Climatology According to the Greenland Ice Cap

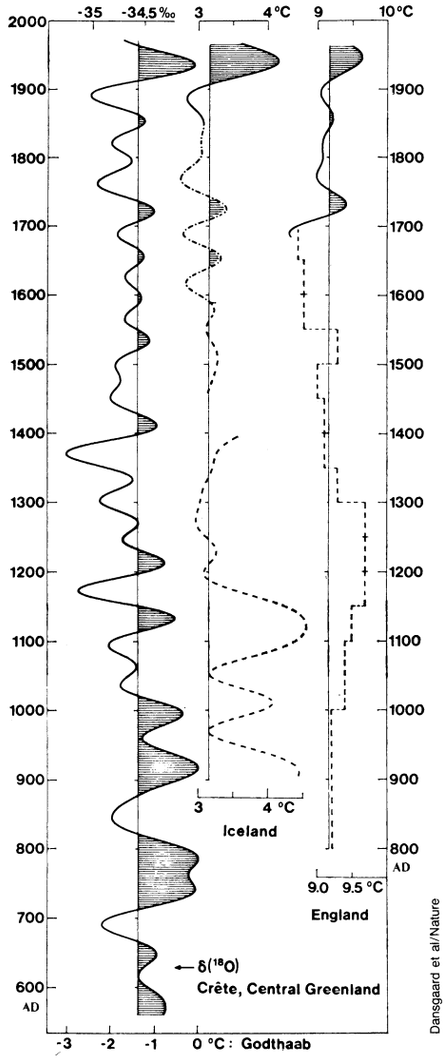
The lost Norse colony in Greenland is one of history's great romanticisms. Shrouded in the fogs of icy seas it clung to life and even a little prosperity for a surprisingly long time. Vatican records indicate that the last bishop of Greenland was appointed in the late 15th century just about two decades before Columbus sailed. It is not recorded that he arrived at his see—contact by then may have been lost—but his appointment shows that memory of the island was still green among officials of the Roman Curia.

Yet that date is almost 500 years after Erik the Red found and named the island in 982. It is sobering to remember that the present North American settlements have lasted less time—since 1608 at Quebec and 1607 at Jamestown. The Greenlanders did so well that they were able to send expeditions to the North American mainland and even set up a colony there. Had they been more numerous, had their lifeline been a bit thicker, would Snorri Torfinnson, the first European child born in North America, now be regarded as the father of our country? Would a Norse dialect now be spoken in New York—in neighborhoods beside Bay Ridge, that is?

These things are among the might-have-been's of history, a fertile field for the fantasy novelist. The fact is, the Greenland colony was doomed. It lived out its half-millenium under a Damoclean sword made of ice, and when the ice came down, it perished, victim of a climatological reversal known as the little ice age. With the world beginning to cool off again after a warm century and a half, some people wonder whether its fate might be a paradigm of everybody's future (SN: 3/1/75, p. 138).

The ice that killed the Greenland colony is proving very useful in determining the history of climatological cycles and in attempts to diagnose their causes. Scientists hope to predict climatological factors that will affect more people than a handful of Norse settlers in an island at the end of the world. There is a possibility of being able to determine whether warm conditions are likely to return or whether the present cooling-off period—the growing season in England, for example, has been reduced by a week or two since 1940—is a return to normal from a highly anomalous warm spell.

The latest ice core, drilled through the crest of the ice sheet in central Greenland at a site called Crête last summer extends the record back to 554 A.D. more than 600 years before the earliest previous data. Already its analysis shows a curious



0-18 concentration in ice core compared to temperatures at Godthaab (on same curve at left) in Iceland and in England.

fact: Climatic changes happen in Greenland centuries before they do elsewhere in the Northern Hemisphere. The work is reported in the May 1 NATURE by Willi Dansgaard, S. J. Johnsen, N. Reeh, N. Gundestrup, H. B. Clausen and C. U. Hammer of the University of Copenhagen. It is part of the Greenland Ice Sheet Program, a collaboration of the United States, Denmark and Switzerland.

The way to establish climatic cycles from the ice core is to study the variations in the concentration of the heavy oxygen isotope of mass number 18, specifically, how it differs from the concentration in Standard Mean Ocean Water. Water containing oxygen 18 tends to precipitate preferentially during cooler weather.

Of course, the core must be dated so that cold and hot periods can be labeled. Dating accuracy depends on steady rates of accumulation and simple patterns of ice flow. These are so good at Crête that the investigators have confidently cut 1,420 samples from the core, one for each year. They have drawn curves of 0-18 concentration going back before 600 A.D.

To be sure of what one has, and because changes in elevation due to geologic uplift or downthrust can alter 0-18 concentrations, one must correlate the data with actual temperature records. At Godthaab in Greenland these go back just a hundred years (much less in other Arctic locations), in Iceland to 1846 and in England to 1680. Additionally, the Norse (and the English) left historical records about the weather, crops and sea ice, and these can be used to extend the check somewhat less precisely.

A curious fact emerges. The 0-18 concentrations in the Crête core correlate well with temperature changes at Godthaab, but with other points there is a time lag, 100 to 150 years for Iceland, 250 years for England. What happens in central Greenland comes to pass generations later in West Europe, Iceland and North America. (Comparisons were also made with the White Mountains of New Hampshire.)

The investigators are cautious about using this circumstance predictively, but if it is a phenomenon that holds for millenia, it suggests a cooling trend in West Europe for the next century. The suggested explanation for the lag combines motions of the Rossby waves (disturbances of upper tropospheric winds), the polar front and the Gulf Stream.

The Crête samples continue to be studied, and the investigators are getting ready to go back for more. They want to be able to check variations on all time scales between 10 and one million years (the current work filters out variations on a shorter scale than 60 years). The present record can do it only for scales between 30 and 1,000 years, but the record can be extended to 100,000 years merely by drilling deeper in Greenland. Nowhere else in the world, they say, can one find Greenland's combination of favorable ice conditions for long and accurate records and meteorologically significant location (near the main tracks of North Atlantic cyclones). "This is why GISP has selected the Crête area for the drilling to the bedrock planned for 1977," Dansgaard and his colleagues conclude. □