather will gradually evolve in response. But it is also possible that the change will come, as it has in the past, in the form of something much worse.

Greenland, the world's largest island, is nearly four times the size of France-eight hundred and forty thousand square miles-and except for its southern tip lies above the Arctic Circle. The first Europeans to make a stab at settling it were the Norse, under the leadership of Erik the Red, who, perhaps deliberately, gave the island its misleading name. In the year 985, he arrived with twenty-five ships and nearly seven hundred followers. (Erik had left Norway when his father was exiled for killing a man, and then was himself exiled from Iceland for killing several more.) The Norse established two settlements, the Eastern Settlement, which was actually in the south, and the Western Settlement, which was to the north of that. For roughly four hundred years, they managed to scrape by, hunting, raising livestock, and making occasional logging expeditions to the coast of Canada. But then something went wrong. The last written record of them is an Icelandic affidavit regarding the marriage of Thorstein Olafsson and Sigridu Bjornsdottir, which took place in the Eastern Settlement on the "Second Sunday after the Mass of the Cross" in the autumn of 1408.

These days, the island has fifty-six thousand inhabitants, most of them Inuit, and almost a quarter live in the capital, Nuuk, about four hundred miles up the western coast. Since the late nineteen-seventies, Greenland has enjoyed a measure of home rule, but the Danes, who consider the island a province, still spend the equivalent of three hundred and forty million dollars a year to support it. The result is a thin and not entirely convincing First World veneer. Greenland has almost no agriculture or industry or, for that matter, roads. Following Inuit tradition, private ownership of land is not allowed, although it is possible to buy a house, an expensive proposition in a place where even the sewage pipes have to be insulated.

More than eighty per cent of Greenland is covered by ice. Locked into this enormous glacier is eight per cent of the Earth's freshwater supply: enough, were it to melt, to raise sea levels around the world by more than twenty feet. Except for researchers in the summer, no one lives on the ice, or even ventures out onto it very often. (The edges are riddled with crevasses large enough to swallow a dog sled, or, should the occasion arise, a five-ton truck.)

Like all glaciers, the Greenland ice sheet is made up entirely of accumulated snow. The most recent layers are thick and airy, while the older layers are thin and dense, which means that to drill down through the ice is to descend backward in time, at first gradually and then much more rapidly. A hundred and thirty-eight feet down, there is snow dating from the American Civil War; some twenty-five hundred feet down, snow from the days of Plato; and, five thousand three hundred and fifty feet down, from the time when prehistoric painters were decorating the caves of Lascaux. At the very bottom, there is snow that fell on Greenland before the last ice age, which began more than a hundred thousand years ago.

As the snow is compressed, its crystal structure changes to ice. (Two thousand feet down, there is so much pressure on the ice that a sample drawn to the surface will, if mishandled, fracture, and in some cases even explode.) But in most other respects the snow remains unchanged, a relic of the climate that first formed it. In the Greenland ice there is volcanic ash from Krakatau, lead pollution from ancient Roman smelters, and dust blown in from Mongolia on ice-age winds. Every layer also contains tiny bubbles of trapped air, each of them a sample of a past atmosphere.

All across the Earth, there are, of course, traces of climate history-buried in lake sediments, deposited in ancient beetle casings, piled up on the floor of the oceans. The distinguishing feature of the Greenland ice, and what separates it from other ice, including ice extracted from the Antarctic, is its extraordinary resolution.

Even in summer, when the sun never sets, the snow doesn't melt in central Greenland, though during a clear day some of the top layer will evaporate. Then at night-or what passes for night-this moisture will refreeze. The immediate effect is lovely to behold: one morning, I was wandering around North GRIP at about five o'clock, and I saw the hoarfrost growing in lacy patterns underfoot. As the summer snow gets buried under winter snow, it maintains its distinctive appearance; in a snow pit, summer layers show up as both coarser and airier than winter ones. It turns out that even after thousands of years the difference between summer snow and winter snow can be distinguished. Thus, simply by counting backward it is possible to date each layer of ice and also the climatological information embedded in it.

The North Greenland Ice-core Project consists of six cherry-red tents arrayed around a black geodesic dome that was purchased, mail order, from Minnesota. In front of the dome, someone has planted the standard jokey symbol of isolation, a milepost that shows Kangerlussuaq, the nearest town, to be nine hundred kilometres away. Nearby stands the standard jokey symbol of the cold, a plywood palm tree. The view on all sides is exactly the same: an utterly flat stretch of white which could be described as sublime or, alternatively, as merely bleak.

Beneath the camp, an eighty-foot-long tunnel leads down to what is known as the drilling room. This chamber has been hollowed out of the ice, and inside the temperature never rises above fourteen degrees. A few years ago, foot-thick pine beams were added to reinforce the ceiling, but the weight of the snow piling up on top has grown so great that the beams have splintered. Because of the way the ice moves, the chamber, which is lit by overhead lights and filled with electronic equipment, is not just bein buried but is also slowly shrinking and at the same time sinking.

Drilling begins at North GRIP every morning at eight. The first task of the day is to lower the drill, a twelve-foot-long tube with big metal teeth on one end, down to the bottom of the borehole. Once in position, the drill can be set spinning so that an ice cylinder gradually forms within it. This, in turn, can be pulled up to the surface by means of a steel cable.

The first time I went down to watch the process, a glaciologist from Iceland and another from Germany were manning the controls. At the depth they had reached-nine thousand six hundred and eighty feet-it took an hour for the drill just to descend. During that period, there was not much for the two men to do except monitor the computer, which sat on a little heating pad, and listen to Abba. The ice near the bottom of the hole was warmer than expected, and it had been breaking badly. "The word 'stuck' is not in our vocabulary," the Icelander, Thorsteinn Thorsteinsson, told me, with a nervous giggle. Eventually, the drillers managed to pull out a short piece of core-about two feet-to show Birthe Weiss, who arrived in the chamber wearing a red snowsuit. To me, it looked a lot like a two-foot-long cylinder of ordinary ice, except that it was heavily scored around the edges. It was made up of snow that had fallen a hundre and five thousand years ago, Thorsteinsson said. Weiss exclaimed something in Danish and seemed suitably impressed.

After a piece of core comes up, it is packed in a plastic tube, put in an insulated crate, and shipped out on the next LC-130 to Kangerlussuaq. From there, it is flown to Denmark, where it is stored in a refrigerated vault at the University of Copenhagen, to be cut up later for analysis. Inevitably, more researchers want a piece of the core than there are pieces to give out. A small library of papers has been written on the various gases and dust particles and radioactive by-products that have been trapped in the ice. These papers have shown that the concentration of greenhouse gases in the atmosphere has fluctuated over time, and that these fluctuations have occurred roughly in tandem with changes in the climate. But the crucial insight has to do with the ice itself.

Water occurs naturally in several isotopic forms, depending on the hydrogen and oxygen atoms that joined together to make it. Typically, hydrogen has one proton and an atomic weight of 1, but when its nucleus also contains a neutron and it has an atomic weight of 2, it produces heavy water, which is used in nuclear reactors. Oxygen generally has eight neutrons and an atomic weight of 16, but it also comes in another stable version, with two extra neutrons and an atomic weight of 18. In any given water sample, the lighter 16O atoms will vastly outnumber the heavier 18O atoms, but by how much, exactly, is variable. In the early nineteen-sixties, Willi Dansgaard, a Danish chemist, proved that the ratio between the two in rainwater was related to the temperature. Dansgaard took samples of rain from around the world and demonstrated that, by running them through a mass spectrometer, he could in most cases arrive at the average temperature of the spot where they had fallen. Subsequently, he showed that this same technique could be applied to ice and, in particular, to the Greenland ice sheet.

Going back over the past ten thousand years, the Greenland 18O record shows lots of bumps and squiggles. There is, for example, a slight but perceptible increase in temperature in the early years of the Middle Ages, which leads to what has become known as the Medieval Warm Period, when the English planted vineyards and the Norse established their Greenland settlements. And there's a dip some six or seven hundred years later, corresponding to the Little Ice Age, which killed off the vineyards and, most likely, led to the demise of the Greenland Norse. But the variation is limited. Between the Medieval Warm Period and the Little Ice Age, Greenland's average temperature fell by only a few degrees. Its average temperature today, meanwhile, is not very different from what it was ten millennia ago, when our ancestors stopped doing whatever it was that they had been doing and learned to plant crops.

It's hard to look much farther back in the record, however, without feeling a little queasy. About twenty thousand years ago, the Earth was still in the grip of the last ice age. During this period, called the Wisconsin by American scientists, ice sheets covered nearly a third of the world's landmass, reaching as far south as New York City.

The transition out of the Wisconsin is preserved in great detail in the Greenland ice. What the record shows is that it was a period of intense instability. The temperature did not rise slowly, or even steadily; instead, the climate flipped several times from temperate conditions back into those of an ice age, and then back again. Around fifteen thousand years ago, Greenland abruptly warmed by sixteen degrees in fifty years or less. In one particularly traumatic episode some twelve thousand years ago, the mean temperature in Greenland shot up by fifteen degrees in a single decade.

If we go back farther still, the picture is no more comforting. Even as much of Europe and North America lay buried under glaciers, the temperature in Greenland was oscillating wildly, sometimes in spikes of ten degrees, sometimes in spikes of twenty. In an effort to convey the erratic nature of these changes, Richard Alley, a geophysicist who is leading a National Academy of Sciences panel on abrupt climate change, has compared the climate to a light switch being toyed with by an impish three-year-old. (The panel recently issued a report warning of the possibility of "large, abrupt, and unwelcome" climate changes.) He has also likened it to a freakish carnival ride. "Dozens of rapid changes litter the record of the last hundred thousand years," he observed. "If you can possibly imagine the spectacle of some really stupid person (or, better, a mannequin) bungee jumping off the side of a moving roller-coaster car, you can begin to picture the climate."

The first Greenland ice core was drilled in the mid-nineteen-sixties, at a U.S. military installation called Camp Century. The goal was not to challenge established views of the Earth's climate. Rather, the core was an instance of what Thomas Kuhn, in his famous essay "The Structure of Scientific Revolutions," called "normal science"-although it would perhaps be unfair to label anything associated with Camp Century as normal.

Built in 1959 in the northwestern corner of Greenland, the camp was a semi-secret research station for a very cold war. It featured a tunnel eleven hundred feet long and twenty-six feet wide, called Main Street which led to dormitories, a ten-bed hospital, a mess hall, a skating rink, and a store that sold perfume to send back home-all under the ice. (A favorite camp joke was that there was a girl behind every tree.) Powering the enterprise was a portable nuclear reactor. "In an era in which it has become fashionable to describe the democratic countries as soft or lazy, the fantastic ice city is a wholesome answer to such nonsensical cliches," one particularly patriotic visitor reported. (The camp, which closed after a decade in operation, has since been obliterated by the movement of the ice.)

The U.S. Army Corps of Engineers led the camp's ice-coring effort. The Americans managed to drill their way right down to the bottom of the ice sheet, but when they were finished they didn't quite know what to do with the core they had produced. It fell to Chester Langway, a glaciologist who was working for the Corps's Cold Regions Research and Engineering Laboratory, to figure something out. Langway i now semi-retired and operates a small antique store on Cape Cod. He recalled travelling all around the country, attempting to drum up interest. "Some people looked at it and they said, 'That's just ice,' which it's not," he told me. Eventually, he and Dansgaard got in touch, and together the two men made the first study of the core.

At the time, one of the central questions in climate research was how ice ages began and how they ended. One theory, first worked out in detail in the nineteen-twenties by a Serbian astrophysicist named Milutin Milankovitch, was that glaciers advance and retreat in response to slight, periodic changes in the Earth's orbit. These changes alter the distribution of sunlight at various latitudes during various seasons, and Milankovitch predicted that the strongest effects would be observed at intervals of nineteen thousand, twenty-three thousand, forty-one thousand, and a hundred thousand years.

Dansgaard and Langway's study of the Camp Century core confirmed these so-called Milankovitch cycles but also gave evidence of the climate's carnival- ride-like reversals. This evidence was dismissed by many as an idiosyncrasy of the polar ice. Sigfus Johnsen was a student of Dansgaard's who worked with him on the Camp Century core, and he happened to be travelling to North GRIP at the same time I was. Johnsen is now sixty-one, with wispy white hair and pale-blue eyes, and looks like a slightly dissolute Santa. He told me that the scientists working on the Camp Century core weren't sure themselves what to make of what they had found. "It was too incredible, something we didn't expect at all," he said.

It took fifteen years for anyone to drill another Greenland core. Largely because of Dansgaard and Langway's friendship, this second core was a European-American collaboration. It was drilled at an American radar base, Dye 3, a spot chosen for budgetary rather than scientific reasons, and from the outset everyone involved in the project knew that the location was a problem. Dye 3 was so close to the coast that the oldest layers of ice had mostly flowed out to sea. Nevertheless, the core confirmed all the most significant Camp Century results, demonstrating that findings which had seemed anomalous were a least reproducible. When the Dye 3 results were published, in the early nineteen-eighties, they set off what is perhaps best described as an ice rush, and the spirit of international cooperation quickly broke down. The Europeans decided to drill a new core where the ice is most stable, along the ice divide, and the Americans decided to do the same thing some twenty miles away.

Theorists are still struggling to catch up with the data from those two cores, the first of which was completed in 1992 and the second a year later. No known external force, or even any that has been hypothesized, seems capable of yanking the temperature back and forth as violently, and as often, as these cores have shown to be the case. Somehow, the climate system-through some vast and terrible feedback loop-must, it is now assumed, be capable of generating its own instabilities. The most popular hypothesis is that the oceans are responsible. Currents like the Gulf Stream transfer heat in huge quantities from the tropics toward the poles, and if this circulation pattern could somehow be shut off-by, say, a sudden influx of freshwater-it would have a swift and dramatic impact. Computer modellers have tried to reproduce such a shutdown, with some success. But once the ocean circulation comes to a halt, modellers have had a hard time getting it to start up again. "We are in a state now where the more we know, the more it becomes clear how little we really understand about the system," the oceanographer Jochem Marotzke told me.

For at least half a million years, and probably a lot longer, warm periods and ice ages have alternated according to a fairly regular, if punishing, pattern: ten thousand years of warmth, followed by ninety thousand years of cold. The current warm period, the Holocene, is now ten thousand years old, and, all things being equal-which is to say had we not interfered with the pattern by burning fossil fuels-we should now be heading toward another ice age.

As a continuous temperature record, the Greenland ice gives out at about a hundred and fifteen thousand years ago, at a moment in the climate cycle roughly analogous to our own-the end of the last interglacial period, which the Europeans call the Eemian and the Americans the Sangamon. What this part of the record suggests is disputed. The European core seemed to indicate that the period ended with a cataclysm even worse than the wild temperature swings that occurred at the end of the Wisconsin. During this cold snap, temperatures appear to have plunged from warmer than they are today to the coldest levels of the ice age, all within a matter of a few decades, and then to have climbed back up again, equally dramatically, a century or so later. The Europeans euphemistically dubbed this instant Eemian ice age Event One.

The Americans, however, determined that at the bottom of their core the ice had folded in on itself as it flowed, making accurate interpretation impossible. The two groups got together for a conference in Wolfeboro, New Hampshire, in 1995, and agreed on virtually everything except for Event One. Steffensen, North GRIP's field leader, recalls that the Europeans, who had rushed to publish their results were crestfallen to have them discredited. He remembers going down to the hotel bar in Wolfeboro with some colleagues and thinking, The Eemian is dead; we have to bury it. Then, he told me, "we had a few drinks, and it came back to life."

The driving purpose behind North GRIP is to drill a core that will finally provide a clean record of the last interglacial period and validate Event One. Doing so would obviously be significant for several reasons: retrospectively, it would show temperature instabilities in yet another part of the climate cycle, and prospectively it would seem to suggest a cataclysm in our own not too distant future. "In the first place, if we find this it will scare the hell out of us," Sigfus Johnsen told me. But getting back to the

Eemian remains a daunting technical challenge. In the summer of 1997, after the drillers at North GRIP had reached nearly a mile deep, the drill got stuck and could not be retrieved. The next summer, they had to start all over again. They were almost two miles down when, in July, 2000, the drill got stuck again. At that point, they poured antifreeze down the hole, and eventually managed to yank the drill back up, but by then the weather was turning, and they had to close the station for the season. When I arrived, last June, they had finally finished bailing out the antifreeze and resumed drilling. Still, things were not going well. Something-presumably geothermal heat from some previously undetected "hot spot"-was warming the ice from below, making drilling extremely difficult.

Everyone I met at North GRIP was quite open about saying he believed-and hoped-that Event One had indeed taken place. Apparently, the prospect of having spent six summers up on the ice with essentially nothing to show for it was more disturbing than any fate that might lie in store for the planet. I found myself feeling torn as well. On the one hand, Event One did not sound like much to look forward to. On the other, it did seem to offer a certain perverse consolation: global warming versus Event One-either way, things were bound to end badly. I proposed this idea to Steffensen. Unimpressed, he pointed out that, if you believed the climate to be inherently unstable, the last thing you'd want to do is conduct a vast unsupervised experiment on it, and he went on to explain that it would be wrong to think of global warming and Event One as alternatives. It is entirely possible, if apparently paradoxical, that global warming could produce a precipitous cooling, at least in Europe and parts of North America, by, say, shutting down the Gulf Stream. It is also possible that it could push the climate into an unstable mode, leading, especially in the upper latitudes, to a period of wild temperature swings of the sort that characterized the end of the last ice age. Finally, it is possible that we have changed the atmosphere so much-carbon-dioxide levels are approaching those of the age of the dinosaurs-that we will enter a new climate phase altogether. During the Cretaceous period, there were no major ice sheets, or ice ages, and much of the planet was covered with steamy swamps. To the extent that the historical record is any guide, the result of any climate change is unlikely to be a happy one. Steffensen recited to me an old Danish saying, whose pertinence I didn't entirely understand, but which nevertheless stuck with me. He translated it as "Pissing in your pants will only keep you warm for so long."

Life at North GRIP, if not exactly comfortable, is at least well supplied. Lunch the day I arrived was a fish stew prepared in a delicate tomato base. In the midafternoon, there was coffee and cake; then, in the evening, cocktails, which were served in a chamber hollowed out of the snowpack, to relieve pressure on the drilling room. The German driller had provided a recipe for Gluhwein, and everyone-scientists, graduate students, the Danish minister and her entourage, and the crew from the Air National Guard-was standing around in the dark, in cold-weather gear, drinking. ("Why do all the Danes I meet seem to come from Copenhagen?" I heard one of the pilots ask a young glaciologist.) For dinner, although I wasn't really hungry, I had a lamb chop in cream sauce, topped with diced leeks. At around midnight, the drillers finally emerged from under the ice. It was broad daylight outside, and inside the geodesic dome there was still a crowd drinking beer and smoking cigars.

As with so many recent discoveries about natural history, what seems, in the end, most surprising about the Greenland cores is exactly what might have seemed, at the outset, not to require any explanation at all. How is it that we happen to live in this, climatologically speaking, best of all possible times? On statistical grounds, it certainly seems improbable that the only period in the climate record as stable as our own is our own. And it seems, if anything, even more improbable that climatologists should make the discovery that we are living in this period of exceptional stability at the very moment when, by their own calculations, it is likely nearing an end.

But to approach the problem in this way is to fail to realize the extent to which we are ourselves a product of the climate record. Scientists were once puzzled by the evidence in lake sediments of the return of Arctic flowers to northern Europe at a time when the ice age had been over for more than a thousand years. Now those lake sediments seem to provide exemplary evidence of how the climate shifted and shifted again during that period. The reappearance of cold-loving beetles in the British Isles and the resurgence of tiny, cold-tolerant foraminifers in the North Atlantic can also be interpreted in these terms. And so, too, arguably, can the rise of human civilization and, by extension, the progress of climatology.

One night, I was sitting in the geodesic dome at North GRIP with Steffensen. He was coming to the end of a month on the ice, and had the weatherbeaten look of someone who has spent too long at sea. "If you look at the paleoclimatic output of ice cores, it has really changed the picture of the world, our view of past climates, and of human evolution," he said, while, next to us, a group of graduate students playec board games and listened to the soundtrack from "Buena Vista Social Club." "Now you're able to put human evolution into a climatic framework. You can ask, Why did human beings not make civilization fifty thousand years ago? You know that they had just as big brains as we have today. When you put it ir a climatic framework, you can say, Well, it was the ice age. And also this ice age was so climatically unstable that each time you had the beginning of a culture they had to move. Then comes the present interglacial-ten thousand years of very stable climate. The perfect conditions for agriculture. If you look at it, it's amazing. Civilizations in Persia, in China, and in India start at the same time, maybe six thousand years ago. They all developed writing and they all developed religion and they all built cities, a at the same time, because the climate was stable. I think that if the climate would have been stable fifty thousand years ago it would have started then. But they had no chance."

The only way into North GRIP is through Kangerlussuaq, and it is the only way out as well. The name means "very long fjord," and Kangerlussuaq does indeed lie at the end of a hundred-and-eighty-mile-lon fjord, which opens out into the Davis Strait. The setting is spectacular-snow-covered mountains rising out of a glacial plain. The town itself, however, is mostly poured concrete and corrugated iron, the remains of a now defunct American Air Force base that was called Sonderstrom, or, for short, Sondy. The night I arrived, I was invited to dinner at the town's best restaurant, at the airport. I missed the hors d'oeuvres, which had included whale skin, but arrived in time for the entree, which was reindeer. When I left, at about 9 P.M., I saw a musk ox on the hillside just beyond the terminal.

The edge of the ice sheet lies some ten miles away, and it can be seen-a ghostly white blur in the distance-by climbing just about any hill. After returning from North GRIP, I had a few days to spend in Kangerlussuaq, and one afternoon I hitched a ride out to the ice with some glaciologists who were also awaiting flights home. We took a dirt road that had been built by Volkswagen, and someone put Pink Floyd on the truck's CD player. Almost as soon as we got out of town, we were in the wild, cutting through fields of tiny purple Arctic rhododendron.

The Volkswagen road goes all the way up onto the ice sheet and ends a hundred miles later at a test track. (Rumor has it that there is also a three-star hotel and restaurant in a modular building that was trucked out to the site.) We stopped far short of that, at a fast-running river, brown with silt. The ice sheet rose up beyond it, like a wall, two hundred feet high. It was a startling shade of blue. One of the glaciologists explained that the color was an effect of the ice's peculiar density. Up at North GRIP, a set of poles that are slowly drifting apart mark the glacier's flow; at the edge of the ice, the same process produces more dramatic results. As we were talking, a huge section of the wall tore free and crashed into the river, sprinkling us with ice chips.

Although it was a clear blue day, a chill wind was blowing off the glacier, and, after we had all finished taking pictures, we climbed back into the truck. Soon we passed a small herd of reindeer that had come down to drink at a half-frozen lake, and then, a little later, the remains of a recent reindeer hunt-a pile of hooves with the fur still on them. The only other signs of human life we encountered were some ancient Inuit graves, or cairns; traditionally, Greenlanders buried their dead under mounds of rocks, a concessioı to the fact that most of the year the ground is frozen solid.

Humans are a remarkably resourceful species. We have spread into every region of the globe that is remotely habitable, and some, like Greenland, that aren't even that. The fact that we have managed this feat in an era of exceptional climate stability does not diminish the accomplishment, but it does make it seem that much more tenuous. As we drove back to Kangerlussuaq, listening to Pink Floyd-"Hey you, out there in the cold / Getting lonely, getting old / Can you feel me?"-I found myself thinking again abou the Greenland Norse. They had arrived on the island at a moment of uncharacteristically benign weather but they wouldn't have had any way of knowing this. Then the weather turned, and they were gone. (c)

LOAD-DATE: January 8, 2002