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Climate Variability and Disappearance of the Norse from South Greenland

Kurzfassung

Während der günstigen Klimabedingungen zu Beginn der mittelalterlichen Warmzeit bauten die Wikinger um das Jahr 985 „Die östliche Siedlung" in Südwest-Grönland auf, die beinahe 500 Jahre bestand. Um mögliche Gründe für das Verschwinden der Siedlung zu finden, wurde eine Rekonstruktion der Veränderung des spätholozänen Klimas auf der Grundlage terrestrischer und mariner Untersuchungen in den Fjord-Regionen Süd-Grönlands vorgenommen. Verstärktes Auftreten von Stürmen in Verbindung mit der Tiefendurchmischung des Fjordwassers kulminierten im Übergang von der mittelalterlichen Warmzeit in die „Kleine Eiszeit" in der Phase, als die Wikinger aus Grönland verschwanden.

Abstract

During the favourable climatic conditions at the beginning of the Medieval Warm period the Norse established around AD 985 a community called "the Eastern Settlement" in south west Greenland which lastet for almost 500 years. In order to find possible causes for their disappearance a reconstruction of late Holocene climatic changes based on terrestrial and marine investigations have been undertaken in fjord regions of south Greenland. Conditions with increased storm activity associated deep mixing of fjord waters appear to have culminated at the transition from the Medieval Warm Period to the Little Ice Age, i.e. the time when the Norse disappeared from Greenland.

Résumé

Sous les conditions atmosphériques favorables au début de la période chaude du Moyen-Âge, environ en 985 les Vikings ont fondé une communauté dite „colonie de l'est" dans le sud-ouest du Groenland. Afin de trouver des motifs éventuels pour sa disparition, on a reconstitué sur la base des explorations terrestres et marines le changement de climat à la fin de l'holocène dans les régions des fjords dans le sud du Groenland. Des tempêtes gagnant en intensité et un mélange profond de l'eau des fjords culminaient dans la transition de la période chaude du Moyen-Âge à la „petite période glaciaire" en un temps où les Vikings ont disparu du Groenland.

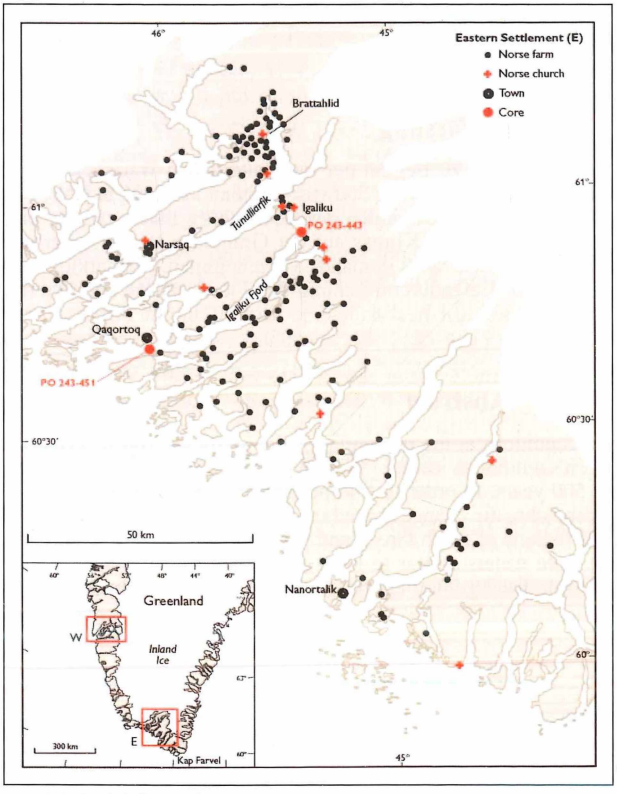
Keywords

Climate Change, Late Holocene, Norse

1. Introduction

Even minor changes in climate may have profound impact on environment and mankind in the Arctic. Greenland, which spans 14 degrees of latitude from 60°N to almost 84°N, is located in the arctic realm and is a very sensitive indicator of climate changes. Only the narrow coastal areas in Greenland are ice-free today. During glacial times the Greenland ice sheet reached out and covered the marine shelf (WEIDICK, 1972), and Greenland has only been inhabited for the last 4500 year after retreat of the ice from the coastal areas.

The Inuits were hunters and lived in northern Greenland when Norse settlers around AD 985 established a northern outpost of European civilisation in south-west Greenland. They came to the mild and lush fjords of south-west Greenland, and established during the favourable climatic conditions of the Medieval Warm period a community called "the Eastern Settlement" and further to the north the "Western Settlement" (Fig. 1). The Norse were farmers and constructed fairly large cattle farms in the inner most part of the fjord systems.



The Norse survived in Greenland for almost 500 years, and the last information on their life in Greenland is from 1408. After this account no information is available on the fate of the Norse. Many theories for the cause of their disappearance have been suggested including problems caused by the climate deterioration following the Medieval Warm Period, attacks by pirates, epidemics, starvation, inbreeding and many others.

Fig. 1: Southwest Greenland: A medieval northern outpost of European civilisation. (Main figure: the Eastern Settlement; inserted figure: positions of the Eastern Settlement [E] and the Western Settlement [W])

2. Methods and Data

Within the framework of paleoenvironmental studies of the Viking-age fjord environment of southern Greenland a marine cruise was conducted in the Tunulliarfik and Igaliku fjords of the Eastern Settlement with the German research vessel RV "Poseidon" in 1998 (HOFFMANN et al., 1999; KUIJPERS et al. 1999). The cruise included a sediment

coring programme and a detailed multibeam echosounder mapping of target areas in the innermost part of the fjords. As part of the shallow seismic and sediment coring cruise, a shallow water side-scan sonar survey was also conducted in the Tunulliarfik Fjord using one of the larger rubber boats of R/V "Poseidon" (HOFFMANN et al., 1999). Field work including retrieval of short cores from coastal areas of the Igaliku Fjord and analysis of terrestrial sediment profiles close to Norse settlements was carried out in 1999 and 2001 (MIKKELSEN et al. 2000).

The sediment cores are presently subjected to a wide array of analyses including microfossil, geochemical, paleomagnetic, and lithological studies, and with a chronological control given by AMS ^{14}C dating and $^{210}Pb/^{137}Cs$ measurements.

3. Results and Dicussion

Two cores from the 1998 Poseidon cruise are presently being analysed in detail, Core PO 243–443 from the inner part of the Igaliku Fjord (water depth 229m) and core PO243–451 from the outer part of the fjord system off Qaqortoq (water depth 304 m) (Fig. 1). A rich calcareous foraminifer fauna had previously been reported from the outer part of the fjord system (HERMAN et al. 1972). Results from $^{210}Pb/^{137}Cs$ measurements indicate recent sedimentation rates of 1–2mm/year in the fjord. The cores are characterized by homogenous and fine-grained pelagic sediment interrupted by pronounced and well-defined mass-flow sequences (KUIJPERS et al. 1999) which points to occasional slope instabilities in the narrow fjords. AMS ^{14}C dates of shells in the mass flow deposits and ages of in situ samples above these units indicate that the coastal instabilities increased during the period c. AD 1300–1400 which coincides with at the transition from the Medieval Warm Period to the Little Ice Age. The instabilities are ascribed to an intensification in the general atmospheric circulation pattern of the region (LASSEN et al., 2000), and it coincides with the time of the disappearance of the Norse from Greenland.

Enhanced surface water mixing due to the higher wind and storm surges is thought to have resulted in increased marine productivity (LASSEN et al. 2000). It has long been argued that one of the reasons for the Norse culture to founder was that the Norse did not adapt to live from marine food but kept on with their diary products (MCGOVERN et al. 1983). However, carbon isotopic investigations of Norse skeletal material covering the entire Norse era has proved a change from predominantly land-based food to mainly marine-derived food (ARNEBORG et al. 1999). This shows that the Norse tried to adapt to the changing environmental conditions that negatively affected the farming potential of southern Greenland at the termination of the Medieval Warm period. The Norse were in addition to the changing weather pattern also threatened by rising sea level. A shallow water side-scan sonar survey carried out near Brattahlid, the site of the first Norse settlement from c. AD 985, thus revealed a drowned beach about 110 m from the present coastline and at a depth of 3–4 m below mean sea level (KUIJPERS et al. 1999). Correlation with a nearby drowned desiccation horizon about 9 m below sea level and dated at 3080 ^{14}y BP (unpubl. data, A. WEIDICK) gives a relative sea level rise of more that 100 cm /500 yrs. since the Norse arrived in Greenland. As the Norse were farmers keeping big live stocks the relatively fast sea level rise was fatal, as they for their living were deeply dependent on the hay for winter fodder which they harvested from the low lying and coastal pastures.

3. Acknowledgements

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