CHAPTER 8

Norse Greenland's End

Introduction to the end ■ Deforestation ■ Soil and turf damage ■ The Inuit's predecessors ■ Inuit subsistence ■ Inuit/Norse relations ■ The end ■ Ultimate causes of the end ■

In the previous chapter we saw how the Norse initially prospered in Greenland, due to a fortunate set of circumstances surrounding their arrival. They had the good luck to discover a virgin landscape that had never been logged or grazed, and that was suitable for use as pasture. They arrived at a time of relatively mild climate, when hay production was sufficient in most years, when the sea lanes to Europe were free of ice, when there was European demand for their exports of walrus ivory, and when there were no Native Americans anywhere near the Norse settlements or hunting grounds.

All of those initial advantages gradually turned against the Norse, in ways for which they bore some responsibility. While climate change, Europe's changing demand for ivory, and the arrival of the Inuit were beyond their control, how the Norse dealt with those changes was up to them. Their impact on the landscape was a factor entirely of their own making. In this chapter we shall see how the shifts in those advantages, and the Norse reactions to them, combined to bring an end to the Norse Greenland colony.

The Greenland Norse damaged their environment in at least three ways: by destroying the natural vegetation, by causing soil erosion, and by cutting turf. As soon as they arrived, they burned woodlands to clear land for pasture, then cut down some of the remaining trees for purposes such as lumber and firewood. Trees were prevented from regenerating by livestock grazing and trampling, especially in the winter, when plants were most vulnerable because of not growing then.

The effects of those impacts on the natural vegetation have been gauged by our friends the palynologists examining radiocarbon-dated slices of sediments collected from the bottoms of lakes and bogs. In those sediments oc-

cur at least five environmental indicators: whole plant parts such as leaves, and plant pollen, both of which serve to identify the plant species growing near the lake at that time; charcoal particles, proof of fires nearby; magnetic susceptibility measurements, which in Greenland reflect mainly the amounts of magnetic iron minerals in the sediment, arising from topsoil washed or blown into the lake's basin; and sand similarly washed or blown in.

These studies of lake sediments yield the following picture of vegetational history around the Norse farms. As temperatures warmed up at the end of the last Ice Age, pollen counts show that grasses and sedges became replaced by trees. For the next 8,000 years there were few further changes in the vegetation, and few or no signs of deforestation and erosion—until the Vikings arrived. That event was signaled by a layer of charcoal from Viking fires to clear pastures for their livestock. Pollen of willow and birch trees decreased, while pollen of grasses, sedges, weeds, and pasture plants introduced by the Norse for animal feed rose. Increased magnetic susceptibility values show that topsoil was carried into lakes, the topsoil having lost the plant cover that had previously protected it from erosion by wind and water. Finally, sand underlying the topsoil also was carried in when whole valleys had been denuded of their plant cover and soil. All of these changes became reversed, indicating recovery of the landscape, after the Viking settlements went extinct in the 1400s. Finally, the same set of changes that accompanied Norse arrival appeared all over again after 1924, when the Danish government of Greenland reintroduced sheep five centuries after their demise along with their Viking caretakers.

So what?—an environmental skeptic might ask. That's sad for willow trees, but what about people? It turned out that deforestation, soil erosion, and turf cutting all had serious consequences for the Norse. The most obvious consequence of deforestation was that the Norse quickly became short of lumber, as did the Icelanders and Mangarevans. The low and thin trunks of the willow, birch, and juniper trees remaining were suitable for making only small household wooden objects. For large pieces of wood to fashion into beams of houses, boats, sledges, barrels, wall panels, and beds, the Norse came to depend on three sources of timber: Siberian driftwood washed up on the beaches, imported logs from Norway, and trees felled by the Greenlanders themselves on voyages to the Labrador coast ("Markland") discovered in the course of the Vinland explorations. Lumber evidently remained so scarce that wooden objects were recycled rather than discarded. This can be deduced from the absence of large wooden panels and furniture at most Greenland Norse ruins except for the last houses in which the Norse of

Western Settlement died. At a famous Western Settlement archaeological site called "Farm Beneath the Sands," which became almost perfectly preserved under frozen river sands, most timber found was in the upper layers rather than in the lower layers, again suggesting that timber of old rooms and buildings was too precious to discard and was scavenged as rooms were remodeled or added. The Norse also dealt with their poverty in timber by resorting to turf for walls of buildings, but we shall see that that solution posed its own set of problems.

Another answer to the "so what?" response to deforestation is: poverty in firewood. Unlike the Inuit, who learned to use blubber for heating and lighting their dwellings, remains in Norse hearths show that the Norse continued to burn willow and alder wood in their houses. A major additional demand for firewood that most of us modern city-dwellers would never think of was in the dairy. Milk is an ephemeral, potentially dangerous food source: it is so nourishing, not only to us but also to bacteria, that it quickly spoils if left to stand without the pasteurization and refrigeration that we take for granted and that the Norse, like everyone else before modern times, didn't practice. Hence the vessels in which the Norse collected and stored milk and made cheese had to be washed frequently with boiled water, twice a day in the case of milk buckets. Milking animals at saeters (those summer farm buildings in the hills) was consequently confined to elevations below 1,300 feet, above which firewood was unavailable, even though pasture grasses good for feeding livestock grew up to much higher elevations of about 2,500 feet. In both Iceland and Norway we know that saeters had to be closed down when local firewood became exhausted, and the same presumably held for Greenland as well. Just as was true for scarce lumber, the Norse substituted other materials for scarce firewood, by burning animal bones, manure, and turf. But those solutions too had disadvantages: the bones and manure could otherwise have been used to fertilize fields for increased hay production, and burning turf was tantamount to destroying pasture.

The remaining heavy consequences of deforestation, besides shortages of lumber and firewood, involved shortages of iron. Scandinavians obtained most of their iron as bog iron—i.e., by extracting the metal from bog sediments with low iron content. Bog iron itself is locally available in Greenland, as in Iceland and Scandinavia: Christian Keller and I saw an iron-colored bog at Gardar in the Eastern Settlement, and Thomas McGovern saw other such bogs in the Western Settlement. The problem lay not

with finding bog iron in Greenland but with extracting it, because the extraction required huge quantities of wood to make the charcoal with which to produce the necessary very high temperature of fire. Even when the Greenlanders skipped that step by importing iron ingots from Norway, they still needed charcoal to work the iron into tools, and to sharpen, repair, and remake iron tools, which they had to do frequently.

We know that the Greenlanders possessed iron tools and worked with iron. Many of the larger Norse Greenland farms have remains of iron smithies and iron slag, though that doesn't tell us whether the smithies were used just to rework imported iron or to extract bog iron. At Greenland Viking archaeological sites have been found examples of the usual iron objects expected for a medieval Scandinavian society, including axe heads, scythes, knives, sheep shears, ships' rivets, carpenters' planes, awls to punch holes, and gimlets to bore holes.

But those same sites make clear that the Greenlanders were desperately short of iron, even by the standards of medieval Scandinavia, where iron wasn't plentiful. For example, far more nails and other iron objects are found at British and Shetland Viking sites, and even at Iceland sites and at the Vinland site of L'Anse aux Meadows, than at Greenland sites. Discarded iron nails are the commonest iron item at L'Anse aux Meadows, and many are also found at sites in Iceland, despite Iceland's own shortage of wood and iron. But iron poverty was extreme in Greenland. A few iron nails have been found in the lowest archaeological layers there, almost none in later layers, because iron became too precious to discard. Not a single sword, helmet, or even a piece of one has been found in Greenland, and just a couple of pieces of chain mail armor, possibly all from a single suit. Iron tools were reused and resharpened until worn down to stubs. For example, from excavations in Qorlortoq Valley I was struck by the pathos of a knife whose blade had been worn down to almost nothing, still mounted on a handle whose length was all out of proportion to that stub, and evidently still valuable enough to have been resharpened.

The Greenlanders' iron poverty is also clear from the many objects, recovered at their archaeological sites, that in Europe were routinely made of iron but that the Greenlanders made of other, often unexpected, materials. Those objects included wooden nails and caribou-antler arrowheads. Iceland's annals for the year 1189 describe with surprise how a Greenland ship that had drifted off course to Iceland was nailed not with iron nails but with wooden pegs, and then lashed together with whale baleen. However, for

Vikings whose self-image focused on terrifying opponents by swinging a mighty battleaxe, to be reduced to making that weapon out of whalebone must have been the ultimate humiliation.

A result of the Greenlanders' iron poverty was reduced efficiency of essential processes of their economy. With few iron scythes, cleavers, and shears available, or with those tools having to be made of bone or stone, it would have taken more time to harvest hay, butcher a carcass, and shear sheep, respectively. But a more immediately fatal consequence was that, by losing iron, the Norse lost their military advantage over the Inuit. Elsewhere around the world, in innumerable battles between European colonizers and the native peoples whom they encountered, steel swords and armor gave Europeans enormous advantages. For instance, during the Spanish conquest of Peru's Inca Empire in 1532-1533, there were five battles in which respectively 169, 80, 30, 110, and 40 Spaniards slaughtered armies of thousands to tens of thousands of Incas, with not a single Spaniard killed and only a few injured—because Spanish steel swords cut through Indian cotton armor, and the Spaniards' steel armor protected them against blows from Indian stone or wooden weapons. But there is no evidence that the Greenland Norse after the first few generations had steel weapons or steel armor anymore, except for that one suit of chain mail whose pieces have been discovered, and which may have belonged to a visiting European on a European ship rather than to a Greenlander. Instead, they fought with bows, arrows, and lances, just as did the Inuit. Nor is there any evidence that the Greenland Norse used their horses in battle as cavalry steeds, which again gave decisive advantages to Spanish conquistadors battling the Incas and Aztecs; their Icelandic relatives certainly didn't. The Greenland Norse also lacked professional military training. They thereby ended up with no military advantage whatsoever over the Inuit—with probable consequences for their fate that we shall see.

Thus, the impact of the Norse on the natural vegetation left them short of lumber, fuel, and iron. Their other two main types of impact, on soil and on turf, left them short of useful land. In Chapter 6 we saw how the fragility of Iceland's light volcanic soils opened the door there to big problems of soil erosion. While Greenland's soils are not as supersensitive as Iceland's, they still rank as relatively fragile by world standards, because Greenland's short cool growing season results in slow rates of plant growth, slow soil formation, and thin topsoil layers. Slow plant growth also translates into low soil

content of organic humus and clay, soil constituents that serve to bind water and keep the soil moist. Hence Greenland soils are easily dried out by the frequent strong winds.

The sequence of soil erosion in Greenland begins with cutting or burning the cover of trees and shrubs, which are more effective at holding soil than is grass. With the trees and shrubs gone, livestock, especially sheep and goats, graze down the grass, which regenerates only slowly in Greenland's climate. Once the grass cover is broken and the soil is exposed, soil is carried away especially by the strong winds, and also by pounding from occasionally heavy rains, to the point where the topsoil can be removed for a distance of miles from an entire valley. In areas where sand becomes exposed, as for example in river valleys, sand is picked up by the wind and dumped downwind.

Lake cores and soil profiles document the development of serious soil erosion in Greenland after the Norse arrived, and the dumping of topsoil and then sand by wind and running water into lakes. For instance, at the site of an abandoned Norse farm that I passed at the mouth of the Qoroq Fjord, downwind of a glacier, so much soil was blown away by high-velocity winds that only stones remained. Wind-blown sand is very common at Norse farms: some abandoned ones in the Vatnahverfi area are covered by sand ten feet deep.

The other means besides soil erosion by which the Norse inadvertently made land useless was that they cut turf for buildings and to burn as fuel, because of their shortage of timber and firewood. Almost all Greenland buildings were constructed mostly of turf, with at best only a stone foundation plus some wooden beams to support the roof. Even St. Nicholas's Cathedral at Gardar had only the lowest six feet of its walls made of stone, above which the walls were of turf, with a roof supported by wooden beams and with a wood-paneled front. Although Hvalsey Church was exceptional in having walls entirely of stone up to their full height, it was still roofed with turf. Greenland turf walls tended to be thick (up to six feet thick!) in order to provide insulation against the cold.

A large Greenland residential house is estimated to have consumed about 10 acres of turf. Furthermore, that amount of turf was needed more than once, because turf gradually disintegrates, so that a building must be "returfed" every few decades. The Norse referred to that process of acquiring turf for construction as "flaying the outfield," a good description of the damage done to what would otherwise be pastureland. The slow regeneration of turf in Greenland meant that that damage was long-lasting.

Again, a skeptic, on being told about soil erosion and turf cutting, might answer: "So what?" The answer is simple. Remember that, among the Norse Atlantic islands, Greenland even before human impact was the coldest island, hence the one most marginal for hay and pasture growth and most susceptible to loss of vegetation cover by overgrazing, trampling, soil erosion, and turf-cutting. A farm had to have sufficient pasture area to support at least the minimum number of animals required to breed back herd numbers after a long cold winter had reduced them, before the next long cold winter. Estimates suggest that the loss of only one-quarter of the total pasture area at Eastern Settlement or Western Settlement would have sufficed to drop the herd size below that minimum critical threshold. That's what actually appears to have happened at Western Settlement, and possibly at Eastern Settlement as well.

Just as in Iceland, the environmental problems that beset the medieval Norse remain concerns in modern Greenland. For five centuries after Greenland's medieval Norse died out, the island was without livestock under Inuit occupation and then under Danish colonial rule. Finally, in 1915, before the recent studies of medieval environmental impacts had been carried out, the Danes introduced Icelandic sheep on a trial basis, and the first full-time sheep breeder reestablished the farm at Brattahlid in 1924. Cows were also tried but were abandoned because they took too much work.

Today, about 65 Greenland families raise sheep as their main occupation, with the result that overgrazing and soil erosion have reemerged. Greenland lake cores show the same changes after 1924 as occurred after A.D. 984: a decrease in tree pollen, increase in grass and weed pollen, and increase of topsoil carried into lakes. Initially after 1924, sheep were left outdoors in the winter to forage for themselves whenever the winter was sufficiently mild. That caused grazing damage at the time when the vegetation was least capable of regenerating. Juniper trees are especially sensitive, because both sheep and horses browse them in the winter when there is nothing else available to eat. When Christian Keller arrived at Brattahlid in 1976, juniper was still growing there, but during my visit in 2002 I saw only dead juniper.

After more than half of Greenland's sheep starved to death in the cold winter of 1966-67, the government founded a Greenland Experimental Station to study the environmental effects of sheep by comparing vegetation and soil in heavily grazed pastures, lightly grazed ones, and fields fenced to keep sheep out. A component of that research involved enlisting archaeologists to study pasture changes during Viking times. As a result of the appre-

ciation thereby gained about Greenland's fragility, Greenlanders have fenced off their most vulnerable pastures and brought sheep indoors for barn feeding throughout the entire winter. Efforts are being made to increase the supplies of winter hay by fertilizing natural pastures, and by cultivating oats, rye, timothy, and other non-native grasses.

Despite these efforts, soil erosion is a big problem in Greenland today. Along Eastern Settlement fjords, I saw areas of bare stone and gravel, largely devoid of vegetation as a result of recent sheep grazing. Within the last 25 years, high-velocity winds have eroded the modern farm at the site of the old Norse farm at the mouth of the Qorlortoq Valley, thereby furnishing us with a model for what happened at that farm seven centuries ago. While both the Greenland government and the sheep farmers themselves understand the long-term damage caused by sheep, they also feel under pressure to generate jobs in a society with high unemployment. Ironically, raising sheep in Greenland doesn't pay even in the short run: the government has to give each sheep-farming family about $14,000 each year to cover their losses, provide them with an income, and induce them to carry on with the sheep.

The Inuit play a major role in the story of the demise of Viking Greenland. They constituted the biggest difference between the histories of the Greenland and Iceland Norse: while the Icelanders did enjoy the advantages of a less daunting climate and shorter trade routes to Norway compared to their Greenland brethren, the Icelanders' clearest advantage lay in not being threatened by the Inuit. At minimum, the Inuit represent a missed opportunity: the Greenland Vikings would have had a better chance of surviving if they had learned from or traded with the Inuit, but they didn't. At maximum, Inuit attacks on or threats to the Vikings may have played a direct role in the Vikings' extinction. The Inuit are also significant in proving to us that persistence of human societies wasn't impossible in medieval Greenland. Why did the Vikings eventually fail where the Inuit succeeded?

Today we think of the Inuit as *the* native inhabitants of Greenland and the Canadian Arctic. In reality, they were just the most recent in a series of at least four archaeologically recognized peoples who expanded eastward across Canada and entered Northwest Greenland over the course of nearly 4,000 years before Norse arrival. Successive waves of them spread, remained in Greenland for centuries, and then vanished, raising their own questions of societal collapses similar to the questions that we are considering for the

Norse, Anasazi, and Easter Islanders. However, we know too little about those earlier disappearances to discuss them in this book except as background to the Vikings' fate. While archaeologists have given to these earlier cultures names like Point Independence I, Point Independence II, and Saqqaq, depending on the sites where their artifacts became recognized, the languages of those people, and their names for themselves, all are lost to us forever.

The Inuits' immediate predecessors were a culture referred to by archaeologists as the Dorset people, from their habitations identified at Cape Dorset on Canada's Baffin Island. After occupying most of the Canadian Arctic, they entered Greenland around 800 B.C. and inhabited many parts of the island for about a thousand years, including the areas of the later Viking settlements in the southwest. For unknown reasons, they then abandoned all of Greenland and much of the Canadian Arctic by around A.D. 300 and contracted their distribution back to some core areas of Canada. Around A.D. 700, though, they expanded again to reoccupy Labrador and northwestern Greenland, though on this migration they did not spread south to the later Viking sites. At Western and Eastern Settlements, the initial Viking colonists described seeing only uninhabited house ruins, fragments of skin boats, and stone tools that they guessed were left by vanished natives similar to the ones that they had encountered in North America during the Vinland voyages.

From bones recovered at archaeological sites, we know that Dorset people hunted a wide range of prey species varying among sites and time periods: walrus, seals, caribou, polar bears, foxes, ducks, geese, and seabirds. There was long-distance trade between the Dorset populations of Arctic Canada, Labrador, and Greenland, as proven by discoveries of tools of stone types quarried from one of these sites appearing at other sites a thousand kilometers distant. Unlike their successors the Inuit or some of their Arctic predecessors, though, Dorset people lacked dogs (hence also dogsleds) and didn't use bows and arrows. Unlike the Inuit, they also lacked boats of skin stretched over a framework and hence could not go to sea to hunt whales. Without dogsleds, they were poorly mobile, and without whale-hunting, they were unable to feed large populations. Instead, they lived in small settlements of just one or two houses, big enough for no more than 10 people and just a few adult men. That made them the least formidable of the three Native American groups that the Norse encountered: Dorset people, Inuit, and Canadian Indians. And that, surely, is why the Greenland Norse felt

safe enough to continue for more than three centuries to visit the Dorset-occupied coast of Labrador to fetch timber, long after they had given up on visiting "Vinland" farther south in Canada because of the dense hostile Indian populations there.

Did Vikings and Dorset people meet each other in Northwest Greenland? We have no firm proof, but it seems likely, because Dorset people survived there for about 300 years after the Norse settled the southwest, and because the Norse were making annual visits to the Nordrseta hunting grounds only a few hundred miles south of Dorset-occupied areas and made exploratory trips farther north. Below, I shall mention one Norse account of an encounter with natives who might have been Dorset people. Other evidence consists of some objects clearly originating with Vikings—especially pieces of smelted metal that would have been prized for making tools—discovered at Dorset sites scattered over Northwest Greenland and the Canadian Arctic. Of course, we don't know whether Dorset people acquired those objects by face-to-face contacts, peaceful or otherwise, with Norse, or whether they were merely scavenged from abandoned Norse sites. Whichever was the case, we can be confident that Norse relations with the Inuit had the potential for becoming much more dangerous than those relatively harmless relations with Dorset people.

Inuit culture and technology, including mastery of whale-hunting in open waters, arose in the Bering Strait region somewhat before A.D. 1000. Dogsleds on land, and large boats at sea, enabled the Inuit to travel and transport supplies much more rapidly than could Dorset people. As the Arctic became warmer in the Middle Ages and the frozen waterways separating Canadian Arctic islands thawed, the Inuit followed their bowhead whale prey through those waterways eastwards across Canada, entering Northwest Greenland by A.D. 1200, and thereafter moving south along Greenland's west coast to reach the Nordrseta, then the vicinity of Western Settlement around A.D. 1300, and the vicinity of Eastern Settlement around 1400.

The Inuit hunted all of the same prey species that Dorset people had targeted, and probably did so more effectively because they (unlike their Dorset predecessors) possessed bows and arrows. But the hunting of whales as well gave them an additional major food supply unavailable to either Dorset people or the Norse. Hence Inuit hunters could feed lots of wives

and children and lived in large settlements, typically housing dozens of people, including 10 or 20 adult male hunters and fighters. In the prime hunting grounds of the Nordrseta itself, the Inuit established, at a site called Sermermiut, a huge settlement that gradually accumulated hundreds of dwellings. Just imagine the problems it must have created for the success of the Norse Nordrseta hunt if a group of Norse hunters, who could hardly have numbered more than a few dozen, were detected by such a big group of Inuit and failed to establish good relations.

Unlike the Norse, the Inuit represented the climax of thousands of years of cultural developments by Arctic peoples learning to master Arctic conditions. So, Greenland has little wood available for building, heating, or illuminating houses during the months of Arctic winter darkness? That was no problem for the Inuit: they built igloos for winter housing out of snow, and they burned whale and seal blubber both for fuel and for lighting lamps. Little wood available to build boats? Again, that was no problem for the Inuit: they stretched sealskins over frameworks to build kayaks (Plate 18), as well as to make their boats called *umiaqs* big enough to take out into unprotected waters for hunting whales.

Despite having read about what exquisite watercraft Inuit kayaks were, and despite having used the modern recreational kayaks now made of plastic and widely available in the First World, I was still astonished when I first saw a traditional Inuit kayak in Greenland. It reminded me of a miniature version of the long, narrow, fast battleships of the U.S.S. *Iowa* class built by the American navy during World War II, with all of their available deck space bristling with bombardment guns, anti-aircraft guns, and other weaponry. Nineteen feet long, tiny compared to a battleship, but still much longer than I had ever imagined, the deck of the slim kayak was packed with its own weaponry: a harpoon shaft, with a spear-thrower extension at the grip end; a separate harpoon head about six inches long, attachable to the shaft by a toggle connection; a dart to throw at birds, with not only an arrow point at the tip but three forward-facing sharp barbs lower on the dart shaft to hit the bird in case the tip just missed; several sealskin bladders to act as drags on harpooned whales or seals; and a lance for delivering the death blow to the harpooned animal. Unlike a battleship or any other watercraft known to me, the kayak was individually tailored to its paddler's size, weight, and arm strength. It was actually "worn" by its owner, and its seat was a sewn garment joined to the owner's parka and guaranteeing a waterproof seal so that ice-cold water splashing over the decks could not wet him. Christian Keller tried in vain to "wear" modern kayaks tailored to

his Greenlander friends, only to discover that his feet couldn't fit under the deck and that his upper legs were too big to enter the manhole.

In their range of hunting strategies, the Inuit were the most flexible and sophisticated hunters in Arctic history. Besides killing caribou, walruses, and land birds in ways not unlike those of the Norse, the Inuit differed from the Norse in using their fast kayaks to harpoon seals and to run down seabirds on the ocean, and in using umiaqs and harpoons to kill whales in open waters. Not even an Inuit can stab to death at one blow a healthy whale, so the whale hunt began with a hunter harpooning the whale from an umiaq rowed by other men. That is not an easy task, as all you devotees of Sherlock Holmes stories may remember from the "Adventure of Black Peter," in which an evil retired ship's captain is found dead in his house, with a harpoon that had been decorating his wall thrust clean through him. After spending a morning at a butcher's shop, vainly attempting himself to drive a harpoon through a pig's carcass, Sherlock Holmes deduces correctly that the murderer must have been a professional harpooner, because an untrained man no matter how strong cannot drive in a harpoon deeply. Two things made that possible for the Inuit: the harpoon's spear-thrower grip that extended the throwing arc and hence increased the hunter's throwing force and the impact; and, as in the case of Black Peter's murderer, long practice. For the Inuit, though, that practice began already in childhood, resulting in Inuit men developing a condition called hyperextension of the throwing arm: in effect, an additional built-in spear-thrower.

Once the harpoon head became embedded in the whale, the cleverly designed toggle connection released, allowing the hunters to retrieve the harpoon shaft now separated from the harpoon head embedded in the whale. Otherwise, if the harpooner had continued to hold a rope tied to the harpoon head and shaft, the angry whale would have dragged underwater the umiaq and all its Inuit occupants. Left attached to the harpoon head was an air-filled bladder of sealskin, whose buoyancy forced the whale to work harder against the bladder's resistance and to grow tired as it dived. When the whale surfaced to breathe, the Inuit launched another harpoon with yet another bladder attached, to tire the whale even more. Only when the whale had thus become exhausted did the hunters dare bring the umiaq alongside the beast to lance it to death.

The Inuit also devised a specialized technique for hunting ringed seal, the most abundant seal species in Greenland waters but one whose habits made it difficult to capture. Unlike other Greenland seal species, the ringed seal winters off the Greenland coast under the ice, by opening breathing

holes through the ice just large enough for its head (but not for its body). The holes are difficult to spot because the seal leaves them covered with a cone of snow. Each seal has several breathing holes, just as a fox makes an underground burrow with several foxholes as alternate entrances. A hunter could not knock the snow cone off the hole, else the seal would realize that someone was waiting for it. Hence the hunter stood patiently next to a cone in the cold darkness of the Arctic winter, waited motionless for as many hours as necessary to hear a seal arrive to catch a quick breath, and then tried to harpoon the animal *through* the snow cone, without being able to see it. As the impaled seal swam off, the harpoon head then detached from the shaft but remained attached to a rope, which the hunter played out and pulled until the seal became exhausted and could be dragged in and lanced. That whole operation is difficult to learn and execute successfully; the Norse never did. As a result, in the occasional years when other seal species declined in numbers, the Inuit switched to hunting ringed seals, but the Norse did not have that option, and so they were at risk of starving.

Thus, the Inuit enjoyed those and other advantages over the Norse and the Dorset people. Within a few centuries of the Inuit expansion across Canada into Northwest Greenland, the Dorset culture, which had previously occupied both areas, disappeared. Hence we have not one but two Inuit-related mysteries: the disappearance first of the Dorset people, then of the Norse, both of them soon after Inuit arrival in their territories. In Northwest Greenland some Dorset settlements survived for a century or two after the Inuit appeared, and it would have been impossible for two such peoples to be unaware of each other's presence, yet there is no direct archaeological evidence of contact between them, such as Inuit objects at contemporary Dorset sites or vice versa. But there is indirect evidence of contact: the Greenland Inuit ended up with several Dorset cultural traits that they had lacked before arriving in Greenland, including a bone knife for cutting snow blocks, domed snow houses, soapstone technology, and the so-called Thule 5 harpoon head. Clearly, the Inuit not only had some opportunities to learn from Dorset people but also must have had *something* to do with their disappearance after the latter had lived in the Arctic for 2,000 years. Each of us can imagine our own scenario for the end of Dorset culture. One guess of mine is that, among groups of Dorset people starving in a difficult winter, the women just deserted their men and walked over to Inuit camps where they knew that people were feasting on bowhead whales and ringed seals.

What about relations between the Inuit and the Norse? Incredibly, during the centuries that those two peoples shared Greenland, Norse annals include only two or three brief references to the Inuit.

The first of those three annal passages may refer to either the Inuit or else Dorset people because it describes an incident from the 11th or 12th century, when a Dorset population still survived in Northwest Greenland, and when the Inuit were just arriving. A *History of Norway* preserved in a 15th-century manuscript explains how the Norse first encountered Greenland natives: "Farther to the north beyond the Norse settlements, hunters have come across small people, whom they call skraelings. When they are stabbed with a nonfatal wound, their wounds turn white and they don't bleed, but when they are mortally wounded, they bleed incessantly. They have no iron, but they use walrus tusks as missiles and sharp stones as tools."

Brief and matter-of-fact as this account is, it suggests that the Norse had a "bad attitude" that got them off to a dreadful start with the people with whom they were about to share Greenland. "Skraelings," the Old Norse word that the Norse applied to all three groups of New World natives that they encountered in Vinland or Greenland (Inuit, Dorset, and Indians), translates approximately as "wretches." It also bodes poorly for peaceful relations if you take the first Inuit or Dorset person whom you see, and you try stabbing him as an experiment to figure out how much he bleeds. Recall also, from Chapter 6, that when the Norse first encountered a group of Indians in Vinland, they initiated friendship by killing eight of the nine. These first contacts go a long way towards explaining why the Norse did not establish a good trading relationship with the Inuit.

The second of the three mentions is equally brief and imputes to the "skraelings" a role in destroying the Western Settlement around A.D. 1360; we shall consider that role below. The skraelings in question could only have been Inuit, as by then the Dorset population had vanished from Greenland. The remaining mention is a single sentence in Iceland's annals for the year 1379: "The skraelings assaulted the Greenlanders, killing 18 men, and captured two boys and one bondswoman and made them slaves." Unless the annals were mistakenly attributing to Greenland an attack actually carried out in Norway by Saami people, this incident would presumably have taken place near Eastern Settlement, because Western Settlement no longer existed in 1379 and a Norse hunting party in the Nordrseta would have been unlikely to include a woman. How should we construe this laconic story? To us today, 18 Norse killed doesn't seem like a big deal, in this

century of world wars in which tens of millions of people were slaughtered. But consider that the entire population of Eastern Settlement was probably not more than 4,000, and that 18 men would have constituted about 2% of the adult males. If an enemy today were to attack the U.S., with its population of 280,000,000, and killed adult males in the same proportion, the result would be 1,260,000 American men dead. That is, that single documented attack of 1379 represented a disaster to Eastern Settlement, regardless of how many more men died in the attacks of 1380,1381, and so on.

Those three brief texts are our sole written sources of information about Norse/Inuit relations. Archaeological sources of information consist of Norse artifacts or copies of Norse artifacts found at Inuit sites, and vice versa. A total of 170 objects of Norse origin are known from Inuit sites, including a few complete tools (a knife, a shears, and a fire-starter), but mostly just pieces of metal (iron, copper, bronze, or tin) that the Inuit would have prized for making their own tools. Such Norse objects occur not only at Inuit sites in locations where the Vikings lived (Eastern and Western Settlements) or often visited (Nordrseta), but also in locations that the Norse never visited, such as East Greenland and Ellesmere Island. Hence Norse material must have been of sufficient interest to the Inuit that it passed by trade between Inuit groups hundreds of miles apart. For most of the objects it is impossible for us to know whether the Inuit acquired them from the Norse themselves by trade, by killing or robbing Norse, or by scavenging Norse settlements after the Norse had abandoned them. However, 10 of the pieces of metal come from bells of Eastern Settlement churches, which the Norse surely wouldn't have traded. Those bells were presumably obtained by the Inuit after the demise of the Norse, for instance when Inuit were living in houses of their own that they built within Norse ruins.

Firmer evidence of face-to-face contact between the two peoples comes from nine Inuit carvings of human figures that are unmistakably Norse, as judged by depictions of a characteristically Viking hairdo, clothing, or a crucifix decoration. The Inuit also learned some useful technologies from the Norse. While Inuit tools in the shape of a European knife or saw could just have been copied from plundered Norse objects without any friendly contact with a live Norseman, Inuit-made barrel staves and screw-threaded arrowheads suggest that the Inuit actually saw Norse men making or using barrels and screws.

On the other hand, corresponding evidence of Inuit objects at Norse sites is almost non-existent. One Inuit antler comb, two bird darts, one ivory towline handle, and one piece of meteoric iron: those five items are

the grand total known to me for all of Norse Greenland throughout the centuries of Inuit/Norse coexistence. Even those five items would seem not to be valuable trade items but just discarded curiosities that some Norse person picked up. Astounding by their complete absence are all the useful pieces of Inuit technology that the Norse could have copied with profit but didn't. For instance, there is not a single harpoon, spear-thrower, or kayak or umiaq piece from any Norse site.

If trade did develop between the Inuit and Norse, it would probably have involved walrus ivory, which the Inuit were skilled at hunting and which the Norse sought as their most valuable export to Europe. Unfortunately, direct evidence of such trade would be hard for us to recognize, because there is no way to determine whether the pieces of ivory found on many Norse farms came from walruses killed by the Norse themselves or by Inuit. But we certainly don't find at Norse sites the bones of what I think would have been the most precious things that the Inuit could have traded to the Norse: ringed seals, Greenland's most abundant seal species during the winter, hunted successfully by the Inuit but not by the Norse, and available at a time of year when the Norse were chronically at risk of exhausting their stored winter food supply and starving. That suggests to me that there really was very little, if any, trade between the two peoples. As far as archaeological evidence for contact is concerned, the Inuit might as well have been living on a different planet from the Norse, rather than sharing the same island and hunting grounds. Nor do we have any skeletal or genetic evidence of Inuit/Norse intermarriage. Careful study of the skulls of skeletons buried in Greenland Norse churchyards showed them to resemble continental Scandinavian skulls and failed to detect any Inuit/Norse hybrid.

Both the failure to develop trade with the Inuit, and the failure to learn from them, represented from our perspective huge losses to the Norse, although they themselves evidently didn't see it that way. Those failures were not for lack of opportunity. Norse hunters must have seen Inuit hunters in the Nordrseta, and then at the Western Settlement outer fjords when the Inuit arrived there. Norsemen with their own heavy wooden rowboats and their own techniques for hunting walruses and seals must have recognized the superior sophistication of Inuit light skin boats and hunting methods: the Inuit were succeeding at doing exactly what the Norse hunters were trying to do. When later European explorers began visiting Greenland in the late 1500s, they were immediately amazed at the speed and maneuverability of kayaks and commented on the Inuit appearing to be half-fish, darting around in the water much faster than any European boat could

travel. They were equally impressed by Inuit umiaqs, marksmanship, sewn skin clothing and boats and mittens, harpoons, bladder floats, dogsleds, and seal-hunting methods. The Danes who began colonizing Greenland in 1721 promptly embraced Inuit technology, used Inuit umiaqs to travel along the Greenland coast, and traded with the Inuit. Within a few years, the Danes had learned more about harpoons and ringed seals than the Norse had in a few centuries. Yet some of the Danish colonists were racist Christians who despised the pagan Inuit just as had the medieval Norse.

If one tried to guess without prejudice what form Norse/Inuit relations might have taken, there are many possibilities that were actually realized in later centuries when Europeans such as the Spanish, Portuguese, French, English, Russians, Belgians, Dutch, Germans, and Italians, as well as the Danes and Swedes themselves, encountered native peoples elsewhere in the world. Many of those European colonists became middlemen and developed integrated trade economies: European traders settled down or visited areas with native peoples, brought European goods coveted by the natives, and in exchange obtained native products coveted in Europe. For instance, the Inuit craved metal so much that they went to the effort of making cold-forged iron tools from iron in the Cape York meteor that had fallen in Northern Greenland. Hence one could have imagined the development of a trade in which the Norse obtained walrus tusks, narwhal tusks, sealskins, and polar bears from the Inuit and sent those goods to Europe in exchange for the iron prized by the Inuit. The Norse could also have supplied the Inuit with cloth and with milk products: even if lactose intolerance would have prevented the Inuit from drinking milk itself, they would still have consumed lactose-free milk products such as cheese and butter, which Denmark exports to Greenland today. Not only the Norse but also the Inuit were at frequent risk of starvation in Greenland, and the Inuit could have reduced that risk and diversified their diet by trading for Norse milk products. Such trade between Scandinavians and Inuit promptly developed in Greenland after 1721: why didn't it develop already in medieval times?

One answer is the cultural obstacles to intermarriage or just to learning between the Norse and the Inuit. An Inuit wife would not have been nearly as useful to a Norseman as was a Norse wife: what a Norseman wanted from a wife was the ability to weave and spin wool, to tend and milk cattle and sheep, and to make *skyr* and butter and cheese, which Norse but not Inuit girls learned from childhood. Even if a Norse hunter did befriend an Inuit hunter, the Norseman couldn't just borrow his friend's kayak and learn how

to use it, because the kayak was in effect a very complicated and individually tailored piece of clothing connected to a boat, made to fit that particular Inuit hunter, and fabricated by the Inuit's wife who (unlike Norse girls) had learned from childhood to sew skins. Hence a Norse hunter who had seen an Inuit kayak couldn't just come home and tell his wife to "sew me one of those things."

If you hope to persuade an Inuit woman to make you a kayak to your own measurements, or to let you marry her daughter, you have to establish a friendly relationship in the first place. But we have seen that the Norse had a "bad attitude" from the beginning, referring to both North American Indians in Vinland and Inuit in Greenland as "wretches," and killing the first natives they encountered in both places. As church-oriented Christians, the Norse shared the scorn of pagans widespread among medieval Europeans.

Still another factor behind their bad attitude is that the Norse would have thought of themselves as the natives in the Nordrseta, and the Inuit as the interlopers. The Norse arrived in the Nordrseta and hunted there for several centuries before the Inuit arrived. When the Inuit finally appeared from northwestern Greenland, the Norse would have been understandably reluctant to pay the Inuit for walrus tusks that they, the Norse, regarded as their own privilege to hunt. By the time that they encountered the Inuit, the Norse themselves were desperately starved for iron, the most coveted trade item that they could have offered to the Inuit.

To us moderns, living in a world in which all "native peoples" have already been contacted by Europeans except for a few tribes in the most remote parts of the Amazon and New Guinea, the difficulties in establishing contact are not obvious. What do you really expect the first Norseman spotting a group of Inuit in the Nordrseta to have done?—shout out "Hello!", walk over to them, smile, start using sign language, point to a walrus tusk, and hold out a lump of iron? Over the course of my biological fieldwork in New Guinea I have lived through such "first-contact situations," as they are called, and I found them dangerous and utterly terrifying. In such situations the "natives" initially regard the Europeans as trespassers and correctly perceive that any intruder may bring threats to their health, lives, and land ownership. Neither side knows what the other will do, both sides are tense and frightened, both are uncertain whether to flee or to start shooting, and both are scrutinizing the other side for a gesture that could hint that the others might panic and shoot first. To turn a first-contact situation into a friendly relationship, let alone to survive the situation, requires extreme

caution and patience. Later European colonialists eventually developed some experience at dealing with such situations, but the Norse evidently shot first.

In short, the 18th-century Danes in Greenland, and other Europeans meeting native peoples elsewhere, encountered the same range of problems that the Norse did: their own prejudices against "primitive pagans," the question of whether to kill them or rob them or trade with them or marry them or take their land, and the problem of how to convince them not to flee or shoot. Later Europeans dealt with those problems by cultivating that whole range of options and choosing whichever option worked best under the particular circumstances, depending on whether the Europeans were or were not outnumbered, whether the European colonist men did or did not have enough European women along as wives, whether the native people had trade goods coveted in Europe, and whether the natives' land was attractive to Europeans to settle. But the medieval Norse had not developed that range of options. Refusing or unable to learn from the Inuit, and lacking any military advantage over them, the Norse rather than the Inuit became the ones who eventually disappeared.

The end of the Greenland Norse colony is often described as a "mystery." That's true, but only partly so, because we need to distinguish ultimate reasons (i.e., underlying long-term factors behind the slow decline of Greenland Norse society) from proximate reasons (i.e., the final blow to the weakened society, killing the last individuals or forcing them to abandon their settlements). Only the proximate reasons remain partly mysterious; the ultimate reasons are clear. They consist of the five sets of factors that we have already discussed in detail: Norse impact on the environment, climate change, decline in friendly contact with Norway, increase in hostile contact with the Inuit, and the conservative outlook of the Norse.

Briefly, the Norse inadvertently depleted the environmental resources on which they depended, by cutting trees, stripping turf, overgrazing, and causing soil erosion. Already at the outset of Norse settlement, Greenland's natural resources were only marginally sufficient to support a European pastoral society of viable size, but hay production in Greenland fluctuates markedly from year to year. Hence that depletion of environmental resources threatened the society's survival in poor years. Second, calculations of climate from Greenland ice cores show that it was relatively mild (i.e., as "mild" as it is today) when the Norse arrived, went through several runs of

cold years in the 1300s, and then plunged in the early 1400s into the cold period called the Little Ice Age that lasted until the 1800s. That lowered hay production further, as well as clogging the ship lanes between Greenland and Norway with sea ice. Third, those obstacles to shipping were only one reason for the decline and eventual end of trade with Norway on which the Greenlanders depended for their iron, some timber, and their cultural identity. About half of Norway's population died when the Black Death (a plague epidemic) struck in 1349-1350. Norway, Sweden, and Denmark became joined in 1397 under one king, who proceeded to neglect Norway as the poorest of his three provinces. The demand by European carvers for walrus ivory, Greenland's principal export, declined when the Crusades gave Christian Europe access again to Asia's and East Africa's elephant ivory, whose deliveries to Europe had been cut off by the Arab conquest of the Mediterranean shores. By the 1400s, carving with ivory of any sort, whether from walruses or elephants, was out of fashion in Europe. All those changes undermined Norway's resources and motivation for sending ships to Greenland. Other peoples besides the Greenland Norse have similarly discovered their economies (or even their survival) to be at risk when their major trading partners encountered problems; they include us oil-importing Americans at the time of the 1973 Gulf oil embargo, Pitcairn and Henderson Islanders at the time of Mangareva's deforestation, and many others. Modern globalization will surely multiply the examples. Finally, the arrival of the Inuit, and the inability or unwillingness of the Norse to make drastic changes, completed the quintet of ultimate factors behind the Greenland colony's demise.

These five factors all developed gradually or operated over long times. Hence we should not be surprised to discover that various Norse farms were abandoned at different times before the final catastrophes. On the floor of a large house on the largest farm of the Vatnahverfi district of Eastern Settlement was found a skull of a 25-year-old man with a radiocarbon date around A.D. 1275. That suggests that the whole Vatnahverfi district was abandoned then, and that the skull was of one of the last inhabitants, because any survivors would surely have buried the dead man rather than just leave his body on the floor. The last radiocarbon dates from farms of Qorlortoq Valley of Eastern Settlement cluster around A.D. 1300. Westem Settlement's "Farm Beneath the Sands" was abandoned and buried under glacial outwash sand around A.D. 1350.

Of the two Norse settlements, the first to vanish completely was the smaller Western Settlement. It was more marginal for raising livestock than

was Eastern Settlement, because its more northerly location meant a shorter growing season, considerably less hay production even in a good year, and hence greater likelihood that a cold or wet summer would result in too little hay to feed the animals through the following winter. A further cause of vulnerability at Western Settlement was that its only access to the sea was by a single fjord, so that a hostile group of Inuit at the mouth of that one fjord could cut off all access to the crucial seal migration along the coast on which the Norse depended for food in the late spring.

We have two sources of information about the end of Western Settlement: written and archaeological. The written account is by a priest named Ivar Bardarson, who was sent to Greenland from Norway by the bishop of Bergen to act as ombudsman and royal tax collector, and to report on the condition of the Church in Greenland. Some time after his return to Norway around 1362, Bardarson wrote an account called *Description of Greenland*, of which the original text is lost and which we know only through later copies. Most of the preserved description consists of lists of Greenland churches and properties, buried among which is an exasperatingly brief account of the end of Western Settlement: "In the Western Settlement stands a large church, named Stensnes [Sandnes] Church. That church was for a time the cathedral and bishop's seat. Now the skraelings [= wretches, i.e., the Inuit] have the entire Western Settlement.... All the foregoing was told us by Ivar Bardarson Greenlander, who was the superintendent of the bishop's establishment at Gardar in Greenland for many years, that he had seen all this, and he was one of those that the lawman [a high-ranking official] had appointed to go to the Western Settlement to fight against the skraelings, in order to drive the skraelings out of the Western Settlement. On their arrival they found no men, either Christian or heathen . .."

I feel like shaking Ivar Bardarson's corpse in frustration at all the questions that he left unanswered. Which year did he go there, and in which month? Did he find any stored hay or cheese left? How could a thousand people have vanished, down to the last individual? Were there any signs of fighting, burned buildings, or dead bodies? But Bardarson tells us nothing more.

Instead, we have to turn to the findings of archaeologists who excavated the uppermost layer of debris at several Western Settlement farms, corresponding to the remains left in the settlement's final months by the last Norse to occupy it. In the ruins of those farms are doors, posts, roof timbers, furniture, bowls, crucifixes, and other big wooden objects. That's unusual: when a farm building is abandoned intentionally in northern Scandina-

via, such precious wooden objects are typically scavenged and carried away to reuse wherever the farm owners are resettling, because wood is at such a premium. Recall that the Norse camp at L'Anse aux Meadows on Newfoundland, which was abandoned after such a planned evacuation, contained little of value except 99 broken nails, one whole nail, and a knitting needle. Evidently, Western Settlement was either abandoned hastily, or else its last occupants couldn't carry away their furniture because they died there.

The animal bones in those topmost layers tell a grim story. They include: foot bones of small wild birds and rabbits, which would normally have been considered too small to be worth hunting and usable only as last-ditch famine food; bones of a newborn calf and lamb, which would have been born in the late spring; the toe bones of a number of cows approximately equal to the number of spaces in that farm's cow barn, suggesting that all cows had been slaughtered and were eaten down to the hoofs; and partial skeletons of big hunting dogs with knife marks on the bones. Dog bones are otherwise virtually absent in Norse houses, because the Norse were no more willing to eat their dogs than we are today. By killing the dogs on which they depended to hunt caribou in the autumn, and by killing the newborn livestock needed to rebuild their herds, the last inhabitants were in effect saying that they were too desperately hungry to care about the future. In lower debris layers of the houses, the carrion-eating flies associated with human feces belong to warmth-loving fly species, but the top layer had only cold-tolerant fly species, suggesting that the inhabitants had run out of fuel as well as food.

All of these archaeological details tell us that the last inhabitants of those Western Settlement farms starved and froze to death in the spring. Either it was a cold year in which the migratory seals failed to arrive; or else heavy ice in the fjords, or perhaps a band of Inuit who remembered their relatives having been stabbed by the Norse as an experiment to see how much blood ran out of them, blocked access to the seal herds in the outer fjords. A cold summer had probably caused the farmers to run out of enough hay to feed their livestock through the winter. The farmers were reduced to killing their last cows, eating even the hoofs, killing and eating their dogs, and scrounging for birds and rabbits. If so, one has to wonder why archaeologists did not also find the skeletons of the last Norse themselves in those collapsed houses. I suspect that Ivar Bardarson failed to mention that his group from Eastern Settlement performed a cleanup of Western Settlement and gave a Christian burial to the bodies of their kinsmen—or else that the copyist

who copied and shortened Bardarson's lost original omitted his account of the cleanup.

As for the end of Eastern Settlement, the last Greenland voyage of the royal trading ship promised by the king of Norway was in 1368; that ship sank in the following year. Thereafter, we have records of only four other sailings to Greenland (in 1381, 1382, 1385, and 1406), all by private ships whose captains alleged that their destination had really been Iceland and that they had reached Greenland unintentionally as a result of being blown off course. When we recall that the Norwegian king asserted exclusive rights to the Greenland trade as a royal monopoly, and that it was illegal for private ships to visit Greenland, we must consider four such "unintentional" voyages as an astonishing coincidence. Much more likely, the captains' claims that to their deep regret they had been caught in dense fog and ended up by mistake in Greenland were just alibis to cover their real intentions. As the captains undoubtedly knew, so few ships by then were visiting Greenland that the Greenlanders were desperate for trade goods, and Norwegian imports could be sold to Greenlanders at a big profit. Thorstein Olafsson, captain of the 1406 ship, could not have been too sad at his navigational error, because he spent nearly four years in Greenland before returning to Norway in 1410.

Captain Olafsson brought back three pieces of recent news from Greenland. First, a man named Kolgrim was burned at the stake in 1407 for having used witchcraft to seduce a woman named Steinunn, the daughter of the lawman Ravn and the wife of Thorgrim Solvason. Second, poor Steinunn then went insane and died. Finally, Olafsson himself and a local girl named Sigrid Bjornsdotter were married in Hvalsey Church on September 14,1408, with Brand Halldorsson, Thord Jorundarson, Thorbjorn Bardarson, and Jon Jonsson as witnesses, after the banns had been read for the happy couple on three previous Sundays and no one had objected. Those laconic accounts of burning at the stake, insanity, and marriage are just the usual goings-on for any medieval European Christian society and give no hint of trouble. They are our last definite written notices of Norse Greenland.

We don't know exactly when Eastern Settlement vanished. Between 1400 and 1420 the climate in the North Atlantic became colder and stormier, and mentions of ship traffic to Greenland ceased. A radiocarbon date of 1435 for a woman's dress excavated from Herjolfsnes churchyard suggests that some Norse may have survived for a few decades after that last ship returned from Greenland in 1410, but we should not lay too much stress on

that date of 1435 because of the statistical uncertainties of several decades associated with the radiocarbon determination. It was not until 1576-1587 that we know definitely of further European visitors, when the English explorers Martin Frobisher and John Davis sighted and landed in Greenland, met Inuit, were very impressed by their skills and technology, traded with them, and kidnapped several to bring back to exhibit in England. In 1607 a Danish-Norwegian expedition set out specifically to visit Eastern Settlement, but was deceived by the name into supposing that it lay on Greenland's east coast and hence found no evidence of the Norse. From then on, throughout the 17th century, more Danish-Norwegian expeditions and Dutch and English whalers stopped in Greenland and kidnapped more Inuit, who (incomprehensibly to us today) were assumed to be nothing more than descendants of blue-eyed blond-haired Vikings, despite their completely different physical appearance and language.

Finally, in 1721 the Norwegian Lutheran missionary Hans Egede sailed for Greenland, in the conviction that the kidnapped Inuit really were Norse Catholics who had been abandoned by Europe before the Reformation, had reverted to paganism, and must by now be eager for a Christian missionary to convert them to Lutheranism. He happened first to land in the fjords of Western Settlement, where to his surprise he found only people who were clearly Inuit and not Norse, and who showed him ruins of former Norse farms. Still convinced that the Eastern Settlement lay on Greenland's east coast, Egede looked there and found no signs of the Norse. In 1723 the Inuit showed him more extensive Norse ruins, including Hvalsey Church, on the southwest coast at the site of what we now know to be Eastern Settlement. That forced him to admit to himself that the Norse colony really had vanished, and his search for an answer to the mystery began. From the Inuit, Egede gathered orally transmitted memories of alternating periods of fighting and friendly relations with the former Norse population, and he wondered whether the Norse had been exterminated by the Inuit. Ever since then, generations of visitors and archaeologists have been trying to find out the answer.

Let's be clear about exactly what the mystery involves. The ultimate causes of the Norse decline are not in doubt, and the archaeological investigations of the top layers at Western Settlement tell us something about the proximate causes of the collapse in the final year there. But we have no corresponding information about what happened in the last year of Eastern Settlement, because its top layers have not been investigated. Having taken the story this far, I can't resist fleshing out the end with some speculation.

It seems to me that the collapse of Eastern Settlement must have been sudden rather than gentle, like the sudden collapse of the Soviet Union and of Western Settlement. Greenland Norse society was a delicately balanced deck of cards whose ability to remain standing depended ultimately on the authority of the Church and of the chiefs. Respect for both of those authorities would have declined when the promised ships stopped coming from Norway, and when the climate got colder. The last bishop of Greenland died around 1378, and no new bishop arrived from Norway to replace him. But social legitimacy in Norse society depended on proper functioning of the Church: priests had to be ordained by a bishop, and without an ordained priest one couldn't be baptized, married, or receive a Christian burial. How could that society have continued to function when the last priest ordained by the last bishop eventually died? Similarly, the authority of a chief depended on the chief's having resources to redistribute to his followers in hard times. If people on poor farms were starving to death while the chief survived on an adjacent richer farm, would the poor farmers have continued to obey their chief up to their last breath?

Compared to Western Settlement, Eastern Settlement lay farther south, was less marginal for Norse hay production, supported more people (4,000 instead of just 1,000), and was thus less at risk of collapse. Of course, colder climate was in the long run bad for Eastern as well as Western Settlement: it would just take a longer string of cold years to reduce the herds and drive people to starvation at Eastern Settlement. One can imagine the smaller and more marginal farms of the Eastern Settlement getting starved out. But what could have happened at Gardar, whose two cattle barns had space for 160 cows, and which had uncounted herds of sheep?

I would guess that, at the end, Gardar was like an overcrowded lifeboat. When hay production was failing and the livestock had all died or been eaten at the poorer farms of Eastern Settlement, their settlers would have tried to push their way onto the best farms that still had some animals: Brattahlid, Hvalsey, Herjolfsnes, and last of all Gardar. The authority of the church officials at Gardar Cathedral, or of the landowning chief there, would have been acknowledged as long as they and the power of God were visibly protecting their parishioners and followers. But famine and associated disease would have caused a breakdown of respect for authority, much as the Greek historian Thucydides described in his terrifying account of the plague of Athens 2,000 years earlier. Starving people would have poured into Gardar, and the outnumbered chiefs and church officials could no longer prevent them from slaughtering the last cattle and sheep. Gardar's

supplies, which might have sufficed to keep Gardar's own inhabitants alive if all the neighbors could have been kept out, would have been used up in the last winter when everybody tried to climb into the overcrowded lifeboat, eating the dogs and newborn livestock and the cows' hoofs as they had at the end of Western Settlement.

I picture the scene at Gardar as like that in my home city of Los Angeles in 1992 at the time of the so-called Rodney King riots, when the acquittal of policemen on trial for brutally beating a poor person provoked thousands of outraged people from poor neighborhoods to spread out to loot businesses and rich neighborhoods. The greatly outnumbered police could do nothing more than put up pieces of yellow plastic warning tape across roads entering rich neighborhoods, in a futile gesture aimed at keeping the looters out. We are increasingly seeing a similar phenomenon on a global scale today, as illegal immigrants from poor countries pour into the overcrowded lifeboats represented by rich countries, and as our border controls prove no more able to stop that influx than were Gardar's chiefs and Los Angeles's yellow tape. That parallel gives us another reason not to dismiss the fate of the Greenland Norse as just a problem of a small peripheral society in a fragile environment, irrelevant to our own larger society. Eastern Settlement was also larger than Western Settlement, but the outcome was the same; it merely took longer.

Were the Greenland Norse doomed from the outset, trying to practice a lifestyle that could not possibly succeed, so that it was only a matter of time before they would starve to death? Were they at a hopeless disadvantage compared to all the Native American hunter-gatherer peoples who had occupied Greenland on and off for thousands of years before the Norse arrived?

I don't think so. Remember that, before the Inuit, there had been at least four previous waves of Native American hunter-gatherers who had arrived in Greenland from the Canadian Arctic, and who had died out one after another. That's because climate fluctuations in the Arctic cause the large prey species essential for sustaining human hunters—caribou, seals, and whales—to migrate, fluctuate widely in numbers, or periodically abandon whole areas. While the Inuit have persisted in Greenland for eight centuries since their arrival, they too were subject to those fluctuations in prey numbers. Archaeologists have discovered many Inuit houses, sealed up like time capsules, containing the bodies of Inuit families that starved to death in that house during a harsh winter. In Danish colonial times it happened often

that an Inuit would stagger into a Danish settlement, saying that he or she was the last survivor of some Inuit settlement all of whose other members had died of starvation.

Compared to the Inuit and all previous hunter-gatherer societies in Greenland, the Norse enjoyed the big advantage of an additional food source: livestock. In effect, the sole use that Native American hunters could make of the biological productivity of Greenland's land plant communities was by hunting the caribou (plus hares, as a minor food item) that fed on the plants. The Norse also ate caribou and hares, but in addition they allowed their cows, sheep, and goats to convert the plants into milk and meat. In that respect the Norse potentially had a much broader food base, and a better chance of surviving, than any previous occupants of Greenland. If only the Norse, besides eating many of the wild foods used by Native American societies in Greenland (especially caribou, migratory seals, and harbor seals), had also taken advantage of the other wild foods that Native Americans used but that the Norse did not (especially fish, ringed seals, and whales other than beached whales), the Norse might have survived. That they did not hunt the ringed seals, fish, and whales which they must have seen the Inuit hunting was their own decision. The Norse starved in the presence of abundant unutilized food resources. Why did they make that decision, which from our perspective of hindsight seems suicidal?

Actually, from the perspective of their own observations, values, and previous experience, Norse decision-making was no more suicidal than is ours today. Four sets of considerations stamped their outlook. First, it is difficult to make a living in Greenland's fluctuating environment, even for modern ecologists and agricultural scientists. The Norse had the fortune or misfortune to arrive in Greenland at a period when its climate was relatively mild. Not having lived there for the previous thousand years, they had not experienced a series of cold and warm cycles, and had no way to foresee the later difficulties of maintaining livestock when Greenland's climate would go into a cold cycle. After 20th-century Danes reintroduced sheep and cows to Greenland, they too proceeded to make mistakes, caused soil erosion by overstocking sheep, and quickly gave up on cows. Modern Greenland is not self-sufficient but depends heavily on Danish foreign aid and on fishing license payments from the European Union. Thus, even by today's standards, the achievement of the medieval Norse in developing a complex mix of activities that permitted them to feed themselves for 450 years is impressive and not at all suicidal.

Second, the Norse did not enter Greenland with their minds a blank

slate, open to considering any solution to Greenland's problems. Instead, like all colonizing peoples throughout history, they arrived with their own knowledge, cultural values, and preferred lifestyle, based on generations of Norse experience in Norway and Iceland. They thought of themselves as dairy farmers, Christians, Europeans, and specifically Norse. Their Norwegian forebears had successfully practiced dairy farming for 3,000 years. Shared language, religion, and culture bound them to Norway, just as those shared attributes bound Americans and Australians to Britain for centuries. All of Greenland's bishops were Norwegians sent out to Greenland, rather than Norse who had grown up in Greenland. Without those shared Norwegian values, the Norse could not have cooperated to survive in Greenland. In that light their investments in cows, the Nordrseta hunt, and churches are understandable, even though on purely economic grounds those may not have been the best use of Norse energy. The Norse were undone by the same social glue that had enabled them to master Greenland's difficulties. That proves to be a common theme throughout history and also in the modern world, as we already saw in connection with Montana (Chapter 1): the values to which people cling most stubbornly under inappropriate conditions are those values that were previously the source of their greatest triumphs over adversity. We shall return to this dilemma in Chapters 14 and 16, when we consider societies that succeeded by figuring out which of their core values they could hold on to.

Third, the Norse, like other medieval European Christians, scorned pagan non-European peoples and lacked experience of how best to deal with them. Only after the age of exploration that began with Columbus's voyage in 1492 did Europeans learn Machiavellian ways of exploiting native peoples to their own advantage, even while continuing to despise them. Hence the Norse refused to learn from the Inuit and probably behaved towards them in ways ensuring their enmity. Many later groups of Europeans in the Arctic similarly perished as a result of ignoring or antagonizing the Inuit, most notably the 138 British members of the well-financed 1845 Franklin Expedition, every single one of whom died while trying to cross areas of the Canadian Arctic populated by Inuit. The European explorers and settlers who succeeded best in the Arctic were those most extensively adopting Inuit ways, like Robert Peary and Roald Amundsen.

Finally, power in Norse Greenland was concentrated at the top, in the hands of the chiefs and clergy. They owned most of the land (including all the best farms), owned the boats, and controlled the trade with Europe. They chose to devote much of that trade to importing goods that brought

prestige to them: luxury goods for the wealthiest households, vestments and jewelry for the clergy, and bells and stained glass for the churches. Among the uses to which they allocated their few boats were the Nordrseta hunt, in order to acquire the luxury exports (such as ivory and polar bear hides) with which to pay for those imports. Chiefs had two motives for running large sheep herds that could damage the land by overgrazing: wool was Greenland's other principal export with which to pay for imports; and independent farmers on overgrazed land were more likely to be forced into tenancy, and thereby to become a chief's followers in his competition with other chiefs. There were many innovations that might have improved the material conditions of the Norse, such as importing more iron and fewer luxuries, allocating more boat time to Markland journeys for obtaining iron and timber, and copying (from the Inuit) or inventing different boats and different hunting techniques. But those innovations could have threatened the power, prestige, and narrow interests of the chiefs. In the tightly controlled, interdependent society of Norse Greenland, the chiefs were in a position to prevent others from trying out such innovations.

Thus, Norse society's structure created a conflict between the short-term interests of those in power, and the long-term interests of the society as a whole. Much of what the chiefs and clergy valued proved eventually harmful to the society. Yet the society's values were at the root of its strengths as well as of its weaknesses. The Greenland Norse did succeed in creating a unique form of European society, and in surviving for 450 years as Europe's most remote outpost. We modern Americans should not be too quick to brand them as failures, when their society survived in Greenland for longer than our English-speaking society has survived so far in North America. Ultimately, though, the chiefs found themselves without followers. The last right that they obtained for themselves was the privilege of being the last to starve.