

GREENLAND

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GREENLAND lies northeast of the North American continent and, with its eight to nine hundred thousand square miles, is the world's largest island. Although the entire country is arctic in nature, conditions vary widely because, from north to south, almost 25 degrees of latitude are covered.

The most striking feature of the island is the ice-cap — *Indlandsisen* — that covers about five-sixths of the total area and is more than ten thousand feet thick, leaving only a marginal zone around the coastline free of ice. This marginal zone is mountainous, and in some places rises to more than twelve thousand feet, so that Greenland actually is one big bowl of ice. There are cracks in the edge of that bowl through which glaciers flow all the way down to the sea, depositing icebergs in the ocean. Besides the icebergs there is a great deal of ocean ice around the coastlines of the island, especially on the east coast where the East Greenland Current brings the pack ice down from the northern polar basin, hampering navigation to a great extent.

Greenland was discovered about four thousand years ago by people coming across the narrow straits from the Canadian archipelago. Ruins of their homes have been found, but no remains of the people themselves. It is believed that they must have been the forefathers of the present-day Eskimos. We know that since then many waves of Eskimos have moved back and forth across Greenland, so that even the thousands of miles of uninhabited coastline, some of which is the most northerly land in the world, have been inhabited at one time or another.

About a thousand years ago Greenland was first sighted from the East by an Icelander by the name of *Gunnbjörn*, but the first European to set foot on the land was Erik the Red from Iceland. He had been expelled from Iceland for three years on account of a small incident of killing his neighbours, and he used those three years to investigate Greenland. He found out that this was a nice country to live in; that was why he called it Greenland. When the three years were up he went back to Iceland but soon returned to Greenland bringing with him people who settled on the southwest coast and established a farming community that existed for five hundred years. Erik's son, Leif, was actually the man who discovered America, in the year 1000, five hundred years before Christopher Columbus discovered the Bahama Islands.

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Part of Godthåb, Capital of Greenland.

From those days originate the ties between Denmark and Greenland, and it is very important to note that Greenland as a part of Denmark is not an eighteenth-century colonial venture but a thousand-year-old historical fact. Even though the old Norsemen in Greenland died out around the year 1500 and even though connection was interrupted for a couple of hundred years, the Kings of Denmark never forgot that Greenland was part of their realm; and in 1721 a missionary, Hans Egede, was dispatched. From that year we date the modern history.

The modern history of Greenland is about two hundred years of Danish endeavours to cope with the responsibilities this possession has put upon Denmark: above all, the social responsibilities, responsibilities of governing and supporting the 40,000 people who now live there, the descendants of the old Eskimos and the Danish settlers.

But the Danish people also keenly feel their scientific responsibilities in Greenland, for although only one per cent of them live on this island that constitutes 98 per cent of the whole of Denmark, within that 98 per cent there are scientific problems of greater moment than in the European part of the nation.

We have from the sagas the first descriptions of the country a thousand years ago. No maps, of course, but quite accurate navigational directions. We have in our day excavated practically all the farms and churches and monasteries from the old time, and we can recognize most of them from the descriptions in the sagas and give them their original names.

The missionary, Hans Egede, was the first to start surveys and map-making in Greenland, and since his time the whole coastline and the whole interior have been surveyed and mapped fairly accurately. And with the exception of a small part of northeast Greenland (surveyed in 1869-70 by the German expedition under Koldewey and Payer) and a part of the northern coast (surveyed by Peary), this work has been carried out by Danish expeditions. Hans Egede was also the first to treat the language and economic and social culture of the Eskimos scientifically.

In our day the surveying of Greenland is carried out by two organizations in Denmark: the Royal Danish Geodetic Institute and the Royal Danish Hydrographic Office. Space does not permit me to give the names of all those able men who have been carrying out this work for the last two hundred years, some of them losing their lives during their endeavours. During the last forty years the accurate mapping of the whole of Greenland, on the scale of 1:250,000 has been in progress. The charting of the sea around Greenland, the Greenland coastline, and the approaches to the ports is also very detailed in our days, especially the whole of the west coast from 67°N.

Next in line come the people of Greenland and the scientific problems they represent.

As mentioned above, the study of the Greenland Eskimos goes back to Greenland's apostle, Hans Egede, who in a book published in 1741 gave a description of their life and customs, which for its time was outstanding. His two sons and some of the early missionaries also made valuable contributions to our knowledge of the native population in the eighteenth century.

The first orthographical standard for the Eskimo language was established and methodically treated shortly after the middle of the last century by Samuel Kleinschmidt, a teacher at the Teachers College at Godthåb.

The first real scientific study of the Eskimos, and particularly their folklore and language, was made by H. Rink, a remarkable person, a distinguished scientist, and at the same time a brilliant administrator of Greenland. His studies were not limited to Greenland; thus in 1871 he was the first to formulate a theory on the origin of Eskimo culture which was supported by scientific evidence.

The next important contribution to Eskimo ethnology is Gustav Holm's account of the Angmagssalik Eskimos, visited by him in 1884. His description of the culture of these people is one of the classics in Eskimo literature. His and later collections from Angmagssalik were described by Professor Thalbitzer, who also studied the language, folklore, and music; and for a long time the Angmagssalik Eskimos were the best known of all Eskimo groups.

At the opposite end of Greenland, in the Thule district, another professor, H. P. Steensby, was studying the Polar Eskimos, the most northern people in the world, and Peary's faithful companions; the people who ultimately took him to the Pole. In 1924 appeared another classic, Birket-Smith's "Ethnography of the Egedesminde District" which actually deals with the ethnography of all of West Greenland.

Outstanding, of course, amongst all names in the study of Greenland's ethnography, is that of Knud Rasmussen. Thanks to him not only the Greenland Eskimo, but all the Eskimos around the Arctic Ocean are perhaps better known than any other primitive people of the world.

Systematic investigations of the prehistory of the Greenland Eskimos were started in 1929 by Dr. Therkel Mathiassen, who had laid the foundation for Eskimo archaeology as archaeologist on the Fifth Thule Expedition, 1921-24, to Arctic Canada. Before Mathiassen, excavations and collecting of old artifacts had been in the hands of interested amateurs, who either held positions in Greenland or participated in expeditions. In connection with the latter it deserves mentioning that archaeological investigations were included in several Danish expeditions to East Greenland at the beginning of this century.

The systematic investigations which began in 1929 have since been carried out regularly by the National Museum, and we now have a fairly clear picture of the development of Eskimo culture in Greenland. The earliest traces of the so-called Paleo-Eskimo culture date back to about 2,000 B.C. and this culture existed, at least in parts of Greenland, for about three thousand years. A later, Neo-Eskimo form of culture that came to Greenland from Canada after A.D. 1,000, is the foundation of the culture of the Greenlanders of the present day.

Since 1924 the National Museum has also been engaged in another series of archaeological investigations, namely those in connection with the remains of the Norsemen who came to Greenland about A.D. 980 and managed to live there for almost five hundred years. Although Hans Egede was the first to be interested in the fate of the Norsemen, systematic investigations did not begin until 1898 when Daniel Bruun made a thorough study first of the East Settlement and later, in 1903, of the West Settlement. He mapped most of the farms and churches, but the actual excavations of these began twenty years later.

Of the many interesting finds that were made, primarily by Dr. Poul Nørlund, that of the mediaeval costumes from Herjulfsnæs was the most sensational. Preserved in the frozen ground, they are now on exhibit in the National Museum, which also contains the most extensive Eskimo collections in the world. During the last few years excavations have been carried out in the chapel and surrounding cemetery that Thjodhilde, the wife of Erik the Red built at Brattahlid about a thousand years ago. This, of course, is the oldest Christian church in the western hemisphere; and it is interesting to realise that one of the bodies exhumed may be Leif Eriksson, the discoverer of America.

Modern social life in Greenland, the impact of the modern world on its old-fashioned society, offers a very wide field for investigation into social questions. A special board has been set up to take care of such problems; and it has, during the last eight or ten years, published extensive reports.

One social aspect of life in Greenland is the health service. This of course has a special interest because many problems involved in health



Geological Survey of Greenland: Base camp near Frederikshaab.

service can be studied in Greenland under conditions unlike any other conditions in the world. Take, for instance, the first occurrence of measles in a society. A great deal of scientific research has been undertaken on problems of this nature.

Let me then turn to the physical features of Greenland and start by mentioning the geological surveys. Geology, of course, is one branch of science which always gets the thick end of everything because we all hope the geologists will find the gold mines we could use so well, all of us.

Geological surveys have been carried out in Greenland for over two hundred years with increasing efficiency, and since the war with improved methods and larger appropriations. Up to a hundred persons now take part in the survey every summer, with the result that an increasing number of reports and maps are printed. Many of the regular bulletins about Greenland, the "Meddelelser om Grønland", are filled with geological data. In the field of geology, especially, we have to a great extent been cooperating with foreign scientists, both in the laboratories and in the field, including scientists from other countries with arctic regions such as the United States, Canada, and the U.S.S.R.

The fauna of Greenland offers a great many scientific problems. There is no fertile soil in which to grow crops, and the climate would prevent it anyway. So apart from some sheep farming in the southwest, the Greenlanders depend for their livelihood on hunting and fishing. Therefore, zoological research, and biological research to support the fisheries, has been

given a very high priority on the list of Danish scientific endeavours in Greenland. The Greenland Fisheries Research, organized under the Department of Greenland, has for the last two generations been studying the fluctuations of the fish in the waters off shore and, to a small extent, in the inland waters. Thousands of fish of many types, especially codfish, have been marked and recaptured. The age, weight and sex of hundreds of thousands of them have been determined and a great deal is known of what happens to them from birth until they strike the hook. Inland, systematic zoographical research is also carried out. Zoological research is regularly included in the budget of the Department. The zoology of Greenland cannot be mentioned without also mentioning the name of Otto Fabricius. His book *The Fauna Groenlandica* was published in 1780 and was at that time the only source of information on any arctic fauna, and was for almost a hundred years the most important handbook in this field.

The flora of Greenland has been systematically investigated for more than sixty years. Yearly research is carried out under regular grants from the Greenland Department and at the Arctic Station in Greenland of the University of Copenhagen.

Glaciological investigations are carried out in various fields. One of the classics is Hinrich Rink's investigation a hundred years ago on the origin of icebergs. In our day glaciological stations have been established at several places and Denmark is participating in the international glaciological work that has been carried out during the last ten years.

Meteorology is a very important subject in Greenland, as conditions there influence the weather all over the North Atlantic; in collaboration with the International Civil Aviation Organization surface and upper-air observations are being made throughout the country.

Especially in the meteorological field, foreign scientists have been active. Nansen, one of the greatest names of all times in arctic research, undertook the first crossing of the Indlandsis in 1888 and carried out the first meteorological survey of that important area. In this respect also the German meteorologist Alfred Wegener should be mentioned.

Aurora borealis and magnetism are studied in great detail in Greenland. From 1865 to 1880, Samuel Kleinschmidt carried out a series of very careful aurora borealis observations at Godthåb. It was then proved that the Northern Light to the north of the belt varied with the eleven-year sunspot cycle as opposed to the Aurora observed south of the belt. Measurements of variations within the earth's magnetic field are carried out regularly at the observatories at Godhavn, Thule, and Sukkertoppen.

Physical observations include cosmic radiation, Northern Light (which is automatically photographed), and ionospheric conditions at several stations. Especially the ionospheric observations deserve a little attention, because this is a field in which there is a great deal of cooperation between Denmark, Canada, and the United States.

Danish activities in the study of the ionosphere are centred at two ionosphere observatories: one in Godhavn operated since 1951, and the other

in Narssarssuaq near the south tip of Greenland, taken over from the U.S. authorities in 1957. Both stations are being operated in close cooperation between the U.S. National Bureau of Standards (NBS), the Danish Meteorological Institute, and the Danish National Committee of The International Scientific Radio Union. The measuring equipment is on loan from NBS, and housing and personnel are provided by various Danish institutions. The observations consist in recording automatically, some eight times per hour, the field strength and delay of radio signals emitted from the station and reflected from the ionized layers. From these data the ion density and the height of the layers can be deduced.

The scientific and practical value of such observations will appear from the fact that more than a hundred ionospheric stations are being operated all over the world. Among these the Greenland stations carry special weight because the ionospheric phenomena are much more complicated in arctic regions than further south, the dividing line being the so-called auroral zone which passes just south of Greenland and touches northern Alaska, northern Siberia, and northern Norway. A number of stations, amongst them Narssarssuaq, are situated in the auroral zone, but only Greenland and northern Canada offer relatively easy access to the inner part of the zone where the Danish station at Godhavn and an American station at Thule are situated.

It should be mentioned that data from the Narssarssuaq observations are being daily communicated to the North Atlantic Radio Warning Service to serve in the selection of optimum radio wave lengths for communication with aircraft crossing the North Atlantic.

Other important measurements consist in recording with a so-called riometer the field strength of cosmic noise, from which can be derived the total absorption suffered by radio waves passing through all the ionized layers. Thanks to the grant from U.S. Office of Aerospace Research, Brussels, a riometer is being installed at Godhavn. At Narssarssuaq we plan to operate a sweep frequency riometer bought from Western Electrodynamics, Colorado Springs.

A new, promising field of study is offered by the different types of radio noise on very low frequencies. Their special behaviour in arctic regions seems to throw light on phenomena taking place in and outside the ionosphere, and observations have been started in Narssarssuaq, Godhavn, Thule, Qanaq, and Station Nord in the northeastern part of Greenland. The Qanaq station is being operated in cooperation with the Geophysical Institute, University of Alaska.

A fire at the Godhavn station on 21 October 1959 destroyed the instrument building with all measuring equipment. However, our friends at the National Bureau of Standards traced the existence of a spare Cosser Ionosonde in Canada, which, at their request, was placed at our disposal by the Defence Research Telecommunications at Ottawa; and the station could thus resume its work on 2 January. We feel that this was a fine example of international cooperation.

Seismic and gravimetric studies have been carried out in Greenland for thirty or forty years and we have at present three stations operating.

Of course, what has been written above is only a broad outline of the picture. There are millions of details that could be recounted if space allowed. Let me just give a few facts about the organization of Danish research.

In the 1870's a Commission for Scientific Research in Greenland was established and it is still responsible for this work. It consists of a number of scientists, each representing a scientific branch, and it publishes the "Meddelelser om Grønland" (Reports on Greenland). Almost 170 volumes have now been published, covering something like twenty-four feet of shelf space, and this is really the standard scientific publication for all research in Greenland. A great many of the volumes, especially the latest, have been published in English.

Work is still carried out by the Arctic Station on the Disko Island which now belongs to the University of Copenhagen. It was established in 1906 and has facilities for visiting scientists from Denmark or abroad. They can find there not only a library and a laboratory but also room and board at a moderate price and even, to a certain extent, transportation facilities.

Cooperation between Danish arctic scientists and foreign arctic institutes is carried out by the Danish Arctic Institute. They publish a yearly account of Danish arctic research carried out in Greenland or other arctic areas and abroad.

Money for all this scientific activity is mostly provided by the State. Apart from the meteorological work in Greenland which is, to a certain extent, financed by the International Civil Aviation Organization, the yearly appropriation for scientific research is somewhere between one and two million dollars, or rather the equivalent thereof in Danish kroner. The State mostly pays through the Greenland Department but some money also comes from University grants or from the accounts of the National Museum, the Royal Danish Geodetic Institute, the Royal Danish Hydrographic Office or other State organizations. Besides the State grants, money is also provided from private sources. I could mention the Carlsberg Foundation, a very well heeled organization which owns the largest brewery in Denmark.

Denmark very keenly feels the responsibility for the solving of all the scientific riddles of Greenland. We do our best to live up to this responsibility ourselves, but we certainly also welcome foreign participation in this field. I can state that we are wide open to anybody who wants to do a serious job of work here. Of course we want to know what's going on and to help wherever we can. And this cooperation with foreign scientific activity is effected through the Commission for Scientific Research in Greenland. Whenever possible, we like to attach Danish scientists to foreign expeditions in Greenland.

Greenland is a part of Denmark. Only one per cent of the population lives in Greenland but we are very keenly aware of our responsibilities there, and that, certainly, includes our scientific responsibilities.