

EARLY INTRUSION OF AGRICULTURE IN THE NORTH ATLANTIC SUBARCTIC REGION

GUDMUND HATT

INTRODUCTION

In the eastern part of the North Atlantic region, farming is carried on farther north than in any part of the world. The reason for this is partly climatic, for the isotherms are pushed northwards by the Gulf Stream. However, this is not the whole explanation. In northwestern Europe farming is pursued near to the arctic limit, if this is fixed at the July isotherm of ten degrees Centigrade, which is close to the northern limit of trees (Vahl and Humlum, 1949). In Norway, farming is carried on near to that limit and in Iceland, although just south of the Arctic Circle, on or beyond the limit of trees.

This extension toward the north is not a recent feature. About one thousand years ago, the farming culture of North Europe made a push towards the arctic, reaching Iceland and even Greenland. The Icelanders are still a farming community. Greenland was retained by Norse farmers for 500 years, although corn production was impossible there.

Northwest European farming was better prepared for this thrust into the sub-arctic than any other farming culture. The ancient American farming, the maize agriculture, met its climatic limit a little north of the St. Lawrence Valley. East Asiatic farmers, rice cultivators, met their climatic bounds in more southerly latitudes. Neither maize nor rice agriculture had any natural possibility of ever reaching the arctic. Wheat agriculture had better prospects. Wheat may succeed in very northerly latitudes, and its satellite or substitute, barley, is still more hardy.

However, it was not agriculture in the strict sense of the word that took Norse farmers into the far north. What these expansive farmers sought and found was not grain land, but pastures. The need of new pastures, and also the desire for new hunting and fishing grounds, impelled the Norsemen to occupy and settle Hålogaland, the islands north of Scotland, the Faeroes, Iceland, and Greenland. In this northward movement they carried agriculture with them as far north as nature allowed, and they supplemented their own scant grain production by importing quantities of grain from more southerly latitudes. In their great days of youth and power, the Norse colonists were great seafarers and traders. This position could not be maintained very long, because the settlements lacked material for shipbuilding. This deficiency was conducive to political and economic dependence, and for Greenland— isolation, starvation, and ruin.

The great Norse expansion was made possible by the cultural versatility of the Norse farmers. This versatility was, to some extent, present everywhere in northwest Europe. The old farming culture was rich and many-sided.

When neolithic agriculture reached northern Europe, wheat and

barley, in several varieties, were its most characteristic plants. However, the neolithic farmers of northern Europe were not only plant cultivators, but they were also stockbreeders; they had cows, pigs, and sheep, also goats, and later on, horses. Animal husbandry was in great parts of Scandinavia more important than the raising of corn. For Norway, Hasund has maintained that grain production was, in most places, only of secondary importance until the time of Christ (Hasund, 1933, p. 169). This seems to hold good also for large parts of Sweden and Finland. On the other hand, in southern Sweden and in Denmark grain production was of great importance aside from animal husbandry.

An intensification of farming took place in Scandinavia in the Iron Age. This intensification seems to be a human response to the climatic change which set in at the transition from the Bronze Age to the Iron Age, about 500 B.C. The sub-boreal climate of the Bronze Age was succeeded by the sub-atlantic climate, which was moister and cooler. The summer temperature was lowered; the winters brought more snow than before (Nordhagen, 1930; Jessen, 1935; Faegri, 1942).

This climatic change had a great influence upon natural vegetation and also upon farming. The upper limit of the pine forest in Scandinavia sank somewhat but the birch forest could stand the change better. The belt of birch trees in the Scandinavian mountains seems to be due to the sub-atlantic climate, and it has a greater vertical extension in western Norway's oceanic climate than in the more continental parts of Scandinavia. In Denmark, the beech forest expanded, the oak forest receded, and the calluna heath got its great chance under the cool and moist sub-atlantic climate.

Cereal culture suffered. Wheat, which had been very important in neolithic times, was pushed back. It seems that the relative importance of barley was already increasing during late neolithic times. In the late Bronze Age, barley was the most important grain in Denmark, and in the early Iron Age it was still more dominant. Oats made its appearance in the Bronze Age and prospered greatly in the early Iron Age, favored by the oceanic sub-atlantic climate, especially in western Jutland, and probably also in western Norway.

Animal husbandry must also have suffered from the effects of the climatic change. To begin with, we have reason to believe that no stables were used in the Stone Age and the Bronze Age, the animals staying in open air the year around, the sub-boreal winters being mild and not very snowy. Under the sub-atlantic climate, the natural conditions of such a primitive form of husbandry deteriorated. The snowy winters made it difficult or impossible for the cattle to survive without protection, shelter, and feeding.

Evidently, the climatic change brought in its train serious difficulties for the farmers. These difficulties were met by technical improvements.

It became necessary to keep the cattle in stables during the winter and feed them. In Jutland, the stable was simply an extension of the dwelling house. We know the early Iron Age house of Jutland with

human habitation in the west end and the stable in the east end. There were two rows of cow stalls in the stable. The floor of the stable was a little lower than the floor of the dwelling part; often the east end was sunk into the ground about one-half meter (Hatt, 1937, 1938, 1943).

The custom of keeping the cattle under the same roof as the human habitation is found in Jutland and south of Jutland. It has also been pointed out in Iron Age house sites in Rogaland in southwestern Norway (Petersen, 1933, pp. 105-106). However, in Norway and Sweden it is the custom to keep cattle in separate buildings, and so it was already in the Iron Age, as is known from many excavations.

The harvesting implements from the Iron Age show an increased interest in the gathering of fodder. The scythe appears, in its oldest form, short-handled and evidently derived from the sickle. Throughout the Iron Age, both of these implements were in use: the sickle for the harvesting of grain, the scythe for cutting grass (Steensberg, 1943, pp. 100-114).

The reaping and collecting of foliage for winter fodder came next in importance to the making of hay. The sickle was used not only for harvesting cereals, but also for cutting foliage. A special implement, the leaf knife, was much used in some places.

The custom of feeding the cattle and keeping them in stables during the winter made it possible to collect manure, which might be used in the fields. And so the more careful tending of the cattle made it possible to improve agriculture. We have reason to believe that the farmers of the Stone Age and the Bronze Age had to abandon their fields after a few crops and take up new land. The use of manure made agriculture more permanent, and habitation more stable.

The intensive and permanent agriculture left visible traces upon the surface of the land. The primitive plow or *arð* moved the soil, the fields got a flat basin-shape, and they were separated by lynchets or balks. In some parts of the Jutland heaths, deserted fields from the early Iron Age may still be seen (Hatt, 1949); these are very similar to the ancient fields which archaeologists in southern England have termed "Celtic fields".

It has been argued that the remarkable development of husbandry in the early Iron Age might to some extent be due to cultural influences from the Roman Empire, where indoor feeding of cattle, manuring of the fields, and, on the whole, a very rational farming technique was found. Such influences may perhaps have reached northern Europe (Steensberg, 1943, pp. 179-180). However, it should be noticed that the great farming improvements in Jutland took place in the pre-Roman Age, at a time when the Celtic peoples obstructed the cultural connections between Rome and Scandinavia.

Indoor feeding of the cattle during the winter time was used in the Iron Age not only in Jutland, but in Norway and Sweden as well. On the Norwegian coast, the climatic change hardly brought any deterioration of the pasture, rather an amelioration, because the pine forest was restricted (Brøgger, 1933, p. 29). Inland, the cold and snowy

winters made the technical improvements of the Iron Age, the stables and the indoor feeding, especially useful. The Iron Age brought a sort of inland colonization, which gained impetus in the younger Iron Age, after 600 A.D. in the so-called Merovingian Age and the Viking Age. In Norway, archaeological finds of sickles, scythes, and leaf knives are especially numerous after 600 A.D. However, these harvesting implements are less conspicuous in the grain producing parts of the country, like the fertile landscapes at the Oslo Firth and in inner Troendelagen. More important are the finds of scythes and leaf knives in the inner valleys where cattle farming is, and was, predominant over grain production (Brøgger, 1933, pp. 70-72). Evidently, the inland colonization occupied the valleys and utilized also the mountain plateaus, especially the rich pastures of the birch forest and above the limit of trees.

The mountain pastures were utilized in the Iron Age, as now, by means of secondary farmhouses or shealings (Norwegian: *sæter*; Swedish: *fäbod*), used temporarily during the summer. The distance between the main farm and the *sæter* may be considerable. The moving of cattle and people between the main farm and the *sæter* may require more than one day. This Scandinavian utilization of mountain pastures, a parallel to certain forms of *Alpenwirtschaft* in Switzerland and elsewhere, reaches back to prehistoric times.

Bjørn Hougen has set forth the hypothesis that a sort of cattle-nomadism existed in Scandinavia during the Bronze Age and in late neolithic times. Archaeological finds prove the existence of a sparse inland population already in these periods; and Hougen thinks that this inland population may have been nomadic cattle farmers who spent the winters in the mild coastal region, and the summers in the inland valleys (Hougen, 1947, pp. 85 ff). This hypothesis has some plausibility. The winters were hard and snowy in the Scandinavian inland, also under the sub-boreal climate. We can hardly assume that stables were known before the Iron Age.

The pastures were not the only natural riches that drew people into the mountains. The wild game and the fish in the lakes attracted hunters, trappers, and fishermen. The iron ore of the bogs in the mountain plateaus attracted smiths who produced iron from the bog ore by means of charcoal which they made in the woods. Now, it was partly the same people who herded cattle, hunted, fished, and made iron. The Scandinavian farmers were versatile, and they had to be so, in order to make their living.

This versatility has always been characteristic of Scandinavian farmers, especially in Norway. When agriculture entered Norway in neolithic times, it was adopted by a population of hunters and fishermen; and hunting and fishing continued to be the essential occupations and means of livelihood for people who raised corn and owned cattle. This intimate connection between different modes of living, on the one hand hunting and fishing, on the other hand farming, is even more conspicuous on the Norwegian coast than inland. In western Norway, the farmers

are often fishermen and hunters, leaving their farms part of the year, and so it was in prehistoric times. A. W. Brøgger has stressed this feature of Norwegian culture (Brøgger, 1925, pp. 39ff.) and as a prehistoric example he mentions *inter alia* the archaeological find of a late neolithic or early Bronze Age site at Ruskenes, south of Bergen. The Ruskenes find contains bones of many game animals, especially deer and seal, but also a few bones of ox, sheep, and swine while in pottery sherds imprints of barley were seen. Evidently, we have here an example of mixed farming and hunting economies. Such mixed economies have been traced in neolithic finds in many parts of Europe (Clark, 1952, pp. 48 ff), but above all in western Norway. The introduction of farming meant an enrichment of the old economy, but not a discontinuance of hunting, trapping, and fishing. The Ruskenes site was a hunting station where farmers lived part of the year, hunting deer and seal.

It is significant that the introduction of agriculture into Denmark meant an almost sudden transformation of the natural vegetation, which geologists have pointed out in Danish peat bogs (Iversen, 1941). In Norway, the influence of agriculture upon the natural landscape was much weaker. As K. Fægri says: "On the whole the introduction of agriculture into Norway is rather "half-hearted" in contrast to Denmark, where the land occupation transforms the landscape very quickly" (Fægri, 1944, p.460).

The introduction of agriculture into Norway started a little later than in Denmark and southern Sweden and required much time, because it was retarded by the hunting culture. The first farmers in Norway, belonging to the megalithic culture, settled at Oslo Firth and did not spread very far. A little later came the single grave or corded ware people whose characteristic weapon was the battle axe and who swept over middle and northern Europe in late neolithic times, coming from the east. They seem to have brought the horse, and perhaps they were horse riders, herding cattle and sheep, in other words nomadic people, but not without a little agriculture. It is generally supposed that they were Indo-Europeans. Their nomadic way of living was soon given up. They mixed with the older population and turned into sedentary farmers. In great parts of Scandinavia, and especially in most of Norway, it was the single grave people who first introduced a farming culture. However, this process was rather slow, because the hunting population held on to the old way of living. The hunting culture and the farming culture influenced each other, and the final result was a mixture, well adapted to natural conditions. This synthesis of hunting and farming may have caused strife and friction through many centuries (Gjessing, 1945). At last, however, these different ways of making a living, these two opposing cultures, were twisted together as strands in a rope (Brøgger, 1925, p. 21).

NORSE COLONIZATION IN HALOGALAND

The primitive versatility of Scandinavian farmers, due to the double origin of their culture, was a valuable asset making them effective colonizers.

We have already mentioned the farmer's occupation of inland valleys and mountain pastures, but from southwestern Norway the expansion of farming culture went mainly by sea. From the overpopulated districts in western Norway, especially from Rogaland (the country of Stavanger), people migrated northwards along the coast to Hålogaland in northern Norway. This northern seaway was the origin of the name of the country itself (Norvegr). Archaeological finds show that the connections between Rogaland and Hålogaland were rather intimate. In the sixth century A.D. this migration into Hålogaland was active (Lund, 1939, p. 85), but it had probably begun much earlier. Also from the Throndeim Fiord region, farming culture went northwards along the coast. A late neolithic or early Bronze Age find from the island Dønna in Nordland Fylke, a little more than 66 degrees north, bears witness to a mixed hunting and farming culture, recalling the Ruskenes find; there are bones not only of fish, birds, otter, seal and deer, but also of such domesticated animals as sheep, cows and pigs (Gjessing, 1945, pp. 139, 141, 448).

The Norse colonization in Hålogaland was decidedly coastal, not only because the settlers were seafaring people and utilized fishing grounds and hunted sea mammals and birds, but also because they found much better natural opportunities for their husbandry at the coast than inland. It is also true today, for the Norse settlers were first of all farmers (Brøgger, 1931, pp. 33 ff). They found good pastures for their cattle on the sea coast, but in the inner firths and valleys, conditions were less favorable. The reason for that is essentially climatic. The islands and the sea coast have a mild oceanic climate, due to the Gulf Stream and the southwesterly winds. Inland, the climate is more continental with cold winters. The Norse population in the Iron Age had their dwelling sites on islands and coasts, the inner firths and valleys were left to the Lapps.

A. W. Brøgger has stressed the fact that the Iron Age culture of northern Norway was in perfect conformity with the culture of southern Norway. Archaeological finds prove that Norse farmers lived in northern Norway in the Roman Iron Age (before 400 A.D.) and developed their economic culture through the Migration Age (400-600 A.D.), the Merovingian Age (600-800 A.D.), and the Viking Age (800-1000 A.D.). The grave finds give a picture of their daily work. Sickles and scythes are found in Iron Age graves in the districts of Helgeland, Ofoten, Lofoten, Vesterålen, and as far north as Tromsø Sound. Even a plowshare is known from a Viking Age find, but evidently the harvesting of fodder (leafage, grass) was more important than ploughing.

Then, as now, the climate set limits to the production of grain. Today, barley is cultivated in the southernmost part of Troms Fylke,

near the coast. As far north as the Målselv Valley, just north of 69 degrees north, barley is cultivated, but one may not expect mature corn more than one year out of three (Reusch, 1927, p. 185). In our time, potatoes are by far the most important crop all over Troms Fylke and also in a few favorable localities in Finmark and Swedish Lapland. However, the Iron Age farmers had no cultivated plant as hardy as the potato.

In bad years, the harvest in Hålogaland was insufficient, and grain was imported from the south. King Olav Haraldson prohibited this traffic. This brought him in bloody conflict with Asbiörn Sigurdson, a young magnate, living at Trondenes on Hindoe, about 68 degrees 49 minutes north, who made a journey to Jæren in southwestern Norway and brought a ship load of corn, but had his cargo confiscated by the king's servants. The conflict brought death to young Asbiörn and gave King Olav many deadly foes, among them Asbiörn's near kinsman and neighbor, Tore Hund of Bjarkoe, who felled King Olav in the battle at Stiklestad on July 29, 1030 (Cf. Snorre Sturlason's Saga of the Norwegian kings).

The settlements of the Iron Age farmers extended considerably north of the Arctic Circle. Their northernmost settlements seem to have been on the islands Karlsoe and Vannoe, about 70 degrees north (Brøgger, 1931, p. 41). Norse hunters and traders went even farther east through Finmark, as it is proven by archaeological finds. However, cultivation did not reach the climatic limit of the arctic on the Norwegian coast. It is first met with near North Cape, on Mageroe, running from there to Vadsö in the Varanger Firth.

Farming was fundamental in the economy of the Norse settlers, but they were also fishermen, hunters, and traders. They fished only for household purposes; the great fisheries for export did not begin until the 13th century (Brøgger, 1931, p. 32). Hunting and especially the fur trade brought riches to the Norsemen. Trading took them into the mountainous country of the Lapps, and on seafaring expeditions far towards the east, around North Cape, along the Murman Coast, into the White Sea and the Dvina country. On these expeditions, trading and robbery went hand in hand. These traders were Vikings (Brøgger, 1928b).

The sea is larger and more dangerous in northern Norway than in southern Scandinavia. The Norse chieftains in Hålogaland had excellent vessels, large, sea worthy and well adapted to the natural conditions.

EARLY SCANDINAVIAN INFLUENCE UPON THE LAPPS

The Lapps (or Finns, as the Lapps were called by the Norsemen) were made tributary by the warlike Norse chieftains. Later on, in the 9th century, the Norwegian king appropriated this tribute and authorized certain local chieftains to collect it.

We learn about this tribute in Egil Skallagrimsson's saga. Thorolf, Skallagrim's brother, inherited two estates in Hålogaland and also the right to collect the Lapp tribute, as the Norwegian king's liege. We are told that Thorolf went up in the mountains in winter with a large

following of about 90 men. He took tribute from the Lapps and also traded with them. Everything was adjusted amicably, but the Lapps were afraid of the Norsemen. Thorolf went farther east, and he heard that the "Kylfinger" (probably the revenue collectors of the Swedish king) had come also to trade with the Lapps. Thorolf attacked his Swedish competitors, killed about 120 of them, and collected an incredible lot of goods, which he brought back to Hålogaland. We are told that Thorolf applied himself eagerly to hunting and catching fish and seal, and he had many men in his service. He sent the Norwegian king the Lapp tribute, consisting of a large amount of good peltry. However, King Harald mistrusted him, and authorized some of Thorolf's enemies to collect the Lapp tribute. Nevertheless, Thorolf again made a winter expedition into the mountains, and the next summer he sent a ship to England, loaded with hides and several kinds of peltry which he had procured in the mountains. In England the goods were sold, and in return the ship was loaded with wheat, honey, wine, and cloth.

Egil Skallagrimsson's saga was written in the latter part of the 12th century, almost three centuries after Thorolf's time. Nevertheless, this saga, is, on the whole, trustworthy, and it gives a realistic picture of the relations between Norsemen and Lapps.

We learn more about the relations between the Norsemen and the Lapps from Ottar's account. Ottar was a chieftain who lived far north in Hålogaland, perhaps in Senjen. He went to King Alfred in England, and probably entered the English king's service. In the geographical part of King Alfred's Anglo-Saxon translation of Orosius' world history, a report is included which Ottar gave King Alfred about conditions in Hålogaland and a sea voyage which Ottar had made to the White Sea. Ottar "was amongst the first men in the land, though he had not more than twenty horned cattle, twenty sheep, and twenty swine; and the little that he plowed, he plowed with horses.¹ But their revenue is chiefly in the tribute that the Finns pay them, which tribute is in skins of animals, feathers of birds, in whale bone, and ship ropes, which are made from the whale's hide², and from the seal's. Everyone pays according to his means: the richest must pay fifteen skins of the marten, and five of the reindeer, and one bear's skin, and two ship ropes, each sixty ells long, one made from the whale's hide², and the other from the seal's" (Bosworth, 1853, pp. 12-13).

Most interesting is the part of Ottar's report which deals with the reindeer, the oldest historical account of reindeer breeding in Scandinavia: "He had, moreover, when he came to the king, six hundred tame deer of his own breeding. They call these reindeer: of them, six were decoy deer, which are very valuable among the Finns, because with them they take the wild deer" (Bosworth, 1853, p. 12).

¹It is characteristic that Ottar plowed with horses. In most of Norway and in northern Sweden, the horse became the favorite animal for draught. On the other hand, in southern Sweden, southeastern Norway, and in Denmark, the ox was very much used for draught (Erixon, 1933, p. 195).

²Should be: walrus hide.

The Lapps in northern Scandinavia had, in Ottar's time as later, different modes of living. On the coast they were fishermen and hunters, in the mountainous inland they were reindeer nomads and hunters. The Norsemen subjugated the Lapps, extorted tribute from them in the form of peltry, hides, ship ropes, and feathers, and took also an economic interest in reindeer breeding. Ottar owned a herd of reindeer and we must assume that his herd was tended by Lappish herdsmen; it has been and still is a recognized custom in Scandinavia that Norwegians and Swedes may own reindeer which are tended by the Lapps.

Ottar mentions the use of decoy deer as a Lappish custom. This hunting method is known from many reindeer nomads throughout the northern world and may perhaps be the oldest element in reindeer nomadism.

The Swedes like the Norsemen had similar relations to the Lapps. As we have learned from Egil Skallagrimsson's saga, there was a sort of bloody competition between Norwegian and Swedish traders and tax collectors in Lapland. The Swedish "birkarlar" were traders, living far north in Sweden and having the privilege of trading with the Lapps and exacting taxes from them; the "birkarlar" are mentioned as early as 1328 in a document about the administration of justice in northern Sweden (Fellman, 1912, p. 336).

However, the Scandinavians were not only acquisitive, they were also to some extent instructors in their relations with the Lapps, yielding useful elements of culture. Certain traits in the Lappish utilization of the reindeer seems to be borrowed from Scandinavian farmers.

Divergent opinions are held about the origin of reindeer breeding. A theory set forth and ably defended by K. B. Wiklund, argues that the Lappish reindeer nomadism had its origin in Lapland, quite independently of the Samoyedic and other eastern forms (Wiklund, 1918, 1937-1938). Most ethnologists, who have discussed the problem, assume some cultural historical connection between the different forms of reindeer nomadism found in northern Eurasia. Certain traits, found over the whole area of reindeer nomadism, are probably very old, for example, castration of male animals by biting, owner's marks cut in the animal's ear, the use of the lasso and ski, and human urine or salt used for alluring and taming the deer. Every one of these traits also exists outside of the area of reindeer nomadism, and the question is unsolved, where and when reindeer breeding originated. Almost all investigators seem to be agreed in one point: the oldest reindeer domestication arose among reindeer hunters, and in this process, the use of decoy deer seems to have been important (Sirelius, 1916; Hatt, 1919; Schmidt, 1951).

However, some cultural elements are found only within certain limited parts of the area of reindeer nomadism. Among these elements with limited expansion is the milking and the use of milk. By no means did all reindeer nomads practise milking. In northern Asia, the reindeer is milked by the Soyot, the Karagas, and the Tungus, and in Europe

we find reindeer milking in Lapland. There does not appear to be any possibility of a cultural historical connection between Asiatic and Lappish reindeer milking. Evidently, in both cases reindeer nomads have taken over milking and dairying from neighboring peoples. The Lapps have borrowed this important cultural element from Scandinavian farmers. The Lappish words for milk and cheese, and most of the names of implements, etc., connected with the milking industry, are of Scandinavian origin (Qvigstad, 1893, p. 65). The whole technique seems to be derived from Scandinavian sources. As an example we may mention the Lappish cheese moulds, which are very similar to those used by Scandinavian farmers. We may also note the use of certain wild plants which are mixed with the reindeer milk that is reserved for future use, namely *Angelica archangelica*, *Rumex acetosa*, and *Mulgedium alpinum*. Their use may also have been borrowed from the Scandinavians, who have long utilized the same and other species (Holmboe, 1929). The very superstitions connected with milk and milking are borrowed from the Scandinavians. The only use of reindeer milk which may be safely assumed to be originally Lappish, is the suckling of the does, which is occasionally practised by children and herdsman, and which is also known from reindeer nomads who do not practise any regular milking, for example, the Chukchi (Bogoras, 1904-09, p. 84).

On the other hand, the use of the reindeer for transport does not contain many traits of Scandinavian origin. The reindeer harness has essentially the same form everywhere among the reindeer nomads, from Lapland to northeastern Asia; it is probably evolved from a dog harness. The boat-shaped Lappish reindeer sledge is peculiar, but small boat-shaped sledges, drawn by man, are known from the Finns, the Cheremiss, and some tribes in Siberia. It is an old sledge-type, originally a hunter's hand sledge, in Lapland made into a reindeer sledge. The Lapps also use reindeer for carrying burdens. The Lappish pack saddle is peculiar and very different from those used by Tungus and Soyot reindeer people in Asia. However, the Lappish pack saddle is very similar to an old Scandinavian pack saddle, known from the Færoes and the Shetland Islands (Jirlow, 1931, pp. 90-95).

So it will be seen that Lappish reindeer nomadism contains certain elements of Scandinavian origin. Scandinavian farmers have, in the past made an imprint upon that strange culture, enriching it.

NORSE COLONIZATION IN THE ISLANDS OF SCOTLAND

The colonization of northern Norway by Norse farmers during the Iron Age is only one of the effects of an increasing population pressure. The means of livelihood of the Norse Iron Age farmers were essentially an extensive cattle breeding and dairying, coupled with some agriculture and with a supplementary economy of fishing, trapping, and hunting. This required great areas, and as population increased, a critical period set in. The Viking Age was a critical period. The Norse farmers met the crisis in two ways: by intensification of agriculture, and by

emigration (Brøgger, 1940). Intensification took place where there was plenty of arable soil and a favorable climate, that is, Osterdalen, Troendelages and Jæren.

An example of inner colonization is immortalized in Snorre Sturlason's saga of the Norwegian kings, where it is told that the great chieftain Erling Skjalgson gave land to his serfs and let them make their own corn fields. The serfs bought their freedom by selling corn to Erling, and so they became free men in the course of one, two, or three years.

However, in western Norway, north of Jæren, there was not much arable soil and therefore not much opportunity for an intensification of agriculture. The so-called "reitbruk", where small plots or "reitar" are cultivated with spade in favorable localities, may still be seen in Norwegian fiord and mountain districts (Hasund, 1932, p. 20; 1933, pp. 171 ff). This may be the reason why many people emigrated from western Norway in the Iron Age, not only to Hålogaland, but overseas, to the Hebrides, the Orkneys, the Shetlands, the Færoes, and Iceland.

This overseas migration had not only a political background, the conflict between King Harald Fairhair and the local chieftains who refused to obey him and pay taxes, but also was a result of the critical situation which arose when cattle breeding farmers required more room than they could find in the old country. The big cattle farmers were estate owners with numerous serfs and dependents. It would not be correct to speak of over population, but it became more and more difficult to find room for new estates. So when the Norwegians heard of grassy islands in the western seas, they felt a yearning after these new countries, not unlike the longing for America which, in the 19th century, thousands of European peasant boys have felt (Brøgger, 1928a, pp. 10 ff). It seems that Irish clergymen were a sort of forerunners for the Norse colonization in the western islands. From around 700 A.D., much soil was brought under cultivation in western Europe. The church took a special interest in this movement. Cultivation was a main task for the Christian clergy, the monks, and the missionaries. Irish and Scotch priests and monks discovered the Orkneys, the Shetlands, the Færoes, and even Iceland. They retired from the world in these lonesome islands, and tried to cultivate them. Probably, it was Irish monks who first brought sheep to the Færoes; later on Norse settlers found sheep running around about, and therefore they called the islands "Færoes", that is, "sheep islands". (Brøgger, 1928a, pp. 24 ff).

Brøgger thinks it probable that Norwegian seafaring men, visiting England and Ireland, heard about these grassy islands north of Scotland, and sailed to them. Good pastures were in great demand among the farmers of western Norway. The distance from Rogaland to Hålogaland is several times longer than from Rogaland to the Scotch islands. When these islands first became known to the farmers in western Norway, emigration to the Shetlands and the Orkneys was a very natural thing. The distance from Norway to the Shetlands is less than 200 miles.

According to Brøgger, this emigration started before 800 A.D. The

Shetlands, which the Norse people named Hjalmland, was a sort of key to the Norwegian expansion overseas. From Foula in the Shetland Islands, the Orkneys are within view, and from there one may see Scotland, and so the way is clear to the Hebrides which the Norsemen called the Southern Islands (Sudreyar), and further on to Ireland and the Isle of Man. Somewhat less obvious was the way to the Færoes which are 325 miles west of Norway and 160 miles northwest of the Shetlands. However, Irish priests had discovered the Færoes about one hundred years before the Norsemen came.

The Viking colonization brought the Norsemen in contact with Christendom and particularly with Celtic people. There are archaeological monuments on the Shetlands and the Orkneys considerably older than the Norse settlements. Agriculture had reached these northern isles long before the Norsemen appeared. In the neolithic times barley was cultivated in the Orkneys, and from the late Bronze Age a find of barley is known from the Shetland Islands (Jessen and Helbæk, 1944, pp. 44-47, Figs. 16, 19). However, when the Norsemen arrived there were probably very few inhabitants. The Shetlands and the Orkneys became Norse lands with purely Norse communities, and this seems to have happened without any warlike conquest (Brøgger, 1930, p. 262). The same is true of the Færoes, although the first Norse settlers may have met a few Irishmen there. The Irish monk Dicuil wrote a geography which he finished in 825 A.D. In this work he mentions a group of islands, mostly small and separated from each other by narrow straits, lying in the northern sea. They may be reached from the northern British islands by sailing two days and two nights with full sails and a fair wind. In these islands, anchorites from Ireland had lived, for about a hundred years, says Dicuil. "But just as they always since the beginning of the world have been deserted, so they are now, because of Norman pirates, untenanted by anchorites, full of innumerable sheep and very many different kinds of seabirds" (Brøgger, 1937a, p. 21; Dicuil, ed. Parthey, 1870, p. 43).

These northern islands must be the Færoes and according to Dicuil, Irish anchorites had sought refuge there shortly after 700 A.D. The holy men departed when the Vikings came, leaving only their sheep.

The Norse emigrants were used to the oceanic climate of western Norway. They settled in the Atlantic islands, the Hebrides, the Orkneys, the Shetlands, and the Færoes, which had an even more pronounced oceanic climate. The winters are milder, the summers cooler than in western Norway in the same latitudes. The natural conditions in the new lands were favorable to the most important part of their farming, namely cattle, and sheep breeding and dairying. Barley and oats were the corn of western Norway, and also of the Atlantic islands. In our day, the potatoes are more important.

The worst natural handicap was the lack of forest, because wood was a vital necessity. In house building, it was to some extent supplemented and even replaced by stone and turf and peat was used for fuel. Ships and boats were made of wood and without ships and

boats, human life was doomed. The settlers were, by necessity, seafaring men. Part of their livelihood must be gained from the sea, by fishing and hunting, and the North Atlantic sea is violent and dangerous, even more so than the home waters of Norway. In their home country the Norse people had plenty of excellent timber. Some of their finest, most seaworthy ships were built in the north; in Hålogaland. In the Atlantic islands, practically no timber grows; not only the cool summers, but the stormy winds hinder the growth of forest, and the innumerable sheep prevented even the rise of birch copses, which the climate might allow. The importation of timber and boats was indispensable. That is probably one important reason why the Norwegian kings succeeded in binding the Atlantic settlements to their realm in spite of the localism and self-assertion of these island communities.

THE FAEROES

If the climatic limit of the Arctic is put at the July isotherm of 10 degrees Centigrade, the Færoes are not far from that limit. The mean temperature of July is 10.8 degrees at Thorshavn, and only July and August are free from frost. Agriculture suffers from the lack of summer heat and also from the excessive moisture. Furthermore, the areas of arable soil are small, the total cultivated area has been estimated at three per cent of the total surface area. The Færoes are the ruins of a volcanic mountain massive of Tertiary age. The old river valleys were deepened and made into fiords and straits by the glaciers during the ice age. The basaltic rocks are either naked or covered with soil in a rather thin layer. Moors and bogs cover large areas. The small cultivated fields surround the villages or hamlets and are placed upon the lower slopes, near the coast. When a new field is made, stones must first be cleared away, and good soil added from elsewhere. In the past, the spade has always been much more important an implement than the plow. Harrow and roller is also absent from the old fashioned Færoe agriculture. Implements and working methods are very primitive and may be regarded as relics of a very old northwest European culture (Jirlow, 1931, pp. 97-133).

The typical fields are narrow, only three or four meters broad, separated by narrow ditches. Every field has a sloping surface, high on one side and sloping towards the ditch on the other side. In a profile through a group of fields, the fields will look like teeth in an enormous saw (Botany of the Færoes, Vol. III, 1901-08, pp. 1006 ff). This system gives an effective drainage and is a result of the cultivation of the soil. In the spring, the field is worked with the spade; the sod is cut and turned with the grass downwards, and under the grass, manure is placed (stable dung, sometimes mixed with fermented seaweed). This process is *velting* in the Færoe language, that is, turning over. After that, the barley is sown, which is always done by women, preferably the housewife herself. After sowing comes the so-called *saksing*, which is also women's work. With a spade, the soil is hacked into small pieces and in that way crumbled; sometimes a rake is also used. Lastly, the field is tapped and flattened with a board on a long handle. And so,

in a laborious and primitive way, the field undergoes the same treatment which, in modern agriculture, is performed by means of plow, harrow and rollers.

Weeding of the field is, or was, done by hand about the middle of the summer. Harvesting is done at sometime between the end of August and the end of October. The barley is cut with a common knife, or a special harvest knife, somewhat curved, made from an old scythe. A certain number of sheaves, generally twelve, make a burden which is carried from the fields.

Before thrashing, a man tears the ears from the straw; this was formerly done by the fingers, now by means of an iron comb. The straw is bound into sheaves again, cleaned for weeds, and kept for use as thatch or as fodder. The ears are dried over a peat fire upon an oven in a special drying house (*sodnhus*); a man carries the ears into the *sodnhus*, but a woman takes care of the drying. We shall meet this drying of corn again in Iceland, where it is used for the ears of lyme grass; the method seems to be of Celtic origin.

After drying, women do the thrashing by means of wooden sticks or clubs upon the floor. In the 18th century a remnant of a still more primitive method was found in the Færoes: the ears were trampled by girls with bare feet, before the thrashing with clubs (Jirlow, 1931, p. 120).

After thrashing, the corn is winnowed by shaking in flat wooden troughs, and after winnowing, the corn is kept in sacks for future use. It requires the work of one man in twelve days and of one woman in twelve days to produce four bushels of corn. The Færoe barley is a hardy variety, six-rowed, which has been grown from ancient times (Botany of the Færoes, Vol. III, 1908, p. 1014). Lützen mentions a primitive way of upholding the quality of the seed corn by collecting the big ears and keeping them for seed upon a special part of the field, from which the seed corn is taken next year (Lützen, 1924, p. 58). The yield has long been decreasing, because the necessary care and precision in the agricultural work cannot be maintained, the wages for human labor rising enormously. About seventy years ago, the yield was estimated at ten hkg. pr. hectares.

The primitive technique requires much human labor, and it has been attempted to modernize agriculture by means of plow and harrow, drawn by horses, and also by means of thrashing and winnowing machines. This has not hindered the steady decline of corn production. A hundred years ago, certain parts of the Færoes were almost self sufficient in corn. Now, the corn production is quite insignificant, less than one per cent of the consumption; the importation and consumption of corn is multiplied many times. Barley cultivation in the Færoes would have disappeared long ago, if it had not been kept up in some places to maintain the fertility of the fields and the production of hay. In former days, the usual rotation of crops was: one year barley, after liberal manuring, and following the barley, six years grass for hay.

So there was a connection between corn cultivation and stock

breeding, although animal power was seldom used in agriculture for plow, harrow, and wheeled vehicle were almost absent in former times.

The intensive and laborious cultivation of barley and grass used only small areas near the houses, the home field or *bður*. Grass is the most important agricultural crop, hay being indispensable for bringing the cattle through the winter.

The hay harvest falls almost as late as the corn harvest: it starts generally in the beginning of August and sometimes lasts about three months, if the weather is especially rainy. The grasses of the *bður* are, on the whole, very nutritious, but excessive rain may reduce the value of the hay. The grass is mowed with a scythe with a short, broad blade and a very long handle (Jirlow, 1931, Figs. 14, 16). A similar scythe is used for cutting grass in the Shetlands (Mitchell, 1880, Fig. 67). When dry, the hay is carried home by men, and placed in large stacks near the houses.

Small parts of the *bður* is now used for potatoes and root crops (turnips) and less for barley. The *bður* is often much split up between the owners, which makes it difficult to modernize agriculture (Lützen, 1924).

Gardening is a rather new feature. The cultivation of *angelica* in certain enclosures at the houses is probably also a comparatively new development, although the collecting and use of the wild *angelica*, growing in the mountains, is old in the Færoes and probably brought in from Norway. *Angelica* is often used as an admixture to milk (Jirlow, 1931, pp. 121-122).

A certain place name in Sandoy, Linteigar, that is, flat fields, has been understood as implying flax cultivation in some distant past (Jakobsen, 1904, p. 32).

Most of the farm land is used in common as uncultivated pasture and is called *hagi*. This is used for pasturing cattle, horses, and especially sheep. The number of sheep in the Færoes is around 100,000 with 600 horses and 4,000 cattle. Stone walls protect the cultivated *bður* against intruding animals from the *hagi*.

Sheep have always been the most important economically. They live in open air all the year round and in the hard weather they find protection in a sort of open folds. The people who own a *hagi* in common have the right to graze a certain number of sheep in it. Marks are cut in the right ear of a lamb to indicate in what *hagi* it belongs, and in the left ear to indicate the owner. The sheep are generally kept in the mountain regions of the *hagi* in summer, fall, and the first part of the winter; in the winter and in the spring, they are kept upon lower land nearer to the dwellings, in the so-called *hushagi*, where the grass is better and the weather less hard. In exceptionally hard cases, they may get a little hay.

All the sheep in a *hagi* are herded in common, and each owner gets a certain fraction of the yield of wool and meat, etc., corresponding to his part of the *hagi*. The sheep throw their wool in the spring or early summer; they are generally not shorn, but the wool is plucked by hand. In the fall, about thirty per cent of the sheep are slaughtered.

Dried mutton is the favorite food in winter. The wool is used for wadmal and for knitted stockings and jerkins. The sheep are not milked. Although in early days, sheep milking may have been practised in the Færoes; it is mentioned in tales (Bruun, 1929, p. 197).

There are very few small horses in the Færoes. These are sometimes used for carrying manure and peat, and eventually for riding; but as we have seen, there is not much use for them in the agricultural work. They go in the *hagi* all the year round, are kept in the stables, and very seldom do they get any hay. Once a year the mane is cut, and their hair is used for rope.

Much care is given to the cattle. The cows are grazed in the best part of the *hagi*, the *hushagi*. The small calves are allowed in the *bøur* in spring and early summer. In the fall, the cows are put into the stable and kept there until spring. They are fed on hay, and eventually on dry fish. In the stable, which may be in the end of the dwelling house or in a special building, the cows stand in two rows with their heads against the wall on both sides, each in its own stall; between the rows is a shallow groove in the floor, for the dung. When too much dung has accumulated, it is cleared away. This was originally woman's work. Milking is also done by women. In winter, the cows are underfed and give little milk. In summer, when the cows graze in the *hushagi*, they give much good milk. Milk is a very important food used in the household, and some of it has always been used for making butter and cheese.

In modern times, swine are almost non-existent in the Færoes. Without doubt, swine were kept in the islands in former days; the word *svín* being found in many place names (Matras, 1932, p. 279).

Several kinds of poultry are kept. The most important being geese, which are fed by grazing in the *hagi*.

The original farming culture, brought by the settlers in the Viking Age, has been remarkably well preserved in the Færoes. Old techniques are still found there, which may throw light upon the early history of farming in northwestern Europe.

However, farming was only one side of the old Norse economy. The utilization of the wild fauna through fishing, trapping and hunting was another side, which has also persisted to this day. Whale hunting and bird catching are very conspicuous elements of Færoe life, while fishing has gained immensely during the latest generations and has furnished the economic basis for the remarkable progress of the Færoe people. The Færoes had in 1801 only 5,265 inhabitants, but in 1901, 15,230, and in 1950, 29,198 inhabitants. The fisheries are now by far the most important industry, making possible a large export and import trade.

ICELAND

The barley fields of the Færoes are near to the climatic limit of possible grain production. However, the Norse farmers carried agriculture farther north, to Iceland, and kept it up there through several centuries, quite close to the arctic tundra region.

Iceland, just south of the Arctic Circle, has mild winters on account of the comparatively warm sea. The Gulf Stream washes the south coast and sends a branch, the Irminger Stream, along the west coast. An offshot of the Irminger Stream runs along the north coast, but its relatively warm water is mixed with and overlaid by a cold stream coming from the north, the East Iceland Polar Stream, which washes the northeast coast. Northern winds may bring great masses of ice to the north coast, and if this happens in the late part of winter, it may fatally diminish the summer temperature.

Also in ordinary years, Iceland's summer is cool, with a temperature below that of Siberian regions of the same latitude. Favored parts of the coastland, especially in the southwest, have July mean temperatures of ten degrees Centigrade or slightly above. When the Norse settlers came to Iceland, they found birch forests in the coastland, from the coast to the mountains; today a few small remnants of these forests are left, in the shape of birch copses, a few meters high. A comparatively large stretch of lowland is found in the southwest, where the summer is also comparatively warm, and in this favored part of the country lives more than a third of the population. Iceland's population is now about 140,000; it has increased very considerably of late and has about doubled in this century. The total area of the country is 102,846 square kilometers, but only about 14,000 square kilometers are inhabited.

Most of Iceland is a plateau, lying 600 to 800 meters above the sea, with a poor and scarce vegetation, often mainly consisting of mosses and lichens. Large stretches consist of young lava, almost without vegetation. Some parts of the plateau are higher, reaching above the snow line, and covered with firns and glaciers (*jökull*, *jöklar*). The climate of Iceland, with cool summers and considerable precipitation in fall and winter, favors the formation of large firns.

Iceland consists almost entirely of volcanic material from the Tertiary and Quaternary periods. Many volcanoes are still active or have had eruptions in historic times. Some of them are rather flat lava fields or cupolas, some are more or less conical, built up of loose products from the eruptions. Many of the volcanoes are overlaid by large firns, and their eruptions give rise to enormous melting of the snow and dreadful torrents (*jökul-hlaup*). The largest firn, Vatna jökull, in southeastern Iceland, has a group of volcanoes in its southern part, among them the highest mountain in Iceland, Oræfajökull (2119 meters). Several eruptions have taken place in historic time, causing tremendous water torrents from Vatna jökull. Volcanic eruptions have brought about dreadful calamities for the farmers, not only by the water torrents, but still more by the volcanic ashes which have been spread over large parts of the island, destroying the grass and giving rise to famines and diseases among sheep and cattle.

Farming in Iceland is beset with great natural difficulties. Nevertheless, the Norse colonization in the so-called "landnam" period, 874-930 A.D., was characterized by spontaneous energy. Evidently, Iceland gave the colonists something which they lacked in old Norway.

In Iceland they found room for their expansive cattle and sheep farming. This may have been the main attraction, although the sagas put stress upon a more dramatic motive, the political tension between the king of Norway and the local magnates.

Several nations may claim part in the discovery of Iceland. The Irish monk Dicuil mentions this northern land in his geographical work, and it seems clear from his details that Irish clergymen had visited Iceland some time before the year 800 A.D. (Parthey, 1870, pp. 42-43). Furthermore, we are told by Iceland's oldest historical work, Ari Thorgilsson's "Íslendingabók", that the Norsemen found Christian men or "Papar" in the island, but these went away because they would not live among heathen people.

According to "Landnáma", Iceland was discovered accidentally by Scandinavian seafarers. The first attempt at a colonization was made by a Norwegian, Flóki Vilgerðarson who set out from Scotland for the purpose of going to the newly discovered island. He had cattle with him, and he tried to make a settlement at a fiord in western Iceland. However, his cattle died because he was so occupied with fishing that he forgot to collect winter fodder. He left the country somewhat disappointed and gave it the name Iceland because he had seen a fiord full of ice.

The Norse colonization of Iceland began in 874 A.D. when Ingólfur Arnarson and Hjørleifur Hróðmarson took land. The period from 874 A.D. until about 930 A.D. was the so-called "landnáma" time, in which the inhabitable parts of Iceland were taken and settled by Norwegian chieftains and their dependents and serfs. The story of this great colonization is told in a collection of sagas, the "Landnámabók"; in this is given the names and native places of the prominent colonists. This material has been utilized for elucidating the origin of the Icelandic people. Of approximately 1,000 colonists named in "Landnámabók", about 84 per cent were from Norway, three per cent from Sweden, 12.6 per cent from Ireland, Scotland, England, the Hebrides, and the Orkneys.

However, as the Norwegian anthropologist Halfdan Bryn has pointed out, these 1,000 individuals are only about five per cent of the total number of colonists, which must be estimated at about 20,000.

The 95 per cent, whose names and native places are unknown, were mainly dependents, women and serfs. A large part of these were probably of Celtic origin.

Physical anthropology has shown that the people of Iceland are distant from the people of western Norway, although a majority of the immigrants, mentioned in the "Landnámabók", came from western Norway. For instance, blond hair is exceedingly rare in Iceland among grown up individuals. In the shape of the head there is also characteristic differences between Iceland and western Norway. Halfdan Bryn, whose comparative analysis utilizes the Icelandic material published by Gudmundur Hannesson, finds it necessary to assume that the population of Iceland has a racial composition somewhat different from that of the population of western Norway. He thinks that

the differences are due to the fact that the Icelandic people are the result of an intermixture of Norwegian elements with strains from England, Scotland, Ireland, and the Hebrides (Bryn, 1928).

The Icelandic anthropologist Jón Steffensen, in his investigation of skeletal material from Iceland's heathen time (before 1000 A.D.) and from the cemetery at Skeljastaðir in Þjórsárdalur (probably 11th century), is also of the opinion that a considerable contingent of immigrants came from the British Isles and especially from Ireland, as the Vikings of western Norway usually went to Ireland in their warlike expeditions, and often brought captive Irish persons back with them as serfs, and even as wives (Steffensen, 1943, p. 241).

The Norse settlers and their Celtic serfs were equally used to farming in their home countries. In Norway as in Ireland, farming meant first of all the rearing of animals. However, agriculture and corn production was also a constituent part of their civilization (about ancient Irish agriculture, see Duignan, 1942).

Certain agricultural implements and techniques may have come to the Norsemen from the Celtic world, as claimed by Alexander Bugge, calling attention to certain loan-words in Old Norse (Bugge, 1905, pp. 256 ff, 358-359). Bugge's work has been criticized by Finnur Jónsson who finds the Celtic influence upon Iceland's culture very slight (Jónsson, 1921). At any rate, Irish serfs did a great part of the work on the Norse farms in Iceland.

It is told in the "Landnámabók" that Hjörleifur, one of the first colonists who settled on the south coast near Hjörleifshöfði, started ploughing the first spring. However, he had only one ox, therefore he ordered his Irish serfs to draw the primitive plough (*arð*). The serfs disliked that work and rebelled against their master, killing Hjörleifur and his men.

So, the first known attempt at agriculture in Iceland ended tragically. However, there were other attempts, and some of them succeeded. Evidence of this fact is found in the old Icelandic laws, in the old deeds, in the sagas, in names of farmsteads and other place names, and furthermore there are many visible traces of ancient fields. Most of this historical and archaeological material has been brought together by Björn Magnússon Olsen in an attempt to prove that corn production was of some practical importance in Iceland in the past and not, as the geographer Th. Thoroddsen meant, more for pleasure than for use.

It is evident from Olsen's and Thorarinsson's investigations that grain was cultivated in Iceland from the beginning of the Norse colonization until the middle of the 16th century. Furthermore, it appears that grain production was at first carried out in most of the Iceland settlements, although in the northern and eastern parts of the country it is not proved by written documents, but only by certain place names. The greatest importance and largest continuance of the grain production was localized in the southwestern parts of the country.

Olsen has made the interesting observation that the cornfields in the western and southern districts were mainly placed quite near to

the coast or even upon small islands. He offers the explanation that these localities were less exposed to late night frosts which might be fatal to the young corn plants. Also, he thinks that agriculture was mostly a secondary occupation for the fishing population. In the northern districts, on the other hand, the place names would indicate that the cornfields were not placed upon the coast, but further up in the valleys, where corn growing may have been a secondary occupation for herdsmen, taking care of cattle (Olsen, 1910, pp.135-136). It may perhaps be allowed to set forth the suspicion that some of the place names combined with *gerði* (*gerðar*), which Olsen interprets as ancient cornfields, may have been fences for cattle.

Olsen thinks that agriculture stopped very early in the northern and eastern districts, wherefore no contemporary written documents mention any cornfields in these parts. However, in the southwestern districts corn production is mentioned many times in deeds from the 12th, 13th, and especially from the 14th century, in inventories of the landed property and revenue of churches and cloisters.

It seems that grain cultivation decreased considerably during the 13th and 14th centuries, and Thorarinsson is inclined to see one of the causes of this decline in a climatic deterioration. During the 14th century, two extremely unfavorable years for agriculture (1331 and 1389) are mentioned in Icelandic annals. Nevertheless, it appears from an ecclesiastical inventory that grain cultivation was still carried on at the close of the 14th century in Iceland's most southwesterly district, Gullbringusýsla. The church in Garðar in Alftanes owned in 1397 about four hectares of sown corn land, and as it was customary to have 50 per cent of the corn land lying fallow, we may assume that the church in Garðar owned eight hectares of corn land in all. We are also told that this church owned two old plow oxen (Olsen, 1910, p. 92; Thorarinsson, 1944, p. 135).

Olsen and Thorarinsson have adduced certain facts which prove that grain cultivation still remained in existence in the 16th century in southwestern Iceland. According to the bailiff-accounts for the king's estate Bessastaðir in Gullbringusýsla, twenty-three farms paid their rents for the years 1547 to 1552, or for at least one of these years, partly in grain and (or) beer (Thorarinsson, 1944, pp. 137-140).

Moreover, Thorarinsson cites a Latin treatise, written around the year 1593 by a man from south Iceland, Sigurdur Stefánsson, who says that many inhabitants of south Iceland still make good use of their agriculture. However, Stefánsson also says that agriculture is much neglected because most Icelanders think that it is more profitable to buy imported grain than to have the trouble and expense of native agriculture. Several Icelandic authors from the 17th century say that native grain cultivation had entirely stopped. It seems that the end of the old Icelandic grain cultivation came at the close of the 16th century (Thorarinsson, 1944, pp. 140-141).

However, the learned Gisli Magnússon cultivated barley and several garden vegetables on his estate Hlíðardendi in Rangarvallarsýsla in the

17th century (1653-1687); and in the following centuries other attempts at grain cultivation were made in Iceland. In the 20th century, these attempts have met with some success (Thorarinsson, 1944, pp. 142, 144-146); we shall return to these recent experiments at the end of this paper.

Olsen has dwelt upon the fact that a great part of the place-names, which indicate corn cultivation, belong to outlying farms, parcelled off from the large estates. It seems likely that corn production was a sort of specialty for small farmers, economically and socially dependent upon the estate owners whose main interest was extensive cattle and sheep breeding. Some place-names, that is "þrælsgerði", seem to indicate that the cultivators were serfs. Probably, the serfs could win emancipation by this sort of colonization. This custom was known from Norway; previously we have mentioned the famous example of Erling Skjalgson who let his serfs make their own cornfields. Many of the serfs in Iceland were probably of Irish descent; this is reflected in the place-name "Iragerði" (Olsen, 1910, pp. 137-143).

The sagas were mostly put into writing long after the time of their story. Nevertheless, what they tell us about agriculture does probably correspond to actual conditions. We shall mention a few examples.

In Níál's saga we hear about Halgerd's first husband, Thorvald, who was a great estate owner and also possessed the Bear Islands which lie out in the Breiðfjörður, rather far off from his domicile, Straðfelli in the Hvammsfjörður. Meal and dry fish were produced at the Bear Islands, evidently by some of Thorvald's dependents; he went there in a big boat with eight men to bring back provisions. In one of these trips, he met his slayer. In another part of Níál's saga we hear of Atle, a workman, coming from the east, asking for work on Níál's estate. Níál's wife Bergthora, asked him what work he could do. Atle said that he was a farmer, but willing to do other kinds of work. Bergthora engaged him and used him for executing a deed of blood revenge.

On the other hand, we learn in the sagas that certain kinds of agricultural work might be the estate owner's personal job. Especially the work of sowing seems to be a favorite occupation. Höskuld, the Hvitamesgoði, woke up an early spring morning, took the seed corn basket in one hand and the sword in the other hand and went to the field and started sowing. There in his field he was surprised by his foes, Níál's sons, and was killed by Skarphedin. Gunnar of Hlíðarendi was sowing in a field near his home on a spring day when Otkel galloped across the field and rode in upon him, injuring him and hurting his feelings, from which incident very bloody consequences arose. The warlike hero Gunnar loved his fields so much that he could not leave Hlíðarendi when he was banished from the country. Gunnar's famous words, "the fields are yellow, the *tún* is cut", refer to the ripe barley fields and the mown hay field, which he would not leave. We learn from this that agriculture was not regarded by the old Icelanders only as serf's work. A noble hero like Gunnar loved the fields he himself had sown.

Olsen has shown that a system of four years rotation, known in Norway, was used in Iceland. A field was divided into four parts, and each of them was cultivated two years in succession, laying fallow two years. Before sowing, it was manured and tilled. Sometimes seaweed was used for manure.

Probably not all Icelandic farmers had oxen to draw a plow; it seems that the cornfields were in many cases worked with spade, as it was considered a man's work in a day to till forty-nine square fathoms (Olsen, 1910, p. 144). In this connection we should remember that the cultivating of small fields or "reitar" in Norway was also spade work; in the Færoes tilling is also done with spade, and in the Hebrides likewise (with so-called *caschrom*, see Mitchell, 1880, p. 95).

Another feature, which must have come from Norway, is the use of irrigation, mentioned in the Icelandic lawbooks "Grágas" and "Jónbok". Irrigation was used in some places, not only upon meadows, but also on cornfields (Olsen, 1910, p. 84). In this connection we must remember that irrigation is used from past times in the Gudbrabds Valley in Norway (Hatt, 1915). Olsen mentions two localities where traces of artificial water channels have been visible in connection with remnants of ancient fields, namely in Landssveit, in Rangárvallasýsla, and in Landbroti in Skaftafellssýsla. Furthermore, irrigation of cornfields is mentioned in a deed from 1343 about water rights of the Kálfafell church in Hull in Flóthshverfi in Skaftafellssýsla (Olsen, 1910, pp. 103, 108, 110).

Irrigation of meadows is used in many parts of Iceland in modern times, since the middle of the 19th century. P. B. Feilberg mentions as an example, certain irrigation constructions in Grund, an estate in Eyjafjorðarsýsla in north Iceland. Water from a river is led into large and solid enclosures, where the water covers the surface in a thickness of two feet. The water stands there for several weeks in the spring time, protecting the field against frost, and depositing fertilizing substances, as nitrogen, phosphoric acid, calcium and potassium. The phosphorus content of Icelandic rivers, especially the glacier rivers (*jökull-ás*), seems to be very great. Afterwards, the water is again turned off. The fertilizing properties of glacier rivers is also seen in many places in Iceland where such rivers produce natural irrigation of meadows (Feilberg, 1897, pp. 52-53; Stefánsson, 1920, pp. 32-36; Sigurðsson, 1940, pp. 184-185). However, in later years drainage is claiming more interest in Iceland than irrigation. It is hoped that great areas of humid moorland may be turned into good grassland by drainage.

Eggert Olafson, who travelled in Iceland after the middle of the 18th century, mentions irrigation of the *tún* or home grassfield in north Iceland and east Iceland as an old art, almost forgotten. He says that old irrigation channels may still be seen, and he heard a tradition about a clever old man who brought the water to high and dry fields by means of leather conduits, and so irrigated the grassland. Olsen thinks that the ancient Icelanders sometimes irrigated the cornfields, lying fallow, in order to fertilize them (Olsen, 1910, pp. 144-145).

The grain cultivated by the ancient Icelanders was barley and it

is not proven that they cultivated any other kind of grain. Rye is mentioned in a poem from the 11th century, but this does not prove that rye was cultivated in Iceland. Rye was probably imported from Norway, from where considerable quantities of grain went to Iceland during the Middle Ages. Certain small islands in Breiðfjörður were named Rúgeyar (Rye Islands). It may be that rye cultivation has been attempted there, but we have no proof of a regular rye production. Neither do we, in the old literature nor in the place names, find anything about ancient cultivation of oats or wheat in Iceland (Thorarinsson, 1944, pp. 142-143).

However, Thorarinsson has thrown more light upon the ancient grain cultivation in Iceland by his pollen analysis of certain strata belonging to the home fields of two ancient farms in Thjórsárdalur, devastated and deserted by Hekla's eruption in 1300 A.D. Thorarinsson could determine the niveau of the first settlement, the "landnam" niveau. At this niveau, charcoal began to appear, and at the same point the amount of betula pollen decreased and the quantity of grass pollen increased. Evidently, the first settlement brought a shrinkage of the birch forest and a corresponding augmentation of the grassy vegetation. The facts are best explained when we assume that the first settlers burned the natural vegetation and in that way promoted the growth of grasses and so improved the pasture. At the same time, the burning of birch copses was probably also a first step in agriculture. Thorarinsson's pollen analysis indicates that a number of weeds were introduced with the "landnam"; among these were *Spergula arvensis* and *Polygonum aviculare*. Of special interest is the find of a few pollen of the *Myrica gale* or bog myrtle. This plant does not grow in Iceland today. It was used in the Middle Ages in Scandinavia and the British Isles instead of hops in beer brewing. The find of the pollen of bog myrtle in Thjórsárdalur makes it probable that this plant was used and perhaps even cultivated in Iceland in ancient times (Thorarinsson, 1944, pp. 123-129).

It is also of great interest that Thorarinsson's pollen analysis has disclosed pollen cultivated cereals, belonging to two species (Thorarinsson, 1944, pp. 163-170). One of these is identified as barley, the other as oats. This shows that grain cultivation took place in Thjórsárdalur from the "landnam" until the devastation of the valley in the year 1300 A.D. Barley was the main cereal, while oats may perhaps have been a sort of weed in the barley fields. Such an intrusion of oats in barley is known from Jutland in the early Iron Age (Hatt, 1937, p. 28). As mentioned above, there is no literary proofs of oat cultivation in ancient Iceland.

Another plant which may have been cultivated in ancient Iceland is flax. We have no absolute proofs of this, but a few place names seem to indicate flax cultivation, among these *Linakrar* near Njál's estate Bergthorshvoll in Rangárvallasýsla (Jónsson, 1900, pp. 4-5; Thorarinsson, 1944, pp. 171-172). These *linakrar* are ancient fields of the "Celtic field" type (Hatt, 1949, p. 162).

A sort of substitute for grain is the lyme grass, *Elymus arenarius* (Icelandic: *melur*), which grows wild in many parts of Iceland in sandy places. Eggert Olafsen asks whether *melur* represents a degeneration of the corn which ancient Icelanders cultivated or whether the ancient Icelanders may have cultivated the *melur* (Olafsen, 1772, Vol. II, p. 681)? To the first of these questions, the answer must be no; lyme grass is not degenerated barley. To the second question a definite answer can not be given. Such an authority as Sigurður Sigurðsson finds it probable that *melur* was cultivated; he suggests that *melur* is sometimes meant when the sagas speak of cereal culture (Sigurðsson, 1940, p. 122); but positive proofs of this are lacking (Thorarinsson, 1944, p. 147).

The production of meal from the kernels of *melur* is described from western Skaftafellssýsla by Eggert Olafsen. In August it was cut with a sickle well above the root and collected in small bundles. Twenty bundles made a sheaf, and six sheaves made a horse burden. This wild corn was brought home, dried, and thrashed. The straw might be used for thatch. The kernels were kept, and during the winter they were dried in a special drying house (Icelandic: *sofnhús*) by means of a fire. Over the fire was placed a wooden grate with a layer of straw, upon which the *melur* grain was placed. This grate was called *sofn*. The fire was kept low, but the heat was considerable, and after a while the *melur* grain was hard and could be ground upon the primitive hand mill. The meal was eaten as porridge, or as flat cake, or as a sort of raw dough, mixed with whey. This dough was a very nourishing food; the shepherds took a lump of it with them when they went out herding sheep all day. The production of meal from the *melur* required much work, and the yield was very small. Olafsen says that the people were satisfied if they got one barrel of meal from forty horse burdens of *melur*.

It seems that western Skaftafellssýsla was the only district in Iceland where *melur* was used for human food. The reason why the people in that district stuck to that old industry was, according to Olafsen, the remoteness of western Skaftafellssýsla; the people did not buy any foreign corn because they would have to bring it a very long and difficult way from the distant harbor. The coast of this district, and most of Iceland's south coast, is sandy, dangerous and without harbors (Olafsen, 1772, pp. 829-832). The making of *melur* meal was carried on in western Skaftafellssýsla until the beginning of the 20th century (Thorarinsson, 1944, p. 146).

The reason why the *melur* grains were dried over fire was their softness. The heat made them hard and fit for the quern. Probably, the Icelandic barley in the Middle Ages was likewise dried in the *sofn* before grinding. This is the opinion of Eggert Olafsen (Olafsen, 1772, pp. 957-958) and of Olsen (Olsen, 1910, pp. 149-150): and both of them remind us of the fact that the Færoe barley is actually dried by fire; the drying house is called *sodnhús* (Bruun, 1929, pp. 186-188). Olafsen says that the attempt of cultivating barley in Iceland, which the Danish government undertook in the middle of the 18th century by means of

Danish and south Norwegian farmers, failed because these people did not know the process of drying corn over fire. Icelandic barley must have soft kernels, for climatic reasons, and may be hardened by drying over fire. The same has been done in parts of Norway. In Verdal, Norway, an oven for drying malt is called *sonn*. The name, and probably the idea of the oven for corn drying, has come to the Norse people from the Celts (Bugge, 1905, pp. 257, 359).

The collecting of *melur* is especially interesting because the technique of preparing meal from this wild grass is probably similar to the ancient mode of dealing with barley. There are, however, several other wild food plants in Iceland. Most important is a lichen, Iceland moss (*Cetraria islandica*), growing profusely in low regions of the highland, especially in the northern and eastern parts of the country. Iceland moss was formerly gathered in large quantities and used instead of meal, in the form of gruel and porridge. It was possible to spare one-third of the annual purchase of corn by using this substitute. Grains of *Potentilla anserina* were also mixed with the meal (Aðils, 1926-27, p. 472). An edible seaweed, dulse (*Rhosdymenia palmata*, Icelandic: *söl*), grows at the coast, especially in the southern and western parts of the country: it is washed and dried and eaten with meat or fish. *Archangelica officinalis* (Icelandic: *hvönn*), is eaten as a delicacy, both stem and root. Other wild plants, used as vegetables, are scurvy grass (*Cochlearia officinalis*, Icelandic: *skorfa-kál*), and sorrel (*Rumex acetosa*, Icelandic: *túnsúra*). Furthermore, many wild berries (blueberries, blackberries, etc.) are collected (Sigurðsson, 1940, pp. 68-69).

Gardening has increased very much in late years. Potatoes have become an important food resource, and the growing of potatoes "a reasonably dependable business in Iceland" (according to the Ministry of Agriculture). Several kinds of cabbages, beets, and other vegetables are produced in Icelandic gardens. Marvelous results are now obtained in hot house gardening by means of heat from the hot springs. In the saga time, gardening was not entirely unknown. We are told, for instance, in the Laxdöla saga that the famous Gudrun had a *laukagarður*. Beets and onions were introduced early. However, gardening was a rare thing until lately (Sigurðsson, 1940, pp. 191-199). The Icelanders got their vegetable food from wild plants.

Now, it should be emphasized that corn and vegetables were not nearly as important to the Icelanders in former days as in modern times. Nowadays, bread-corn is regarded as the most indispensable of all the necessities which Iceland must import. It was only a hundred years ago that bread became a usual food among common people in Iceland. Formerly, the Icelanders lived almost exclusively on meat, milk, dried fish, and butter (Thoroddsen, 1913-14, p. 213). Meal was used for porridge, which was eaten with milk or sour milk (Aðils, 1926-27, p. 472). According to Jón Steffensen's investigations of skeletal material, the Icelandic population was formerly practically free from *caries dentium*; only the last three or four generations have been infected

with that disease. This is probably due to the fact that, formerly, the Icelanders lived much more from animal food than now. On the other hand, Jón Steffensen, in his investigation of the skeletons from a medieval cemetery in Þjorsádalur, found distinct evidence of scurvy, due to C-avitaminosis, caused by the lack of vegetable food in the diet (Steffensen, 1943, p. 255-258).

The rareness of corn in ancient Iceland is also reflected in high corn prices. Around the year 1200 A.D. in southwestern Iceland, Arnessýsla one pound of meal cost as much as one pound of butter (Thoroddsen, 1913-14, p. 213). However, it seems that corn prices were falling in the 14th and 15th century, probably because more corn was imported and the population diminished after the great plague (1402-04). The value of one pregnant cow (one *kú-gildi*) was equivalent to three *vættir* meal (one *vætt* equal to thirty-five kilograms) in the 11th, 12th and 13th centuries; in the 14th century, four *vættir*, and in the first half of the 15th century, six *vættir* meal were paid for with one *kú-gildi* (Jóhannesson, 1933, p. 26, note).

What the Norse emigrants found in Iceland was, first of all, room for their expansive cattle farming; but they utilized also other opportunities which the new land offered. A great example of an all around colonist is Skallagrim, the poet Egil's father, such as he is described in Egil's saga. Although the saga was first written around 1200 A.D. and may not in all details be historic truth, it gives a realistic picture of life in the period of colonization. Skallagrim took land in western Iceland, at Borgarfjörður. In the 29th chapter of Egil's saga, we are told how Skallagrim strove to utilize all natural resources, which was quite necessary, as there was not, to begin with, cattle enough to feed the people. Skallagrim let some of his men carry on fishing in the sea, seal hunting, and egg collecting. Drift timber he used for boat building. One of his farms he placed at a point where drift timber came in from the sea, and at this place he had cornfields made and called the farm *Akrar*, that is, "cornfields". Some of his men he sent inland to catch salmon in the rivers and also to herd cattle and sheep which found good pasture in the mountains in summer. Furthermore, he was an able and industrious smith and made iron of the bog iron ore.

The colonization period lasted about 60 years, from 874 A.D., when the first settlement arrived, until 930 A.D., when Iceland was politically organized as a republic. During that period, practically all land of value from a farmer's viewpoint was occupied.

The following centuries brought a prosperous development of cattle farming. Þorkell Jóhannesson, in his interesting book about the free workmen in Iceland, has named the period 930 to 1300 A.D. "the age of farming" (*Zeitalter der Landwirtschaft*). Farming, supplemented with fishing, gave the population all the necessities of life.

In the first generations of this period, the population increased very rapidly. At the end of the 11th century, the tax paying farmers were numbered; this census was occasioned by the introduction of liability to pay tithes to the church. The number of tax paying farmers was, at

that time, 4,560, and upon that basis, the total number of Iceland's inhabitants has been estimated at 77,000 to 80,000. However, this seems to represent a culmination, for during the following centuries, the population density seems to have decreased, partly from economic causes (Olsen, 1907-15, pp. 295-384; Jóhannesson, 1933, p. 31).

The rapid increase in population density during the first part of the age of farming was a result of the utilization of the natural opportunities which the cattle farmers found in this new country. The low land between the coast and the mountains, and the valleys which stretch far inland in continuance of the firths, had rich natural pastures. These were quickly occupied; the influx of settlers was very rapid in the "landnam" period, and the natural increase of the population was also very lively. In that way, all useful land was taken up, and the settlers went beyond the natural limits. Deserted farms in mountain valleys and on the plateaus are witnesses of a retreat which had often taken place in medieval time. Without doubt, the natural resources were some what diminished by the human influences. Especially, the birch forests were destroyed, not only by the clearance fire method of the farmer, but also by charcoal burners. It was difficult for the forest to regenerate so close to its climatic limit when exposed to the cropping of large herds of sheep. In some places, the destruction of natural vegetation made the wind erosion very active. In southern Iceland, certain areas, formerly inhabited, are now bare lava fields because the wind has blown the soil away. Volcanic eruptions have also caused much devastation. A climatic deterioration may have taken place in the late Middle Ages, although some authorities have denied this. Also, without a climatic change, the human influences would diminish the natural resources.

The most important domestic animals were sheep, cows, and horses. Less prominent were goats and swine. However, it seems that swine prospered in Iceland in the "landnam" time. There are several narratives in the sagas about colonists whose swine broke away and got wild and were found again later when they had increased to numerous herds (Schönfeld, 1902, pp. 252-254). Swine breeding was continued in Iceland until the 15th century, and then it stopped entirely. Different kinds of poultry were also introduced in the "landnam" time, but they never gained significance.

The milch cows received most care. They were kept during winter in stables and fed with hay. The sheep were driven out every day in winter to seek their food beneath the snow, and brought back in their stables at night. The work of the shepherd was especially hard in winter. In modern times, the sheep are better cared for and also given hay in winter. The horses, although they were indispensable as means of transport, were mostly left to shift for themselves during winter; only the favorite riding horses received a better treatment.

The necessity of providing winter fodder for the cattle compelled the farmers to collect hay. The very first Norse attempt at colonization in Iceland was a failure, because Floki Vilgerðson forgot to collect winter

fodder. Hay harvesting was, and is, a most important work in summer. In the sagas, the concept "work" is almost identical with "hay making" (Schönfeld, 1902, p. 27), although there were, of course, many different kinds of work upon an Icelandic farm in the saga-time (Jóhannesson, 1933, pp. 74-78).

For instance, it was necessary to provide fuel for the hearth. The burning of charcoal was carried on as long as there was any birch forest left. Peat was dug, or sheep dung from the stables or folds was cut into pieces and dried for fuel. Fences were made of stones and sod. The summer was a very busy part of the year. In the spring, the cattle were sent out on the natural pastures. In May, the lambing season came and in June, the sheep's wool was shorn or plucked, and then the sheep were driven into the mountains. The milch-cows and milch-sheep were driven to the *sel*, or summer dairy farm in the mountains; there, a herdsman tended the animals, and women took care of the milk and prepared cheese, butter, and *sykr*, a sort of curdled milk which was, and is, a chief article of food in Iceland. July, August, and part of September was the time of hay making. The grass in natural meadows and good pastures was cut with the scythe, raked, and turned, and lastly, when dry, the hay was tied into large bundles and carried to the hay barn by means of horses. Very good hay was cut in the *tún*, the manured home field, which was fenced in. In the last part of the hay harvest, the corn harvest began, if the farmer had a corn field.

After harvest, the animals were brought from the mountains. The sheep, belonging to the different owners, were separated in special folds. As in the Færoes, the sheep had owner's marks cut in the ears. The fall was also the time of slaughtering. In winter, there was hard work for the shepherds who looked after the sheep in the day time. Other people took care of the cows in the stables, feeding them with hay, milking them, and removing the dung.

A very important work during the winter was the spinning and weaving of the wool. The homespun cloth, *vaðmal*, was not only clothing for the family and the servants, but also an important article of commerce. *Vaðmal* served as a standard of value, a sort of money. Another standard of value was the *kú-gildi* or cow's value; to have full value, the cow should be with calf.

The farms, which the "landnam" men established, comprised very large areas and were in many cases quite considerable estates. Also in later times, the Icelandic farms were big. In the Færoes, the subdividing of farms resulted in villages or hamlets and a parcelling out of the homefields in small lots. In Iceland, the large, solitary farm was continued as a characteristic feature. Only a small part of the farm's area, the home field, is given cultivation and manure. The largest area is utilized without any cultivation. This system is old, for the "landnam" men brought it with them from Norway. A Norwegian historian has called this primitive economy "harvest farming", in contradiction to real agriculture. Skappel assumes "that in the time of quite primitive farming 85 to 90 per cent of the crop came from uncultivated land"

(Skappel, 1937-40, p. 235). This was in medieval Norway. Since then, economic evolution has augmented the importance of real agriculture in Norway considerably. In Iceland it may also be said that agriculture, in the form of grass cultivation, has increased and improved considerably in modern times. The *tún* or home field is now intensively cultivated and much increased in area.¹ On the other hand, the *sel* or summer dairy farm is now given up.

However, in late Middle Ages farming did not make any progress in Iceland. Þorkell Jóhannesson has called the period 1300 to 1550 A.D. "the age of fishing" (Zeitalter der Fischerei). After 1300 A.D., the products of fishing came in great demand. Formerly, Iceland exported wool, wadmal, and hides. In the 14th century, the Hanse merchants got hold of the fish trade, which had a center in Bergen; and dried fish and fish oil became the most saleable of Iceland's products. The result was that many Icelanders turned from farming to fishing. At the same time, the prices of corn and other products of farming fell. The great plague which raged in Iceland (1402-04) and killed off one-third of the population, also did much harm to farming and many farms were deserted.

The expansive power of the Norse cattle farmers, characteristic of the "landnam" period and the first part of the age of farming, was quite spent in the late Middle Ages. But, when this expansive power was at its height, it could not find room enough in Iceland, and therefore, Icelandic farmers went across the western sea with their cattle and colonized Greenland.

GREENLAND

Eric the Red, the man who started the colonization of Greenland, was born in Jæren in southwestern Norway. He came to Iceland as a child with his father Thorvald who had to leave Norway because of manslaughter. At that time, Iceland was already largely settled, and Thorvald took land in a rather bleak and unattractive part of the country, Drangaland in Strandasýsla (northwestern Iceland) facing the Arctic Ocean. In this region, less adapted by nature to farming than to fishing and seal hunting, Eric the Red grew up. Later on, Eric married Thorhilde (or Thjodhilde), a woman of a respectable family, and settled in Haukadal in Dalasýsla, a more populous and attractive district. However, Eric was as combative as his late father had been. He was exiled from Haukadal for homicide, and later on for new manslaughter he was outlawed and had to leave Iceland for three years. He made his ship ready for a long journey, saying that he wanted to find the land which the Norwegian Gunbiörn had seen when he was driven west from Iceland by a storm, and if Eric succeeded in finding that land, he would return to his friends in Iceland.

¹According to unofficial information from the Icelandic Ministry of Agriculture, the acreage of the *túns* increased from 23,061 hectares, average for 1919-23, to 43,208 hectares in 1949. In the same period, the crop of *tún* hay increased from 59,800 tons to 159,700 tons, and hay from uncultivated land decreased from 106,200 to 60,000 tons.

Eric sailed west from Snæfellsnes in western Iceland and came to a part of East Greenland which he called Miðjökull, evidently because the land was covered by inland ice. Eric was looking for habitable land, and therefore he sailed south along the coast and came to West Greenland, of which he explored the southern parts systematically from a cattle farmer's point of view. He used three years in exploring activity. In the summer time, he went into the fiords. He selected a dwelling site for himself at Brattahlid in Eric's Fiord (now Tunugdliarfik in Julianehaab District), the most attractive and fertile region in Greenland. He explored also the great system of fiords in the Godthaab District, and in the last summer he explored again the southern part of East Greenland's coast (Nørlund, 1936, pp. 17-18). He did not winter in the fiords, and probably he did not have any cattle with him on this journey. He probably lived on fishing and seal hunting.

After three years, Eric returned to Iceland and landed in Breiðfjörður. He told his friends about the new land, which he gave the name Greenland, to make it more attractive for settlers. His propaganda for the new land met with success and the following summer, which was 985 A.D., fifteen years before the religion of Christ was legally introduced into Iceland, twenty-five ships with settlers, cattle and other goods left western Iceland (Breiðfjörð and Borgarfjörð) and sailed for Greenland. Only fourteen of these ships reached Greenland, according to the "landnam" book; of the others, some were driven back and some were lost.

This first European migration to Greenland was a great undertaking; as Nørlund remarks, the greatest enterprise ever directed towards Greenland. On board the ships may have been between 500 and 700 persons (Nørlund, 1936, p. 19). In the following years, the migration continued. For example, in Thorfin Karsefni's saga we are told that Thorbjörn Vífilson on Laugarbrekka came in economic difficulties; he then sold his landed property in Iceland and went to Greenland, accompanied by a considerable number of friends who would not part from him. They had a difficult journey, lost their way upon the sea, but nevertheless, at the beginning of the winter they reached Herjolfsnes in southern Greenland. Later on, Thorbiörn continued his journey to Brattahlid and met his old friend Eric the Red, who received him well and gave him land nearby on Stokkenes.

So, around 1000 A.D., the Norse farmers in Iceland were expansive enough to settle that part of Greenland where the natural conditions allowed cattle farming. They brought with them an aristocratic form of social organization. A few chiefs took land, and they allowed the lesser men to settle. Eric on Brattahlid was the leading authority as long as he lived. Most of the settlers lived in the so-called *Eystribyggð* (eastern settlement), in what is now Julianehaab District. The *Vestribyggð* (western settlement) lay around the present colony of Godthaab.

Very few Norsemen settled on the open coast towards the sea, where the natural conditions were not favorable to cattle farming. In the

inner fiords, the summers were, and are, warmer, and the vegetation more luxuriant; and there, the ruins of the Norse farms are very numerous. However, the Norsemen were also fishermen and hunters, and these activities were vitally important. According to Thorfin Karlsefni's saga, there was a great scarcity in Greenland that winter when Thorbjörn and his followers arrived at Herjolfsnes, because the men who had gone upon fishing and hunting expeditions had caught very little, and some of them had not returned (*Grønlands historie Mindesmærker*, 1838, Vol. I, p. 373).

Fishing and hunting expeditions were a necessary part of the economy of the settlers in Greenland. In Bjarni Jónsson's so-called "Grønlands Annaler" it is said that all the great farmers (*stórbændr*) in Greenland own ships which they send north for fishing hunting; it is necessary for the Greenlanders to undertake these expeditions to the uninhabited northern coasts to get drift wood and for hunting (*Grønlands historiske Mindesmærker*, 1845, Vol. III, p. 238-245). An archaeological find, a runic stone, found in a cairn on the small island, Kingigtorsuaq north of Upernivik, near seventy-three degrees north, shows that the Norsemen's expeditions might have penetrated to this point.¹

It seems unlikely that the Norsemen, making such extended voyages, should not have found the American continent, and a number of Norse voyages to America are mentioned and even described in details in medieval Icelandic sagas.

One of the first Norsemen who saw the American continent, was Bjarni, the son of Herjolf who went with Eric the Red and settled at Herjolfsnes. Bjarni, a rich and independent young man who owned a seagoing ship, was at that time in Norway; but he returned to Iceland in the summer, his father having sailed for Greenland in the spring. Bjarni decided that he would in search of Greenland and spend the winter with his father. He did not know the route, and before he reached Greenland he saw other lands, which were since identified with some of the lands discovered by Eric the Red's son Leif.

Leif visited Norway in the year 1000 A.D. and met the king, Olaf Trygvesson, who converted him to the Christian religion and exhorted him to bring Christianity to his countrymen in Greenland. On his return journey to Greenland, Leif lost his way, like Bjarni, and found "Vinland the Good", a wonderfully fertile land with self-sown wheat, grape vines, and large trees. Leif is also credited with the discovery of a flat forest land, Markland.

Several Vinland voyages are described in the sagas. Attempts were made at colonizing Vinland. The greatest venture was that of the Icelandic merchant Thorfin Karlsefni. In Thorfin Karlsefni's saga, we are told he took 160 men with him (*Grønlands historiske Mindesmærker*, 1838, Vol. I, p. 409). The expedition is said to have

¹Even farther north, in Inglefield Land, about seventy-nine degrees north, Norse artifacts have been found; these may perhaps have been brought so far north by Eskimo, trading in Norse utensils as curiosities (Holtved, 1945).

lasted four years (A.D. 1007-1011). Karlsefni had his wife with him, and there were several other women. Evidently, the idea was to lay the foundation of a permanent settlement, for cattle were also brought. The colonization did not succeed, because the natives, whom the Norsemen called "Skrælings", were hostile and numerous. Karlsefni and his people got the opinion that, although the land had many natural riches, they would have continually to fear hostilities from the original inhabitants. Therefore, they prepared their return to their home country.

It is generally agreed that "Markland" was Labrador. About the position of "Vinland" there is much dissension. Different authors have placed it differently, between Florida and northern Newfoundland. One, H. P. Steensby, has placed it inland, in the St. Lawrence Valley, and the narrative of Karlsefni's voyage may support the theory that Karlsefni's expedition went up the St. Lawrence (Holm, 1925). F. Hansen, in his great work "In Northern Mists", has placed Vinland in the world of fancy, comparing it to the isles of the blest in classical myths and similar islands in Irish folklore. This view has met with strong opposition from many sides. It cannot be denied, however, that the sagas of Vinland voyages contain many folklore motifs. For instance, Karlsefni's expedition met the Unipeds, and the "Skrælings" of Vinland evince certain traits that remind us of mythical, supernatural beings; that is, they have a curious predilection for milk, which agrees with "Nisser" and "Huldrer" in northwestern European folklore, but contrasts singularly with the food usages of American aborigines (Nansen, 1911, Vol. II, p. 15). Attempts at identifying the "self-sown wheat" with American cereals have not been successful. However, abundance of wine and wild corn are essential features of the *Insulæ Fortunatæ*, described by Isidorus whose work was widely known in Iceland (Nansen, 1911, Vol. I, pp. 345-353).

However, in spite of these and many other folklore elements, the Vinland sagas may perhaps contain a kernel of truth. It cannot be doubted that the Norse Greenlanders made trips to the American continent. From Icelandic annals it is known that a ship from Greenland arrived at Straumfjörðr in Iceland in 1347 A.D., coming from Markland; on its return journey from Markland, the ship was driven over the sea to Iceland (*Grønlands historiske Mindesmærker*, 1845, Vol. III, p. 15). In Markland, the Norse Greenlanders probably fetched timber, one of their greatest necessities. In the Vinland sagas, we are told that the ships were loaded with wood when they returned to Greenland. This is probably a realistic trait.

Another trait, that also looks like a piece of realism, is the great interest which the Vinland voyagers took in good pastures. Cattle farming was certainly the most important business of the Norse Greenlanders. It has been suggested that the name Vinland might originally have nothing to do with wine, *vin* being an ancient Norse word for pasture (Nansen, 1911, Vol. II, pp. 62 ff). It is a difficulty of this theory that the place names with *vin* are supposed to belong to an earlier period. However, the idea that Vinland might simply mean

"pasture land" has given rise to an attempt at localizing Vinland outside of the region of wild grape zones and maize culture, in northern Newfoundland (Tanner, 1941).

The sagas mention the discovery of the American continent (Markland, Vinland) as occurring very shortly after the settlement of Greenland, which seems probable. In this early period, before the sailing route to Greenland was well known, a ship destined for Greenland, might easily happen to lose its way and land in Labrador.

The story of Tjorfin Karlsefni's expedition leaves the impression that the colonization of Vinland was given up mainly because the natives were numerous and hostile. In fact, this is probably the essential reason why no permanent Norse colonization was made in pre-Columbia time upon the American continent. Greenland was uninhabited when the Norsemen arrived there, although fragments of boats and stone implements indicates the presence of inhabitants (*Grønlands historiske Mindesmærker*, 1838, Vol. I, pp. 168-176).

What makes all attempts at localizing Vinland hypothetical, is the absence of any trustworthy archaeological evidence of Norsemen in pre-Columbia times upon the American continent. Several attempts have been made to produce such evidence but so far, the results have been unconvincing.¹

On the other hand, in Greenland the archaeological material from the Norse Icelandic colonization is rich and abundant. Danish investigations are responsible for this material. In 1880, G. F. Holm made a survey of ruins in the old East Settlement in the Julianehaab District (Holm, 1881). His work was continued by Daniel Bruun who made archaeological and topographical surveys of the East Settlement and the West Settlement (Bruun, 1896, 1917). Daniel Bruun's thorough knowledge of habitation, daily life, and archaeological remains in Iceland (Bruun, 1918) and the Færoes (Bruun, 1929) made it possible for him to understand and interpret the remains of the Norse settlements in Greenland. The old literary sources were also explored in order to throw new light upon the topography of ancient Greenland, especially by Finnur Jónsson (1898). A comprehensive view of the Norse or Icelandic colonization of Greenland was given by Daniel Bruun (Bruun, 1918).

Then followed a series of more intensive investigations of important archaeological sites in Greenland, bringing a flood of information (Nörlund, 1924, 1929; Nörlund and Stenberger, 1934; Roussell, 1936). The foremost leader of these newer investigations is Poul Nörlund, and he has given an instructive view of the results (Nörlund, 1936).

¹Bronsted discusses the so-called Kensington runic stone and other finds brought forward by Hjalmar R. Holand and others. In Bronsted's opinion, none of these finds give clear evidence of the presence of Norsemen on the American continent in pre-Columbia time; probably, all Scandinavian archaeologists will agree with Bronsted on that point. Nevertheless, Bronsted thinks that such evidence may perhaps some day appear, and he proposes a systematic search for medieval Norse dwelling sites in America (Bronsted, 1950).

Nölund's assistants, especially Aage Roussell, have continued his work. An important comparative study of the architecture of farm buildings and churches in the Norse settlements of Greenland was made by Roussell (Roussell, 1941).

According to an old manuscript which Bjarni Jónsson copied in the 17th century in his "Greenland annals", there were 190 farms in the East Settlement and 90 in the West Settlement (Grønlands historiske Mindesmærker, 1845, Vol. III, p. 229), or 280 farms for all Greenland. On this basis, the medieval Norse population of Greenland has been estimated at 3000, at the time when all the farms were occupied. In many cases it seems evident that a subdivision of farms had taken place. The natural increase of the inhabitants would necessitate such subdividing. The ruins show a not inconsiderable density in the central part of the East Settlement, with two focal points: at Brattahlíð, Eric the Red's farm where the secular authority had its seat, and at Gardar (now Igaliko) where Greenland's bishop resided. Christianity was introduced very shortly after the first immigration, and early in the 12th century Greenland became a bishopric. There were twelve churches and two monasteries in the East Settlement and four churches in the West Settlement. Bishop Arnald arrived in 1126 A.D. and took up his seat at Gardar on a tongue of the land between the two best populated fiords, Ericsfiord and Einarsfiord. At Gardar an imposing cathedral was built of stone and another large building was the Episcopal dwelling house. There are ruins of many other buildings, among them two large stables or cow houses. The Episcopal farm was the biggest in Greenland and the archaeological investigation of Gardar has thrown much light upon the economy of Norse Greenland (Nörlund and Roussell, 1929).

The two cow houses were enormous buildings. The largest of them had an inside length of 63.5 meters and an inside breadth of 41.2 meters. The other one had the same breadth and a length of 41.5 meters. They were both divided in two compartments by a transverse wall; the eastern compartment was in both cases a little larger than the western and they were solidly built. The walls were made of large blocks of sandstone, with turf and earth as filling, 1.5 meters thick. Outside the stone walls were thick mounds of turf. Stall stones, large flat flags of sandstone, were found in the eastern compartments, along both long walls. The number of stalls in the eastern part of the larger cow house had been sixty-five, and in the eastern part of the smaller cow house, forty-two. These two cow houses together had room for more than a hundred cows. The western compartments of the cow houses were probably used for hay. Besides there were horses, pigs, and large numbers of sheep and goats on the Norse farms. A number of ruins at Gardar were probably winter stables or storm shelters for the flocks. Some of these buildings lie scattered upon the home field or *tún*, but most of them lie directly against the surrounding *tún* fence or outside of it. There are also folds that presumably were used as milking pens or night folds where sheep and lambs were separated at night, so that the sheep could be milked in the morning before the animals were driven out to the mountain

pastures. Certain larger enclosures may have been used as grazing folds or as cattle pens in spring and autumn when the animals could be out in the day time, but had to be stabled at night.

The area of the *tún* at Gardar is more than 15 hectares. It has natural boundaries on three sides; a steep mountain side on the west, a stream on the south, the fiord and some lakes and marshes on the east, and a fence of stone and earth towards the north and northeast. The vegetation of this large home field was used for hay making; it was probably the watch dog's job to keep the animals away from the *tún*. Probably additional hay was brought in from other places. In summer, sheep and goats have grazed upon the mountain slopes, and the cattle were probably sent by means of boats to good pastures near the fiord. Nörlund cites, in this connection, a description of Greenland from the 14th century by Ivar Baadson, a Norwegian priest who lived in Greenland for many years as a steward of the Episcopal estate. In this description, it is said that "on the right as one sails into the fiord to the cathedral, which stands at the head of it, there is a large forest which belongs to the cathedral, and in the same forest the cathedral has all its cattle grazing, both large and small" (Nörlund, 1936, p. 134; Jónsson, 1898, pp. 278-79).

The "forest" in this text may have been a copse wood of birch and willow, as Nörlund remarks. Nowadays, the locality is a bare and inhospitable district devastated by wind. Evidently, conditions must have been more favorable for pasturing in the Middle Ages. The very existence of the large cow houses and numerous sheep stables and folds seems to prove that the natural conditions have been better than they are now.

In fact, Gardar is now the home of a small farming community of mixed blood, descending from a Norwegian, Anders Olsen from the island Senjen in northern Norway, who settled Igaliko as a cattle and sheep breeder in 1780 A.D. Hay making and a little kitchen gardening is practised on the old *tún*, but the whole production is certainly far below that of the Episcopal estate in the good period.

However, the Norsemen at Gardar, as everywhere else in Greenland, did not live entirely by farming. This is evident from the animal bones found in the layers of kitchen refuse in the farm yard. Sealing was very important, for bones of the saddleback (*Phoca groenlandica*) were more numerous than those of any other animal and without doubt, this seal was taken in the fiord. Other seals, such as the bladder-nose, must have been taken at the open sea coasts; and the walrus, of which many skulls were found, was caught farther away, on hunting trips to the east coast and especially to the northern part of the west coast. Fishing was probably very important in the fiord, although very few fish bones were found. Perhaps the fish refuse has been used for cattle feed, as in northern Norway.

Among the land animals, the caribou was the most important. Among the domestic animals, sheep and goat occur most frequently. There were also remnants of oxen, pigs and horses. The Norsemen have

kept pigs in Greenland, as they also did in Iceland in medieval times. In Iceland, the pigs were driven out on the hill pastures together with the sheep in the summer; the same method may have been used in Greenland. From their bones it is seen that the cows in Greenland were small animals, about the same size as the small race which we had in Denmark in medieval times. The horses were also mostly of a small race; they were probably not very numerous in Greenland. The sheep were mostly of a "goat-horned" form and somewhat more powerful than the medieval sheep in Denmark; Degerbøl thinks that this may be due to an adaptation of life in a mountainous country (Degerbøl, 1929, 1934, 1936).

The great importance of the cows depended upon the milk production. Milk, from cows, sheep, and goats, was an essential part of the diet. Butter, cheese, and curdled milk (*skyr*) were vital dairy products.

One would expect that summer dairy farms were used in the mountains, as in Iceland and Norway. However, archaeological proofs of this seem, so far, to be lacking. The remains of inland farms, that have been investigated, seem generally to be meant for all year habitation, having cow houses and sheep stables. An exception is a small ruin in Austramannadal in the West Settlement (Roussell, 1941, pp. 229-230), which may have been a summer dairy farm, if it is not the last remnant left of the buildings of an ordinary farm.

The landed property of the cathedral was certainly very considerable; all Einarsfiord (now—Igaliko Fiord) belonged to the cathedral, says Ivar Baardson. The numerous farms of that fiord were "leased farms under the see, but all the same they have been independent working units" (Nörlund and Roussell, 1929, pp. 134-135), and not summer dairy farms.

In the "Speculum Regale" or "King's Mirror", a sort of encyclopedic work from the beginning of the 13th century written by a Norwegian, very good information is given about the natural condition and economy of Greenland. The book has the form of a dialogue between father and son. The father says that in Greenland there are good pastures and large and good farms, for the people there have much cattle and sheep, and much butter and cheese is made. The people live much upon that, and also upon meat of caribou, whale, seal, and bear. As to cereal culture, the father says that the country has not much benefit of that, but "there are men—and they are looked upon as the highest and mightiest—who try, as an experiment, to sow. But the greater number in that land do not know what bread is and have never seen bread."

The information about Greenland in the "King's Mirror" is remarkably sober in its form and seems to be quite realistic. Nansen has pointed out that this old work contains some climatological details which are surprisingly correct and in accordance with modern science (Nansen, 1925, pp. 8-10). Cereal culture can not have been any success in medieval Greenland, nevertheless, it must have been tried; and the Episcopal farm at Gardar is one of the places where such trials would

be made. Nörlund has suggested that certain enclosures at the border of the home field were used for cattle in the spring and autumn and in that way were manured, while in summer the same enclosures were perhaps used for grain growing (Nörlund and Roussell, 1929, p. 140). In this connection he mentions also the finds of mill stones in Greenland. By his investigation at Gardar, fragments of three mill stones were brought to light; their radius was 15 to 20 centimeters. Previously, other mill stones were found at Gardar and also at several other large farms in the East Settlement, among them Brattahlid (Nörlund and Stenberger, 1934, pp. 131-132), mill stones have been found. In one of the island farms, excavated by Vebæk, east of the Igaliko Fiord, a half part of a mill stone of gneiss was found, 31.5 centimeters in diameter (Vebæk, 1943, pp. 87-88). That grain was ground in Greenland is therefore probable, and this means that porridge and probably also bread were eaten.

We can not know for a certainty whether the grain was domestic or imported. However, there is reason to believe that the imported grain came mostly in the form of flour (Nörlund and Roussell, 1929, p. 142).

In the closing part of Ivar Baardson's relation are some surprising utterances. We are told that much snow falls in Greenland, but it is not as cold as Iceland or Norway. On the mountains and below there are fruits as large as apples and as good to eat, and "there grows the best wheat that can be". It has been suggested that this might refer to Vinland (Grønlands historiske Mindesmærker, 1845, Vol. III, p. 264). It may perhaps also be an old man's beautifying memory. Ivar Baardson had been steward of the Episcopal estate in Gardar for many years. He remembered certainly the glorious summers in the inner fiords, and perhaps also some promising attempts at grain growing on the Episcopal farm.

The clergy would naturally have a special interest in grain growing. Bread and wine are necessary for the performing of the holy communion and the procuring of these items must have been a serious problem for the priests in subarctic surroundings. As to wine, a substitute, used at the holy communion, was a beverage made from the berries of *Empetrum nigrum*, which grows profusely in Greenland.¹

European civilization had its origin in lands of wheat and wine. Wheat represents the Christian God's body, wine his blood. It may be understood that the island of wine and wild wheat was beloved in northwest European legend and saga, and that the priests at Gardar took a lively interest in grain growing.

However, more vital than all grain growing experiments was the problem of bringing the cattle safely through the Greenland winter.

¹In the Icelandic bishop Paul's saga it is told that bishop Jon from Greenland came to Iceland on a visit, and taught people how to make wine from crowberries. Jon had learned this art from the Norwegian king Sverre (Grønlands historiske Mindesmærker, 1838, Vol. II, p. 765).

Two things were necessary: sufficient winter fodder and warm stables. In Greenland, as in Iceland, the hay making was indispensable and willow twigs were also used for fodder.

A curved leaf knife was used for cutting twigs, and a short scythe for cutting grass. Remarkably well preserved specimens of both implements were excavated by Roussell in a room in the ruin of a large and complex farmhouse, in Austmannadal, West Settlement (Roussell, 1941, p. 270, 273, Fig. 169, 295-6). The scythe is called a sickle by Roussell; however, Stenberger has the right designation (Stenberger, 1943, p. 202). The blade of this scythe is only 20 centimeters long, 2.2 centimeters broad; the wooden handle is missing. From Nörlund's and Stenberger's excavation at Brattahlid has come a fragment of a sharp edged iron blade, 15 centimeters long, with a curved back; this fragment is interpreted as a sickle (Nörlund and Stenberger, 1934, p. 133, Fig. 99); it may well be a fragment of a scythe. The scythe was used for cutting grass in the level home fields, but also in outlying pastures which were often uneven and stony. Sickles and scythes of iron were also found in a Norse farm, in the Vatnahverfa district southeast of the Igaliko Fjord, East Settlement (Vebæk, 1952, p. 114).

Willow twigs were probably an important winter fodder; they were presumably also used for bedding in stables and perhaps in dwelling houses too. Roussell has published three well preserved curved leaf knives from his excavations in the West Settlement. One of them is mentioned above, and two others were found in the Sandnes farm (Roussell, 1936, pp. 111, 117, Fig. 89). It may be remarked that Roussell found a layer of willow twigs upon the floor in one of the rooms of a stable complex belonging to the Sandnes farm (Roussell, 1936, pp. 45-46, Fig. 32).

The necessity of warm stables taxed the inventiveness of the Norse farmers in Greenland, for the winters were much colder in Greenland than in any other part of the Norse culture region. It is interesting to observe that the Norse Greenlanders have used several expedients or devices for keeping the cold out of the cow houses.

We have mentioned the large cow houses at Gardar which had stone walls, 1.5 meters thick, and in addition very thick mounds of turf on the outsides of the long walls. At Brattahlid, the secular center of ancient Greenland, similar turf mounds are found enclosing the cow stables on all sides. As Nörlund writes, "The intention of these mounds has undoubtedly first and foremost been to provide shelter against the cold; that is why they are principally to be found at the stables which houses the animals that were most precious, the most indispensable, and the most irreplaceable of all the 'inhabitants' of the farm: the cows" (Nörlund and Stenberger, 1934, p. 85).

Such turf mounds were used around the byres everywhere in Greenland. Another device, used everywhere to economize the warmth, was the placing of a hay barn in immediate connection with the stable. In Brattahlid there was found a third device; a long and narrow door passage, in one case with a curved course, evidently intended to prevent

the cold air from entering the stable. We will again cite Nörlund: "How the necessary minimum of fresh air has been able to get in through this narrow canal to the twelve cows is a problem" (Nörlund and Stenberger, 1934, p. 92). Another problem is; where did the Norse farmers get this device? Roussell suggests that it may be a local invention, as, so far, it is only known from Brattahlid and from another big farm, "Undir Höfda", in the East Settlement. Roussell remarks also that projecting entrance passages are known from a Norwegian Viking Age house and also from Icelandic excavations of medieval farms (Roussell, 1941, pp. 220-221). These examples are, however, unlike the door passages of the Brattahlid stables. It can not be denied that these remind us somewhat of the passage ways of Eskimo houses. Could the farmers of Brattahlid have seen Eskimo dwellings on their hunting expeditions in the north?

Eric the Red's estate at Brattahlid was in the course of time split up into several farms. Nörlund and Stenberger have investigated the remains of four farms at Brattahlid. One of these, the "South farm", was comparatively small, but it has the particular interest that its main building is a complex, containing dwelling, stable, barn, and smithy. Roussell suggests that this centralized farm building may have been the home of a superior servant who personally owned a few animals; and he thinks that such centralized complex buildings were very common in Greenland, the natural form for small and medium sized farms (Roussell, 1941, pp. 160 ff). The old system, where the dwelling is a separate building and stables, barns, and store houses lie scattered about the home field, is apparent in the ruin groups of the big farms or estates. The centralized, complex house, where dwelling rooms, livestock rooms, barns, and sometimes other storerooms are concentrated in one large block, is an adaptation of Greenland's winter climate and the lack of fuel. Generally, the cow stable is placed near the middle of the block, surrounded by other livestock rooms and barns and dwelling rooms. There are ordinarily special entrances for the dwelling part and the livestock part, but there is often a passage between them, so that people might tend the cattle in the hard winter without leaving the house. The entrance to the byre from the outside is frequently a long and narrow passage. This large centralized house is the final architectural result of the Norse farmer's endeavor to protect his animals against the rigorous Greenland winter (Roussell, 1941, pp. 159 ff).

It may be added that the centralizing tendency has not always taken the human dwelling into the block. For instance, at the big Sandnes farm in the West Settlement, there is a special dwelling house and two large stable complexes, each containing a cow byre and several sheep and goat stables and barns. In one of the stable complexes, the byre has not only been used for cows, but also for pigs; the excrement of the pig was preserved. Evidently, the pigs have shared the warmest room in the stable complex with the cows (Roussell, 1936, p. 43).

The cleaning of stables must have been an important work. In the byres, the floor was generally laid with stone, and a gutter in the middle

collected the urine. Some of the many spades and shovels of wood, whale bone, and antler, which Roussell found in the Sandnes farms, may have been used for cleaning the stables.

END OF THE NORSE SETTLEMENTS IN GREENLAND

In Ivar Baardson's relation, we are told that "now the *Scrælings* have all the West Settlement, and there are enough horses, goats, cattle, sheep, all wild, and no people, Christian nor heathen". Further, we learn that Ivar Baardson was one of those who were sent by the Law Speaker, that is, the secular authority at Brattahlid, to the West Settlement to drive the *Scrælings* out; "and when they came there, they found no man, neither Christian nor heathen, but some wild cattle and sheep, and they fed themselves upon wild cattle and sheep, as much as the ships could carry, and sailed home with that" (Jónsson, 1898, p. 328; Nörlund, 1936, p. 134). The expedition may have taken place about the year 1360 A.D., as Ivar Baardson appears to have returned to Norway before 1364 A.D.

This seems to have been the end of the West Settlement. The East Settlement lasted considerably longer, although historic accounts are not known later than the year 1410 A.D., when an Icelandic ship left the Greenland shores after a four year visit.

Poul Nörlund's remarkably successful excavation of a Norse cemetery in Herjolfsnes (now Ikigait) in the southernmost part of the East Settlement (Nörlund, 1924) proved definitely that the Norse settlers had not been quite without contact with Europe during the 15th century. The dead persons were buried in their wearing apparel, and the clothing was surprisingly well preserved in the frozen soil. It came out that the Norse people at Herjolfsnes have followed the fashions of western Europe, and a few of the dresses reveal cultural influences which must be dated to a late part of the 15th century. Herjolfsnes, the southernmost harbor in Norse Greenland, must have had a few visits by ships during the 15th century, although official communications had ceased entirely. Probably, it happened that Hanseatic or English traders, going to Iceland after dried fish, were beaten off their course and landed in Greenland where they traded with the inhabitants (Nörlund, 1924, p. 254).

Accordingly, we may assume that the last of the Norse Greenlanders did not die before some time in the 16th century. However, when John Davis rediscovered the Davis Strait and West Greenland (1585), and the Danish-Norwegian government resumed its interests in Greenland, the Norse settlements were entirely dead.

Why did the Norse settlements succumb? Many answers have been given to this question. A large number of real or possible adversities have been pointed out by different authors. It appears that the Norse people in Greenland were exposed to so many dangers that their final extinction may seem less surprising than the fact that they maintained themselves during a half millennium.

The Norse farmers had reached the climatic limit of their farming culture. They could not expand farther in Greenland, and they would

not have been able to maintain themselves at all if they had been less versatile. They lived partly upon hunting and fishing; hunting seals and reindeer seems to have been as important as animal husbandry, according to the finds of animal bones in the middens (See papers by Degerbøl). Even the inland farms, placed at a considerable distance from the fiords, lived partly upon the hunting of marine animals (Roussell, 1938, p. 64; Vebæk, 1943, p. 114). But the Norse people could not do without their cattle and sheep, for milk products were essential for their well being. As far as possible, they made themselves self sustaining. They extracted iron from bog iron ore (Nielsen, 1929). However, much fuel was necessary for this process, and fuel was scarce. Many implements were made of bone and wood, but iron was indispensable, for instance for the scythes, used in hay making. We must assume that most of the iron had to be imported. Iron and timber are mentioned in "Speculum Regale" as imports to Greenland (Grønlands historiske Mindesmærker, 1845, Vol. III, p. 327). Grain was also imported, although perhaps regarded as a sort of luxury.

In Thorfin Karlsefni's saga it is told that the Icelandic merchant Karlsefni spent a winter in Brattahlid as Eric the Red's guest. When Yule was near, Eric became despondent; and Karlsefni asked for the cause of his dejection. Eric answered that he feared his guests would say elsewhere that they had never passed a worse Yule than when Eric the Red entertained them in Brattahlid in Greenland. Karlsefni said: "We have in our ship both malt and corn; take as you want it and make a feast as great as you like" Eric accepted that, and a Yule feast was prepared, the stateliest that people had seen in a poor country (Grønlands historiske Mindesmærker, 1838, Vol. I, pp. 402-407). Beer was perhaps the most beloved cereal product; and the saga gives a true picture of how rare this luxury was in Greenland. In the sequel we learn that Karlsefni claimed a special reward for his generosity, as he asked Eric to give him the young widow Gudrid in wedlock.

In "Speculum Regale", some of the export articles of Greenland are mentioned: products of goats, sheep, and cattle (hides, seal skins, rope made of walrus hide, and walrus teeth) (Grønlands historiske Mindesmærker, 1845, Vol. III, p. 327). The walrus products were highly prized, for the ropes and thongs made of the hide were exceedingly strong, and were used in ships, while the teeth were used as ivory in European art industry. The main object of the hunting expeditions north of the settlements was probably the procuring of walrus teeth for the export trade.

As in Iceland, the homespun wadmal or frieze was a valuable commercial article. It is told, in Thorfin Karlsefni's saga, that Eric the Red's son Leif had a love affair with a high born woman in the Hebrides, and as a parting gift he gave her a gold finger ring, a cloak of Greenland wadmal, and a belt made of walrus teeth (Grønlands historiske Mindesmærker, 1838, Vol. I, p. 384).

The lack of iron and wood in sufficient quantities was probably the worst natural handicap which the Norsemen met in Greenland. The

first settlers had large seagoing ships; when these wore out or were lost, new good seagoing ships could not be built in Greenland, although this was attempted. In Icelandic annals, it is recorded that in the year 1189 A.D. a ship from Iceland arrived in Breiðafjörð in Iceland with thirteen men aboard; the planks of that ship were held together by means of wooden pegs and sinews. The master of the ship was Asmund Kastanrasti. The following year, Asmund left Iceland; but his ship was lost with many good Icelandic men (*Grønlands historiske Mindesmærker*, 1845, Vol. III, p. 762).

In 1261 A.D., Greenland became a tributary of the Norwegian king. Probably, it was promised that the king would maintain communications with the home country. To some extent, this was done; in part of the 14th century a ship, the "Greenland Knarr", sailed in regular route between Bergen in Norway and Greenland, until it sank in 1367 or 1369 A.D. The king tried to uphold a sort of trade monopoly, for it was forbidden to sail to Greenland without the king's permission. This monopoly was, of course, an obstacle to the Greenland trade (Nörlund, 1936, pp. 102-103). As the official navigation to Greenland stopped entirely, it may seem justified to give the monopoly the blame for Greenland's isolation. However, the results of Nörlund's excavations at Herjolfsnes have made it evident that the isolation was not perfect. As we have seen above, the Norse Greenlanders must have received a few visits by sea during the 15th century.

The isolation meant hardships for the Norse farmers in Greenland, but the isolation was not absolute. Since their economy was mainly self-sufficient, it seems unlikely that isolation could alone be the cause of the extinction of the settlements.

It seems necessary to assume a casual relation between the expansion of the Eskimo, coming from the north, and the extinction of the Norse farmers in Greenland. Now, the question is, in what way did the Eskimo act upon the Norse settlements? Was it a hostile conquest and annihilation? Or was it a peaceful penetration and absorption?

Some authors have found the last alternative most probable. It was strongly advocated by F. Nansen who said: "Deserted by the mother country, and left to their own resources, the Greenlanders were forced to adopt the Eskimo mode of life, and became absorbed in them. This took place first in the more northerly and more thinly populated Western Settlement, and later in the Eastern Settlement as well". (Nansen, 1911, Vol. II, p. 102). Nansen lays some weight upon a passage in the annals of the Icelandic bishop Gisle Oddson, written in Latin before 1637 A.D., where it is said under the year 1342 A.D.: "The inhabitants of Greenland voluntarily forsook the true faith and the religion of the Christians, and after having abandoned all good morals and true virtues turned to the people of America" (*Grønlands historiske Mindesmærker*, 1845, Vol. III, p. 459; Nansen, 1911, Vol. II, pp. 100-101).

It is not known where Gisle Oddson got this statement, but it accords with the view that the Norse Greenlanders, not being able to uphold their farming, threw their energy upon the other side of their economy,

the hunting and fishing, and became amalgamated with the Eskimo who were quite superior to the Norsemen as hunters of sea mammals.

However, the intensive and extensive archaeological work in Greenland has given no support to the theory of a peaceful amalgamation of the two peoples and their cultures.

Nörlund's finds in the burial ground at Herjolfsnes prove that the Norse Greenlanders in the 15th century were good Catholics, worshipping the Virgin Mary and Jesus. They upheld their European culture, following to the best of their ability, the fashions of western Europe. The material culture of the Norse Greenlanders is known from excavations of numerous ruins and graves; there is no evidence of any important cultural influence from the Eskimo, unless it should be the doorway passages in the stables at Braatahlid, mentioned above.

The Greenland Eskimo have taken over a few elements from the culture of the Norse people; most important is the cooper's technique. The Eskimo knew and used iron before they met the Norsemen; they hammered native iron cold, as native copper. But they did not know how to extract iron from ore, as the Norsemen did; this useful art, the Eskimo did not acquire from the Norsemen. The ordinary Greenland Eskimo works iron "cold" by filing and hammering (Birket-Smith, 1924, p. 83).

On the whole, it is remarkable how little the Eskimo have learned from the Norsemen. The Lapps have learned many times more from the Scandinavians. Evidently, the Lappish reindeer breeders could receive and utilize cultural impulses from the Scandinavian farmers, while the Eskimo hunters had very little use for the Norse culture elements.

The skeletal material from the burial ground at Herjolfsnes, from the 15th century, does not indicate any racial mixture between the Eskimo and the Norse people (Nansen, 1925, p. 430). On the other hand, the skeletons from a Norse burial ground in the West Settlement, at Sandnes, from around the year 1300 A.D., excavated by Rousell and examined by the anthropologist K. Fischer-Møller, has a very few hybrids, showing mixture of Nordic and Eskimo stock. But the great majority of skeletons from Sandnes and from another Norse burial ground in the West Settlement, at Anavik, excavated by Rousell and examined by Fischer-Møller, are apparently quite free from Eskimo admixture. Fischer-Møller has also examined a large collection of Eskimo skeletons from West Greenland, belonging to a period prior to the beginning of the Danish colonization; he did not find any signs of Nordic hybridization in this material.

The West Settlement Norse people were a branch of the Nordic stock, closely related to the inhabitants of the southwestern Norwegian districts of Jæren and Sogn. The Norse Greenlanders had rather more of the brachycephalic (Alpine) element than the Norwegians. Fischer-Møller suggests that this may be due to an admixture of Celtic (Irish) blood. The Norsemen in the West Settlement were probably somewhat smaller than the contemporary Norwegians and Fischer-

Møller thinks that perhaps, in the isolated settlements of Greenland, we have the beginnings of a separate Greenland-Nordic racial type. He does not regard the smaller stature of the Norse Greenlanders as a sign of degeneration. He does not find any evidence of degeneration in the skeletal material from the West Settlement. There is no sign of malnutrition or insufficient nutrition, nor any chronic disease except a few cases of rheumatism, not surprising under the severe natural conditions in Greenland. Among the female skeletons he did not find any pelvic deformities which could form a hindrance to childbirth (Fischer-Møller, 1942).

Fischer-Møller's results may be taken as a corrective to the dark and lugubrious picture which Fr. C. C. Hansen gave of the Norse Greenlanders in his publication of the skeletal remains from Herjolfsnes. Professor Hansen found evidence of a serious degeneration, reduced stature, many cases of chronic diseases, especially rachitis, and consequent bodily deformation. Several female skeletons showed pelvic deformations which would prevent childbirth. On the whole, a decline of vitality, probably caused by intermarriage in a small isolated community, and by serious undernourishment. The last Norsemen at Herjolfsnes were, according to Hansen, a degenerate race, doomed to destruction. However, as Fischer-Møller points out, the skeletal material from Herjolfsnes is in an exceedingly bad state of preservation. It seems hardly possible to draw safe conclusions with regard to bodily defects from this material. On the other hand, the skeletal material from the West Settlement is much larger and much more satisfactorily preserved.

Hansen supposed that the Norse Greenlanders in their last period had been under the necessity of eating much vegetable food of wild plants (Hansen, 1924, pp. 487-493). In all probability, wild vegetables played as great a role in Greenland as in Iceland. The use of vegetable food from uncultivated plants has been general and quite important for a long time in all north European countries (For Norway, see Holmboe, 1929; for Finland, Manninen, 1931). In Denmark, the collecting of several kinds of weeds and other wild plants has played a role for prehistoric agriculturists (Hatt, 1937, pp. 26-27; 1943, p. 12). Hans Helbæk has made a very instructive analysis of the contents of the intestines of a corpse from the early Iron Age, found in a peat bog in the middle of Jutland. The remains of the last meal of this Iron Age man were found in the stomach, the small intestine, and the large intestine; the detailed analysis gave valuable information about the nature and composition of this last meal. It was "a gruel consisting of barley, linseed, *Camelina* seeds, and fruits of *Polygonum lapathifolium*", and lesser quantities of several kinds of weeds. The *Polygonum* and other weeds can not be regarded as accidental impurities from the grain field; they must have been collected and put into the food (Helbæk, 1950, p. 338).

We may safely assume that the collecting and eating of wild plants was a usual trait among the early farmers of northern Europe, and it is not likely that this has in any way caused degeneration.

The Icelandic population has had to stand very severe hardships and also starvation. This caused a stagnation of the population density during several centuries, but in spite of almost continuous famine and defective hygiene during many generations, the Icelandic people do not show any sign of degeneration. On the contrary, Iceland has a very healthy and highly gifted population (Bryn, 1928, pp. 15-16). It seems unlikely that the nearest relatives of the Iceland people, the Norse Greenlanders, should have died out from degeneration. Such a conclusion can not safely be drawn from the very defective and badly preserved skeletal remains from Herjolfsnes, especially not, when it is seen that the larger and better preserved skeletal materials from the West Settlement do not reveal any sign of degeneration.

A series of archaeological investigations by Therkel Mathiassen has disclosed the history of the Eskimo culture in Greenland and especially the emigration of the Eskimo. As we have remarked already, the Norse settlers found their part of Greenland uninhabited. The remains of former inhabitants, mentioned by Are Frode, have not been found by modern archaeologists. However, in the northern part of the west coast of Greenland, the Eskimo arrived early. We must assume that an Eskimo population was living in Disko Bay by the 10th century (Mathiassen, 1934, pp. 165 ff). In the 13th and 14th centuries, the Eskimo at Disko Bay, and also further north, in the Upernivik District, came into frequent contact with the Norsemen who made hunting and trading excursions northwards. Norse influences are seen in the introduction of coopering, spoons of medieval form, and other things. Also a few objects which must have come directly from the Norsemen, pieces of bell metal are found in the Eskimo dwelling sites.

Towards the close of this period, in the 14th century, the Eskimo began a great migration southward. This migration brought about the destruction of the West Settlement about 1360 A.D., of this event we get a glimpse in Ivar Baardson's relation.

Soon afterwards, the Eskimo penetrated the East Settlement. In Icelandic annals it is told that, in the year 1379 A.D., the *Scrælings* made attacks upon the Norse Greenlanders, killed eighteen men, and caught two boys, making them slaves (*Grønlands historiske Mindesmærker*, 1845, Vol. III, p. 33). This does not look like peaceful relations. However, there may have been more peaceful periods, and the hostilities may have been local and intermittent. An Icelander, Bjørn Jorsalfar, stayed in the East Settlement from 1385 to 1387 and was judge and revenue officer for the district of Ericsfjord. From his account we learn that Eskimos were living near the Norse settlement. Bjørn Jorsalfar rescued two Eskimo from drowning, and they served him faithfully. The Norse people subsisted constantly by cattle breeding, and Bjørn received from the farmers, as his due, 260 legs of mutton (*Grønlands historiske Mindesmærker*, 1845, Vol. III, pp. 436 ff; Nörlund, 1924, p. 256).

Mathiassen thinks that there may have been several causes behind the southward expansion of the Eskimo in Greenland: overpopulation in the north; an improved kayak technique which made it possible to

get through the comparatively mild winters in south Greenland; and perhaps also, as Nörlund proposes, a certain curiosity to see the Norsemen's settlements and get hold of their strange possessions. However, the Eskimo expansion went farther; they rounded Cape Farvel and settled also upon the East Greenland coast (Mathiassen, 1936, p. 119).

In somewhat more than a century, Eskimo and Norse people lived together in what is now the Julianehaab District. The Norse farmers held themselves in the inner fiords, while the Eskimo took up their abodes in the middle parts of the fiords, often quite near to some Norse farms which were probably the first sufferers. The large amount of Norse objects, which the archaeologists find in the Eskimo ruins, may be witnesses of Eskimo plunderings of Norse farms. In the course of probably somewhat more than a century, the Eskimo encroachments resulted in the total extinction of the Norse farmers in the East Settlement (Mathiassen, 1936, pp. 78-79). The Eskimo have some legendary traditions about the ancient Norse people, written down about the middle of the 19th century. These traditions are, of course, unhistoric; nevertheless, they may give a true picture of the more or less unfriendly relations between the two peoples, sometimes leading to bloody conflicts, where the superior archery of the Eskimo made itself felt (Rink, 1866, pp. 198-209).

One of the causes of the downfall of the Norse settlements in Greenland was probably a climatic deterioration, diminishing the possibilities of cattle farming. G. F. Holm, in his description of ruins in the Julianehaab District (Holm, 1881, pp. 72-73), found it difficult to understand how it would be possible to collect winter fodder for the cattle, unless the climate had been milder. Forty to fifty years later, the same opinion was strongly voiced by Poul Nörlund. In fact, the idea that the climate must have been milder at the height of the Norse colonization comes naturally to anyone who travels among the numerous ruins of considerable farms in the ancient settlements.

Historians and men of science have hotly debated the question, whether or not a climatic change took place during the late Middle Ages. Arguments against the theory of a climatic change were given by the Icelandic geographer, Th. Thoroddsen (Thoroddsen, 1913-14) and by Fr. Nansen (Nansen, 1925). I would also mention the argumentation of the Norwegian agricultural historian S. Hasund who warns against the rashness of accepting as proof of climatic change the fact that the 14th century brought a decline for the farmers in Norway. Economic deterioration may, of course, come from other causes, and Hasund demands proof of a more unequivocal sort (Hasund, 1942-44, Vol. II, pp. 163-174).

However, the claims of absolute proof of a climatic change in the late Middle Ages is actually complied with by peat bog geologists, studying the history of vegetation.

The change from the drier and warmer sub-boreal climate to the moister and cooler sub-atlantic climate which took place at the

beginning of the Iron Age has made itself visible in the peat bogs. The sphagnum peat from the sub-boreal period is much transformed and humified; the sphagnum peat from the sub-atlantic period is less transformed. Evidently, the wetter and cooler climate made the peat bogs moister and promoted the growth of the sphagnum. The horizon between the two climatic periods presents itself clearly. Now, the Swedish geologist Erik Granlund pointed out several such horizons in Swedish peat bogs; he called these horizons "rekurrens ytor", that is, recurrent surfaces, and numbered them, from above, RYI, RYII, RYIII. RYIII is archaeologically dated to the beginning of the Iron Age, about 600 B.C., RYII to about 400 A.D. and RYI to about 1200 A.D. (Granlund, 1935, pp. 157 ff). Granlund has also pointed out older recurrent surfaces from about 1200 B.C. and about 2300 B.C.

In peat bogs in North Jutland, RYI, RYII, and RYIII have been pointed out, and RYI has been archaeologically dated to about 1300 A.D. (Valdemar M. Mikkelsen in Steensberg, 1952, pp. 120 ff).

So it is evident that a climatic change, analogous to the change from sub-boreal to sub-atlantic climate at the beginning of the Iron Age, had taken place in the late Middle Ages in Scandinavia. We do not know exactly how big this climatic change was, nor do we know how much it may have influenced economic life. The retrogression of agriculture in Norway and Iceland may have had several causes, but it seems probable that one of the causes was a climatic change (Cf. Thorarinsson, 1944, p. 161).

Peat bog investigations in Greenland, by the geologist Johs. Iversen, have shown that a climatic change also occurred there in the late Middle Ages (Iversen, 1934). However, the change in Greenland went in another direction than in Scandinavia, for in Greenland, the climate became drier, that is, more continental. According to Iversen, it is unlikely that the summer temperature underwent any change worth speaking of, but the increased dryness caused a deterioration of the pastures. In addition, a serious attack from the larvæ of a certain butterfly, *Agrotis occulta*, occurred at the end of the Norse period and may have been one of the causes of the destruction of the West Settlement. Iversen happened to see a local attack by the same species of butterfly in 1932 when he visited the Godthaab District. The larvæ devoured all the leaves of the bushes, all the herbs, grasses, and sedges; even moss and lichens were attacked. A layer of cocoons and scaly hairs, belonging to the butterfly, were found in the peat bogs at a level belonging to the end of the Norse period, proving that a general attack of *Agrotis occulta* had taken place in the West Settlement at that time.

Iversen succeeded in determining both the beginning and the end of the Norse period by peat bogs in the Godthaab District. The beginning of the period appeared as a layer of charcoal in the peat bog. Evidently, the Norse settlers had burned the natural bush vegetation to promote the growth of grasses. The pollen analysis shows a very sudden increase of grasses and herbs immediately above the layer of the charcoal. Scattered pieces of charcoal occur throughout the Norse period, the

charcoal disappears, the peat shows increasing dryness, the layer of remains of the *Agrotis occulta* occurs, and at the same time the pollen of *betula* and herbs decrease, and the pollen of *salix* increases; evidently, the willow bushes have spread over the old, deserted pastures.

So, we may consider three factors, contributing to the destruction of the West Settlement: 1) A climatic change, bringing dryness and deterioration of the pastures. 2) A general attack by the *Agrotis occulta*, causing annihilation of the pastures over wide areas. 3) Attack by the Eskimo, coming from the north.

Are there any traces of the life of the ancient Norse colonization in Greenland, except the ruins of buildings and vestiges of fences and enclosures? Is it possible to point out living results of this ancient activity?

As we have said, the victorious Eskimo borrowed a few technical elements from the Norse, of which cooping seems to be the most important. The Scandinavian influence upon the Lapps is much stronger and more important than the Norse influence upon the Eskimo.

During the first centuries of the Norse colonization in Greenland, there was a rather lively connection between Iceland and Greenland. As Roussell has pointed out, there seems to be a connection between the architectural development in Greenland and Iceland, and there is some reason to suppose that Greenland influenced Iceland. The centralizing tendency, a response to the severe climate, is visible in architectural development in Greenland and Iceland. However, the winter cold is much more severe in Greenland, and it may be that the so-called passage house of Iceland was first invented by Greenland farmers. As Roussell says, "it is very much within the bounds of possibility, that this very convenient passage house, which we know only in Greenland and in the Iceland of later times, was an invention of the enterprising Greenland farmers, who lived under conditions where the winter cold was a much more powerful foe than elsewhere within the Nordic culture region of those days" (Roussell, 1941, p. 242).

There was a sort of literary life in ancient Greenland, at least in a part of the Norse period. Sagas were told, and verses were made and recited. An Icelandic poet, Skjald-Helge, is said to have lived in Brattahlid some time in the 11th century. One of the Edda-poems, about the death of Gunnar and Högni and Gudrun's revenge on Atli, has the title "the Greenland Atla-mál". Without doubt, this poem was composed in Greenland, says Finnur Jónsson; a few other Edda-poems may also be of Greenland origin (Nörlund, 1936, pp. 80-81; Jónsson, 1920, pp. 308-314). The Greenland member of the Norse family of nations took its part in the ancient Norse cultural life.

The living nature of present day Greenland contains elements which are due to the activity of the ancient Norse people. A part of the Greenland flora was introduced by the Norsemen. C. H. Ostenfeld says that probably "about thirteen per cent of Greenland's 390 species of vascular plants were brought into the country through the old Norse colonization". We may assume that these plants came in with the hay

which the settlers took with them in the ships to feed the cattle and sheep which they brought with them (Ostenfeld, 1926, pp. 17 ff). Another botonist, M. P. Porsild, thinks that only six species may safely be assumed to be Norse introductions, fourteen others are possible, but doubtful (Porsild, 1932).

Did the Norse voyages to the American continent bring new plants to Greenland? Johs. Iversen has found in the West Settlement, in the bottom of the Godthaab Fiord, an Iridacé, *Sisyrhynchium angustifolium*, a plant whose home is temperate North America; it is known from Newfoundland and from several places in the St. Lawrence region. Iversen suggests that Karlsefni's expedition may have brought this plant when Karlsefni returned to Greenland. They may have had some hay with them in the ship, and in the hay may have been fruits of the *Sisyrhynchium* (Iversen, 1938).

SIGNS OF A NEW AGRICULTURAL IMPULSE IN THE SUBARCTIC

In a few hundred years, a climatic change has made itself felt in many lands, especially around the northern Atlantic. I shall not enter here upon a discussion of this remarkable phenomenon, as there is a large and increasing amount of literature on the subject. I may refer to a marine biological paper by the Danish zoologist Ad. S. Jensen upon recent changes in the distribution of animal species in the arctic and subarctic area, from Greenland in the west to Eurasia in the east (Jensen, 1939), and to a general discussion of the climatic change of a group of Swedish geographers and geophysicists (Ahlmann, Sanström, and Angström in *Ymer*, 1939, pp. 51-82). The climatic change has brought an increase of temperature; it remains to be seen whether the change will be lasting or transitory. However, the question presents itself, how does climatic change influence farming in the subarctic region?

Iceland, on the arctic border line, is interesting in this connection. As we have seen, grain cultivation was carried on in Iceland during more than a half millennium, decreasing in the 13th and 14th centuries. However, it remained for a long time in the most southwesterly district, Gullbringusýsla, probably until the 16th century. Since then, government officials have attempted several times to revive grain cultivation and these attempts have met with some success on agricultural experimental stations in the 20th century. Some authors have taken this fact as an argument against the theory that the extinction of grain cultivation in Iceland in the late Middle Ages should be due to a climatic deterioration. However, Thorarinsson has suggested that the recent climatic change may be the cause of the relatively favorable results of grain growing experiments in the present century. The average summer temperature for the decade 1928 to 1937, was in Stykkishólmur (in west Iceland) and Berufjörður (in east Iceland) 1.2 and 2.4 degrees Centigrade higher than for the decade 1878 to 1887; and the average temperature for the year was 1.6 and 2.1 degrees Centigrade higher than 50 years ago (Thorarinsson, 1941, p. 296). This

rise in temperature means very much when we are near to the northern limit of possible grain cultivation.

According to Klemenž Kr. Kristjánsson, leader of the experimental farm at Sámstaðir, Rangárvallasýsla, the chances for barley and oats to ripen fully appears to be nine out of every ten years in south and southwest Iceland, three out of every five years in the northern and eastern districts, and one out of every two in the western part of the country.

Experiments at Reykjavik and at Sámstaðir have shown that the so-called Donnes barley (a six row barley) gives the best yield between April 20th and May 10th. If it is sown not later than May 10th, it can ripen fully if the mean temperature for July and August is not less than 10.4 to 10.6 degrees Centigrade and the precipitation not over fifty to sixty millimeters each month. Cool springs and warm late summers are favorable for the growing of corn.

Many varieties of barley and oats have been tried. Certain Norwegian sorts have given the best results, especially Donnes barley and Nidar oats, because they mature early. Experiments were also made with rye and wheat. Spring rye seldom ripens, but winter rye matures when the weather is average or better than average. Spring wheat has matured when the weather was exceptionally favorable, and winter wheat has matured in an average season and is preferable to spring wheat.

Kristjánsson concludes "that the growing of barley and oats can be practised in the milder climatic regions of Iceland . . . Although the corn may not mature in unfavorable seasons, it will yield as much nutrients to an acre as an average hay field. In fact, the growing of corn may rather compensate the ill effects of seasons that are unfavorable for the growing of grass for hay making" (Kristjánsson, 1946).

The good results of the experimental farms have not, so far, made corn growing a regular element of farming in Iceland. It seems doubtful whether the farmers will take to corn growing, and it may also be doubtful whether the favorable climatic conditions of the latest decades will continue. In 1952, barley and oats froze in southwest Iceland for the first time in many years, and did not produce any grain, except at Sámstaðir and a few favored localities on the southern coast (Private letter of January 13, 1953 from Mr. Arni G. Eylands, secretary in the Ministry of Agriculture, Reykjavik).

Farming in Iceland will continue as animal husbandry, yielding dairy products, meat, wool, and hides. All the bread corn will be imported. Corn growing may perhaps be taken up, but only if it is profitable from a stock breeders viewpoint.

The great problem of farming in Iceland is the high cost of human labor. Farming must compete with fishing and industry. It seems vitally important for farming to introduce labor saving machinery. The future may bring a depopulation of certain out-of-the-way regions in Iceland, even if the favorable climatic change may continue.

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Bendzvej IA
Copenhagen, Denmark