The West Greenland "Greens" - Favourite Caribou Summer Grazing Areas and Late Holocene Climatic Changes

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Though covering less than 2% of the area around Kangerlussuaq, Midwest Greenland, small "greens" of non-flowering Poa pratensis are used as feeding sites by caribou, 25% of the time during summer, peaking at 78% in the post-calving period. Analyses of pollen content and chemical composition in soil profiles confirm the hypothesis of their formation being a result of grazing. The original vegetation types were Salix glauca scrubs or grassy Betula nana heaths. Indications of earlier grazing periods are seen in some profiles. Besides, a climatically caused change to more humid vegetation is seen in all profiles. This event has been ^{14}C dated at 1690±75 B.P. in one profile. Due to a recent pronounced decline in the caribou population, the greens are now changing with Poa pratensis flowering vigorously as a result of little or no grazing, and Euphrasia frigida is spreading.

Keywords: *Caribou grazing areas, Holocene climatic changes.*

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Close to the Ice Cap in the continental interior of West Greenland some small (100-1000 m^2), moist areas in shallow depressions are covered by nearly uniform, pure stands of *Poa pratensis* L. coll. in a dense moss carpet. Thing (1984) studied the feeding ecology of the caribou in this area and found that although these "greens" covered only 1.6% of the range (Holt, 1983a), they were used as feeding sites by the animals 25% of the time in summer (late May - early October), with a maximum of 78% in late June - early July. Thing (l.c.) considered that the greens were a result of caribou activity and hypothesized the following succession: When the number of caribou is increasing, browsing pressure on stands of *Salix glauca* L. coll. and *Betula nana* L. during leafout eventually destroys the woody plants. Fertilizing with urine and faeces favours a lush growth of grasses, especially *Poa pratensis,* which in turn attracts more caribou, enhancing the growth of *Poa* which now never flowers but propagates only vegetatively. Following a population peak, the now decreasing caribou density and grazing allow for an alteration to a more diverse vegetation.

In order to elucidate the vegetation history, soil profiles in selected greens were sampled at different depths and analyzed for pollen and chemical composition. The results are discussed in relation to former and present grazing as well as to the holocene environmental history of the area.

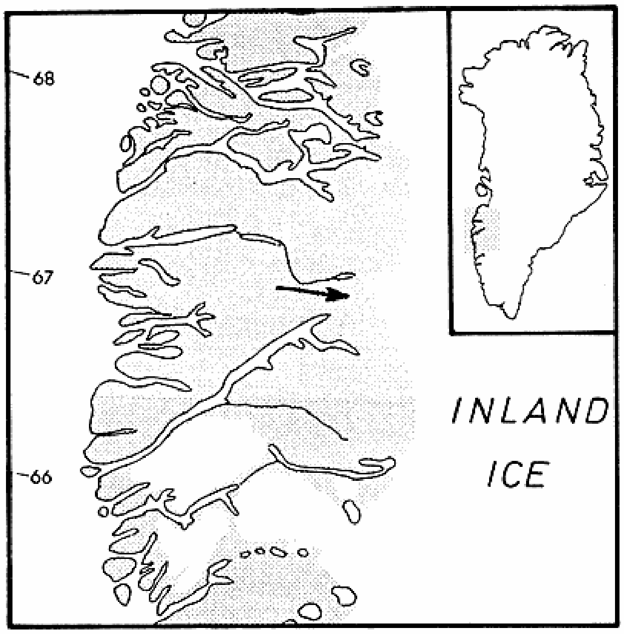

Fig. 1. Map of study area. Arrow shows position of the "greens".

STUDY AREA

The investigated area is situated NE of the head of Kangerlussuaq (Søndre Strømfjord) close to the Inland Ice just north of the Arctic Circle (Fig. 1). Most of the area is a lowland with E-W running, rounded, gneissic ridges only exceptionally exceeding 500 m.a.s.l. As a result of the distance from the sea, the rain-shadow effect of high mountains and the Sukkertoppen Icecap to the southwest, and of its proximity to the Inland Ice, the climate is low-arctic, continental (Fig. 2). Strong easterly winds, either catabatic or foehn, are fairly frequent, often resulting in dust storms which deposit loess-like material (Dijkmans & Törnqvist, 1991). As a consequence of this, and of evaporation during the sunny and warm summers, lakes and ponds are often both alkaline and saline (Böcher, 1949; Hansen, 1970). Soil profiles in lee positions in the lowland show layers of almost pure aeolian material which alternate with approximately humic layers. Acid soils are formed only under mossy dwarf-shrub heaths on north-facing slopes.

Detailed descriptions and phyto-sociological groupings of the vegetation types around the head of Kangerlussuaq were made by Böcher (1954, 1959, 1963). At a later date,

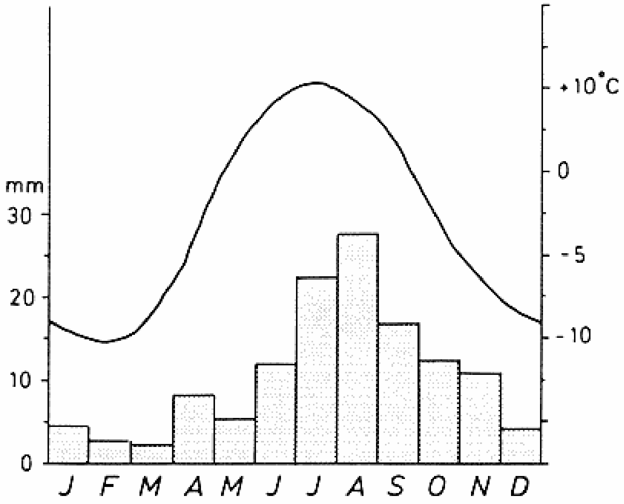

Fig. 2. Climate at Kangerlussuaq airport (1974-1987), redrawn from Dijkmans & Törnqvist (1991). Curve: temperature, bars: precipitation.

Fig. 3. Photo of a green. *Poa pratensis*, preferably eaten by the caribou, dominates the grazed part. The tall grass in the background and to the right is *Calamagrostis lapponica*, eaten only exceptionally.

Holt (1983a,b) mapped and described the vegetation in a smaller adjacent area (c. 300 km^2) to the north based on false colour, infrared, aerial photos and ground truthing. The nine major vegetation types which could be separated on the aerial photos were mapped and their area calculated, given in brackets in the following together with their designation in Holt (1983a,b) and Thing (1984).

The major part of the mapped area is covered by dwarf-shrub heaths, mainly mossy *Betula nana - Ledum palustre* L. ssp. *decumbens* (Ait.)Hult. heaths with *Vaccinium uliginosum* L. ssp. *microphyllum* Lge. on N-slopes (H6, 39%), and *Betula nana - Vaccinium uliginosum* heaths with *Kobresia myosuroides* (Vill.)Fiori & Paol. on S-slopes and dry, level ground (H7, 38%). Locally, grasses are present (H6G, ⟨1% and H7G, 2%). On windswept ridges open *Betula nana - Dryas integrifolia* M.Vahl - *Carex nardina* Fr. fell-fields (H8, 4%) or fell-fields with crustaceous lichens (H9, ⟨1%) are seen. The fens have mainly developed at the edges of ponds and lakes. The drier fens (G1, 3%) are dominated by *Calamagrostis lapponica* (Wbg.)Hartm., the wetter (M2, 4%) by *Eriophorum scheuchzeri* Hoppe and *Calamagrostis neglecta* (Ehrh.)Gaertn., Mey. & Schreb. On slopes with seeping meltwater, a hummocky fen-type (M3, ⟨1%) is seen. *Salix glauca* copses are only found along streams (T3, ⟨1%) or at the foot of south-facing slopes (T5, ⟨1%).

The grasslands occur partly as a steppe-like *Kobresia myosuroides-Carex supina* Wbg. ssp. *spaniocarpa* (Steud.)Hult. vegetation (G4, 7%) on thin, loess-like soil on dry, south-facing slopes, partly as a moist, intensively grazed meadow green, all dominated by *Poa pratensis* (G2, 1.7%, Fig. 3). Where such intensively grazed grassland is drier (G2H), the vegetation consists of *Poa pratensis, Campanula gieseckiana* Vest.in R.& S., *Cerastium alpinum* L. ssp. *lanatum* (Lam.)Asch.& Graebn. and *Stellaria monantha* Hult. Moist grassland (G3, ⟨1%) with *Poa pratensis, Calamagrostis neglecta* and *Ranunculus affinis* R.Br. occurs at lakes or forms a transition zone to fens.

METHODS

Two types of vegetation analysis were carried out on nine greens at four places (sites 3, 6, 7 and 8) at the eastern end of the Lake Aujuitsup tasia, about 20 km ENE of the Kangerlussuaq airport;

a) degree of cover, at regular intervals (2-10 m depending on area) along transects through homogenous vegetation, on the basis of rectangles, 100 X 30 cm.

b) shoot density on the basis of 25 squares, 10x10 cm.

The pollen samples were treated repeatedly with warm 40% HF before acetolysis to remove the minerogenic content. In the pollen diagrams, the pollen sum includes all pollen besides spores of Polypodiaceae and Lycopodiaceae. Exotic pollen includes Greenlandic taxa not occurring in the area (*Alnus*) as well as non-Greenlandic taxa (*Picea, Pinus*). The type *Salix glauca* may include some *S. arctophila* Cockerell. The type *Saxifraga oppositifolia* L. includes *S. tricuspidata* Rottb., *S. aizoides* L. and *S. paniculata* Mill. The Cruciferae pollen are all of the *Draba* type.

The analyses also include frequencies of the testate

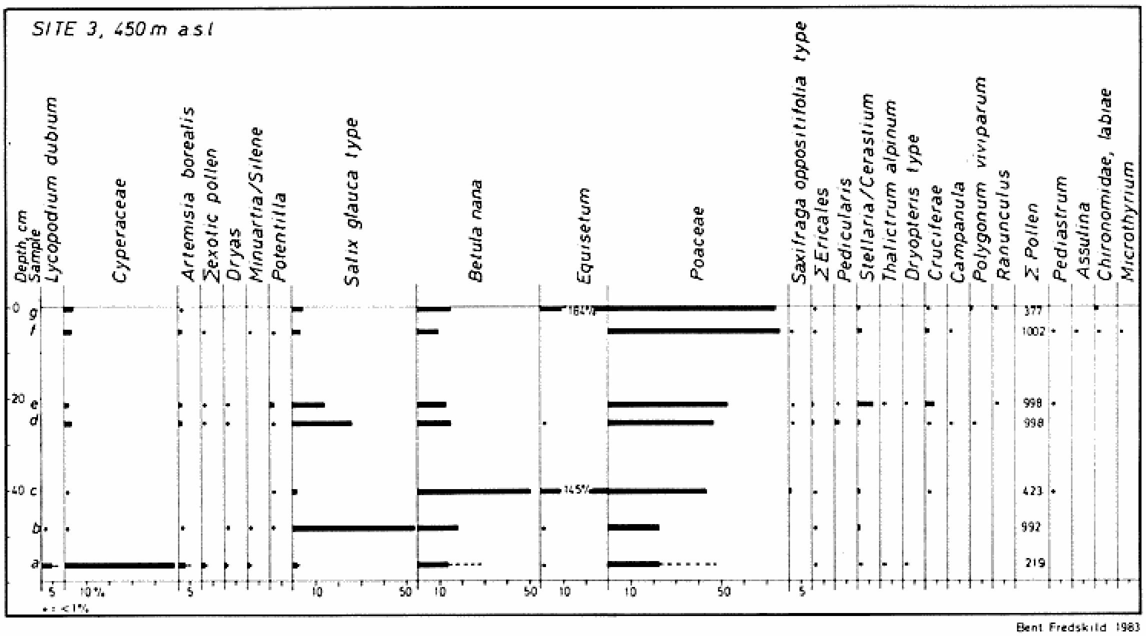

Fig. 4. Pollen diagram from green, site 3. Dashed line in sample a indicates percentages when Cyperaceae pollen are excluded.

amoeba *Assulina* (possibly including some *Euglypha*) of; fruit bodies of the primitive Ascomycete *Microthyrium*, labiae of Chironomidae larvae, the algae *Pediastrum* and *Botryococcus*.

The soil samples were taken from vertical profiles, the digging of which was sometimes hindered by permafrost. Apart from the few centimetres thick, humus, surface layer, the soil is loess-like, with thin layers of former surface humus. Most pollen samples were taken from these thin humus layers which occurred at irregular intervals. The soil samples, however, were five cm thick. They were air-dried in the field. The following were measured: exchangeable Ca, Mg, Mn, Kjeldahl N, loss on ignition, conductivity (soil:water - 1:5) and pH.

RESULTS

Vegetation Analysis

The degree of cover in five moist and four dry greens is summarized in Table 1. Dominating mosses in the moist greens are *Aulacomnium palustre* (Hedw.)Schwaegr., *A. turgidum* (Wg.)Schwaegr., *Drepanocladus aduncus* (Hedw.) Warnst. and *D. uncinatus* (Hedw.)Warnst. Other species are *Ceratodon purpureus* (Hedw.)Brid., *Climacium dendroides* (Hedw.)Web. & Mohr, *Desmatodon latifolius* (Hedw.)Brid., *Isopterygium pulchellum* (Hedw-.)Jaeg. & Sauerb. and *Polytrichum alpinum* Hedw. In dry greens *Drepanocladus aduncus* and *Polytrichum alpinum* dominate. Other species include; *Tortula norvegica* (Web.f.)Wg., *T. ruralis* (Hedw.)Gaertn., plus the same species as in the moist greens less *Aulacomnium palustre, Climacium, Drepanocladus uncinatus* and *Isopterygium.*

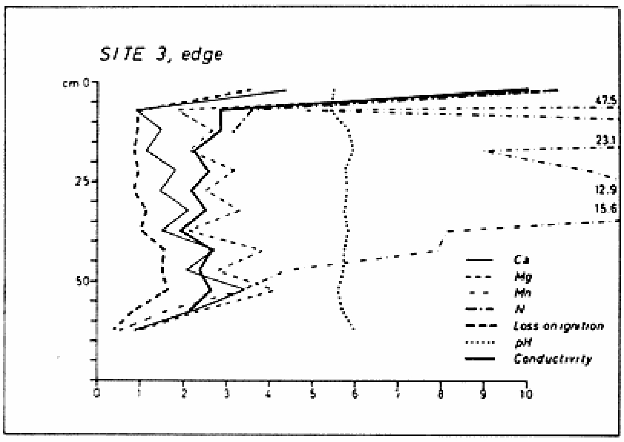

Fig. 5. Soil analyses at site 3. Units are: Ca: ppm x 10^{-3}, Mg: ppm x 10^{2}, Mn: ppm x 10^{-1}, Kjeldahl N: % x 10, loss on ignition: %, conductivity umho/cm x 100.

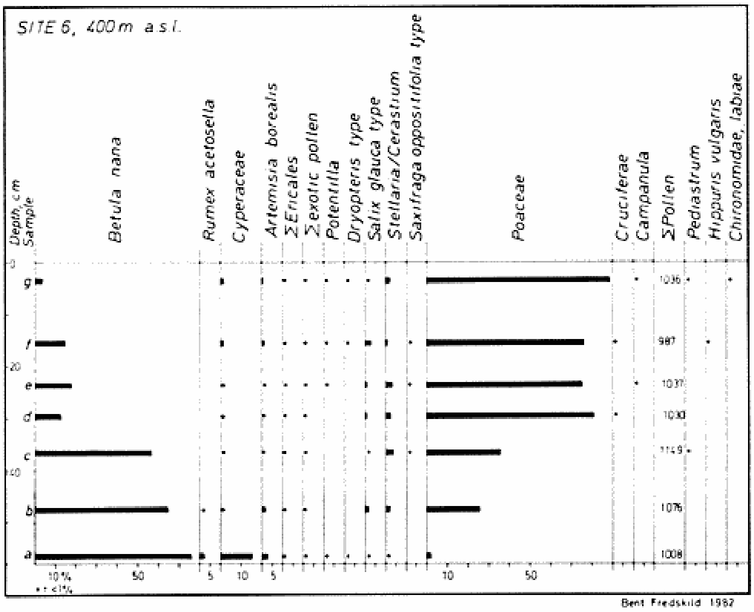

Fig. 6. Pollen diagram from green, site 6.

Pollen and Soil Analysis

Moist greens

Site 3. The ground is totally covered by mosses. *Poa pratensis* covers 27%. The only other phanerogams are *Ranunculus hyperboreus* Rottb., *Equisetum arvense* L., *Cerastium alpinum* and *Polygonum viviparum* L. In sample *a* (Fig. 4) virtually all the pollen, except Cyperaceae, had been almost totally destroyed, and much was too poorly preserved for determination. However, all the Cyperaceae pollen appeared fresh, strongly indicating contamination during sampling. Many wood fragments of *Betula nana* in the slides indicate its local growth. The destruction of the pollen is almost as great as in samples *b* and *c* which both contain *Betula* wood fragments, while it is much less in samples *d* and *e*, and minimal in samples *f* and *g* in which no *Betula* wood fragments were found.

At this site the vegetation seems to have developed from a *Betula* heath with grasses and *Salix glauca* (*b*) through a slightly more humid grassy *Betula-Salix* heath with *Stellaria/Cerastium* and *Draba* (*d-e*) to the present-day, moist green. The occurrence of labiae of Chironomidae and fragments of legs of Cladocera in *f* and *g* indicate open water in spring. The vegetation change in the deeper layer seems to have been caused by the climate, as there is no evidence of grazing until the uppermost sample is reached (Fig. 5).

Site 6. The ground is totally covered with mosses. *Poa pratensis* covers 25%. The only other species are *Equisetum arvense*, *Ranunculus hyperboreus*, *Cerastium alpinum*, *Stellaria monantha* and *Polygonum viviparum*. *Ranunculus affinis* and *Carex norvegica* Retz. grow just outside the analyzed area. The pollen diagram (Fig. 6) shows a change from a *Betula* heath to a grassland, seemingly becoming more humid closer to the present time (*Hippuris* pollen in f, Chironomidae in g). The increase in most soil parameters (Fig. 7) and the concurrent change in vegetation beginning around 40 cm may well have been caused by grazing. Whether the decrease around 20 cm marks a period of less intensive grazing cannot be determined, but the effect of grazing is clearly seen in the uppermost 5 cm.

Dry greens

Site 7. At this site two profiles have been analyzed, one taken from the centre of the green, the other from an open, low *Salix glauca* copse at the edge. At the centre, *Equisetum arvense* and *Poa pratensis* dominate, forming a dense moss carpet. The other phanerogams are *Festuca brachyphylla* Schult. & Schult., *Stellaria monantha*, *Cerastium alpinum*, *Carex norvegica* Retz., *Salix glauca*, *Luzula confusa* Lindeb., *Polygonum viviparum* and *Vaccinium uliginosum*

The four pollen samples from the centre (Fig. 8, below) show a change from a *Betula* heath to a grassland with some *Salix*. As *Betula* is the most prolific pollen producer, and at the same time one of the most widespread plants in

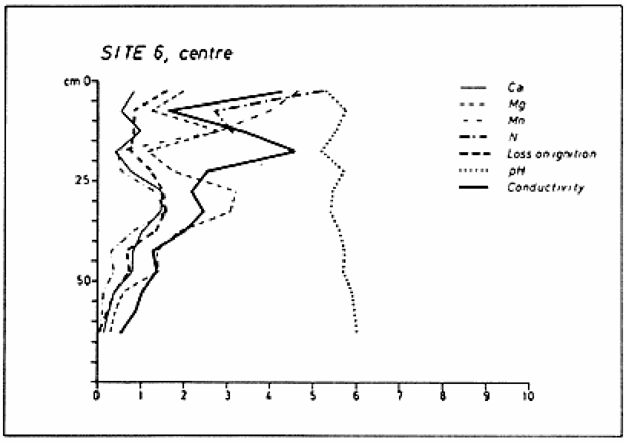

Fig. 7. Soil analyses at site 6. Units: see legend to Fig. 5.

this part of Greenland, 10- 20% are considered as "background noise" (*b- d*). The surface sample (*d*) is from the most humid vegetation (*Pediastrum*, Chironomidae and legs of Cladocera). At what level grazing began is not clear, most likely not until quite recently. This is confirmed by the soil analyses which indicate former grazing (Fig. 9).

The lower half of the profile (*a-d*) under the copse (Fig. 8, above) seems to have been formed under a grassland with scattered stands of *Betula* and *Salix*. The anemophilous *Artemisia borealis* Pall. has been growing within this vegetation as indicated by lumps of its pollen which are visible in *d* and *g*, yet accidentally not in *b*. The vegetation in the upper half seems more humid, with more forbs represented, especially *Polygonum* and *Stellaria/Cerastium* and fewer *Betula. Armeria scabra* Pall. ssp. *sibirica* (Turcz.)Hyl., with big, entomophilous pollen, must also have been growing locally. The effect of the recent grazing is clearly reflected in the soil parameters (Fig. 10).

Site 8. Bare ground is seen in the centre of the green, where phanerogams cover 37%. Mosses, partly growing under the herbs, cover 45%. *Poa pratensis* dominates (26%). Other phanerogams are *Equisetum arvense, Festuca brachyphylla, Cerastium alpinum, Stellaria monantha, Draba glabella* Pursh., *Polygonum viviparum, Armeria scabra, Luzula multiflora* (Retz.)Lej. and *Ranunculus affinis*. Profiles from the centre and the edge were analyzed. In the centre, the oldest vegetation registered is a *Betula* heath with grasses and *Cerastium/Stellaria* (Fig. 11). The pollen slides were rich in fragments of *Betula* wood. This vegetation layer was covered by about 25 cm of aeolian sediments which prevented the destruction of most of the pollen and other botanical remnants, and therefore must have been deposited during a fairly short span of time. After this, the vegetation changed to a *Salix* heath or copse which gradually became richer in grasses and more humid. At one stage, sample *f*, the vegetation was rich in *Artemisia* and *Campanula* indicating little or no grazing. Unfortunately, it is not possible to distinguish

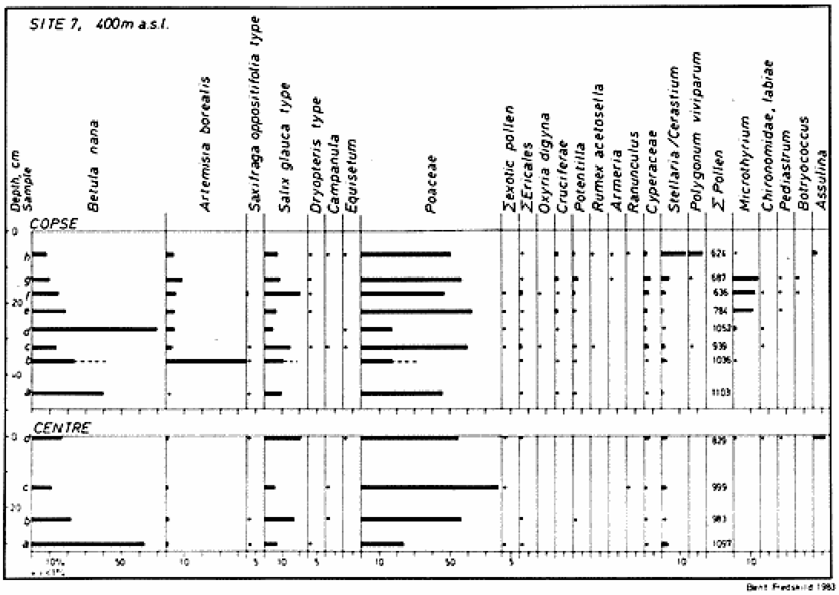

Fig. 8. Pollen diagrams from edge (above) and centre (below) of green, site 7. Dashed line in sample *b*, above, indicates percentages when *Artemisia* pollen are excluded.

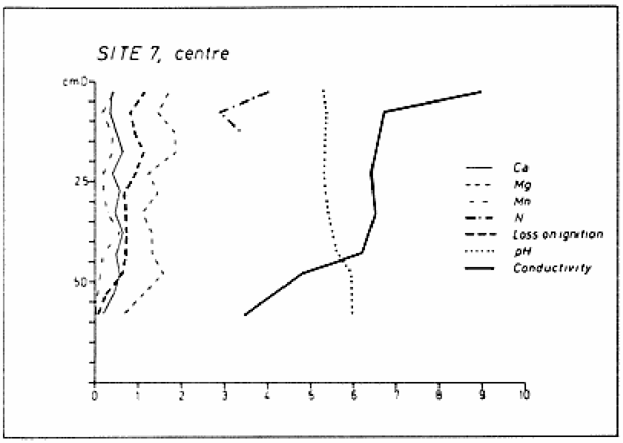

Fig. 9. Soil analyses at site 7, centre. Units: see legend to Fig.5.

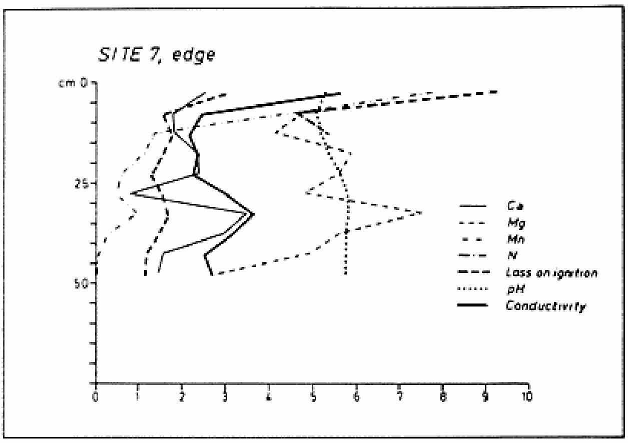

Fig. 10. Soil analyses at site 7, edge. Units: see legend to Fig.5.

the pollen of *Stellaria longipes*, which is eagerly eaten by caribou, from *Cerastium alpinum*, which is not eaten at all.

The vegetation at the edge underwent a similar change: from a *Betula* heath (*a-d*), through a *Salix* copse with many *Artemisia* (although only at one level), to the present day green. The higher frequencies of grass pollen in the recent samples (*k* and *l*) compared to those of the centre (*h*) can be explained by less intensive grazing which enabled the grasses to flower. The soil analyses of both profiles (Figs 12 and 13) indicate that grazing began quite recently. The decrease in several curves of soil parameters at the 40-50 cm level seems connected with the change from a humus soil to minerogenic, aeolian sediments.

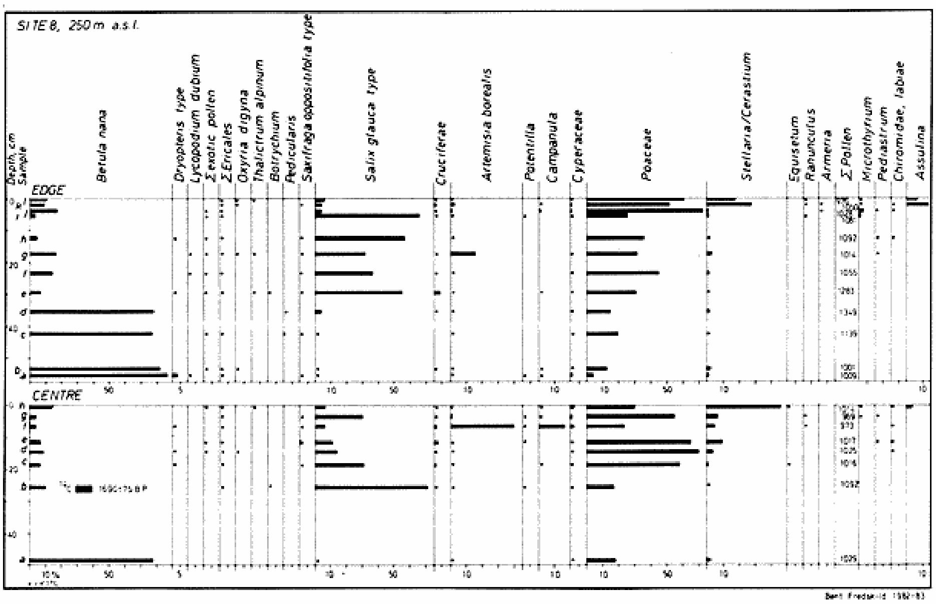

Fig. 11. Pollen diagrams from edge (above) and centre (below) of green, site 8.

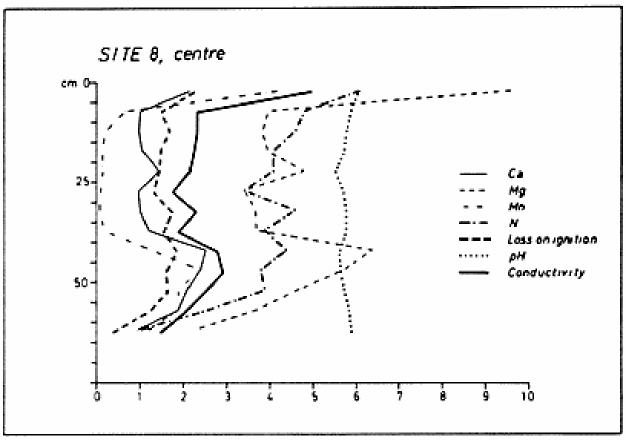

Fig. 12. Soil analyses at site 8, centre. Units: see legend to Fig. 5.

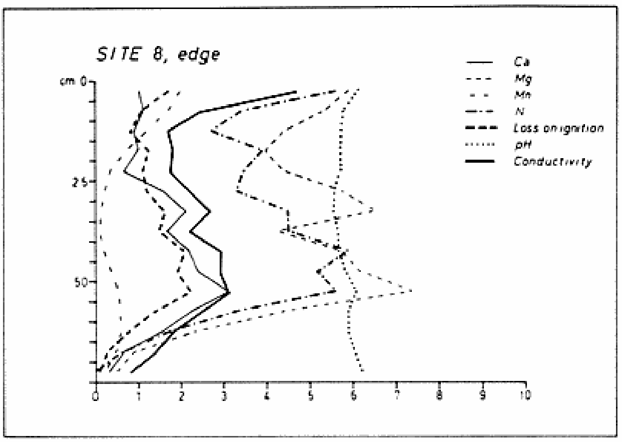

Fig. 13. Soil analyses at site 8, edge. Units: see legend to Fig. 5.

	Moist greens		Dry greens	
Plant species	Mean	Range	Mean	Range
Poa pratensis	25.7	14.7 - 41.7	17.0	10.2 - 26.2
Cerastium alpinum	0.1	+ - 0.4	11.4	2.4 - 22.5
Equisetum arvense	2.5	0 - 6.6	7.4	3.6 - 13.7
Festuca brachyphylla	0.2	0 - 0.6	2.5	+ - 6.3
Campanula gieseckiana			1.6	0 - 3.1
Ranunculus hyperboreus	1.5	0 - 4.4		
Carex norvegica	0.2	0 - 0.7	0.8	0 - 3.0
Stellaria longipes s.l.	+	0 - 0.2	0.7	0.1 - 1.1
Polygonum viviparum	0.1	0 - 0.3	0.6	+ - 2.2
Poa glauca			0.5	0 - 1.9
Carex scirpoidea			0.3	0 - 1.3
Salix glauca	+	0 - 0.1	0.3	+ - 1.1
Euphrasia frigida			0.3	0 - 0.8
Armeria scabra			+	0 - 0.1
Luzula confusa			+	0 - +
Draba glabella			+	0 - +
Draba cinerea			+	0 - +
Melandrium affine			+	0 - +
Pyrola grandiflora			+	0 - +
Ranunculus affinis	+	0 - 0.4	+	0 - +
Eriophorum angustifolium	+	0 - 0.2		
Cardamine pratensis	+	0 - 0.1		
Eriophorum scheuchzeri	+	0 - +		
Mosses	95.1	88.5 - 98.0	73.3	44.8 - 92.4
Total	126	103 - 154	116	82 - 143

Table 1. Degree of cover in five moist (G2) and four dry (G2H) greens. + = (0.1 %.

Radiocarbon Dating

In order to date the marked change from a *Betula* heath to the *Salix* heath or copse, two samples from the centre profile were submitted for ^{14}C dating. The deeper sample, taken from 25-27 cm below the surface, was dated at 1690±75 B.P. (K-3954, calibrated age: 345-380 A.D.), whereas the shallower sample, taken from a depth of 4-5 cm, could not be dated because of the risk of contamination with modern ^{14}C. It gave the average date of the sample as being around AD 1956. However, the character of the upper sediment indicated rapid growth, and thus a fairly recent formation of the green.

DISCUSSION AND CONCLUSION

The results obtained can be referred to two main factors which will be discussed separately, viz. climatic changes during the late Holocene, and the utilization of the area by caribou.

The holocene history of the area

Around 6,000 B.P., during the mid-Holocene warm period, the Inland Ice margin reached its present position, only to withdraw further east (Kelly, 1985; Weidick et al. 1990). Around 3,500 B.P., the beginning of the Vesterbygd glacial period is reflected mainly by changes in the composition of the vegetation (Fredskild, 1985). During the following millennia, several colder and/or more humid periods are registered in the vegetation sequence as well as in the Ice Cap cores (Dansgaard et al. 1975), i.a. some beginning around 2,000 and 1,800 B.P. At site 8, the vegetation change from a *Betula nana* heath to a *Salix* scrub can be most likely ascribed to one of these events.

In the continental part of West Greenland, climatic changes or oscillations are most readily reflected in lakes without outlets or in shallow ponds. Their water levels depend on the ratio of precipitation to evaporation. Thus, at the edge of one of the many saline lakes, Store Saltsø, to the south of Kangerlussuaq airport, a series of peat ridges formed mainly by *Drepanocladus aduncus*, with an alternating content of loess, indicates that former lake levels used to be several metres above the present height (Hansen, 1970). A peat sample from the upper ridge has been dated at 2,330±120 B.P. (Böcher, 1959). Plant and animal remains indicate less alkaline/saline water at that time. The lowering of temperature and increasing precipitation in past decades reflect such oscillations as other

nearby lakes bear evidence of past vegetation, mainly willow, on former banks which have since been drowned. Correspondingly, a shallow depression at the head of Godthåbsfjord 300 km to the south was covered in 1960 by an open, almost one metre high *Salix glauca* copse (Fredskild, 1973). The soil underneath contained seeds of waterplants, proving it to be a dried-up pond. However, around 1970, it became a pond once again as a result of a climatic oscillation towards more humid conditions.

Grottenthaler (1986) has made pedological studies in the Ørkendal area, just south of the study area. One of the most common soil types, especially on south-facing slopes, consists of two layers of aeolian sediments resting on till or bedrock. The deeper layer, often 10-20 cm thick, consists of cryoturbated silt with fine sand and rust-coloured spots. The upper layer, 20-30 cm thick, is silty fine sand with humus stripes, but not cryoturbated. Grottenthaler considers the older (deeper) layer a fossil or relic soil, formed under a more humid and warmer climate. Östmark (1988) worked at Isúnguata Sermia, 6-7 km NE of the "greens", and found two buried organic sandy silts close to the ice margin. Based on the ^{14}C datings of these silts, she concludes that "Soils found inside a supra-glacial diamicton indicate repeated re-advances over humid, vegetated ground some time after c. 3,500 B.P. and c. 2,700 B.P.". Dijkmans & Törnqvist (1991) describe the re-deposition of fluvioglacial sediments in the same area.

Thus, vegetation changes, soil development, fluctuations in water levels as well as of the ice margin, all reflect the late Holocene climatic changes.

Utilization of the greens by caribou

The spring migration of caribou from more coastal areas with large lichen-rich heaths to the inland head of Kangerlussuaq is over in the last days of May, and calves are born in the first half of June (Thing, 1984). During the post-calving period, and throughout the ensuing summer dispersal until the end of August, the greens are the preferred feeding habitats. Utilization peaks at 78% in the post-calving period, and even during the fall migration (September and the first half of October) the greens are frequently used 31% (Thing, 1984). Only during winter do the caribou leave the greens untouched, feeding mainly (76%) on *Betula nana - Ledum decumbens* heaths (H6 and H6G).

The utilization of the *Poa pratensis* greens is an example of selectivity, based on the search for high protein forage. Analyses of fresh *Poa pratensis* shoots from the greens in late May show a protein level in the dry matter to be 19%, and the frequent leaf regeneration favours the availability of high-quality forage for a prolonged period. By the end of July, a protein level of 21% was measured, well above the average of 11% recorded for fresh leaves of other graminoids including leaves and year shoots of *Betula nana* at the same time of year (H.Thing, pers. comm.).

Marked, recurring fluctuations in caribou populations have been recorded throughout the past 250 years in West Greenland (Meldgaard, 1986). Thus, in the Kangerlussuaq-Sisimiut area, the annual harvest of caribou rose from 200 to 8000 during the 1960's, only to drop very dramatically in the late 1970's. In 1990 the total population remained at a minimum of 3000 animals. Heavily grazed, non-flowering *Poa pratensis* greens, often with dead willow stems at the edge were commonly seen in the 1970's and, beyond doubt, were created during the rapid increase in the caribou population. However, as a result of the present low caribou population level, the greens are not "maintained". The use of greens for feeding is now negligible as assessed from the amount of faeces left by the caribou on the sites. From a faecal load of 2.6 kg fresh faecal pellets/100 m^2 during the years with intensive use, the amount has dropped to almost nil. The *Poa pratensis* now flowers vigorously, and both dry and moist greens have an extensive cover of the annual *Euphrasia frigida* Pugsl., a plant species that caribou do not feed on at all (H. Thing, pers. comm.).

In the present investigation, pollen analysis, which is a well- known tool in describing the effect of grazing animals in connection with agriculture (e.g. Birks et al. 1988), has confirmed the hypothesis stating the case for a very recent formation of the greens. Besides, the investigation has shown that this method, and to a certain extent, the measurement of soil parameters of profiles under the greens, can be used in unveiling and dating the presence of greens in earlier periods as a result of caribou grazing.

ACKNOWLEDGEMENTS

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Grottenthaler (1986) has made pedological studies in the Ørkendal area, just south of the study area. One of the most common soil types, especially on south-facing slopes, consists of two layers of aeolian sediments resting on till or bedrock. The deeper layer, often 10-20 cm thick, consists of cryoturbated silt with fine sand and rust-coloured spots. The upper layer, 20-30 cm thick, is silty fine sand with humus stripes, but not cryoturbated. Grottenthaler considers the older (deeper) layer a fossil or relic soil, formed under a more humid and warmer climate. Östmark (1988) worked at Isúnguata Sermia, 6-7 km NE of the "greens", and found two buried organic sandy silts close to the ice margin. Based on the ^{14}C datings of these silts, she concludes that "Soils found inside a supra-glacial diamicton indicate repeated re-advances over humid, vegetated ground some time after c. 3,500 B.P. and c. 2,700 B.P.". Dijkmans & Törnqvist (1991) describe the re-deposition of fluvioglacial sediments in the same area.

Thus, vegetation changes, soil development, fluctuations in water levels as well as of the ice margin, all reflect the late Holocene climatic changes.

Utilization of the greens by caribou

The spring migration of caribou from more coastal areas with large lichen-rich heaths to the inland head of Kangerlussuaq is over in the last days of May, and calves are born in the first half of June (Thing, 1984). During the post-calving period, and throughout the ensuing summer dispersal until the end of August, the greens are the preferred feeding habitats. Utilization peaks at 78% in the post-calving period, and even during the fall migration (September and the first half of October) the greens are frequently used 31% (Thing, 1984). Only during winter do the caribou leave the greens untouched, feeding mainly (76%) on *Betula nana - Ledum decumbens* heaths (H6 and H6G).

The utilization of the *Poa pratensis* greens is an example of selectivity, based on the search for high protein forage. Analyses of fresh *Poa pratensis* shoots from the greens in late May show a protein level in the dry matter to be 19%, and the frequent leaf regeneration favours the availability of high-quality forage for a prolonged period. By the end of July, a protein level of 21% was measured, well above the average of 11% recorded for fresh leaves of other graminoids including leaves and year shoots of *Betula nana* at the same time of year (H.Thing, pers. comm.).

Marked, recurring fluctuations in caribou populations have been recorded throughout the past 250 years in West Greenland (Meldgaard, 1986). Thus, in the Kangerlussuaq-Sisimiut area, the annual harvest of caribou rose from 200 to 8000 during the 1960's, only to drop very dramatically in the late 1970's. In 1990 the total population remained at a minimum of 3000 animals. Heavily grazed, non-flowering *Poa pratensis* greens, often with dead willow stems at the edge were commonly seen in the 1970's and, beyond doubt, were created during the rapid increase in the caribou population. However, as a result of the present low caribou population level, the greens are not "maintained". The use of greens for feeding is now negligible as assessed from the amount of faeces left by the caribou on the sites. From a faecal load of 2.6 kg fresh faecal pellets/100 m^2 during the years with intensive use, the amount has dropped to almost nil. The *Poa pratensis* now flowers vigorously, and both dry and moist greens have an extensive cover of the annual *Euphrasia frigida* Pugsl., a plant species that caribou do not feed on at all (H. Thing, pers. comm.).

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