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THE VIKINGS AND THEIR IMPORTANCE FOR THE NORTH ATLANTIC (ICELAND, GREENLAND, NORTH AMERICA) FROM THE BEGINNING OF THE EXPANSION IN THE 9TH CENTURY UNTIL THE EXTINCTION AROUND 1400

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The Viking colony in West Greenland has always interested historians, archaeologists and climatologists. How could the community of 4,000-5,000 Viking peasants survived in Arctic Greenland for 425 years (985-1400), and why did they finally disappeared? Agriculture of the colonists in an Arctic environment encountered serious challenges. The Viking peasants faced these challenges by adapting old agricultural practices under the new conditions. Greenland became the stepping stone for the Vikings, who the first of the Europeans discovered America and settled briefly in Newfoundland circa 1000. How did they manage to colonize the Arctic Zone from Norway to Canada within one hundred years in the 10th and 11th centuries? In Norse Greenland successful subsistence strategies were developed and underpinned a well-integrated settlement. The Viking community had a global significance which surpassed its modest size. In the last decades researchers have been nearly unanimous in emphasizing that long-term climatic and environmental changes created a situation, where Viking agriculture finally was no longer sustainable and their community was ruined. Ultimate colonists' failure may be attributed the combination of cultural, economic and environmental changes at local, regional and continental scales compounded by hostile relations with the natives.

Keywords: Greenland, Vikings, Iceland, Vinland, Newfoundland, Erik the Red, Little Ice Age, 985, Brattahlid, Norway, Denmark, climatic changes, Innuits, Atlantic Ocean, Hudson Bay, America, Sweden.

ВИКИНГИ И ИХ ЗНАЧЕНИЕ ДЛЯ СЕВЕРНОЙ АТЛАНТИКИ (ИСЛАНДИЯ, ГРЕНЛАНДИЯ, СЕВЕРНАЯ АМЕРИКА) ОТ НАЧАЛА ЭКСПАНСИИ В IX ВЕКЕ ДО ИСЧЕЗНОВЕНИЯ ОКОЛО 1400 ГОДА

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Колония викингов в Западной Гренландии всегда интересовала историков, археологов и климатологов. Как община из 4-5 тысяч крестьян-викингов смогла выжить в арктической Гренландии в течение 425 лет (985-1400) и почему они, в конце концов, исчезли? Сельское хозяйство колонистов в условиях Арктики столкнулось с серьезными трудностями. Крестьяне-викинги, преодолевая эти проблемы, адаптировали старые методы ведения сельского хозяйства в новых условиях. Так Гренландия стала трамплином для викингов, которые затем первыми из европейцев открыли Америку и около 1000 года ненадолго поселились в Ньюфаундленде. Как им удалось освоить Арктическую зону от Норвегии до Канады в течение ста лет в X и XI веках? В скандинавской Гренландии были разработаны успешные стратегии выживания, которые легли в основу хорошо интегрированного поселения. Община викингов имела глобальное значение, которое превосходило ее скромные размеры. В последние десятилетия ученые почти единодушно подчеркивают, что долгосрочные климатические и экологические изменения привели к тому, что сельское хозяйство викингов, в итоге, перестало быть устойчивым, а их община была разрушена. Окончательная неудача колонистов может быть объяснена совокупностью культурных, экономических и экологических изменений на местном, региональном и континентальном уровнях, усугубляемых враждебными отношениями с туземцами.

Ключевые слова: Гренландия, Викинги, Исландия, Винланд, Ньюфаундленд, Эрик Рыжий, Малый ледниковый период, 985 год, Братталид, Норвегия, Дания,, климатические изменения, инуиты, Атлантический океан, Гудзонов залив, Америка, Швеция.

Prologue

Who were the Vikings? The Vikings were seafarers from the part of Europe known as Scandinavia, which today includes Denmark, Norway and Sweden. During the Viking Ages from about 800 to 1050 they spread through Europe and the North Atlantic and conquered or colonized many territories. Although they are primarily thought of as warriors or raiders, the Vikings were also traders, explorers, and settlers. In much of northern Europe they left behind an influence on family names, place names, language, customs, folk tales, and oral traditions.

An extraordinary series of events began in the North Sea and North Atlantic region around the 9th century. Norse raiders and settlers from Scandinavia, better known as the Vikings, began expanding to the west, settling in the British Isles and Ireland, including the smaller groups of islands, the Orkneys, Shetlands, Hebrides and the Isle of Man. Stepping across the North Atlantic, Norse colonists reached the Faeroe Islands by around 825, Iceland by around 875 and Greenland somehow in the 10th century. The Faeroe Islands and Iceland were both inhabited islands when the Vikings arrived [2, p. 19-20].

During the Middle Ages the Viking and later Norse settlements in Greenland were the most northerly outpost of European Christianity and civilization in the Northern Hemisphere. The climate was relatively stable and mild around AD 985 when Eric the Red (950-1003) founded the Eastern Settlement in the fjords of South Greenland. The Norse lived in Greenland for almost 500 years but disappeared in the 14th century. Letters in Iceland report on a Norse marriage in 1408 in the Hvalsey church of the Eastern Settlement, but after this account all written sources remain silent. Although there have been numerous studies and much speculation, the fate of the Norse settlements in Greenland remains an essentially unsolved question [15, p. 68].

The Norse colonization or *landnám* of Greenland, Iceland, Faeroe Islands, Shetland and Orkneys from the ninth century onwards provides opportunities to examine human responses to climate and environmental change. While Greenland was abandoned, and the population in Iceland struggled, the colonies on the other

islands thrived. Because these societies derived from the same origins in Scandinavia, the disappearance of the Norse from Greenland, the struggle on Iceland and success in other places makes it an interesting case study of the fate of these societies and how this is related to the different environments they found themselves in.

The case of Greenland is also instructive in another important way: the Vikings encountered people from a different culture: the Inuit. While the Vikings perished, the Inuit thrived and survive until the present day. The tragedy of the Norse in Greenland illustrates that collapse of a human society is not inevitable because it depends on how people respond to environmental changes. The Inuit responded much better than the Vikings and they survived. This message is important for us, facing global warming and environmental change on an unprecedented scale. The way we respond to these challenges will make the difference between collapse and survival.

The context of Viking voyages to Iceland, Greenland and North America is part of a much larger history of the Vikings exploration of the Arctic areas from North America to Siberia, Europe and Western Asia. From the years 800 until 1066 the Scandinavian Vikings took the world by surprise. Until 800 the Europeans or people in other parts of the world had hardly heard about Scandinavia and its tribes. Scandinavia was a remote location as far as the Arctic Circle with a very tough environment in the most northern part of Europe. The people of the Far North of Europe were farmers and mostly hunters and fishermen, although faming was rather marginal. Agriculture and animal husbandry could only sustain a settled lifestyle, a little-known people literary struggling for survival in rough landscapes and climate. They mostly lived along the fjords of nowadays Norway on the Atlantic coast, on the coasts of the lakes and rivers in nowadays Sweden and on marshy islands of the present Denmark. Always in small communities very near the sea. So was the life in thousands of years.

However, in the late 700s an anonymous shipbuilder somewhere in Scandinavia made an exceptional breakthrough in shipbuilding, neither seen before nor after in the world’s history. In the centuries to come, the most sea-worthy ships sailed all over the oceans around Europa. These Viking ships were the key to an

exploration that amazed the world ad still does. In the 10th and 11th centuries, a good, constructed Viking longship could manage a distance up to 200 kilometers a day. However, not in a storm or a stiff breeze, but on a day where the wind blew steadily in the sail direction. Also, against the wind, the distance was far of such a ship. 1,500 kilometers would take from two until four weeks. In a summer season from May until August, the Vikings and their ship could easily manage 1,600 kilometers out and back. The Arctic Zone, Iceland, Greenland and North America were within reach for the northerners [17, s. 210-212].

Vikings, Iceland and Greenland

The peoples that left their homes to settle new territories in Shetland, the Faroes, Iceland and Greenland and further west to North America had to traverse the Atlantic and depended on safe anchorages and suitable landing places. These harbours were also vital to maintaining contact with Scandinavia and the British Isles. The North Atlantic islands played an important role in the economic history of Northern Europe. Greenland, for instance, supplied Europe with walrus ivory and furs, while Icelanders traded in wool, stockfish and gyrfalcons. These commodities were transported across the Atlantic Ocean by boat, which determined the importance of many harbours and landing sites [6, s. 204-206].

Harbours and landing places were key components of the ocean voyages of the Norse during the process of the westward expansion. The harbours in the Norse colonies of the North Atlantic were generally simple landing places or anchorages that provided natural protection from the wind and waves. Besides the harbours of larger settlements such as Gardar in Southern Greenland (present day Igaliku), there were also coastal trading sites that were only temporarily used during the summer months, such as Gásir in the North of Iceland. However, a solid harbour infrastructure was rare, as neither written sources nor the archaeological record provides indications for structures such as permanently built jetties or wharves [18, p. 130-131].

Since Greenland was settles directly from Iceland, and since both colonies shared a common language and were integrated into the same Norsemen realm after

1264, possibilities for nearly direct historical analogy are very apparently considerable. Around the year 874, the Viking chieftain Ingolfur Arnarson became, according to the Icelandic sagas, the first permanent northerner in Iceland. The saga also tells of Irish monks, but they left when the Norsemen came. However, the Norwegian chieftain Ingolfur Arnarson was not the first from the Nordic countries to visit and live in Iceland. The Icelandic sagas claims that the first Norse man who set foot in Iceland was a Norwegian from Agder named Naddoddur, but who only stayed on the island for a short time, and when he returned to Norway he called the island "Snelandet" (Snow country) [1, s. 68-71].

However, the difference between the colonization of Iceland and Greenland was quite striking. Whereas the pattern of the different settlements in Iceland seemed stable, the colonies in Greenland seemed more unstable. In Iceland, the majorities of the farms and the settlements had continuous habitation on the same site from very early times to present day in the 21st century. By comparison, the settlements and colonies of the Vikings and later the Norsemen in Greenland were of a very temporary nature. These differences come to light in different ways. However, there are two areas where differences are particularly noticeable: in the archeology and in the literature and documentary evidence.

In archeology, it is especially the availability of past deposits for the present day archeologists that prevail. In Iceland the earliest deposits of the Vikings are not easily accessible and the earliest settlements are often excavated sites of unsuccessful sites or sites that have been abandoned because of natural disasters, famine or other unexpected events in the area. While the archaeological record is therefore skewed towards the study of early failures of the Vikings and the Norsemen, the patterns of settlement themselves remain as evidence for early land-use decisions [1, s. 74-75].

On the other hand, the archeology of Greenland is different. The excavations are easily accessed, and the archeology is both rich and comparatively well-known. The Western settlements (around the present day city of Nuuk) and the more northerly of the two main Viking settlement clusters of colony were abandoned in the mid-14th century and the Eastern settlements (around the present day Narsaq and

Qaqortoq) had become deserted a century later. When then adding that these events have left two unique excavation sites and a unique archeological record which has only been damaged later by subsequent Inuit settlements and post-1700 Danish-Norwegian settlements and further colonization, you got an exceptional deposits of archeological objects and traces that is a real treasure, when you want to understand the areas Viking past. The archeological deposits are so easily to find and excavate that archeologists and ethnographers had analyzed the past of Iceland as well as Greenland and the two islands based on the same parameter. Something researchers have begun to question in the 21st century. To avoid the pitfalls of an a-historical and circular approach to complex historical and environmental interactions, the researchers should be clear about the temporal studies the different data and the differences between the different settlement in as well Iceland and Greenland [20, s. 139-145].

The other area is the literature or documentary evidence. Where the medieval Iceland is rich in documentary evidence with an exceptional wealth of narrative sources from the high middle ages and a substantial body of charters and estate records from the 14th century and onwards, Greenland is almost unknown in literature and in documentary evidence. However, the Icelandic (and two Greenlandic) sagas, the main narrative sources, allow for a general description of economic and environmental conditions in especially Iceland in the 12th and 13th centuries whereas the estate records and charters make a detailed analysis of land use, property divisions and ownership patterns possible by early 1300s. Furthermore, medieval data can be supplemented with very detailed human and livestock census data from the 1700s [10, s. 104-106].

Vikings and Greenland (985-1400)

By the mid-10th century Iceland was thus not so much over-populated as "over-chieftained". Sources of wealth that could gain prestige and honour for ambitious individuals and lineages were largely earmarked if not fully developed and contesting these claims could end in defeat and outlawry, as suggested in the very late and somewhat unreliable saga of Erik the Red. In the late 10th century Greenland was

therefore attractive to Icelanders not because of chronic land or subsistence shortage in Iceland, but because of a shortage of ways to gain prestige and honour in Iceland. Did the decision to settle Greenland spring entirely from Erik's failed aggrandizement in Iceland, or was there background in an earlier "untold saga" relating to hunting and Arctic prestige goods rather than to the land-hungry chieftain farmers so extensively featured in the later written sources now familiar to us? [22, p. 131-133].

The Norse discovery of Greenland's massive populations of walrus and other marine mammals, plus fur bearing animals and rare items such as falcons and narwhal tusks would have thus presented attractive economic opportunities to any Icelandic hunters by the mid-10th century. Erik the Red (the nickname Red was due to the colour of his beard) was a wealthy and important man in Iceland. But Erik the Red was involved in severe confrontations with among other persons, Eyvolf the Foul, about the killing of some of Erik the Red's thralls. The Icelanders later sentenced Erik to exile for three years for killing Eyvolf the Foul around 982. The dispute was resolved at the world's first democratic assembly, the Thing (Althing), which outlawed Erik the Red from Iceland from 982 until 985. During the exile he heard about the fabled land in the North – Greenland. Erik the Red and the settlers on 25 Viking ships are considered as the founders of the first Viking settlement near Qaqortoq in 985-986, called Brattahlid, in Greenland. Not the whole Armada reached the southwest coast of Greenland [12, s. 59-61].

Indications of the likely priorities of the Norse in Greenland, and the balance between trade and subsistence may be gained from the circumstances of the initial colonization effort. A written account of Erik the Red and the naming of Greenland, can be found in Islendingabok (Book of the Icelanders), a short chronicle of Iceland's early history, that was written between 1122 and 1133 by Ari Thorgilsson the Learned. In it the famous story is told that the land, which is called Greenland, was discovered and settled from Iceland. Eirik the Red was the name of a Breidafjord man, who went out there from here and took land in settlement at the place, which has ever since been called Eiriksfjord. He gave to this land a name, and called it

Greenland, arguing that men would go there, if the land had a good name. Apparently on the strength of this "sales pitch", Erik was able to mount a very large and successful colonization effort and took over some of the best agricultural land at Brattahlid in what was to become the Eastern Settlement [13, s. 38-39].

In Greenland it is apparent that the Norse did not simply apply proven subsistence strategies based on their prior experience, in Iceland or Norway. The early Greenlandic colonists did import cattle, sheep, goats, pigs and horses, and set up farms ultimately tied to the pockets of inner fjord pasture vegetation in the Eastern and Western settlements in a dispersed pattern of farms clearly tied to pasture resources. Despite this terrestrial base, zooarchaeology and isotopic study of human bones reveal the importance of marine mammals from the first stages of settlement. [8, s. 136-138].

However, Greenland was only one of the northernmost extensions of a Scandinavian expansion into the North Atlantic basin, that already began around 800. Exploiting a transoceanic maritime capability and a diversified and flexible subsistence economy, the Norse colonized the Faroe, Shetland and Orkney Islands, the Isle of Man, the Northern Hebrides, Iceland, Greenland and Vinland (Newfoundland) over a 300 year period. The Norse seems to have filled these island groups rapidly, altering mainland economies to fit diverse local conditions. While Vinland did not survive its first settlement phase and Greenland eventually expired as well, the Norse populations of the other Atlantic islands endured the fluctuations of the Little Ice Age of circa 1200-1840 and late-medieval economic depression, and persist to the present [21, s. 460-461].

However, the Norse colony of Greenland seems to have begun well enough. Encountering an unpeopled landscape, the Norse founded two separate settlements: the Eastern Settlement in modern Narsaq and Qaqortoq Districts in the extreme southwest (about 4000-8000 inhabitants) and a much smaller (about 1000-1700) Western Settlement in modern Nuuk District about 575 kilometers to the North. The life was different in Greenland. While the Icelandic population habitually ate fish of different kinds, the Greenlanders bone assemblages became increasingly dominated

by bones of reindeer and seals. Other differences between the two Viking colonies were the presence of a native people in Greenland and the Greenlandic aristocracy's missing power. By 1125 the Lawmen of the Greenlandic Assembly felt sufficiently prosperous to acquire a bishop from the Norwegian court and to build an episcopal manor and cathedral at Gardar in the Eastern Settlement (present day Igaliku). Around 1150 Norsemen, hunting far to the north of the settlements, encountered immigrating Thule Inuit moving southward. But never was a Greenlander elected to the office of bishop [16, p. 140-145].

Also, the opportunities to pioneer a new wave of settlement and become leaders in a new land most probably have provided the powerful motivation necessary for launching a major and hazardous colonization effort. The initial fleet assembled by Erik the Red, and subsequent fleets of ships and colonists must have represented a very significant capital investment in the 10th century in Iceland. The timing was probably critical. Iceland had been colonized sufficiently early in the Viking Age, that its own potential for providing prestige trade items was effectively exhausted, yet Icelandic settlement was sufficiently well established to mount a substantial colonization effort and, above all, the European market for ivory and fur was buoyant and favorable in the late tenth and early eleventh centuries present-day [19, s. 268-270].

Arctic hunting certainly did not decline with the establishment of farming communities in the inner fjords of southwest Greenland. There are several lost poems describing hunting trips to the Disko Bay, and surviving accounts record the number of weeks of travel required to reach the distant hunting grounds from the Western Settlement and the larger Eastern Settlement further South. These long summer voyages deprived the farming communities to the South of vital adult labor and scarce boats for one of the busiest parts of the agricultural year, but they continued nevertheless throughout the history of Greenland. Fragments of the dense maxillary bone surrounding the deep-rooted walrus tusks are concentrated on high status sites in both Western and Eastern settlements. Final extraction of the ivory and its

preparation for export was thus a dispersed winter cottage industry on most farms and a major household chore on the larger magnate farms [19, s. 280-281].

In addition to their herding/hunting subsistence round, the Norse Greenlanders carried on a transatlantic trade with Europe and a remarkable long-range hunt to maintain it. The low-bulk, high-value arctic products like walrus ivory and hide and polar bear skins were what lured traders on the dangerous Greenland run. While a few walrus and polar bear occasionally entered the settlement areas, the richest hunting grounds for these species were always around the Disko Bay, some 800 km North of the Western settlement. This was the area of the northernmost hunting ground, and this distant resource space was very much part of the Norse economy. A large excavation on the Nuussuaq peninsula in the Disko Bay area gave one evidence of Norse presence. Another is a runestone found at Kingittorsuaq, in the South Central part of the Upernavik archipelago, far North of the Disko Bay area, which dates to May 2, 1333. Faunal evidence from home middens far to the South also suggests expeditions to the Nordrsetur. Worked pieces of walrus skull, especially the maxilla around the tusk root, and penis bones are found in nearly all collections. Walrus post-canines provided raw material for buttons, chess pieces and tiny walrus and polar bear figurines. The exportable tusk ivory itself is extremely rare in Norse collections of animal bone or artifacts. Polar bear remains are nearly as widespread as walrus. These usually consist of phalanges or other elements likely to be left in a hide by rough field-processing.

This residue of final finishing of tusk and hide found on so many home sites strongly suggests that members of most farms participated at one time or another in this dangerous and time-consuming hunt. The scale of the northern hunting is further revealed by the special crusade tax of 635 kilograms of ivory paid by Norse Greenland in 1327. What was bought for this expenditure of scarce time, boats, and lives? Imports included iron and wood, stained glass, church bells, and rich church vestments. Iron and wood were necessary for dally subsistence tasks, as Greenland's driftwood resources did not extend to the large-scale charcoal-making that would have made extensive local smelting feasible. Smelting of Greenlandic bog ore was

attempted on a few large farms, but whalebone padlocks, belt buckles and a bone battle-axe indicate how chronically the demand for metal exceeded supply [11, s. 202].

West Greenland's long coastline is broken into a series of island-like pockets by deep fjord systems, glacial arms of the inland ice, and rugged mountain ranges. Floral communities range from polar desert lichen in the northeast to relatively lush copses of dwarf willow in the low-arctic areas of the extreme southwest. West Greenland's climate is largely controlled by mixtures of the warm, north-flowing Irminger current – an offshoot of the North Atlantic Drift with the colder, south-flowing East Greenland and Labrador currents. Variations in amount of cold East Greenland water and ice carried up the west coast by the Irminger current have major effects on both marine and terrestrial ecosystems throughout the Southwest. In the Southwest, there is marked contrast in climate and flora between a widespread oceanic-maritime coastal zone and a few pockets of continentality in the inner reaches of a few fjord systems. The oceanic zone is characterized by cool summers and moderate winters, high precipitation, and sparse vegetation. The continental pockets nearer the ice cap have warm summers, very cold winters, lower precipitation, and support the richest flora in Greenland. These rich pastures clearly attracted the Norse settlers. An analysis of the location of individual farms indicates that minimization of distance to high-quality pasture rather than maximization of access to easy landing spots or fiord-side resources repeatedly determined the specific farm site.

For the Norse subsistence economy June was probably the cruelest month and early spring the most difficult season. Norse domestic animals, especially the cattle, spent most of their lives inside heavily insulated turf and stone byres. Throughout the North Atlantic cattle were bred in late autumn and spent the winter nearly immobile, standing in a growing pile of their own dung. This confinement reduced fodder consumption to an absolute minimum, though milk production must have ceased by midwinter. Norse cattle were generally tiny animals whose endurance was probably as important as their milk yield. Spring thaw would probably bring the lifting days

when groups of men went from farm to farm carrying emaciated cattle out of the byres and starting them on early spring pasture. Sheep and goat sheds, concentrations of sheep and goat dung in farm buildings and middens, the life cycles of parasites preserved within the dung and the absence of upland shelters all indicate that most Norse sheep and goats also wintered close to the farms. These close herding contrast with recent Icelandic practice of out-wintering and would have increased fodder requirements during Greenland's more continental winters. Numbers of neonatal cattle, sheep and goat bones recovered suggest either chronic stillbirths among the parasitized, undernourished stock or a critical spring shortage of dairy produce for human consumption. Scandinavian stock raising was clearly near its limits in Greenland, and a long winter would severely test the endurance of both the Norse and their stock. This seasonal low point may explain the importance of the migratory seals to the Norse economy.

While faunal evidence indicates that some caribou were killed year-round, modern caribou seasonal movement and fat levels, several researchers suggest that an autumn hunt may have been a feature of the Norse subsistence cycle. Communal caribou drives, probably involving cliffside jump traps and long-limbed deerhounds, may have closely followed communal harvesting of guillemots during their late August flightless phase, these are by far the most common bird remains in the collections. Without the documentary evidence and the Norse finds in Inuit contexts, we would have little indication that the two cultures ever met. Though the Norse inhabited a treeless arctic island and relied heavily upon seals, they never adopted efficient, arctic-adapted Inuit skin clothing, skin boats, or toggling harpoons. Frozen clothing at Herjolfsnes (Ikigait) (near present day Narsarmijit) near Cape Farewell and elsewhere indicates that the Norse kept to the latest European fashions in woolen gowns, caps and trailing liripipe hoods. Boat parts and a steatite boat model indicate the persistence of Scandinavian traditions of clinker-built wooden boats. The absence of harpoons from Norse artifact inventories is further suggested by the near absence of the ringed seal from the Norse middens.

Vikings and North America (1000-1350)

The clearest and most complete narrative of the discovery of Vineland, preserved in the ancient Icelandic literature, is that presented in the Saga of Eric the Red. Of this narrative two complete vellum texts have survived. The eldest of these texts is contained in the Arna-Magnæan Codex (No. 544, 4to), which is commonly known as "Hauk's Book". This manuscript has derived its name from its first owner, for whom the work was doubtless written, and who himself participated in the labour of its preparation. This man, to whom the manuscript traces its origin, has, happily, left, not only in the manuscript itself, but in the history of his time, a record, which enables us to determine, with exceptional accuracy, many dates in his life, and from these it is possible to assign approximate dates to that portion of the vellum which contains the narrative of the discovery. This fact possesses the greater interest since of no one of those who participated in the conservation of the elder sagas, have we data as precise as those which have been preserved. However, also the accounts of two sagas, collectively known as the Vinland Saga, differ significantly but both indicate that sometime around the year 1000, Vikings from Greenland sailed West and came across a new coastline, which they explored and finally attempted to settle [12, s. 59-61].

The earliest known cartographic representation of North America had for many years been the Canerio map, drawn by a Genoese mapmaker around 1503. The map mentions the site of Vinland (Vinlandia) for the first time in history. On the hand, the map bears a series of interesting inscriptions, which seem to support the idea that the mapmaker had read texts from the Vinland Saga. One of the inscriptions says: "By God's will, after a long voyage from the island of Greenland to the South toward the most distant part of the western sea, sailing southwards amidst the ice, the companions Bjarni and Leif Eiriksson discovered a new land, extremely fertile, and even having vines, the which island they named Vinland. Eric, legate of the Apostolic See and Bishop of Greenland and the neighbouring regions, came to this vast and very rich land in the name of God the Almighty in the last year of our most blessed

father Pascal, remained a long time through both summer and winter, and returned north-eastward to Greenland" [9, s. 120-123].

Apart from the obvious reference to as well the Vinland Saga as to the actual discovery of North America, the map's annotation mentions bishop Erik Gnuppson Upsi, who is very well-known from the Icelandic Annals to have gone to Vinland in 1121. Father Pascal is the reigning Pope Pascal II (1099-1118).

Leif Erikson (970-1020), a Viking explorer and son of Eric the Red, is commonly thought to be the first known European to have set foot on continental North America. According to Eric the Red's Saga, Saga of the Greenlanders and the Vinland Saga, Leif Erikson established a Norse settlement at the coastal line of the present day Canada. Vinland is usually interpreted as being coastal North America. Commonly, there is a speculation that the settlement made by Leif Erikson and his Viking Greenlanders corresponds to the remains of a settlement found in the coastal Newfoundland called L'Anse aux Meadows and which was founded around the year 1000. New Scientific studies and later archaeological evidence suggests that Vinland may been the area around the Gulf of Saint Lawrence and that L'Anse aux Meadows colony only was a ship repair station around 1,000 kilometers East of the Gulf [16, p. 199-205].

The earliest foreign mention of Vinland appears in the work of the historian, Adam of Bremen, called *Descriptio insularum aquilonis*. The material for this work was obtained by its author during a sojourn at the court of the Danish king, Svend Estridsson, after the year 1069, and probably very soon thereafter, for his history appears to have been completed before the year 1076, the date of king Svend's death. The most important manuscript of Adam's longer works, the *Gesta Hammaburgensis ecclesiæ pontificum*, is the *Codex Vindobonensis* deposited in the Imperial Library of Vienna under the number 413. This manuscript, written in the 13th century, also contains the complete description of the Northern islands, which is partially lacking in the fine manuscript of the same century, contained in the Royal Library of Copenhagen [20, s. 155-158]. This description was first printed in Lindenbruch's edition of Adam's work, published in 1595, and is the first printed reference to

Vinland, being as follows: "Moreover he spoke of an island in that ocean discovered by many, which is called Vinland, for the reason that vines grow wild there, which yield the best of wine" [5, p. 67].

One reality is the different Norsemen sagas, another reality is the missing (or almost missing) evidence in L'Anse aux Meadows. Today in 2020, the area mostly consists of open grassy lands; however, 1000 years ago there were big forests that were convenient for boatbuilding, house building and iron extraction. The archeologists have found the structure of eight buildings. They are believed to have been constructed of sod placed over a wooden frame. Based on different artefacts, the 8 buildings were identified as dwellings or workshops. Buildings for a chieftain, people of lower status, thralls and shopkeepers were defined. The usual iron smithy with a small blast furnace containing a forge and iron slag, a carpentry workshop with wood debris and a specialized boat repair area containing worn rivets were defined, too. Other things found at the site consisted of common everyday Norse items, including a stone oil lamp, a whetstone, a bronze fastening pin, a bone knitting needle and part of a spindle. Stone weights may have been part of a loom. The presence of the spindle and needle suggests that women as well as men inhabited the settlement.

The found of the Kensington Runestone in the rural township of Solem in the Douglas County in Minnesota increased the interest in Vikings in North America, especially the United States. The Stone weights 92 kilos and is a slab of greywacke covered with runes on its face and its sides. The runestone declares: "We are 8 Swedes and 22 Norwegians on a journey of exploration from Vinland westward". The inscription purports to be a record left behind by Scandinavian explorers in the 14th century (internally dated to the year 1362). There has been a drawn-out debate on the stone's authenticity, but the scholarly consensus has classified it as a 19th-century hoax since the time it was first examined in 1910, with some critics directly charging the purported discoverer Olaf Öhman with fabricating the inscription. Nevertheless, there remains a community convinced of the stone's authenticity. If the Kensington is genuine, the runestone bears one of the longest runic inscriptions found to date anywhere in the Viking World. The carving of such a runestone would have

taken a considerable time. Maybe not the activity you expect from a small Viking party exploring in hostile territory many days or even weeks journey from L'Anse aux Meadows.

However, the most conclusive evidence that L'Anse aux Meadows was really a Viking site around the year 1000, came from the 125 artefacts that the Norwegian archeologist Helge Ingstad and his wife Anne Stine Ingstad found, in the 1960s, around 100 of these were iron nails or typical Viking nail fragments, not a material available for the native Indians in the area. Later Canadian archeologists, Parks Canadian, had found almost 700 items or wood debris all over the excavation site of L'Anse aux Meadows.

What kind of Viking site was L'Anse aux Meadows for the Vikings? Indeed, not a place with farms or an agricultural focal point. Instead of being colonizing venture, it seems more likely that L'Anse aux Meadows was a kind of staging-post or gateway to the rest of Vinland with a population of around 70 Northerners. Ice conditions in the seas around Greenland meant that it was not possible to sail from the island until midsummer and so, in order to avoid being stranded, the return voyage from the Canadian coasts had to be completed by October. Considering these facts, a voyage with a Viking longship would have taken two weeks for the Norsemen. However, the wisdom of having a secure base to act as a platform from which to explore the rest of Vinland is very evident and typical Viking strategy. Furthermore, there are many signs that some of the northerners came from Iceland. Typical Icelandic flint-like tools (fire-starters made from jasper) have been found on the site.

The site of L'Anse aux Meadows is not the only site mentioned in the Viking Sagas. The occurrence of three different named sites, Leifbudir, Straumsfjord and Hop, does present complications for the scientists. Candidates for especially Straumsfjord have included L'Anse aux Meadows itself and the Avalon Peninsula of Southern Newfoundland, while scientists and archaeologists have sought hop in places as Saint Paul's Bay on the Gros Morne Peninsula, some 200 kilometers South of L'Anse aux Meadows and on places near the Hudson River.

As to how and when the Viking colony in Canada died out, the picture is much clearer. The evidence both from sagas and L'Anse aux Meadows suggests that the period from Leif Erikson's first landing in Vinland to the final exploratory voyage was around 20 years, and it looks like that these were not followed up by further large-scale expeditions. However, the Vikings came back after the year 1020. The Vikings visited the North American coasts in the following centuries. An analysis of parts from ships unearthed at Norse ruins in Greenland showed that 6 out of 10 samples were made from larch, which not found there, but native in North America. Furthermore, in the Western Settlement in Greenland, fragments of bison hair and fibers from the fur of brown and black bears were found, which originate from North America. The found of the Maine penny is also an indication of the Vikings travelling to Vinland and contacts with the native traders after 1020. The Maine penny, also referred to as the Goddard coin, is an original Norwegian silver coin dating to reign of King Olaf Kyrre of Norway (1067-1093). It was discovered in Brooklin in Hancock county in Maine in 1957. Near Penobscot Bay on the coast of the Atlantic Ocean at an old native American trade site. One of the best evidences of Pre-Columbian trans-oceanic contact.

Also, the Viking sagas tell of various other voyages to Vinland, particularly of one in the year 1011. In 1121 it is stated, in various places in the sagas that a bishop named Erik Gnuppson Upse (see above) went to find Vinland. All we know with certainty is that he "started for Vinland". However, it is by no means likely that the church would send a bishop to Vinland before a colony was planted there. We know now by the manuscript reports shown among the Vatican Exhibits at the 1904 World's Fair, that the Catholic See of Greenland extended its jurisdiction over all the new discoveries of Lief and Thorvald, and Karlsefni. It was common for priests to accompany voyages, but bishops took charge of the Church interests of colonies and, therefore, by the sending of bishop Erik Upse to Vinland it is reasonably certain that a colony had been planted there and was maintained for several years. This inevitable conclusion is fortified, if not confirmed, by references contained in official reports made by the bishops of Greenland to the Church at Rome. The last expedition

mentioned in the sagas was in 1347, 145 years before the rediscovery by Columbus. In that year it is stated that a vessel came from Markland (Nova Scotia) to Iceland with a cargo of wood. However, it was recorded that the longship of a certain size was blown off course. The purpose of the expedition is without doubt, timber. According to the Vinland saga, Markland had an abundance of timber, without it the Norsemen had to rely on driftwood, which was rare in the Arctic area. But the year 1347, this carries us down to a memorable period in European history. It brings us to the breaking out of the terrible black plague, or Black Death. The ravages of the black plague were so enormous, that so much decimated the population of all European countries that much time was required for recuperation. Also, the areas of the North with other words it would have been very likely to encounter a Norsemen landing party engaged in a humdrum activity of chopping down trees for building wood in Nova Scotia or Newfoundland, 150 years before Christopher Columbus discovered America [3, s. 117-121].

The extinction and settlements declining – why?

Changing trade, a key motivation for the settlement of Greenland by the Norse was to gain access to walrus ivory and furs; characteristic items of early Viking low-bulk, high value trade in prestige goods. In the late 10th and early 11th centuries when the Norse Greenland settlements were becoming established the European market for ivory and fur was buoyant and favourable. Economies changed. The development and expansion of the trade in dried Atlantic cod around 1100 was to have widespread economic impacts throughout Europe, which probably did not work to the advantage of the Norse Greenlanders who did little if any fishing. In the Middle Ages, Hansa merchants in collaboration with Novgorod and other Russian city states developed the fur trade from the Baltic region northwards into the White Sea. Elephant ivory from Africa began to provide unbeatable competition to walrus ivory in European markets and, perhaps most importantly, religious art increasingly moved away from the use of ivory.

The Black Death of 1347-1351 and subsequent plagues heavily depleted the population in Europe including Norway and the other Scandinavian countries the loss

of 30-50% of the population led to an economic collapse. Other developments could have also further eroded the trade position of the Greenlanders: the development of hemp ropes, for example, may have effectively replaced a market for cables made from walrus hide. Add increasing operational difficulties in Greenland, caused by colder, stormier weather and more sea ice, to a fundamental erosion of the Norse Greenlanders' economic position, then, their situation could have become dire. Under these circumstances it is probable that the limits of adaptation were defined by the constraints of adaptation through enhancement and intensification of existing activities. In other words, more effort into making established practice better or more efficient could not on its own meet the challenges faced by the Norse in 14th and 15th Century Greenland. Worse still, even their ability to carry on "business as usual" could have been fatally undermined by population decline [11, s. 203; 14, p. 246-248].

The end of Norse Greenland sometime in the mid-late 15th century is an iconic example of settlement desertion commonly attributed to the climate changes of the "Little Ice Age" combined with a generalized failure to adapt. The idea of chronic Norse adaptive failure has been widely accepted, in part because other peoples in Greenland (the Thule Inuit) survived through the period of Norse extinction. Human settlement of Greenland was possible through the climate fluctuations of the 13th to 17th centuries, despite increasingly well documented changes in temperature, probable growing season, sea ice, storminess, and sea level. The Inuit achieved sustainability during this period of instability and change, but the Norse did not. It is assumed there must have been some degree of Norse maladaptation or more constrained limits to their adaptations than those of the Inuit, and the Norse are seen to have "chosen extinction". We suggest that the picture emerging from recent and current research is far more complex, and propose that the Norse had achieved a locally successful adaptation to new Greenlandic resources but that their very success may have reduced the long term resilience of the small community when confronted by a conjuncture of culture contact, climate change, and new patterns of international trade. The reasons for the final collapse of Norse Greenland are still incompletely

understood, but new data from Greenland and across the North Atlantic, combined with changing ideas and developing cognitive frameworks are refining and deepening our understanding on both adaptation and its limits [7, s. 212-216].

It is apparent that the Norse in Greenland did adapt to changing conditions, through the increasing utilization of marine mammals. That these adaptations were insufficient to ensure the survival of society may be inferred from the final collapse of Norse settlement, but their limited ultimate effectiveness may be best understood in terms of a failure of resilience "the ability of a system to maintain its structure in the face of disturbance and to absorb and utilize change". One possibility is that the initial Norse colonization and settlement of Greenland was followed by a rising level of connection, intensification and investment in fixed resource spaces, social and material infrastructure which increased the effectiveness of adaptation but at a cost of reduced resilience in the face of variation [4, p. 22-24].

Fluctuations in Greenland's climate have long played a role in speculative explanations of Norse extinction. However, geophysical and palynological data have only recently provided enough detail to allow small-scale modeling of the response of Greenlandic ecosystems to short-term changes in temperature, precipitation, and circulation. Different ecological models indicate that common seals would be likely to extend their breeding colonies to the extreme southwest (the Eastern Settlement area) during the prolonged stable warmth of the little climatic optimum, and retreat to their refuge in the fjords of the Western Settlement area during periods with heavy East Greenland drift ice. Our stratified faunal collection from the Eastern Settlement site in contrast, hooded seals would be expected to byred domesticates would be spared the worst effects of the winter storms, and valley-bottom farmers might see real improvement in their summer pastures. However, such improvement would be less evident on hillside farms, while persistent spring snow cover and increased summer precipitation could disastrously extend winter byring and reduce vital summer milk production and hay collection [4. p. 22].

Declining bone frequencies of all terrestrial species in both settlements may reflect such worsening conditions in the inner fjords. Such small farms with poorer,

steeper pastures, less substantial byres, barns, and dwellings, and scantier storage would be the first to feel the effects of reduced caribou populations and unpredictable extensions of byring. The intrusive oceanic storms, whose precipitation may have altered inner fjord flora and disrupted the inner fjord continental regime, which might also increase the hazards of inshore navigation. The longtrip to the most remote sealing grounds (often through steep-walled mid-fjords with no safe anchorage and evil modern reputations for shipwreck) would be made significantly more dangerous by more frequent spring storms. Day-to-day communication within the inner fjord settlements would likewise be disrupted by such increasing storminess. As we have seen, the Norse economy in Greenland was a skillful balancing act, coordinating communal concentrations of labor and seasonal abundances of terrestrial and marine resources. The economy lacked the buffering effects of storable grain and was beyond the range of significant famine relief from Europe. Spacing of resource zones constantly exacted movement costs and complicated the tight scheduling of summer subsistence activity. Such an economy would work best in stable periods of high resource predictability and would be as much disrupted by periods of instability as by extremes of cold or precipitation. Inuit competition; declining contact with Europe (the result of Hanseatic competition as well as increasing drift ice): rising costs of exploitation of outer fjord, and inner fjord resources; declining caribou hunting, stockraising, and seal hunting conditions; and declining predictability of all resources would pose significant threats to the Norse economy as we understand it. The question, then, is whether the coincidence of all these factors in the 14th century explains the contraction and collapse of Norse society in Greenland [16, p. 171-179].

There is little doubt that the Greenlandic Norse economy, as established in the little climatic optimum, faced serious if not fatal challenges in the 14th century. With full inner fjord resource space, heavy investment in ceremonial architecture, and strong linkages to distant and increasingly disinterested European markets, Norse society of circa 1300 showed a dangerous lack of resilience in the face of waning extractive efficiency, fluctuating resources, and Inuit competition. Norse reaction to these challenges seems to have been an intensification of existing strategies.

Was this process inevitable? If not, why did it happen? 14th-century West Greenland was by no means destitute of resources, nor were the fluctuations of the Little Ice Age so severe as to make the island totally uninhabitable. While the Norse colony waned and died, the Inugsuk Inuit hunters spread and prospered. As the modern catch data suggest, the Norse never fully exploited the ringed seal so common in their very inner fjord strongholds. The economic option of permanent occupation of the alternatively, the Norse could have moved entirely to the coast, establishing seal and whale hunting stations and expanding their fishing efforts. A settlement pattern like the modern Danish-Greenlandic towns would be the likely result. Friendlier relations with the Inuit could have evolved into the sort of intercultural trading that proved so profitable to the Dutch in West Greenland by 1600. Thus, to attempt an answer, let us consider the likely source of economic decisions in Norse Greenland at the beginning of the Little Ice Age. Multiple lines of evidence indicate the existence of powerful, partly ecclesiastical elite in Norse Greenland. These elite seems to have occupied ecologically favored locations in the inner fjords, consumed a disproportionate share of imported goods, and operated domestic economies significantly different from the poorest Norse farmers. The diversion of labor and capital that turned precious summer days and hard-won tusk into stone walls and bronze church- bells and produced the centrally planned churches and cathedral of later medieval Greenland testifies to the power and authority of the ecclesiastical elite

Conclusion

In Norse Greenland successful subsistence strategies were developed and underpinned a well-integrated settlement. Ultimate failure may be attributed the combination of cultural, economic and environmental changes at local, regional and continental scales compounded by hostile relations with the natives. Furthermore, unpredictable shifts in local climate and sea ice could have compromised both terrestrial resources and raised the costs and hazards of the utilization of marine mammals. The progressive Inuit expansion from Northwestern Greenland into the coastal areas of Western and Southwestern Greenland resulted in new cultural

contacts and the potential for conflict to disrupt key Norse activities such as access to the Northern Hunting grounds and the spring seal migrations. The communal organization of seal hunting and probably many other subsistence activities in Norse Greenland effectively buffered individual households against shortfall and occasional loss of life at sea, but carried with it the potential for an extreme disaster producing cascading labor shortages encompassing the whole community. Given the small size of the Norse community and the multiple demands upon labor and boats, any set of factors increasing cost and risk had the potential for exceeding buffering limits. The lack of effective multi-year food storage, the recurring shortage of active adult labor, the demands of the increasingly unprofitable sailings to the most remote areas and the diffuse or direct competition from the locational flexible Inuit would certainly have posed daunting challenges to the Norse annual managerial balancing act. If even a few ambitious and able Greenlanders did emigrate back across the Atlantic their absence may have been disproportionately felt by the dwindling community left behind, and imported disease need not have been terribly virulent to have damaged this fine balance of producer and consumer.

The choices made during the initial Norse colonization and settlement of Greenland, followed by a rising level of connection, intensification, and investment in fixed resource spaces, social and material infrastructure, increased the effectiveness of adaptation but at a cost of reduced resilience in the face of variation. We propose that the limits of the Norse Greenlanders ability to adapt to climate change was caused by a series of interrelated factors; firstly the success of the provisioning strategy based on seal hunting was such that initial changes in climate could be met with an intensification of existing practice, with a hidden cost of reduced resilience. When faced with rapid changes in a combination of both natural and human factors the limitations of the pathway chosen were probably too great and social collapse was the result. Certainly any reduction of the total population past a minimum threshold needed to carry out effective communal seal hunting would have triggered a terminal subsistence crisis, and any widespread breakdown of law and community cohesion would probably have been equally fatal.

Physically the Norse faced risks to their survival and prosperity. Longer winters were harder on the slowly dying smaller Norse cows. More sea ice made breathing holes difficult for the ring-neck seal, which the Thule followed down the coast. Peaceful interactions between the Thule and Norse disappeared in competition for hunting grounds, particularly in the slaughter of Norse domestic animals by the Thule. Economically, the Norse faced equally important conflicts. Restrictions on shipping from the Norwegian crown diminished their ability to ship trade goods, except to the Eastern Settlement, which used the profit to support an extensive ecclesiastical building program, at odds with Viking values. The Roman Catholic Church wanted the best farmland and ownership of privately built churches. The Norse paid their last of increasing taxes and tithes in 1327, with no priests, no sacraments and no desire to support a system that ignored them.

Leaving Greenland meant the third move by the Norse away from civilization to a Western new world in less than 500 years. In the 870s they left Norway for Iceland, fleeing the violence of a new king. Icelanders never voted for another king and remain the world's oldest democracy. In 986 Erik the Red led 25 ships to Greenland, seeking new land for farms, but also freedom from the blood feuds of Iceland. Finally, in the 1340s, the Western Settlement left civilization for the new world, never to return or be heard from again. They had a communal system and rapidly mounted a full-scale evacuation of the core of the settlement, taking the fastest, safest sailing route across Davis Strait. Feeling threatened both physically by the Thule and climate change, and economically by the Norwegian crown, the Roman Catholic Church, and the highly Europeanized Eastern Settlement, the Norse in the Western Settlement voluntarily left en masse for the new world, probably in 1342.

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