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ALIEN PLANTS AND APOPHYTES OF GREENLAND

BY

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WITH 2 PLATES

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INTRODUCTION

Before the early half of the last century H. C. Watson endeavoured to divide the plants of Great Britain into groups according to their probable origin and age in the flora. He also coined such terms as "aliens", "casuals", "citizens", "colonists", which still appear in books written in English. In the continental European handbooks of phytogeography we find a recognition of the underlying thought of Watson's words, but it is not until the end of the century that more intensive studies of the suggested problems were taken up there. They started, it appears, in Switzerland, with the writings of Rikli, Naegeli and Thellung.

In these countries where various races of mankind, with various cultures, had for thousands of years, succeeded each other the task proved very difficult; and botanists enlisted history for help. They consulted the oldest books and herbals available, they turned to philology for interpretation of old popular plant-names, to archæological findings, and, last not least, to quaternary geology.

In Denmark too the task was difficult. Those rocky hills which might have served as refuge for original wild plants were absent. The aboriginal forests had been cut and cleared and bog and heathland to a great extent been cultivated. And yet much valuable knowledge can still be obtained; and that great botanical work, the prize essay of Knud Jessen and Jens Lind, reveals what the careful and critical compilation of facts and the comparison of local conditions for plant growth with conditions in adjacent countries can yield. That work has been, to the present writer, not only a most valuable source of information, but also a stimulus for undertaking the much easier task of discussing the alien plants of Greenland.

In northern Scandinavia studies on the introduction of plants by man's activities have been carried on eagerly during the last three decades. Northwards in Scandinavia where the population grows thinner and the cultivated plots smaller, it becomes, compared with conditions

in Central-Europe, a relatively easy task to find out which plants, intentionally or not, were introduced by man. At the same time, however, it becomes evident that culture has also affected the indigenous plants and plant communities of the country. On this subject there is already a vaste literature and the bibliography given at the end of this paper is by no means complete, — partly because several books were not accessible to me, and partly because only such papers are listed as contain information about plants that occur in Greenland.

When more detailed studies of these problems were undertaken the terms of WATSON were found insufficient; and being English, they sometimes offered difficulties in translatation. A system of new terms was therefore gradually developed, and such international words were coined as could serve in the literature of any language. This terminology was started by RIKLI, NAEGELI and THELLUNG, who termed the plants dispersed by man, whether intentionally or not, anthropochorous plants, and the wild and indigenous plants which left their former and natural associations and settled over on cultivated ground apophytic plants or apophytes. In a small paper dated 1910, H. G. SIMMONS has widened the system by naming subdivisions in both groups. He coined a new term, hemerophilous plants, or hemerophytes, those favoured by culture, comprising the anthropochores and the apophytes, and the antithesis of this term hemerophobous plants or hemerophobes, plants suffering from culture (derived from ἥμερος tamed, domesticated).

The system of SIMMONS, as it will be given below, has since been adopted by most Scandinavian and by some German botanists.

I. HEMEROPHILOUS PLANTS (SIMMONS).

APOPHYTES (RIKLI), native plants on new soil.

A. **Autapophytes** (SIMMONS), plants which spontaneously leave their natural associations.
   1. Kenaapophytes (SIMMONS) plants on denuded soil (from κενός empty).
   2. Leimonapophytes (SIMMONS) plants settling on pastures (from λειμών a pasture).
   3. Ergasiapophytes (SIMMONS) plants entering cul-

ANTHROPOCHORES (RIKLI, THELLUNG) plants introduced by man.

A. **Unintentionally introduced** (THELLUNG).
   6. Ephemerophytes (THELLUNG), casuals, unable to be acclimatized.
   7. Epoikophytes (RIKLI) established colonists.
   8. Archeophytes (THELLUNG) introduced by man in ancient or even prehistoric times and now fully naturalized.

tivated soil, gardens or fields (from ἐργασία work).

4. Chomapophytes (SIMMONS) plants on refuse and dumping places (from χῶμα refuse heap).

B. **Ekiophytes** (THELLUNG) native, cultivated plants (as *Dactylis*, *Fragaria* etc. (from οἰκεῖος domestic).

B. **Intentionally introduced** (THELLUNG).

9. Ergasiphytes (THELLUNG, SIMMONS) cultivated plants of foreign origin.

10. Ergasiphygophytes (THELLUNG, SIMMONS) plants escaped from cultivation).

II. HEMERADIAPHOROUS PLANTS (LINKOLA) plants which are neither favoured nor damaged by culture (from ἀδιάφορος indifferent).

III. HEMEROPHOBOUS PLANTS (SIMMONS) plants directly or indirectly suffering from man's activities or neighbourhood.

This system of terms is thought to be sufficient for even the most detailed studies, and generally the main terms: hemerophilous versus hemerophobous, anthropochores versus apophytes will do and they might practically, as has been done by CEDERCREUTZ, be employed in an abbreviated form in flora-lists.

LINKOLA's term is in strict logic needed, when, as LINKOLA has done, the different elements of a flora are worked up "to the bottom", for statistics and the calculation of percentages. Otherwise it would be easier in flora-lists simply to omit a "title" where no actual favouring or damaging of a plant by culture has been observed.

It is easily seen that the same plant species may in one region be an anthropochorous plant, in another an apophytic, or even both cases may occur in different places within the same country. There may, too, be plants which are able to adapt themselves on different kinds of soil, making the subdivisions of the apophytes unwieldy. Yet, as is well known, there is a certain group of plants in every flora which show a preference for the soils which SIMMONS mentions with the various subdivisional terms, which he coined.

Whether or not a plant species is favoured or damaged by man's activities, whether, in short, it is hemerophilous or hemerophobous, seems to be the expression of deeply rooted attributes of its nature. We are therefore permitted to assume that a species observed as an hemerophyte in one region will also be hemerophytic in another. Of course, some caution is always necessary. There are cases where the so-called "main" or "typical" form behaves differently from a form which is considered by taxonomists a variety of the same species. For

instance: *Festuca rubra* var. *arenaria* is in northern countries fairly indifferent to culture; whereas, in lower latitudes, glabrous forms of *Festuca rubra* are strongly hemerophilous, and in some regions even anthropochorous.

In the earliest lists of the plants of Greenland by LANGE some introduced plants were mentioned. In his "Conspectus" those plants which he regarded as established are listed, like the native plants, with a number, whereas the casually introduced plants were entered without number. But LANGE never visited Greenland. A great number of additional introduced weeds was brought by BERLIN, who in 1883, investigated the surroundings of the cryolite mine at Ivigtut, 61°13′ N. The investigation there was repeated in 1889 by N. HARTZ and, in 1899, by LINDHARD, and the results were published by ROSENVINGE and OSTENFELD respectively. We have thus three lists from one of the most visited ports of Greenland and from a place where comparatively large amounts of refuse are dumped.

I have not paid much attention during my stay in Greenland to introduced weeds in other places than my own. A number of specimens from elsewhere, placed at my disposal by other collectors, will be mentioned in chapter I. Before preparing the list given in that chapter, I had an opportunity, during a stay in Europe in 1929, to compare my notes with the specimens in the Botanical Museum at Copenhagen.

Chapters II and III will contain observations, accumulated during many years, on the influence of man upon the native wild plants of Greenland, either as favouring them or damaging. This has not to my knowledge been attempted before. Although I have profited by the use of JESSEN & LIND's book, I was unable to control my observations on this subject by comparison with its statements; for Denmark and Greenland have too few plants in common. Here I consulted the rich literature from Scandinavia proper and from Finland.

Finally, chapter IV will contain a discussion of the single difficult problem offered by Greenland in this connection: the so-called "Old Norse" plants, supposed to have been brought to Greenland by the Norse settlers during medieval times.

When typing this paper for printing I profited by the presence at the Arctic Station of the American artist and writer Mr. ROCKWELL KENT who had become weatherbound on a sledge-trip. Mr. KENT kindly took upon himself the task of ironing the wrinkles out of my English persevering in his labours with such admirable fortitude that I must here express my appreciation and my thanks.

DEN DANSKE ARKTISKE STATION. DISKO, GREENLAND.

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I.

ANTHROPOCHOROUS PLANTS OF GREENLAND

The subsequent enumeration of the introduced weeds in West Greenland is undoubtedly incomplete, only a few collectors having paid special notice to them and only at some of the main ports. In issuing the list as it is, it is hoped that in future the weeds will attract some attention of travellers or local residents.

All trading ships visiting Greenland come directly from Copenhagen, except some ships from Philadelphia, Pa., going to the cryolite mine at Ivigtut. Therefore the origin of the introduced weeds is plain enough. The sources supplying them are also quite clear: some arrive with packing material, but the great majority enter as impurities in garden seeds or fodder for domestic animals, especially for poultry and hogs. A somewhat extraordinary introduction was caused by the late Dr. ALFRED WEGENER'S inland ice expeditions 1930 and 1931, where a number of Iceland ponies were used for transports up to the ice, and for which a large amount of hay from Europe was procured. Around the horse camp, with stables and barns, at a considerable altitude, a rich flora of weeds sprang into existence, of which Governor ROSENDAHL kindly brought forward a couple of interesting examples.

It may here be appropriate to insert a brief account of the status of gardening and livestock husbandry in West Greenland.

From Upernivik, 72°48′ N., and down to the South the Europeans in Greenland keep small garden plots in which some vegetables are grown in cold frames and, according to the latitude, under glass a shorter or longer period of the season. The success depends of course on the local climatic conditions, but also, to a considerable extent, on the owners ability and the labour spent. In former times soil was, somewhat naïvely, imported from Denmark, nowadays it is generally taken from old Eskimo house-sites and treated with suitable fertilizers. According to investigations of C. BARTHEL and H. SANDOW the microbiota of well tilled garden soil may, (cfr. M. P. PORSILD in Dansk Bot. Ark. VI.7.1930), in quantity and quality be very much the same as in any soil of temperate climates. But higher life as earth-worms, insects and rodents is absent.

At the northernmost places can be grown radishes, garden cress, salad, spinach, chervil and kale. At the inner places of Disko Bay, Ritenbenk, Jakobshavn and Christianshaab, 70—68°30′ N., conditions are much better. Here 2 or 3 crops of radishes are grown, and at least one without glass cover, and cabbage, cauliflower, turnips, carrots,

parsley, beets and rhubarb do fairly well, even if the cabbage heads are but $^1/_4$ to $^1/_3$ of the normal size. Potatoes have been tried, but the tubers are not much larger than walnuts, and they are watery. At the more outlying places, Godhavn and Egedesminde, the success is more uncertain. Southwards conditions improve. At Godthaab, 64° N., which, by the way, has no favourable situation, the free land cultures much exceed the cold-frames, and here may also be seen small garden plots owned by natives. Potatoes may here attain to good size, but hardly to such maturity as to be able to be stored for the winter. Also onions, chives and celery may succeed. In the district of Julianehaab nearly every garden vegetable of northern countries can be grown. Strawberries, raspberries and red currants have been tried, but they do not reward the trouble. At Igaliko, the former bishop-see in Old Norse times, the native Eskimo population grow vegetables for their own use and for their cattle, and may even have some potatoes or turnips for sale.

As is well known the Eskimo in Greenland are increasing at a rate better than many civilized peoples, but their existence is severely threatened by the unlimited wholesale slaughtering of the pelagic seals by the seafaring nations. As a substitute for the failing seals, sheep ranching on a large scale has been started and is rapidly developing. Also goats are generally kept and, in few places, cattle.

With increasing live stock a sufficient collecting of "wild hay" for winter's use becomes impossible, and fenced and regularly fertilized home fields will be necessary. These will, of course, afford much better facilities for alien plants establishing themselves, whether they are intentionally introduced and useful, or merely troublesome weeds. It was only thought appropriate to have an inventory of the Greenland weeds before the expected invasion.

Chickens are generally kept by the Europeans who can afford the import of fodder; in the South also geese and sometimes pigeons. Hogs are not bred in Greenland, but pigs are regularly taken up and fattened for slaughtering. It is not a paying proposition, however, but rather a luxury for having the pleasure of tasting fresh meat once in a while.

In the houses of the European population is grown a considerable number of pot flowers, both annuals of every available kind, bulbs and tubers, and perennials and shrubs as well. They generally thrive well, even tropical types such as Palms, Begonias, Cactuses, the only trouble being the providing of a cool but frostfree place to store them in the dark season. When carefully selected and inspected before introduction, they will be free from all vegetable or animal pests indefinitely.

Note:— The plants marked with a * are here mentioned for the first time as introduced to Greenland.

1. **Phleum pratense** L. Consp. III, 727; OSTENF. 1899; J. & L. 363; HEGI: I, 211.

Ivigtut, 1889, good specimens, 3—4 dm high, flowering, N. H.; 1899 flowering specimens, LINDH. Perennial.

Denmark cultivated and probably spontaneous, Iceland and N. Am. naturalized.

2. **Alopecurus pratensis** L. Consp. III, 728; J. & L. 155; HEGI: I, 217.

Ivigtut, well sized, flowering specimens, 1889 N. H.; Nanortalik, 1925, K. N. CHRISTENSEN (det. OSTENF.). Perennial.

Denmark naturalized and cultivated. Iceland, N. Am. intr.

3. **Deschampsia caespitosa** (L.) BEAUV. Consp. III, 730; HEGI: I, 243.

Ivigtut, 1889, N. H. Hitherto the only record. J. & L. 283 in giving the general distribution, say "common in Greenland" which shows that they, following Fl. Arctica, include **D. alpina** (L.) R. & S. which is fairly common in South Greenland, and the high-arctic and rare *D. pumila* (LEDEB.) OSTENF. and *D. arctica* (SPR.) MERR. Perennial.

Denmark and N. Am. common, Iceland common, except N. W. strongly hemerophilous.

4. **Avena sativa** L. Consp. III, 731; HEGI: I, 254; OSTENF. 1899.

Ivigtut, 1889, seedlings, N. H.; 1899, flowering, weak panicles (LINDH.); Arctic Station, 1923, very stout specimens, Sept. 4th, panicle not yet free; 1931, good specimens, panicles free, but weak. Undoubtedly a common ephemerophyte everywhere when chicken are kept. M. P. P.

*5. **Dactylis glomerata** L. J. & L. 273. HEGI: I, 294.

Arctic Station, 1931, very stout specimens with up to 10 straws from the same root, panicles developed, but not flowering Sept. 20th. M. P. P. Perennial.

Denmark common, wild and cultivated, Scand. wild to about 69° N. not exceeding the limit of Conifers in the mountains, Iceland absent, N. Am. naturalized.

6. **Poa annua** L. see **IV.** Nr. 5.

*7. **Bromus tectorum** L. HEGI: I, 360.

Arctic Station, 1916, on refuse, straws radiating and closely appressed to the soil (psychrocliny!), later suberect, panicles well developed, not flowering at the end of Aug. M. P. P.

Denmark naturalized, Iceland and N. Am. intr. Biennial.

*8. **Bromus mollis** L. J. & L. 206; HEGI: I, 365.

Arctic Station, 1916, well developed specimens with spikes, not flowering end of Aug.; 1931 WEGENER's western camp, weak specimens (ROSENDAHL) M. P. P. Annual or biennial.

Denmark common, Iceland not observed, N. Am. intr.

*9. **Lolium multiflorum** LAM. J. & L. 326; HEGI: I, 378.

WEGENER's western camp, 1931, from hay brought up from Denmark, good specimens, 45 cm high, spikes 13 cm long, had not flowered end of Aug. Biennial or perennial (ROSENDAHL) det. M. P. P.

Denmark commonly cultivated, home S. Eur.

*10. **Triticum sativum** LAM. HEGI: I, 394, an awnless sort.

Arctic Station 1931, in a chicken yard, straw 65 cm high, spikes 5 cm stout and richly branching from the root. M. P. P.

11. **Secale cereale** L. Consp. III, 727; HEGI: I, 388. OSTENF. 1899.

Ivigtut, 1888, well developed specimens near flowering in Aug. (ROSENV.); 1889 similar (N. H.); 1899 similar (LINDH.); Arctic Station 1923, 95 cm high, spikes 10 cm long, had not flowered when the first frosts came (M. P. P.).

Also observed in Spitsbergen (EKST.).

12. **Hordeum distichum** L. Consp. III, 727; HEGI: I, 397.

Julianehaab in a garden, 1888, stout and broadleaved, spikes just free Aug. 21st (ROSENV.).

13. **Hordeum vulgare** L. OSTENF. 1899.

Ivigtut, 1899, with free spikes Aug. (LINDH.); Arctic Station 1923, stout specimens, spikes not free Sept.; 1924 up to 9 dm high, spikes 5 cm long, awns excluded (M. P. P.).

Also observed in Spitsbergen (EKSTAM).

14. **Urtica urens** L. Consp. I, 107; BERLIN 60; HEGI: III, 141.

Ivigtut, 1876 (KORN.); 1883 (BERL.); 1889 (N. H.); 1899 (LINDH.) flowering and with nearly ripe fruits. Arctic Station, common in flowerpots, where it has kept for 20 years, specimens up to 65 cm high (M. P. P.) also in gardens, under glass and on free land as well, flowering and fruiting.

Cosmopolitan weed, introduced in Iceland.

15. **Cannabis sativa** L. BERLIN 60; Consp. III, 703; OSTENF. 1899; HEGI: III, 133.

Ivigtut, 1883, specimens 4 dm high, sterile (BERL.); 1899 2 dm high,

sterile (LINDH.); Jakobshavn and Christianshaab 1890, small specimens (N. H.); Godhavn, in cold frames amongst grown vegetables 1931, stout specimens but not flowering (M. P. P.).

Annual, sometimes cultivated in gardens in Denmark. The fruits are sometimes imported to Greenland as food for small birds (canaries especially).

16. **Rumex domesticus** HARTM. see **IV.** Nr. 23.
Also observed in Spitsbergen (LID.).

17. **Rumex obtusifolius** L. Consp. III, 702. HEGI: III, 173.
Ivigtut, 1889, large rosette leaves, not flowering (N. H.) Perennial.
Denmark common, Iceland absent, N. Am. intr. (*Rumex Acetosa* L. see **IV.** Nr. 24. Repeatedly observed adventive in Spitsbergen.)

*18. **Rumex Acetosella** L. is a very common and, on both coasts, widely ranging native plant of Greenland, but has so far never been observed on Disko Island. At the Arctic Station, however, sometimes specimens were seen, where provision boxes from Denmark are opened. They are habitually very different from the wild plant, larger, with longer internodes and broader leaves, but especially the stems are closely appressed to the ground until end of July, whereas the wild plant is erect. From inhabited places in the South I have seen specimens stouter and more broadleaved than usual, but I cannot tell whether they were introduced or apophytic. By most authors the plant is considered strongly hemerophilous. Perennial.
Iceland not common, N. Am. intr. Also adv. Spitsbergen (LID).

19. **Polygonum nodosum** PERS. Consp. II. 277; BERLIN 60; J. &L. 376. HEGI: III, 198.
Ivigtut, 1883, specimens without flowers (BERL.); Arctic Station, 1931, vigourous specimens 6 dm high and flowering in a chicken yard (M. P. P.).
Annual weed, common in Denmark, not reported from Iceland, native in N. Am.

20. **Polygonum Persicaria** L. Consp. III, 701; J. & L. 377; HEGI: III, 200.
Ivigtut, 1889 sterile seedlings from a garden (N. H.); Upernivik, similar 1931 (FR. J.) M. P. P.
Annual, according to J. & L. an archæophyte in Denmark. In their general distribution these authors say "occurring in the Færoes but not in Iceland", but the floras state just the opposite. In Iceland the plant

is widely ranging in the southern section, but only occurring near the vulcanic hot springs. N. Am. intr.

*21. **Polygonum heterophyllum** LINDM. Svensk Fanerogamfl. 2. ed. 239. Has several times been introduced with packing material and vigourous specimens have been found on bare gravel in the yard of the Arctic Station. They were richly flowering and fruiting and would undoubtedly keep, if not checked. The plants are habitually rather different from *P. borale*, which LINDMAN places as a variety of this species and which, by the way, does not occur on Disko Island. M.P.P. Annual. Cfr. **II.** Nr. 31.

22. **Polygonum Convolvulus** L. BERLIN 60; Consp. III, 701; J. &L. 375; HEGI: III, 205; OSTENF. 1899.

Ivigtut, 1883 sterile (BERL.); 1899 ditto (LINDH.); Arctic Station 1923, richly branched specimens with young flowers; 1931, vigourous, flowering and fruiting specimens in a chicken yard; Upernivik 1931, weak but flowering specimens as a garden weed (FR. J.). Probably in all gardens, especially in the hot beds. M. P. P. Also observed in Spitsbergen (LID). Annual.

Common in Denmark; Iceland and N. Am. intr.

23. **Chenopodium album** L. BERLIN 59; Consp. III, 703; J. & L. 242; HEGI: III, 225.

A common annual weed in West Greenland, as far gardening and poultry goes, in the northern parts, however, without mature fruits, notized from all larger settlements between Frederiksdal 60° N. and Upernivik, 72°48′ N.

Denmark common, Iceland and N. Am. intr., also to Labrador. Also observed in Spitsbergen (EKSTAM).

24. **Chenopodium glaucum** L. Consp. I, 107. HEGI: III, 229.

Julianehaab, 1828, Sept. small specimens (J. V.) near the houses. Annual.

Common in Denmark, also S. Scand., not in Iceland, N. Am. naturalized.

25. **Atriplex hastata** L. OSTENF. 1899; HEGI: III, 243.

Ivigtut, young specimens, flowers not fully developed, (LINDH.). Annual.

Common in Denmark and S. Scand.; also in N. Am. In STEFÁNSSON: Flóra Íslands, it is said to be common in the whole country, but *A. glabriuscula* EDM. is not mentioned, although this species is stated for Iceland by FERNALD, Rhodora 1921, 263.

*26. **Spinacia oleracea** L. HEGI: III, 234.

Regularly cultivated in gardens and often escaping out of the hot beds. From Upernivik, 72°48′ N. FR. JOHANSEN took specimens which had wintered without other cover than snow. M. P. P.

27. **Stellaria media** (L.) CYR. Consp. I, 27; II, 243; III, 665; J. & L. 425.

Regularly introduced with garden seeds from the southmost parts to Upernivik, and escaping from the cold frames and gardens. Even from Upernivik FR. JOHANSEN brought vigourous, flowering and fruiting specimens.

Cfr. **IV.** Nr. 28. Also observed in Spitsbergen (A. & H.).

28. **Spergula arvensis** L. BERLIN 31; Consp. II, 245; J. & L. 419; HEGI: III, 418.

Ivigtut 1883, flowering (BERL.) Arctic Station 1931, 4 dm high richly branched and flowering specimens of var. *sativa* (BOENN.) M. & K., in a chicken yard. M. P. P.

In Scandinavia as an archæophyte, according to J. & L. Iceland probably introduced. Annual.

29. **Melandrium album** (MILL.) GARCKE. J. & L. 345; HEGI: III, 302.

Ivigtut, 1889, sterile rosette (det. OSTENF.). Upernivik as a garden weed with flowers and immature fruits, 1931. (FR. J.). M. P. P. Annual or biennial.

According to J. & L. an archæophyte N. of the Baltic, not observed in Iceland, N. Am. introd.

(*Ranunculus acris* see **II.** Nr. 39). Also observed adventive in Spitsbergen (LID).

30. **Ranunculus repens** L. Consp. III, 677; J. & L. 383; HEGI: III, 557.

Ivigtut, both in gardens and on refuse heaps, 1889 (N. H.) 1899 flowering, both glabrous and hairy specimens (LINDH.), 1902 (DEICHMANN). Seemingly established here. Perennial.

According to J. & L. indigenous to Scandinavia, proved by subfossil finds; Iceland widely distributed, but only on cultivated soil and near hot springs. N. Am. probably intr. in Atlantic states, indigenous in the West.

31. **Chelidonium majus** L. BERL. 22; HEGI: IV, 1, 21.

Ivigtut, 1883, flowering and fruiting in Aug. (BERL.). Perennial.

Common in Denmark, not observed in Iceland, N. Am. naturalized.

32. **Papaver dubium** L. OSTENF. 1899; HEGI: IV, 1, 31. J. & L. 360.

Ivigtut, slender specimens, flowering in Aug. (LINDH.). Annual.

According to J. & L. introduced to Denmark with the earliest cereals and still only to be found on or near the cultivated fields; not known from Iceland; N. Am. intr.

33. **Fumaria officinalis** L. OSTENF. 1899; J. & L. 304; HEGI: IV, 1, 47.

Ivigtut, with introduced garden soil, flowering and with immature fruits, 1899, (LINDH.). Annual.

Came to Switzerland and England during the stone age, to Denmark probably somewhat later (J. & L.), in Scand. to Lappland; not in Iceland; N. Am. intr.

*34. **Lepidium sativum** L. HEGI: IV, 1, 81.

Cultivated under glass and on free land in all gardens and easily escaping. Specimens from Upernivik which had wintered under snow, continued growing and flowering but the seeds were immature (FR. J.). M. P. P.

35. **Thlaspi arvense** L. BERL. 26; J. & L. 429; HEGI: IV, 1, 118.

Ivigtut, 1883, flowering specimens. Annual.

To N. Eur. with the earliest cereals (J. & L.) Iceland intr., scarce. N. Am. naturalized. Also in Spitsbergen intr. (EKST.).

36. **Cochlearia officinalis** L. the typical form, different from the native Greenland Cochlearias, some times treated as separate species, or as varieties of *officinalis*, was found at Ivigtut by BERLIN, 1883. Hapaxanthic.

Common in Denmark, perhaps also in Iceland.

37. **Sisymbrium Sophia** L. Consp. I, 51; J. & L. 415; HEGI: IV, 1, 160.

Ivigtut, 1878, near the settlement (KORNERUP). Annual.

To Denmark with earliest cereals (J. & L.), Iceland intr., very local. N. Am. intr.

*38. **Sisymbrium Sinapistrum** CRANTZ. HEGI: IV, 1, 176.

Arctic Station 1923, on refuse, very stout specimens over one meter high, basal leaves 4 dm long, amply flowering, there was no pollinizing. Annual.

Denmark as a weed only, Iceland once observed but specimens much smaller, N. Am. naturalized.

39. **Sinapis arvensis** L. Berl. 23; Consp. III, 674; Ostenf. 1899; J. & L. 413; Hegi: IV, 1, 263.

Ivigtut, 1883 (Berl.); 1889, well sized specimens (N. H.); 1899, from 2—4 dm high (Lindh.); Christianshaab, 1890, (N. H.); Angmagssalik, East Grl. with chicken food (Kr.); Arctic Station, 1923 nearly 1 m high, flowering; 1931 small specimens 35 cm high, but flowering, in some pods a few immature seeds, probably from self-pollinizing. M. P. P. — Also observed in Spitsbergen (Lid). J. & L. 414, quoting Gümbel, state that the seeds are killed when they are exposed to frost in a moist state.

Denmark common, Iceland intr. and seemingly established. N. Am. naturalized.

40. **Sinapis alba** L. J. & L. 411; Hegi: IV, 1, 205.

Narssaq, 64° N. (Sörensen) two seedlings, one with a few flowers (det. Ostenfeld). Annual.

Denmark sometimes cultivated and escaped as a weed, but unable to establish itself; observed in Iceland; N. Am. intr.

*41. **Brassica oleracea** L. Kale and cabbage are grown in all gardens, in the North under glass partially, in the South without. When forgotten, it survives and flowers next year. Biennial but cannot probably bring mature seeds. M. P. P.

42. **Brassica campestris** L. Consp. III, 674; Ostenf. 1899; J. & L. 200; Hegi: IV, 1, 259.

Christianshaab, 1890, big specimen (N. H.); Ivigtut, 1899, big specimens, one with young fruits (Lindh.); Holsteinsborg, 1908 (Deichmann), det. Ostenf. Annual.

Denmark naturalized, Iceland intr. N. Am. nat.

43. **Brassica Napus** L. Berl. 23. Consp. III, 674. Hegi: IV, 1, 252.

Ivigtut, 1883, flowering but without fruits (Berl.), Julianehaab, in a garden (Deichmann) det. Ostenf.; Arctic Station, 1923, on refuse, nearly 1 m high, "approximately the form called by Lund & Kiærskou *sativa oleifera*" (det. Ostenfeld). M. P. P.

*43 a. **Raphanus Raphanistrum** L. subsp. **segetum** (Baumg.) Clavaud; J. & L. 384.

Godhavn, in a chicken yard, vigorous, flowering specimens, Sept. 1932 (Grøntved).

Annual weed, common in Denmark; the plants are killed by light frosts (J. & L.).

*44. **Raphanus sativus** L. HEGI: IV, 1, 280.

Cultivated in all gardens, in the North the first crops under glass. Even at Upernivik specimens had survived a winter with no other covering than snow and were flowering the next summer (FR. J.). M.P.P.

45. **Capsella Bursa pastoris** L. see **IV.** Nr. 30.

*46. **Conringia orientalis** (L.) Dum. HEGI: IV, 1, 440.

Arctic Station, 1923, on refuse, 8 dm high, flowering, but not maturing. Annual.

Denmark intr. rare; Iceland, ditto: N. Am. advent. Also observed in Spitsbergen (LID).

47. **Rubus Idæus** L. HEGI: IV, 2, 768. BERL. 32.

Ivigtut, 1883, a young specimen on refuse (BERL.) Shrub.

In Denmark common, wild and cultivated, not in Iceland.

*48. **Potentilla norvegica** L. HEGI: IV, 2, 856.

Arctic Station, on a heap of soil, moved several years before and overgrown with native grasses. The specimens were very stout, and attained to flowering, but not to fruiting. The subsequent years weaker specimens were found, then it disappeared. Annual or biennial. M.P.P.

Denmark, a rare adventive, also noticed in Iceland. N. Am. native and anthropochorous.

49. **Potentilla anserina** L. BERL. 32; Consp. IV, 2, 889.

The typical form, as it is common in N. Eur. has been stated from several places in South Greenland, but the material has not been revised since *P. pacifica* HOWELL came into general knowledge as occurring also on the Atlantic sea shores. Having no fitting material, I cannot decide the question. The places given in "Conspectus" are mostly the principal trading ports which might suggest an introduction. On the other hand, it might well be possible that *P. anserina* was native here. Perennial.

Denmark common and hemerophilous, stated as common in Iceland, also in N. America. (Cfr. FERNALD: Rhodora 1909, 1—9, 48).

*50. **Lupinus** sp. probably a garden species, found at the Arctic Station on an unfitting, shaded place, 2 dm high, without flowers, 1931. M. P. P.

51. **Medicago lupulina** L. BERL. 31; J. & L. 341; OSTENF. 1899.

Ivigtut, 1883, sterile (BERL.); 1889, seedlings amongst Trifolium

repens (N. H.), det. OSTENF.; 1897, with young flowers and seemingly also with root tubercles (LINDH.), det. OSTENF. Annual and perennial.

Denmark native and cultivated, Iceland intr., rare. N. Am. adv.

52. **Trifolium repens** L. BERL. 31; Consp. III, 653; J. & L. 436; HEGI: IV, 3, 1302.

Ivigtut, 1883, not yet flowering (BERL); 1889, flowering (N. H.); at a much earlier date mentioned from Godthaab by RINK, most likely to be found at most of the inhabited places in South Greenland. Perennial.

Native in N. Eur. by culture carried farther north than naturally (J. & L.). Iceland common, but seemingly bound to cultivated places. N. Am. indigenous northward.

53. **Vicia hirsuta** L. BERL. 32; J. & L. 455; HEGI: IV, 3, 1515.

Ivigtut, 1883, a vigorous, flowering specimen on garden soil (BERL.). Annual.

Denmark, native and common, Iceland intr., rare, N. Am. nat.

54. **Vicia sativa** L. BERL. 32; HEGI: IV, 3, 1546.

Ivigtut, 1883, flowering (BERL.); Arctic Station, 1931, chicken yard, vigourous, branched and flowering specimens, 4 dm high, pods 5 cm long, immature. M. P. P. Annual.

Denmark intr., not common; Iceland adv. rare; N. Am. intr.

55. **Vicia angustifolia** ROTH f. segetalis THUILL. OSTENF. 1899; J. & L. 453; HEGI: IV, 3, 1548.

Ivigtut 1899, a stout specimen with flowers and immature pods (LINDH.). Annual.

Denmark native, common; Iceland not observed; N. Am. nat. Also observed adv. Spitsbergen (EKSTAM).

56. **Pisum sativum** L. OSTENF. 1899; HEGI: IV, 3, 1610.

Ivigtut, not flowering This plant is often seen at inhabited places, generally as small specimens without root tubercles, but where the soil may have been inoculated from introduced soil from flower-pots, large tubercles are developed and the plants are much stouter.

Denmark cultivated; Iceland intr. but rarely flowering. Also observed adv. Spitsbergen (LID).

57. **Erodium cicutarium** (L.) L'HÉRIT. BERL. 31; HEGI: IV, 3, 1719; J. & L. 291.

Ivigtut, 1883, on garden soil, not flowering (BERL.). Biennial.

Denmark common, from the bronce age at least; Iceland once observed; N. Am. adv.

*58. **Oxalis corniculata** L. HEGI: IV, 3, 1655.

Arctic Station, young Danish forest-trees were introduced as "pot flowers". In one was the *Oxalis*, at first tolerated, but soon spreading and annoyant. Some were thrown out, but rooted in gravel before the house last summer. Perennial.

Denmark, not well established; S. Eur. native.

59. **Viola arvensis** MURR. OSTENF. 1899; J. & L. 460; HEGI: V, 1, 601.

Ivigtut, 1899, flowering (LINDH.). Annual or biennial.

Denmark introduced at an early date, N. Am. intr.

*60—63. **Chaerefolium Cerefolium** (L.) SCH. & THELL., **Petroselinum hortense** HOFFM., **Daucus Carota** L. and, in the South, **Apium graveolens** L. are commonly cultivated in cold-frames, under glass, at least part of the season. Forgotten individuals hibernate quite well under snow and will flower. Even from Upernivik, 72°48′ N. FR. JOHANSEN had taken specimens of *Chaerefolium*, 6 dm high, with seamingly mature fruits. M. P. P. Biennials.

64. **Carum Carvi** L. Consp. III. 682; HEGI: V, 2, 1182.

Ivigtut, 1889, with flowers and immature fruits (N. H.). Frederiksdal, 1890, flowering (det. ROSENV.). Not cultivated in Greenland but commonly used as a spice in bread and often wasted, probably to be found at most of the inhabited places.

65. **Anagallis arvensis** subsp. **femina** (MILL.) SCH. & THELL. Consp. III, 684; J. & L. 161; HEGI: V, 3, 1869.

Ivigtut, 1889, in a yard (N. H.). Annual.

Denmark a rare weed, N. Am. adv.

66. **Asperugo procumbens** L. Consp. III, 688; HEGI: V, 3, 2136.

Christianshaab 1888, on cliffs near the flag-battery sterile seedlings only (S. H.) det. ROSENVINGE; 1890, also in the adjoining garden (N. H.); 1924, fully established over the whole rock face and along the shore climbing on *Elymus*, also climbing on the garden fence. (M. P. P.) Klaushavn, an outpost of Christianshaab, 1889, weak seedlings (SØRENSEN). Annual.

N. Eur. as an anthropochorous plant, N. Am. intr. A good description of its ways of dispersal is given by H. GAMS in HEGI: l. c.

67. **Lycopsis arvensis** L. BERL. 55; J. & L. 333; HEGI: V, 3, 2203.

Ivigtut, 1883, sterile seedlings (BERL.), identification not quite certain. Annual.

N. Eur. an archæophyte, following the cereals, Færoes one place, but here noticed with an interval of 30 years. Iceland not observed, N. Am. adv.

68. **Myosotis arvensis** (L.) HILL. OSTENF. 1899; J. & L. 348; HEGI: V, 3, 2170.

Ivigtut, weak plants with not expanded flowers (LINDH.). Annual.

Denmark as a weed, but indigenous in N. Eur. Iceland inclusively, N. Am. indigenous (J. & L. have "intr. in U. S. A.").

69. **Lamium purpureum** L. BERL. 57; Consp. II, 264; HEGI: V, 4, 2450.

Ivigtut, 1883, vigourous and flowering, "will probably keep" (BERLIN); 1889, refound by N. H., and 1899 by LINDHARD. Annual or biennial.

N. Eur. introduced in prehistoric time, Iceland adv. near the towns; N. Am. natural.

70. **Lamium amplexicaule** L. BERL. 57; HEGI: V, 4, 2452.

Ivigtut 1883, flowering (BERL.); Umanaq, 64°29′ N. near a church built by the Moravian Brethren 1907, (GANDRUP) det. OSTENF.; at the same place 1926 (A. LYNGE) seemingly acclimatized, det. M. P. P. Annual.

N. Eur. an archæophyte; Iceland intr. very scarce; N. Am. nat.

71. **Verbascum Thapsus** L. BERL. 55; J. & L. 447; HEGI: VI, 1, 16.

Ivigtut, 1883, seedlings only (BERL.). Biennial.

"To Denmark at the earliest stone age, now bound to cultivated ground" (J. & L.), indigenous in S. Scand.; not in Iceland; N. Am. natural.

*72. **Linaria Cymbalaria** L. HEGI: VI, 1, 27.

At the Arctic Station unintentionally introduced and tolerated as "undergrowth" under an old *Myrtus communis*, grown in a large wooden tub. On warm days with rain, the tub is carried out, whereby seeds of the *Linaria* may have dropped. Weak specimens, but flowering, were found in the yard last year. M. P. P. Perennial, at home in S. Eur.

73. **Veronica arvensis** L. OSTENF. 1899; J. & L. 448; HEGI: VI, 1, 51.

Ivigtut, 1899, 10 cm high, flowering and with some mature fruits (LINDH.). Annual.

Scandinavia indigenous, in Denmark as a weed only, not in Iceland; N. Am. natural.

74. **Plantago major** L. BERL. 59; J. & L. 368; HEGI: VI, 1, 181.

Ivigtut 1883, flowering and fruiting, "will probably keep" (BERL.); 1889 large seedlings N. H. Arctic Stations, with young inflorescence, 1932. Perennial.

To N. Eur. in earliest stone age; Færoes, one locality where noticed with an interval of 30 years; Iceland, near inhabited places and near the hot springs; N. Am. indigenous. Also observed in Spitsbergen (LID).

75. **Plantago Coronopus** L. Consp. III, 683; HEGI: VI, 1, 188.

Klaushavn, 69°5′ N. small flowering specimens, 1890 (SØRENSEN), det. ROSENVINGE. Annual or biennial.

Common on Baltic and North Sea shores, not in Iceland, N. Am. intr.

75a. **Galium Aparine** L. BERL. 40; Consp. III, 693; J. & L. 312. Ivigtut, 1883, on garden soil with young flowers (BERL.); Ritenbenk, 1890, vigorous specimens with hardly developed flowers (HARTZ); Godhavn, 1932, similar (GRÖNTVED).

76. **Xanthium Strumarium** L. Consp. I, 104; HEGI: VI, 1, 499.

The plant depicted in Fl. Dan. t. 970 came from Lichtenau, a Moravian mission post 60°30′ N., in South Greenland, collected by GIESECKE, since not observed. Annual.

A nearly cosmopolitan weed of unknown home. As early as 1542 German vernacular names were printed (FUCHS), now on the way to be extinct in N. Eur.

77. **Gnaphalium uliginosum** L. see **IV.** Nr. 45.

78. **Anthemis arvensis** L. BERL. 41; OSTENF. 1899; J. & L. 167; HEGI: VI, 1, 541.

Ivigtut, 1883, on refuse, only 4 cm high, but flowering (BERL.). 1899, large, richly branched and flowering specimens (LINDH.) Annual.

Intr. to N. Eur. with earliest cereals, becoming scarce in N. Scand.; Iceland intr. rare, N. Am. intr.

79. **Matricaria inodora** L. BERL. 41; J. & L. 337.

Ivigtut, 1883, BERLIN found sterile specimens which, because of their occurrence on refuse, he thinks to be this species and not *M. ambigua*, which see **IV.** Nr. 43. Arctic Station, appeared in the enclosed yard about 1923 and spread along the road, now extinct. Specimens were 1928 transferred to a grave in the church yard of Jakobshavn were it has spread moderately. The plant here had surviving rosettes.

Denmark common, seems to be absent in Iceland, represented by *M. ambigua*; N. Am. intr. Also Spitsbergen (LID).

80. **Matricaria Chamomilla** L. Consp. 103, III, 700; OSTENF. 1899; J. & L. 335; HEGI: VI, 2, 581.

As "*flores Chamomillae*" belong to the fixed stock of medical drugs, sent by the Government to every inhabited place in Greenland, the plant is so often found growing on refuse heaps that actual noting or collecting generally is omitted. The oldest printed record is from

Jakobshavn, 1833, by J. VAHL. LANGE l. c. suggests it to be a garden escape, but in our time, at least, it is not grown here. ROSENVINGE: Consp. III, 700, mentions specimens taken by KORNERUP "near the border of the inland ice and far from the sea", on the latitude of N. Strømfjord. To such a place it undoubtedly had been carried by a caribou hunter who took it along on his trip to combat his regular spring cold.

Greenland specimens may be 4 dm high and very vigourous. I doubt that fruits ever mature here. Annual.

Entered N. Eur. at an early date; J. & L. state it for Iceland, but it is not mentioned in the printed records; N. Am. intr.

81. **Matricaria suaveolens** (PURSH) BUCH. OSTENF. 1899; J. & L. 340; HEGI: VI, 2, 584.

Ivigtut, 1899, small simple specimens with but one head (LINDH.). Christianshaab, 1924, 2 dm high, with young flowers in July. M. P. P. — Arctic Station, ab. 1925 rather weak specimens were notized, growing on gravel in the enclosed yard, since they have spread and developed vigourously and richly branched specimens with up to 60 heads have been found. At least in good summers some of the fruits mature. Annual. M. P. P.

From N. Am. introduced into Botanical Gardens ab. 1840, hence escaped and has now, with a fabulous speed, invaded the whole of Europe even up to high latitudes. Iceland, well established around the capital.

82. **Artemisia vulgaris** L. BERL. 42; J. & L. 183; HEGI: VI, 2, 637.

Ivigtut, 1883, sterile (BERL.); Godhavn, 1931, a specimen grown in a flower-pot, where something better was expected; it was 1.10 m high and flowering, but quite slender. M. P. P. Perennial.

N. Eur. indigenous and as an anthropochorous plant, not in Iceland, N. Am. natural.

83. **Senecio vulgaris** L. BERL. 40; OSTENF. 1899; J. & L. 404; HEGI: VI, 2, 787.

Ivigtut, 1883, flowering and fruiting, "will probably keep" (BERL.); 1889, similar found by N. H.; 1899 by LINDH. Umanaq District, ab. 71°10′ N., at WEGENER's camp well sized specimens flowering, but with no mature fruits were taken by Governor ROSENDAHL (det. M. P. P.).

An annual, cosmopolitan weed, also established in Iceland and notized in Spitsbergen (A. & H.).

84. **Arctium tomentosum** MILL. BERL. 44; HEGI: VI, 2, 832.

Ivigtut, 1883, specimens up to 1 m high with unexpanded heads (BERL.); not notized by later visitors.

Biennial, common in N. Eur.; not in Iceland.

85. **Cirsium arvense** (L.) SCOP. BERL. 44; J. & L. 255; HEGI: VI, 2, 903.

Ivigtut, 1883, sterile specimens (BERL.) 1889, similar (N. H.). Perennial weed in cultivated fields and native on sea-shores in N. Eur., also to high latitudes. At its northern outposts not fruiting, but effectively spreading by subterranean runners and budding roots. Iceland and N. Am. intr.

86. **Centaurea Cyanus** L. OSTENF. 1899; HEGI: VI, 2, 961.

Ivigtut, 1899, richly branched and flowering specimens (LINDH.). Annual or biennial weed on grain fields.

Entered Denmark with earliest cereals; Iceland and N. Am. intr.

87. **Centaurea Jacea** L. BERL. 44; HEGI: VI, 2, 944.

Ivigtut, 1883, sterile specimens (BERL.).

Perennial, native in N. Eur. but often apophytic, not in Iceland, N. Am. intr.

*88. **Lapsana communis** L. HEGI: VI, 2, 1000.

Arctic Station, 1931, nearly 1 m high vigourous and flowering specimens in a chicken yard, no fruits matured before the frost arrived. M. P. P.

Annual or biennial weed in N. Eur. as far cereals are grown, not reported from Iceland, N. Am. intr.

89. **Crepis tectorum** L. OSTENF. 1899; J. & L. 267; HEGI: VI, 2, 1165.

Ivigtut, 1899, flowering specimens (LINDH.).

Annual or biennial weed in Denmark, indigenous N. and S. of Denmark, reported by J. & L. from Iceland and Færoes, but no warrant is found in the respective floras. N. Am. intr.

90. **Sonchus oleraceus** L. BERL. 44; J. & L. 419; HEGI: VI, 2, 1107.

Ivigtut, 1883, sterile specimens (BERL.).

Annual, cosmopolitan weed, not in Iceland; N. Am. intr.

*91. **Sonchus asper** (L.) GARS. J. & L. 418; HEGI: VI, 2, 1109.

Arctic Station, 1931, vigourous specimens 6 dm high, richly branched and flowering, but no fruits mature at end of September, chicken yards. M. P. P.

Annual, widely ranging weed, not reported from Iceland; N. Am. introduced.

Of the 93 species enumerated more than three fourths are hapaxanthic and doomed, unless they can mature their seeds. They are

rightly termed ephemerophytes. The repeated record of a species in a given locality is no convincing evidence of its being established or naturalized, as most of these species inevitably are introduced with the new years supplies. When compared with lists given from Lappland by SYLVÉN, SIMMONS or STERNER, or from Spitsbergen by HÖEG & LID, we shall find that the pioneers amongst the weeds are much the same everywhere.

Farthest ranging and most likely able to stay, because it can enter some natural associations, is *Stellaria media*. The next are, in the South, *Poa annua* and *Capsella Bursa pastoris*. All these were by OSTENFELD considered as introduced by the Norse settlers, for which suggestion the present writer can find no support in their occurrence, even if a remote possibility may be admitted. Of the remaining *Chenopodium album*, *Polygonum Convolvulus* and *heterophyllum*, *Senecio vulgaris* and *Matricaria suaveolens* are observed with mature seeds. The case mentioned of *Asperugo procumbens* is seamingly an exception.

Leaving provisorily *Potentilla anserina* out of the discussion, until a revision of the South Greenlandic material can be done, there seems to be still less chances for the perennials, except the grasses and clover mentioned, which probably will be able to settle on regularly protected and fertilized fields of the future.

II.

APOPHYTES OF GREENLAND

From the investigations carried on, mostly by Scandinavian botanists, on hemerophilous plants *versus* hemerophobous, we may expect to find the hemerophilous species, able to enter cultivated ground amongst

1) hapaxanthic plants, rather than perennials;
2) herbs, rather than shrubs;
3) plants from the sea shore, all being nitrophilous;
4) autotrophic, rather than mycotrophic;
5) species of the families *Gramineae*, *Cannabaceae*, *Urticaceae*, *Polygonaceae*, *Chenopodiaceae*, *Caryophyllaceae*, a few *Ranunculaceae*, *Papaveraceae*, *Cruciferae*, *Resedaceae*, some *Alchemillae* and *Potentillae*, *Leguminosae*, *Geraniaceae*, *Euphorbiaceae*, *Malvaceae*, *Hypericaceae*, some *Violae*, some *Epilobium* species, *Umbelliferae*, some *Gentianae*,

Convolvulaceae, *Borraginaceae*, *Labiatae*, *Scrophulariaceae*, *Solanaceae*, *Plantaginaceae*, *Rubiaceae*, *Valeriana*, *Dipsacaceae*, in all subfamilies and series of *Compositae*, in the large genera *Taraxacum* and *Hieracium*, however, with a marked preference for some sections only, whereas other may be indifferent to culture or even damaged.

(Cfr. introduction to III.)

This will probably hold good for any boreal flora.

If the subsequent list of plants observed apophytic in Greenland be compared with similar lists from Lappland, given by SIMMONS, STERNER, HEINTZE: Åsele etc. or from S. Finland by LINKOLA and CEDERCREUTZ, a number of species common to Greenland and northern Fennoscandia will be found enumerated as apophytic or hemerophilous in Scandinavia, whereas they are not entered so upon the present writer's list. This is, I am confident, not due to different judgment, neither to failing specific identity, but simply to the fact that "culture" here is at its mere beginning, and over there much older, in Lappland by centuries, in Finland by thousands of years. The wild plants, as it were, have in the Arctic regions few chances to find man, in boreal and temperate to avoid man.

1. **Equisetum arvense** L.; J. & L. 288.

Widely ranging in Greenland to the highest latitudes and very common in different associations with sufficient moisture, often forming extensive pure patches on river banks or lake shores. It is also a very troublesome weed in gardens outside the cold frames and inside as well also under glass. Also known to be hemerophilous elsewhere.

2. **Phleum alpinum** L. is common in Greenland to S. Disko, occurring on rich soil at the foot of slopes, well covered with snow during winter. In northern Scandinavia and in Switzerland it is considered strongly favoured by the culture, entering the pastures, and in Switzerland considered one of the most valuable fodder grasses. In Greenland hemerophily is not evident; single specimens may be found around the houses or at the border of refuse.

3. **Alopecurus alpinus** Sm.

I have formerly (Disko 32) at length described how this grass, which is at home on mossy bogs, enters manured places, especially the Eskimo house-sites, and here grows to such an abundance as to nearly exclude all other plants. Its mature spikelets are carried with the fur clothes of men or with the dogs and thus brought several degrees of

latitude south of its natural range, but only there occurring near settlements or camp-sites, not in the bogs.

(*Calamagrostis neglecta* (Ehrh.) Fl. d. Wett. is considered hemerophilous "to a certain degree" by Scandinavian writers. I have not yet seen any influence here).

(*Deschampsia flexuosa* (L.) Trin. is considered by all Scandinavian writers consulted to be favoured by culture; I have only seen it in natural associations, uninfluenced by man).

4. **Dupontia Fisheri** R. Br.; Porsild: Disko 39.

I think I have seen all known occurrences of this higharctic grass in West Greenland and all these were near the sea. One is a pond near the village on Ubekendt Ejland, 71°15′ N. The water of this pond is badly polluted with offal, and *Dupontia* was much stouter here than elsewhere.

5. **Trisetum spicatum** (L.) Beauv.

Common everywhere in many different associations. Also near houses especially on open ground, even if it is strongly manured. It stands competition with the *Poas* well, but is choked by *Alopecurus*.

6. **Phippsia algida** (Sol.) R. Br.; Porsild: Disko 39.

As suggested by its Scandinavian trivial name, the Snow Grass is just at home in the melting zone of perpetual snow-fields, very common in Greenland and often to be found at high elevations. It is also carried down by water and probably other agencies (animals) too, and often met with on lowland stations. It is distinctly hemerophilous (nitrophilous?) and settles easily around houses, on refuse, between paving stones, and, quite paradoxically, is a very common weed in the cold frames under glass, where it develops to "gigantic" flaccid specimens.

7. **Poa alpigena** (Fr.) Lindm. Sv. Fan.-fl. (1918) 91; and apud Holmb. Skand. Fl. (1926) 203.

Under this name should be placed most records of "*P. pratensis*" from Greenland, perhaps except some forms from the southernmost section. This plant is distinctly favoured by human work, it enters sand and gravel flats laid bare, especially when they at the same time are moderately fertilized and irrigated, and develops here a nearly pure meadow. Also borders and levee of roads, built up of stones and sods, are grown with it, often intentionally, for fixing the constructions. But on the overmanured earthwalls around the native houses *Alopecurus alpinus* will keep it out.

8. **Poa glauca** VAHL is so far favoured by man's activities that it enters denuded sand and gravel flats, too dry for *P. alpigena.*

9. **Poa alpina** L. is from Scandinavia and Switzerland reported as strongly hemerophilous. In Greenland the plant may quite regularly be seen near human habitations and is plainly favoured by manure, but never to such an excess as the species of *Puccinellia* and *Poa alpigena.* In this case there is, however, a slight difference in the plants, as the Scandinavian stock is said to be nearly exclusively viviparous, whereas in Greenland, so far known, only flowering and fruiting specimens occur.

10—12. The cespitose sea-shore grasses **Puccinellia retroflexa** (CURT.) HOLMB. subsp. **borealis** HOLMB. in the southern half, **P. angustata** (R. BR.) RAND & REDF. and **P. vaginata** (LANGE) are strongly nitrophilous and often found at the foot of bird rockeries or small islands, used by sea birds for breeding places. Their seeds are, mixed with clay, sticking to footgear or to the dogs' feet and easily transferred to refuse heaps and other strongly manured places around native and European dwellings.

13. **Festuca rubra** L. Scandinavian authors agree in considering this species strongly favoured by culture. SIMMONS: Kiruna 49 even doubts its occurring in a wild state at Kiruna and thinks it introduced by man only. On the other hand, the var. *arenaria* OSB., when mentioned, is generally considered not hemerophilous or indifferent. In Spitsbergen HÖEG & LID expressly state a form with long panicle and glabrous spikelets as introduced, in contradistinction to the native var. *arenaria.* — In Greenland the latter is most common and has the widest range northwards, but taller forms with glabrous spikelets do occur in the South. I have seen them in natural associations, f. inst. in thickets and on river banks and sea shores, and I have not notized them on former house-sites or fields. But this will probably be otherwise when pastures are prepared in the future. The var. *arenaria* may sometimes be found near houses, but a marked preferring of such places is not evident.

14. **Elymus arenarius** L. var. **villosus** E. MEY. is markedly nitrophilous, often to be found at the foot of bird cliffs and often settling near the houses, entering yards and roads. On the last place it is annoyant, because of its tendency to develop tussocks, but neither cutting nor poisoning seem to be able to check it.

15. **Nardus stricta** L. see **IV.** Nr. 3.

16. **Carex incurva** LIGHTF.

I did not see this plant at the Arctic Station until colonisation appeared on denuded sand where it was probably started from herbarium waste. Finally the whole sand flat was covered with a dense growth. But, after some years, *Poa alpigena* took the place, and now the sedge has disappeared.

17—19. **Carex Macloviana** D'URV., **C. canescens** L. and **C. brunnescens** (PERS.) POIR. are considered hemerophilous in Northern Scandinavia, the first even to a high degree (STERNER). Here any influence of man's presence is yet hardly perceptible.

20. **Carex glareosa** WAHL. is, like the other sea shore plants, nitrophilous and may settle on inhabited places, when they are moist enough.

21. **Carex scirpoidea** MICHX. may to some degree take profit of fertilized spots near houses, to the same extent as *Poa alpina* and often in its company.

22. **Carex capillaris** L. is said to be hemerophilous by SIMMONS, LINKOLA, CEDERCREUTZ etc.; this has not been observed here.

23. **Juncus bufonius** L. has at Igaliko repeatedly been observed as having been dispersed by man along foot paths, just as in other countries. In no other way did it appear to have profited by man's presence. Cfr. **IV.** Nr. 17.

24. **Salix glauca** (hybrids) L. As all well sized willows growing near the villages are taken for fuel, they will properly be entered in the next chapter: **III.** But willows growing inside the fence at the Arctic Station are seemingly favoured, not only by that protection, but also by the fertilized soil.

25. **Oxyria digyna** (L.) HILL is to some degree nitrophilous; it is often found in old gardens, not in the cultivated soil, but in some corner where refuse is dumped.

26. **Rumex Acetosa** L. is in northern Scandinavia considered strongly hemerophilous. As to its occurrence in Greenland see **IV.** Nr. 24.

27. **Rumex Acetosella** L. is often stated as hemerophilous. This cannot be said of the native stock, which is only seen on acid rocks and heathland. As to the introduced plant, see **I.** Nr. 18.

28. **Polygonum viviparum** L. is nitrophilous; it is markedly favoured when growing near houses, where it generally appears amongst grasses. The specimens are here much taller and produce more flowers and bulblets than in natural asociations.

29—30. **Koenigia islandica** L. and **Montia lamprosperma** CHAM. are both strongly nitrophilous and very commonly to be found amongst mosses in badly polluted pools near Eskimo dwellings.

31. **Polygonum heterophyllum** LINDM. var. **boreale** (LANGE) LINDM. Sv. Bot. Tidskr. 1912. (*P. aviculare* var. *boreale* LANGE Consp. I, 105; ROSENVINGE: Sydl. 179; *P. aviculare* OSTENFELD Orig. 58 and Botany of the Færöes 72; STEFÁNSSON: Fl. Ísl. 2. ed. 91; *P. boreale* (LANGE) SMALL; FERNALD: Persistence 270; formerly in America called *P. islandicum* MEISN.).

LANGE l. c. states that the Greenland plant is identical with the plant from Iceland and Færoes, and by LINDMAN, in splitting the *P. aviculare* of LINNÆUS' herbarium into *P. heterophyllum* and *P. aequale*, LANGE's plant was referred to the former. However, LINDMAN remarks, it is "a var. *litorale* (LINK) haud satis diversa". In LINDMAN's last treatment in his Sv. Fan.-Fl. 2. ed. 239 they are still coordinate:

"var. *litorale* (LINK) LINDM. leaves somewhat fleshy, broad, obtuse, flowers and fruits large; sea shores."

"var. *boreale* LANGE coarse, decumbent, nearly unbranched, leaves barely of different size." (translated).

In Atlantic N. Am. *Polygonum boreale* is reported from Newfoundl. 49°—Labrador 57° N. (FERNALD) and from north coast of St. Lawrence Gulf (ST. JOHN) and here considered native, in contradistinction to introduced *P. aviculare.*

In East Greenland the plant has not been observed. In West Greenland it is recorded from nearly all inhabited places in the South, and from most of them up to Disko Bay. The northernmost specimens I have seen are from Qeqertaq ab. 70° N. On Disko Island is has not been observed. In all places, so far known, the plant has only been found near the present dwellings, not near Norse ruins or on localities, inhabited by the Norsemen, unless they are also inhabited now.

In consequence of its occurrence in West Greenland and absence from East Greenland, ROSENVINGE: Sydl. 179, thinks it undoubtedly introduced by man, with which opinion I can agree. Neither ROSENVINGE, nor OSTENFELD have suggested it as introduced by the Norsemen, yet such an introduction is not improbable.

In Iceland the plant is common in the N., E., and S.W., scarce in the remaining parts. It is found here as a weed in the fenced fields,

but especially near the houses, probably on every farm. Besides it is found sometimes in vegetation not obviously influenced by man, as sea shores, river-banks and mud flats. If thus Norsemen sailing from Iceland to Greenland brought seeds over, they could hardly have avoided the *Polygonum*. It would easily adhere to footgear, even when no animals or forage were taken on board.

On the other hand, if *P. boreale* is a species, or a variety or a race of its own, genetically, and not merely an "ecologic" form — and it may rightly be considered native to Atlantic N. Am., Iceland, Færoes and N. Scand. — it might as well be able to find its way to Greenland, before man. J. & L., treating *P. "aviculare"* collectively, think that it immigrated to northern Europe during the earliest postglacial epoch.

Cfr. *P. heterophyllum* LINDM. **I.** Nr. 21.

32—34. **Cerastium alpinum** L., **C. cerastioides** (L.) BRITT. and **Stellaria borealis** BIG. are, by Scandinavian botanists, considered hemerophilous to a stronger or weaker degree. In Greenland, *C. alpinum* grows everywhere, also in gardens and on refuse heaps and may stand fertilized soils. The same may be said about *C. cerastioides*, but to a markedly less pronounced degree, and *St. borealis* is in the northern parts of the country a local plant, found in especially favourable situations only, and never seen near houses.

35. **Stellaria longipes** GOLDIE; PORSILD: Disko 73.

Although this species, in Greenland, may in rare cases be found with blackish capsules, seemingly near maturity and full of seeds, regularly opened and seed shedding fruits are never seen, and seedlings have never been found. Still it is one of the most common and widest ranging plants of the country, occurring nearly everywhere from hilltops to the smallest and remotest skerries in the sea. From its spot of origin it spreads enormously by subterranean runners. Moreover the aërial withered shoots from the previous year are easily broken off and carried by wind or water, and in each of the leaf-axils are small green buds able to sprout.

It is the first plant on spots denuded by cutting peat and it enters every garden, creeps into the cold frames and grows very well under glass, the most pertinacious and troublesome weed we have got.

36—37. **Melandrium affine** J. VAHL may stand manured soil quite well, and **M. triflorum** (R. BR.) J. VAHL is markedly nitrophilous. The latter is often found near Eskimo houses or on old house-sites.

38. **Ranunculus affinis** R. BR. which is supposed to be a high-arctic type, at home on fresh morainic soil in the hills, has also been

found and much better developed at the foot of cliffs, in a sheltered position, and growing together with herbs of southern types. In one of these places the soil was much polluted from a neighbouring village. The roots contain endotrophic mycorrhizas (K. JESSEN: Medd. om Grl. 36, 351).

39. **Ranunculus acris** L. ranges in Greenland from the South to about 66° N. on both coasts; it is therefore considered native. On and around the Norse farm-sites in Julianehaab district and similarly in Godthaab district it is as abundant as if it were an introduced weed. It is also supposed to be native in Iceland and is as favoured by culture there as it is in other countries. It is not considered native in N. Am. Perhaps the wild forms might prove to be racial different from the weed form. Also this species has endotrophic mycorrhizas (JESSEN, p. 359).

40—41. **Ranunculus pygmæus** WAHL. and **R. hyperboreus** ROTTB. are both strongly nitrophilous, growing in great abundance in manured pools near the settlements. In the former endotrophic mycorrhizas are found (JESSEN, p. 384).

42. **Arabis Hookeri** LANGE is a rare and local plant in West-Greenland from 64° N. to high latitudes. At the "colony" of Umanaq, 70°40′ N., situated on a small island, it has developed to be the widest spread weed, and from here to all trading posts and smaller settlements in the district, except Nuatsiaq, 71°32′ N., established quite recently. The plant produces an enormous number of small seeds with mucilaginous coats.

43. **Arabis alpina** L. is considered hemerophilous in northern Scandinavia; in Greenland no cases have been observed. Its seeds are winged and do not develope mucilage.

44. **Cochlearia officinalis** L. Like other sea shore plants all arctic varieties of this species are strongly nitrophilous and often occur in great abundance near Eskimo settlements or on birds' breeding places.

45—49. **Draba incana** L., the commonest species in the southern section, is nitrophilous and often found on manured spots. Also **Draba daurica** DC. (*"hirta* L."), **D. cinerea** AD. (*arctica* J. VAHL) and **D. rupestris** R. BR. are, to some degree, favoured by manured soil. **D. aurea** M. VAHL, which is sometimes found at the foot of bird rockeries, has in one case, at Upernivik, 71°8′ N., been found near a village, where it was obviously favoured by man's presence. All have mucilage producing seed coats.

50—54. **Saxifraga cernua** L. is strongly nitrophilous and characteristic in Eskimo house-ruins. **Saxifraga foliolosa** R. Br. and **S. groenlandica** L. may stand manure and thrive well, and casual occurrences on manured places may also be observed of **S. nivalis** L. and **S. rivularis** L.

55. **Potentilla pacifica** Howell and its variety **Egedii** Wormskj. are strongly nitrophilous and favoured by manure from birds' breeding places or from the settlements.

56—57. **Potentilla pulchella** R. Br. is often seen on manured places and **P. nivea** L. may occasionally be found on such places, and both are obviously favoured by fertilizing.

58. **Chamænerium angustifolium** (L.) Spach, which in temperate regions is strongly favoured by man's activities, is not so in Greenland. Our variety, **intermedium** (Wormskj.) is generally unable to produce seeds and is therefore bound to the spot. The best developed specimens I have seen of this were from a rich talus slope under a vertical wall of basaltic tufa, watered by perpetual springs. Quite recently seed-producing specimens, seemingly of var. *intermedium*, were found in Godthaab fiord near Pisigsarfik, 1926, by A. Lynge, and in Ameralik fiord, at Eqaluit, 64°9′ N., 1931, by M. P. P. A possibility of dispersal to new ground is thus at hand, at least in some places, but I have never in this country seen a case of this species settling on new soil.

59. **Chamænerium latifolium** (L.) Spach. The best developed specimens of this species are to be found on banks of coarse gravel and pebbles at the outlet of the larger mountain streams. But it also prospers near human habitations, especially where ashes from Greenland soft coals are dumped (potassium hunger?) requiring only that the place be sufficiently irrigated. A few years after the foundation of the Arctic station an extensive pure patch arose on denuded gravel, to make a gorgeous display of flowers for many years. Afterwards, however, this growth declined markedly, as if the soil had grown "tired".

60. **Gentiana nivalis** L. A white variety of this has been seen dispersed by man along foot-paths near Igaliko.

61. **Mertensia maritima** (L.) Gray. Some specimens have found their way into the fenced yard of the Arctic Station and seem to thrive well there.

62. **Plantago juncoides** Lam. var. **glauca** (Wormskj.) Fernald is nitrophilous like other sea shore plants. At Igaliko it has become the

dominating plant on a very poorly "cultivated" home-field, of the resident cattle breeding Eskimo. This is the type-locality for WORMSKJOLD'S *Plantago glauca*. (*Campanula rotundifolia* L. is stated by STERNER to be hemerophilous; it is not obviously so here.)

63. **Taraxacum.** In the not too rich *Taraxacum*-flora of Greenland the following sections of DAHLSTEDT'S system are represented: IV. *Ceratophora*; VI. *Arctica*; VIII. *Spectabilia*, the most common and widest ranging being *T. croceum* DAHLST. of the *Spectabilia*. This grows in rich soil in sheltered positions, and also at the foot of bird cliffs. Nevertheless I have never seen this species, nor any other of the *Spectabilia* or *Arctica*, accommodate itself near man; but of the *Ceratophora*, **T. groenlandicum** DAHLST., willingly enters cultivated soil though otherwise at home on sand dunes near the sea, and is greatly favoured by the exchange. Last year I saw enormous specimens of probably another species of the same section developed on the dumping from a recently excavated Norse house-site. Unfortunately the specimens rotted in the presses.

III.

HEMEROPHOBOUS PLANTS IN GREENLAND

There is today an active interest in preserving and restoring as much wild nature as possible, and great efforts have been made by all civilized nations to establish wild life parks or reservations, or to pass laws for the preservation of single species of animals or plants. Therefore, libraries may be available, full of single cases of suffering or extermination described, as well of plant species as of plant associations. Still there are seemingly few botanical writers having endeavoured to work out somewhat exact figures, or percentages, of how much a given flora may be suffering. In the books at my service in Greenland I have found but two papers, both by Finnish botanists, both analysing similar areas in South Finland.

For a comparison with Greenland we have to remember that those parts of Finland have been inhabited by man some 4000 years, and from about 200 years B. C. by a people with a pastoral and agricultural culture. From the immigration of the Swedes, in the 12. century, agriculture became the principal means of subsistence. It is therefore no wonder that in the area investigated by LINKOLA was found a very high number of apophytes, native plants entering cultivated ground. It must be

so, because the cultivated areas are still small plots, surrounded by woods, bogs, moors and rocks. Several of the species listed as apophytic by Linkola were not listed so, or only in a very slight degree, by students of the flora of Arctic Scandinavia.

Linkola's list of the hemeradiaphores, the indifferent, is somewhat puzzling, containing a remarkable number of plants which otherwise generally were considered hemerophobes, suffering from culture. In this list he places nearly all the aquatic plants, a number of *Cyperaceae*, *Liliales*, *Orchidaceae*, *Betula nana*, *Saxifragae*, *Pirola minor*, several *Ericales*, *Pedicularis Sceptrum* etc. We shall compare both authors' results:

Groups	Area investigated by Linkola 11.000 km² w. 642 species			Area investigated by Cedercreutz 660 km² w. 237 species		
	species	p.C.	sum	species	p.C.	sum
hemerophobes	101	15.7	**36.6**	65	27.4	**34.2**
hemeradiaphores	134	20.9		16	6.8	
apophytes	242	37.7	**63.4**	127	53.6	**65.8**
anthropochores	165	25.7		29	12.2	

By collecting the groups into two: the hemerophytes and the not hemerophytes the conformity of both authors' results for similar plant associations is remarkably good.

Generally speaking the hemerophobous element of any boreal flora, or the plants directly or indirectly suffering from man's activities, may be found amongst:

1) aquatic plants;
2) trees, shrubs and silvine herbs growing in shade;
3) mycotrophic, saprophytic and insectivorous plants, whereas several of the green hemiparasites are favoured by culture;
4) plants of the orders and families: *Pteridophyta*, *Gymnospermae*, *Typha*, *Sparganium*, *Potamogeton*, *Juncaginaceae*, *Alismataceae*, *Butomus*, *Hydrocharitaceae*, a few *Gramineae*, most of the *Cyperaceae* and *Juncaceae*, *Araceae*, *Lemnaceae*, *Liliales*, *Orchidaceae*, *Ranunculaceae*, *Crassulaceae*, *Saxifragaceae*, *Rosaceae*, *Polygalaceae*, most of the *Violae*, most of the *Epilobia*, *Pirolaceae*, *Ericales*, *Empetrum*, *Diapensia*, *Primulaceae* p. p., *Plumbaginaceae*, some *Scrophulariaceae*, *Orobanchaceae*, *Rubiaceae* partly, and some of the *Compositae*.

In the Arctic also man's activities effect changes and work damage on the flora. In West Greenland the natives long time ago have given up heating and cooking over the blubber lamp and introduced iron

stoves. Great amounts of heather are consumed in every household; in the North the fuel mainly consists of *Empetrum* and *Cassiope tetragona*, in the South of *Empetrum* and *Juniperus*. Although *Salix glauca* is considered a very poor fuel, all fair sized willows around a village are cut, and old specimens of the dwarf birches: *Betula nana* or *glandulosa*, growing espalier-like against rockfaces, are eagerly sought. And in the most southerly part the "forest" birches from all places, near to transportation by boat, are cut away. Real peat, consisting of *Sphagna*, being absent, turf consisting of the superficial stratum of the heath, formed of stems and roots of Ericales, interwoven with mosses and lichens, are cut for fuel to a great extent. Around some of the larger villages the rocks are totally stripped.

Considering the vastness of the area and the scarcity of the population the damage done on the original vegetation is restricted to very small spots. On the other hand, in the Arctic, the damage done by collecting fuel is emphasized by the extremely slow growth of shrubs. ROSENVINGE has (Sydlig. p. 146) investigated the age and annual growth of a great number of trees and shrubs from southmost Greenland, the main results of which we quote:

	number investigated	largest diameter mm			age		
		min.	mean	max.	min.	mean	max.
Salix glauca	15	14	**38.1**	49	19	**36.6**	83
Betula pub. × *tort.*..	31	65	**105.5**	167	47	**65.2**	94
Sorbus decora	6	32	**45.6**	89	18	**30.7**	56
Alnus crispa.....	4	54	**63.0**	74	33	**36.3**	38
Betula glandulosa ...	8	18.5	**25.4**	38	28	**52.5**	73
Junip. comm. v. nana	32	15.5	**88.0**	200	83	**212.8**	400

In fact, the age was higher as the center of many specimens, especially of *Juniperus*, was lacking.

To this may be added that a stem of *Rhododendron lapponicum* or *Ledum groenlandicum*, of the size of a lead pencil, generally is well over 50 years old.

At one of the smaller trading posts in Julianehaab district the present writer saw a pile of trunks of *Juniperus communis* var. *nana*, representing a couple of umiaq-loads, which had been collected in the environs of the place and were intended for one winter's use by one family. Samples taken from some of the stoutest shew that none were under two hundred years old. The destructive influence of man on fuel yielding plants in a subarctic climate will be apparent from this example alone.

After the cutting of *Betula pubescens* × *tortuosa* in the South, wil-

lows will take the ground, if moisture is sufficient, or there will be a close carpet of grasses, *Festucas*, *Poas* or *Calamagrostis*. Also the grasses are the first to settle after willows. Where turf has been cut there will be a good collecting field for seedlings of many kinds, gradually, however, the original vegetation is restored.

The kitchen middens around every Eskimo dwelling are rich in fertilizing substances, as nitrates, from urea, human and animal fæces, lime and phosphates from shells and bones, and potassium compounds from ashes. But all these are generally present in strong overdoses, seemingly acting directly as a poison on many Arctic plants, favouring a few, especially *Alopecurus alpinus* and some sea shore plants.

Every untouched plant association may be considered to be in a state of equilibrium, even such Arctic associations, where the areas of bare ground exceed those "covered" by vegetation. The bare spots, whatever they may be — rocks, sand or clay — are bare for reason; and when the plants have succeeded in getting a foot-hold, they become the "*beatae possidentes*", not willingly allowing newcomers to settle, even if these are seemingly well fitted to. I shall here, by way of illustration, report on some experiments of transferring native Greenland plants, as objects for study, to the Arctic Station where they did not grow before.

Dryopteris fragrans (L.) C. Chr. is common on the mainland of Greenland, north and south of Disko, but on Disko it is only known from one locality. It has many times been carefully dug out from rock fissures, with roots uninjured and ample soil adhering, and transferred to similar places on gneissic rocks. In most cases they died the first winter, a few lasted through the next summer, but finally all died.

Carex canescens L. A large tuft was dug out in 1909 and transferred to the very fertile bank of a brook from a "hot" spring. Since then the surrounding grasses and low willows have been cut back nearly every year, and the tuft is still alive, but diminishing in size.

Tofieldia coccinea Rich. Numerous specimens were dug out and transferred to places like the original ones, well apart for varying the chances. They were healthy, continued flowering, but the next year no more could be found.

Eutrema Edwardsii R. Br. the southern limit of which in Greenland is on North Disko, was repeatedly transferred, partially to the premises of the Arctic Station, partially to some secret spots in a valley near by. The former generally disappeared after the first winter, the others were seen after two winters, but then no more. Before disappearing they had developed mature fruits and seeds.

Arabis arenicola (Rich.) Gelert was found near the station on a waste place, where it probably had been dumped with herbarium sweep-

ings. The plants grew well and attained in a couple of years to flowering and fruiting; then they disappeared.

Saxifraga aizoides L., which is generally a local plant, was transferred to the brook bank mentioned and grew there four or five years. It was constantly protected by weeding around it, but finally it disappeared.

Saxifraga stellaris L. was taken from Godthaab, which is about its northern limit, 65° N. to the same brook bank. It lasted a couple of years longer than the former, but also died.

Potentilla Ranunculus LANGE was transferred with a large clump of soil 1909 to the brook bank. It is still alive, flowering every year and keeping its size but seemingly unable to gain new area.

Primula stricta HORN. A number of specimens with ample soil adhering were transferred, some planted outdoors on places similar to the original, others were kept in pots indoors. The latter grew well, but did not flower; the former disappeared after the first winter.

Linnæa borealis v. *americana* (FORBES) REHDER was taken, twenty years ago, from its northernmost locality in West-Greenland (Disko fiord) to the brook bank and planted under low willows. It is generally "helped" by weeding off some of the grass, it creeps about and also flowers generally. The patch now may be 1 m in diameter, but there are hardly so many rooted individuals as when planted. On the place it came from it grows all over a willow thicket about 200 m long and about 50 m broad, as well as in glades without shade.

Hieracium groenlandicum (ALMQ.) DAHLST. (of the group *Prenanthoidea*, *Alpestria*) was transferred 1908 from its northernmost occurrence (Disko fiord) to a place on the often mentioned brook bank, where there was a growth of grasses and willows similar to that on the original spot. The selected specimens were stout and vigourous and they continued flowering and bearing fruit. The plants flowered for two more years but the specimens were weaker; and after four years no traces of them could be found.

In 1908 about 200 kinds of seeds of Alpine plants, grown in Alpine gardens in Switzerland, were sown in pots. A lot was dug, cleared to the best of our ability, from its original vegetation, and fenced; and the pots were put down, nearly to their rim. Friends in Switzerland had warned that several, if not checked, might turn out to become troublesome weeds. Nearly all germinated, and after some four or five years flowering began, and everybody enjoyed the intense colours of the Alpine flowers, contrasting with the more modest display of the native ones. At the same time, however, a rank growth of a *Polytrichum* sp.

had overrun the whole lot, with pots and all. The plants might have been saved by transferring to new soil if the proper gardening skill — and time for constant watching and weeding — had been available. Being unable to afford the necessary attention and having nobody else to do it, the cultures were given up as an object of study. Some of the most beautiful plants were taken from the pots and transferred to better places. An *Eritrichium* kept itself for about 15 years, and there is still a *Potentilla* of the *verna* group, different from the native *P. maculata*; but it is by no means troublesome.

Should my readers consider me a poor gardener, I may not be offended. But I hope that the enumerated experiments with native Greenland plants will show that plant dispersals and migrations, so willingly and so liberally assumed in every paper of plant geography, may be quite different in nature itself and that plants embraced by the terms hemerophilous and hemerophobous may possess properties, governing their different responses, which are still unknown.

IV.

WHICH PLANTS WERE INTRODUCED TO GREENLAND BY THE NORSE SETTLERS?

From JENS VAHL's first finding of *Vicia Cracca* at Igaliko, more than a century ago, and a long time before the ruins there had been identified as the former bishop's see, and at a time where nothing was known about the significance of the root tubercles of the *Leguminosae*, this plant was considered an Old Norse relic (see Grl. Hist. Mindesm. III. 815).

WARMING, in mentioning plants introduced by man, doubts the introduction of *Vicia*, but only by reason of its wide distribution in other boreal countries. EBERLIN, p. 332, says that the flora of West Greenland is "no longer pure", containing elements introduced at medieval times and later, but he does not state which species he considers "Old Norse".

The first who in a detailed way took up the question was ROSENVINGE (Sydl. p. 178—186. 1896 fr. résumé p. 458). Having considered all available data at his time and very carefully deliberated their *pros* and *contras*, ROSENVINGE lists the plants into different groups:

1) *Polygonum boreale*, *Stellaria media*, *Capsella Bursa pastoris* and *Poa annua* are considered "undoubtedly introduced by man".

2) "undoubtedly introduced by the Norsemen" he says of *Vicia Cracca*, *Juncus bufonius*, *Achillea Millefolium*.

3) "with greater or less probability the same may be said about" *Sagina nodosa*, *Parnassia Kotzebuei*, *Primula egaliksensis*, *Gentiana (serrata) detonsa*, *Leontodon autumnale*, *Gnaphalium uliginosum Rumex domesticus*, *(Platanthera) Orchis rotundifolius*, *Juncus (alpinus) nodulosus*, *Heleocharis (palustris) uniglumis*, *Carex (Buxbaumii) polygama*, *C. (cryptocarpa) Lyngbyei*, *C. Oederi*, *Anthoxanthum odoratum*, *Equisetum (hiemale) trachyodon*.

Of these the species here emphasized are the only ones mentioned in the resumé, which suggests that the author held them to be the more probable.

4) ROSENVINGE now describes a very peculiar difference in the flora of the northern and southern sections of Julianehaab district. For the northern *Anthoxanthum* and *Leontodon* are characteristic, whereas to the southern section belong *Rubus saxatilis*, *Subularia aquatica*, *Atriplex* (?) *Babingtonii*, *Juncus squarrosus*, *Athyrium alpestre* and *Nardus stricta*. Having not visited this region himself, ROSENVINGE somewhat reluctantly states that "an introduction by man may, probably be considered for *Atriplex*, *Juncus* and *Nardus*".

5) A group of plants peculiar to southernmost Greenland generally and by preference growing near the Norse ruins, "may be thought introduced by man", even if as to the great majority of them no other facts favour this assumption

Matricaria (phaeocephala) ambigua, often on manured spots,
Scirpus pauciflorus, only found at Igaliko,
Agrostis (alba) stolonifera,
Juncus filiformis,
Carex (ampullacea) rostrata,
Lathyrus maritimus.

6) Finally ROSENVINGE emphasizes the circumstances impeding an immigration of southern plants by natural ways into Julianehaab district: the coast is constantly swept by the East Greenland Polar Current which is generally heavily loaded with pack ice; and the suitable places are far from the outer skerries.

From later investigations the known ranges of some of the plants mentioned by ROSENVINGE have been so extended as to make the statement "only found at the former Norse places" untrue. However,

ROSENVINGE's conclusions are generally so cautiously worded that we may still accept them as furnishing so near a solution of the problem that there would have been no reason for resuming the discussion, as we do on the following pages, had not the late Professor OSTENFELD recently treated the problem in a different way.

In his paper, "Origin" p. 17—19, OSTENFELD lists 50 species as probably introduced by the Norsemen, but to four he appends a question mark. With that list is given the distribution in Greenland as to geographical latitudes only, and with a letter is marked their occurrence in neighbouring countries:

D = N. Am. and Scand., but not Iceland,
E = N. Eur. and Iceland, but not N. Am.,
G = N. Eur., Iceland and N. Am.,

but nothing is said about the plants' occurrence in Greenland, whether scarce or numerous, whether bound to the house-sites or not, whether occurring on cultivated soil at all or in natural associations. OSTENFELD writes:

"The possible "old Norse plants" should (1) preferably show a range of distribution answering to the areas of the old colonies, which are now, as above noted, well defined (DANIEL BRUUN). Furthermore, they must (2) be species living in Iceland or Norway, and finally, (3) should preferably occur in habitats which might suppose to produce hay, i.e. meadows and grassy slopes. As will be seen from the accompanying list there are about 50 species of flowering plants which can be said to fulfil these conditions fairly well; that is to say, as regards their distribution, that they are, on the whole, only found within an area reaching from the northern part of the Godthaab Fjord in the north to Lindenow Fjord in the extreme southern part of the east coast in the south — answering to the phytogeographical districts W, III., W, II. and I., mentioned below (see also General List). Most of these are meadow or grassland plants, and no fewer than 20 are grasses or grass-like plants. The majority are found only in District I., answering to the ancient southern settlement (Eystri byggd) and several of them which extend farther north are lacking in W, II., only to reappear in W, III., Godthaab Fjord, the ancient Vestri byggd.

We may thus reckon, with some degree of probability, that one-eighth (abt. 13 p. c.) of Greenland's 390 species of vascular plants were brought into the country through the old Norse colonisation."

Following ROSENVINGE, OSTENFELD makes the 61° parallel the limit of his floral district W, I. If the border line is made to follow the height of land of the peninsula South of Kobberminebugt, it may be right; and though the map on p. 21 is small scaled, the trend of the borderline shown suggests that this was his opinion. This brings it to coincide with the remarkable southern limit of the Greenland Alder.

But in this case the northernmost Norse ruins of the Eystri byggd,

in the Arsuk-Ivigtut region, up to Sermiligarssuk, 61°25′ N. are cut out, which in this problem, is unfortunate. And the next floral district W, II., reaching from 61° to 64° N., just south of the Vestri byggd, is also somewhat unfortunately chosen. It is much better as ROSENVINGE has it, to place a borderline through the Frederikshaab Glacier at 62°30′ N., as a good deal of the species here concerned are still found there. But from 61°25′ to 64° N. no ruins of Norse homesteads have been found, the 2 or 3 insignificant ruins in existence there being only of haybarns or fish-stores.

When OSTENFELD says that the supposed "old Norse" plants are absent from this section, some of them to reappear in the Godthaab district, it is true only for a small part. In fact the following have been found outside the areas formerly occupied by the Norse settled people:

> *Poa nemoralis*, *Carex panicea*, *C. stylosa*, *Juncus bufonius* (far up to 67° N.), *J. nodulosus*, *J. filiformis*, *Luzula multiflora*, *Betula pubescens* × *tortuosa*, *Rumex Acetosa*, *Cerastium caespitosum*, *Stellaria media* (to 72°48′ N.), *Geranium silvaticum* (the only locality so far known being outside the Norse area), *Epilobium palustre* (to 69°15′), *Ligusticum scoticum*, *Rhinanthus groenlandicus*, *Galium triflorum*, *Erigeron borealis*, *Hieracium groenlandicum* (to 69°33′ N.), *H. hyparcticum* (to 67°10′ N.),

and from the east coast:

> *Nardus stricta* (in the south), *Matricaria ambigua* (at 73°10′ N.) totalling 21 species out of 50.

It so happens that this stretch of land, between the Vestri and Eystri byggd, is botanically much less explored than the adjoining areas. All botanical travellers seem to have hurried through here to arrive at the more famous region of the ancient settlements. Yet this neglect is undeserved, for here occur such interesting plants as *Asplenium viride* (found nowhere else on the west coast), *Viola Selkirkii*, *Geranium silvaticum* (found nowhere else in Greenland), *Andromeda glaucophylla* (found in two spots within this area and nowhere else in Greenland), *Linnaea borealis v. americana* (found in but four other widely scattered localities).

OSTENFELD'S second and third conditions are fairly well fulfilled. A few exceptions need not be mentioned here as they will be pointed out by the discussion of the species in question. But, in the present writer's opinion, there should be two more conditions named:

4) The suggested Norse plants should preferably not occur in Atlantic N. America as indigenous plants, but only as introduced. For if boreal plants of European type could immigrate to Atlantic N. America,

without man's help, they could probably immigrate to S. Greenland too. We must always keep in mind the great number of southern, strictly American types which, in some remote past, were able to immigrate to West Greenland. Of the plants here concerned 26 species — over the half — are also indigenous in Atl. N. America, and the majority of these are considered European types there. All southern types of plants in Greenland were unable to survive the maximum extent of glaciation, consequently they must have arrived in one of the postglacial epochs. Under present conditions an immigration seems impossible, but we do not know how conditions were at a milder epoch; we only know that such an epoch did exist in Greenland.

5) Plants successfully introduced by the Norsemen should be hemerophilous, favoured by culture. So are in fact some of the grasses mentioned by OSTENFELD, but not all. Furthermore it should be considered, as was done by ROSENVINGE, whether the plants now occur only on cultivated ground or in natural associations as well. Unfortunately OSTENFELD never saw these plants in the field, his only visit to Greenland being an excursion of one or two days into Ameralik fiord.

In the chapter headed Hemerophobous Plants I have shown how difficult it may be to a plant to settle in a new area where no extensive cultivation of the soil has at some time been undertaken. It cannot well have been easier in the middle ages than it is today.

It is true that the Norse occupation of Greenland lasted at least four hundred years, but it was only in the early years that introduction of live stock was important. Communication with the parent countries was always difficult for voyages were dangerous and long. There resulted a gradual decline of ocean traffic which was felt in Greenland in the diminishment of resources and supplies. Iron and wood, essential to the maintenance of ships, grew scarce; and finally, in 1261, the free republic of Greenland was brought, by sheer necessity, to subject itself to the rule of the Norwegian king. The Crown, for its part, granted the establishing of a regular traffic with Norway and a provisioning of the colony. With the conversion of the trade, during the following years into a royal monopoly the complete dependence of Greenland was accomplished. The subsequent decline and final abandonment of the trade left Greenland, without ships and wood to build them of, quite helpless. And the decay which followed was, one might say, inevitable.

During the present colonisation the communication with Europe has never totally failed, not even during our war with England 1807—14, or during the World War. Today every major port of West Greenland is visited by several ocean going steamers annually, and engine driven schooners and boats run between these ports and the minor trading

posts throughout the whole open season. How amazingly little has even this traffic affected the vegetation!

In Julianehaab district, which embraces one fifth of the Greenland population, the district in which agricultural operations always have been most developed, motored schooners go between the settlements nearly the whole year, distributing European goods, and returning with live sheep for slaughtering and fish. Why are the widely ranging and strongly hemerophilous *Anthoxanthum* and *Leontodon* still confined to the northern section, as they were over a century ago, when the botanical exploring of the district started, and why is the equally common and hemerophilous *Nardus* still in the South? Why do they not move? Certainly not because of want of transportation facilities. Here also there seem to be difficulties of which the nature is still unknown.

For the following species the possibility of introduction by the Norsemen was taken into consideration by ROSENVINGE; whereas, mostly on account of subsequent finds, OSTENFELD left them out.

a. **Equisetum trachyodon** A. BR.

In 1888 ROSENVINGE found at Qagssiarssuk, Igaliko fiord, a peculiar *Equisetum* which he identified as *E. hiemale* var. *Doellii* MILDE (Consp. III. 741). The plant has not been found since. In the leading floras *E. hiemale* was reported from Atl. N. Am., Iceland and N. Eur.

On palæo-geographical reasons, however, the well known student of *Equisetum*, J. H. SCHAFFNER, doubts the occurrence of *E. hiemale* in Greenland and in Atlantic America, east of the Rocky Mountains, (Amer. Fern Journ. 20. 99 ff.) and he refers the Greenland specimens to *E. trachyodon* A. BR., a view with which the late Professor OSTENFELD agreed (SCHAFFNER in litt.).

By some European botanists (HEGI: Flora VII, 147; HOLMBERG: Fl. 42), this plant has been thought to be the hybrid *E. hiemale* × *variegatum*. If it is a separate species, as A. BRAUN, ROUY, and SCHAFFNER suggest, we shall need a revision of North European and North American material of this and related forms, before an opinion of the history of the Greenland plant can be obtained.

b. **Subularia aquatica** L., formerly only known in Greenland from the southern section of Julianehaab district, has been found, by BERLIN and KRUUSE in the Angmagssalik region on the East Coast, ab. 66° N. Also in N. Am.; Iceland and N. Eur.

c. **Gentiana detonsa** ROTTB. 1770. (*G. serrata* GUNN. 1776).

ROSENVINGE (Sydl. 183—184) thought it "not improbable" that

this species, occurring in several places in Julianehaab district, might have been introduced by Norsemen, and he thinks that it grows mostly near Norse ruins. It is, however, a plant of the sea shores; it is also known from Iceland and from Northern Norway, but not from those parts of Norway from which the settlers in Iceland and Greenland came. In West Greenland it has since been repeatedly observed at the head of Itivdleq fiord, 66°10′ N. in places where there have probably been neither Norse nor Eskimo habitations.

In Norway no hemerophilous tendencies have been noticed by NORMAN, NOTØ or JØRGENSEN.

LANGE, Consp. 82, includes Arctic America and the Altai Mountains for its general distribution, and OSTENFELD (Origin 63) marks it S. G., meaning thereby a circumpolar, subarctic species. But the plants from Altai belong to another related species, and probably even the plants from Arctic Russia are different. In N. America it has not yet been found, the species there which were accepted as "*G. detonsa*" being other related species (see TH. HOLM: Ottawa Naturalist 15, 1901; FERNALD: Rhodora 1923, 85 ff.)[1]).

d. **Athyrium alpestre** (HOPPE) RYLANDS, probably var. **gaspense** FERN., Rhodora 1928, 48, pl. 168,
Orchis rotundifolia BANKS,
Parnassia Kotzebuei CHAM. & SCHL.,
Primula egaliksensis WORMSK.,

are subarctic, American types, of which ROSENVINGE thinks an introduction by the Norsemen possible. The sagas give several accounts of ships returning directly from Vinland to Greenland. They also mention the export of cattle to Vinland, accompanying an attempt at colonisation. With the abandonment of the enterprise the returning ships would have no reason to carry live animals back. The homeward cargoes, as the sagas say, were wood, grapes and vines. The possibility, therefore, of an introduction of smaller plants from America by the Norsemen seems negligible. The presence, moreover, of a considerable number of southern American types, from areas outside the Norsemen's byggds needs other explanation. *Orchis rotundifolia* has recently been found at the head of Søndre Strømfjord, 66°50′ N. by ERLANSSON, 1927, and at Ameragdlâ in Ameralik fiord, 64°9′ N. by M. P. P. 1931.

[1]) HOLM l. c. states the absence of nectar glands in *G. detonsa* in contradistinction to all American species of the section *Crossopetalae* investigated, but this is no specific character. I have seen specimens from Greenland, Iceland and Norway with glands and others without, in the last case, however, the vascular bundles at the base of the corolla show plainly where the glands should have been. The lack of glands is probably a defect correlated with deficient insect-life on the habitat of some specimens. NOTØ (Kvænangen 313) observed cleistogamous forms also.

1. **Zostera marina** L. was found drifting in the Godthaab fiord-system by JENS VAHL a century ago; and in 1885 S. HANSEN found its growing place in the Kapisigdlit-branch, 64°20—25′ N. (Consp. I, 117; II, 282). In the general description of that district in "Grønland i Tohundredaaret etc." II, p. 198, (also issued as Medd. om Grl. vol. 61) it is also mentioned from the Itivdleq-branch of Ameralik-fiord, to which locality may be added Eqaluit in the Ameragdlâ-branch (M.P.P. 1931). Furthermore, in the book quoted, it is said that even small piles of "Tang" may be found, washed ashore. Having visited these places, I think a slight correction is needed. On the shores of Denmark piles of "Tang" generally means *Zostera*, but the piles on these places were *Fucaceae*, with only rarely a shoot of *Zostera* between.

For a long time the Greenland *Zostera* was only known sterile (Consp. III, 710), but in 1924 Mr. A. NISSEN succeeded in getting flowering specimens at the end of August (cfr. SETCHELL: Univ. Calif. Publ. Bot. 14, 431, 1929).

OSTENFELD lists the plant between the "Old Norse" species, saying in a footnote: "I consider it to have most probably been brought by a ship in some way or other". (Why just a Norse one?). But recently A. E. PORSILD has found *Zostera* to be common in James Bay, the southern extension of Hudson Bay, an occurrence which, under the conditions now prevailing, is just as difficult to explain. To the present writer both occurrences are easiest understood as relics from a former, postglacial, milder epoch; this is also suggested by OSTENFELD l. c.

2. **Anthoxanthum odoratum** L. From Qagssimiut at the western end of the northern section of Julianehaab district inwards as far as the fiords go, this plant grows abundantly. The southernmost locality is at Amitsuarssup Qingua, in Agdluitsoq, 60°40′ N. (E.&M.P.). It is often the dominant plant in vegetation, but it may also occur, on dryish, sunny soil, amongst other grasses, or at the borders of thickets. In Greenland it is a lowland plant, not connected with human habitations; its highest altitude is, so far, 300 m.

In other countries it is said to be hemerophilous, invading clearings with poor soil. It is indifferent to the chemical character of the soil, being, however, unable to stand manuring or the tilling of the soil. In Iceland it grows outside of fenced fields. It is said to be able to stand warm summers and any amount of cold, even under thin covers of snow; and the seeds may keep their vitality for years.

It is considered a pasture plant without much value. A single tuft may be eaten eagerly by cattle, but when it grows in excess the cattle will avoid it. Generally it withers immediately after flowering and becomes worthless as hay.

Common in N. Scandinavia to which it immigrated in earliest postglacial times, before the Birch (J. & L. 173); common in Iceland; it has sometimes been considered native in Atlantic N. America, but according to Gray: Manual and numerous articles of recent date in Rhodora, it is introduced and naturalized only. Thereby ROSENVINGE's and OSTENFELD's assumption that it was introduced by the Norsemen gains in strength.

3. **Nardus stricta** L. In contradistinction to the preceding, *Nardus* occupies the southern section of Julianehaab district, from Lindenow fiord on the east coast, 60°30′ N. to about the same latitude on the west. Some of the localities are near the favoured Norse places in the fiords, but most are on the outlying islands. It is generally found growing in patches, from a dozen to a hundred meters across. A typical place is a shallow depression where its upper limit is the line demarcating the level of thick snow during winter. It may also be met with on peaty soil or at the border of ponds amongst heather. Its need of easily accessible water during summer and of a snow cover during winter is evident.

Nardus is known to be an extreme oxylophyte, never occurring on uncovered limestone, and at the same time mycotrophic. It is an anthropochorous plant in so far as its seeds or the whole spikes are easily carried by domestic animals, f. inst. sheep. When the soil is drained, manured, or given lime, it disappears. It is of little value as a fodder plant, though sheep, in early spring will nibble at the young shoots. A pasture with *Nardus*, having been grazed by reindeer, sheep, or cattle, will be full of shoots torn off and rejected by the animals in their efforts to get other grasses. It cannot be mowed, the wiry leaves and stems simply bending before the scythe. In poor countries it is sometimes collected for litter.

In Scandinavia and Iceland *Nardus* is a common grass from sea level to over the Birch zone. When the valleys are fairly well cultivated, it keeps to the hills. It is considered an old member of the flora and to have immigrated shortly after the retreat of the glaciers. In Atl. N. America it is generally considered introduced; in S.E. Newfoundland, however, it is stated as indigenous (FERNALD: Rhodora 1926, 81).

OSTENFELD lists it as introduced by the Norsemen; and a possibility of such an introduction cannot be denied. In MALTE's paper mentioned below, p. 108, is reported a remarkable case of the successful transferrence of an *Agrostis* from Nova Scotia to New Zealand through its having been used for the stuffing of the mattresses of emigrants; and some similar means may here be imagined. Yet the plants occurrence on the east coast, on islands uninhabited by the Norsemen, and its indigenous state in Newfoundland makes an immigration by natural ways just as probable.

4. **Agrostis stolonifera** L. (*A. alba* L.) MALTE: Commercial Bent grasses. Ann. Rep. Nat. Mus. Can. Ottawa 1928.

This plant is rarely recorded from the fiords in the northern section of Julianehaab district, the southernmost locality being near the thermes at Ûnartoq, 60°30′ N. This species contains several varieties and forms, some of which are hemerophilous or cultivated, f. inst. recently on golf-links; other are wild, f. inst. var. *compacta* HARTM. (*A. maritima* LAM.) which grows on sea shore meadows. J. & L. suppose that the species immigrated to Scandinavia at an early postglacial epoch, contemporaneously with the Birch. They also consider it to be indigenous to South Iceland, and they state that it was introduced to N. Am. from Europe. This may be true for some occurrences, but according to American authors it is undoubtedly indigenous to Northern New England and the Maritime Provinces of Canada. In Iceland it is much valued as a foddergrass.

These facts, especially that of its scarcity in Greenland, favour OSTENFELD'S theory of introduction by the Norsemen; but an immigration by natural means cannot be left unconsidered.

5. **Poa annua** L.

OSTENFELD lists this cosmopolitan weed as introduced by the Norsemen, and gives its distribution as 60—62° N. Its home seems to be the Mediterranean countries, and according to J. & L. 371 it came to Denmark in neolithic time. It is widespread in Scandinavia, where it has been naturalized; in the northernmost parts, however, it is only an anthropochorous weed. It most likely came to Iceland with the earliest settlers, and it is common there in inhabited places; it is probably around every farm. It has no value as fodder, and cannot be made into hay because it will rot before drying.

Supposing it to have been as common in medieval times as it is now in Iceland, the immigrants to Greenland could hardly have avoided carrying seeds with them, but its present occurrence in Greenland gives no ground for the theory. In fact all recorded localities — and they are, I am confident, too few — are places now inhabited. There is one exception, the head of Amitsoq fiord (BERLIN), and this place is in a district around Cape Farewell where no Norse ruins have been found. The most extensive growth I have seen was around the Eskimo village at Sangmigssoq, ab. 60° N. where the inhabitants were fishermen and had no domestic animals. Here the grass covered all the overmanured areas to where the natural soil began.

If *Poa annua* had ever been growing near the Norse farms in Greenland as it does to-day in Iceland, it would hardly have been able to keep to these places during that interval of over three centuries that

probably elapsed between the extinction of the Norsemen and the resettling, in 1780, of a Norse farm site (Igaliko), by the Eskimo. The luxuriant growth of native grasses: *Calamagrostis*, *Festuca*, *Poa* etc. would probably soon have outgrown *Poa annua*. Now the plant is introduced every year with garden seeds and chicken food and in the soil of pot-flowers. It is recorded as a garden weed in Disko Bay, at the Arctic Station it would cover the yard if not weeded, hibernating with green leaves under the snow, and it is most likely common at the trading centres of South Greenland.

The Greenland status of *Poa annua* is very much like that of *Stellaria media*.

6. **Poa nemoralis** L.

OSTENFELD, who thinks this species was brought to Greenland by the Norsemen, is inconsistent in regard to its range. In the list of "Old Norse" plants, p. 19, he gives:

c. 61°10′—60° (—66°?), whereas in the tabulated view, on p. 67, he gives:

W.: 66—64°; 64—61°; S.: 61—60—61°; E.: 61—65°; Angmagssalik.

In OSTENFELD: Flora Arctica, GELERT had given:

W.: 60°—69°20′(!); E.: 65°35′(!); 70°—71°(!); the ! means that GELERT accepted the identifications.

When OSTENFELD was preparing his paper I sent him, at his request, a list of ranges, as far as I knew them, and I had proposed for *Poa nemoralis*:

W.: 60°—67°; E.: 60°—66°; 71°.

When the list was returned, it had been in OSTENFELD's handwriting corrected to:

64°10′

W.: 60°—(67°); E.: 60°—66°; (71°),

which would suggest that 61°10′ on p. 19 of OSTENFELD's paper be corrected to 64°10′ and the column 66°—64° on p. 67 be removed. But yet, there may be another explanation, as will be shown in the following.

The *Poas* of Greenland are badly in need of revision. The late Professor LINDMAN at Stockholm devoted the last decade of his life mostly to studying and disentangling the relationships in the genus of *Poa* from Spitsbergen, Novaya Zemlya and Fennoscandia. His final treatment of the genus is given in the second edition of his Svensk Fanerogamflora and in the Nr. 2 of the HOLMBERG-flora, both issued 1926, somewhat before OSTENFELD's paper. It is possible that OSTENFELD reviewed his material in accordance with LINDMAN's opinions and forgot to make the corrections necessary in one of his statements.

Whilst nobody will confuse a typical specimen of *Poa nemoralis* with a specimen of typical *Poa glauca*, yet, LINDMAN says, the northern and alpine var. *montana* GAUD. of *P. nemoralis* may be hardly distinguishable from *P. glauca* subsp. *conferta* (BLYTT) var. *laxiuscula* (BLYTT), even if they are genetically of different stock.

Having here no access to the figures nor to the exsiccata quoted by LINDMAN, I cannot make a final revision of my own materials and must leave the question open. But even if it was OSTENFELD's intention to restrict the range of *Poa nemoralis* to 60°—61°10′ N., there is nothing in its occurrence there to suggest an introduction by man. It grows at the borders or in glades of *Betula*, *Alnus* or *Salix*-thickets, and does not occur in or near house-sites. It is in fact placed by LINKOLA and CEDERCREUTZ amongst the hemerophobous plants.

In N. Eur., Iceland and N. Atl. Am. the species is common and native.

7. **Puccinellia maritima** (HUDS.) PARL. OSTENFELD, not ROSENVINGE, has considered this plant introduced by the Norsemen.

According to a revision by the late O. HOLMBERG there are four collections of this species from as many widely separated localities in Julianehaab district, between 59°55′ and 60°53′ N. Now in that district the sea shores are generally rocky and there are but few opportunities for the growth of the plant. These are mostly at the heads of the bigger fiords, for instance Tasermiut. P. *phryganodes* (TRIN.) is also found there and is probably more common.

In Iceland, *P. maritima* is widely distributed on the S., S.W. and N.W. coasts, but is very scarce elsewhere; and *P. phryganodes* is absent there. In Atlantic N. Am. *P. maritima* is native to the coasts of New Engl. and Newfoundland, whereas it is considered as introduced to sea shores S. of New England. In W. Eur. the plant ranges much higher northwards on the Atlantic coast than on the Baltic.

The facts given may make an introduction by the Norsemen possible, but if this strictly W. European type could immigrate by natural ways to New England and Newfoundland, it could quite as well so enter S. Greenland.

8. **Carex polygama** SCHK. (*C. Buxbaumii* WAHL.). As to the nomenclature see SIMMONS: Kir. 59.

Well sized specimens with nearly mature fruits were once found in Sermilik fiord, 61°10′ N. (ROSENVINGE). It is, however, considered a circumpolar, subarctic species, with wide gaps in its range. It is absent from Iceland, the Færoes and Scotland, but it occurs in the *Betula*- and *Salix*-region of Scandinavia, mostly in boggy or springy places

and in moist meadows; it sometimes descends to the sea. Its occurrences in Scandinavia are not continuous. It is not reported as favoured by culture in any way; in fact SIMMONS: Kir. 59 thinks it suffers from draining operations.

ROSENVINGE thinks its introduction by the Norse possible, and OSTENFELD lists it as an "Old Norse" plant. Yet as conditions were the settlers of Greenland could only have gotten it in Norway, and the chances for obtaining it there were small. In N. Am. the species ranges northward to Quebec, Newfdl. and S. Labr. and westwards over the continent to the Pacific coast. Consequently an immigration from the West seems much more likely.

9. **Carex stylosa** C. A. MEY. (*C. nigritella* DREJ.) is listed by OSTENFELD — with a question mark — as an "Old Norse" plant. It is not only common in the whole of the Southern Norse settlement but is found to 60°30′ N. on the east coast, and to 62°30′ N. on the west. It grows on grassy slopes and on peaty soil. ROSENVINGE, Consp. III, 724, says "especially in the outer parts"; but since his visits here specimens have also been taken from the heads of the fiords or from interior parts. It is absent from Iceland and the rest of Europe except one locality in Arctic Norway (according to C. B. CLARKE and KÜKENTHAL). But the Norsemen of medieval times did not start their voyages to Iceland or Greenland from Arctic Norway.

In its beaviour in Greenland nothing suggests an introduction by man, and this strictly American type is best considered as having like many others, immigrated from the West by natural ways.

10. **Carex Lyngbyei** HORNEM. 1827.

Under this name, which was given to plants from the Færoes, OSTENFELD in Fl. Arctica p. 75 unites *C. filipendula* DREJ. 1841 from Iceland and Igaliko fiord, S. Greenland and *C. capillipes* DREJ. 1841, from Iceland. Furthermore, he refers to it *C. cryptocarpa* C. A. MEY. from the Pacific coast. And the same view is held by KÜKENTHAL in Engler's Pflanzenreich. Recently HULTÉN: Fl. Kamtch. I, 188, wishes to keep the Pacific plant apart as a subspecies.

In a discussion of these and some more Pacific plants TH. HOLM (Am. Journ. Sc. 50, 1920) considers *C. Lyngbyei* an endemic plant of the Færoes only, *C. filipendula* as a synonym of *C. cryptocarpa* with the range Iceland, S. Grl. and Pacific coast, and *C. capillipes* as a nearly related, endemic Icelandic species. These plants thus represent puzzling questions for the taxonomist and phytogeographer as well. As the floras of Iceland, Færoes and S. Greenland are very young, the occurrence

of endemic species is, if somewhat surprising not unparallelled, as we shall see in the genus *Hieracium*. The færoese plant is scarce, found in a few localities only, and considered a shore plant associated with *C. salina*. Identical with this is the plant from a single Norwegian locality in the S.W. at about 62° N. The Icelandic botanists, however, state positively that their plants occur in bogs (mýr) on pond and lake shores and on inundated sand-flats (flói).

In Iceland, the plant is considered one of the best fodder grasses and, growing abundantly, is much cut for hay.

More common than this plant in S. Greenland (60° to 61°45′ N.) is a sedge, called by DREJER *C. hæmatolepis*, but which OSTENFELD, on account of its morphological and anatomical characters and because of its always empty achenes, considers a hybrid of *C. Lyngbyei* and *C. rigida*. This hybrid has also been observed several times in Iceland.

Considering all facts so far known, the introduction of these sedges to Greenland by the Norsemen seems very probable.

11. **Carex Goodenowii** GAY.

Under this name OSTENFELD accepts most of the plants named by LANGE and ROSENVINGE *C. vulgaris* (Consp. I—III) and part of LANGE's *C. groenlandica*, whereas the remaining — and some earlier identifications — are regarded as hybrids with *C. rigida*. (For full synonymy see Fl. Arctica p. 72). *C. Goodenowii* is, according to OSTENFELD, common in S. Grl. to 61°, whereas he considers records north of 61° as hybrids.

In Iceland the plant is common and is considered a valuable fodder and pasture grass. It often grows together with *C. Lyngbyei*, or, when in separate associations, *C. Goodenowii* choosing the drier habitats, while *C. Lyngbyei* takes the wettest. The extensive use of this sedge for "wild hay" in Iceland makes its introduction to Greenland by the Norsemen possible. Nothing, on the other hand, in its present occurrence in Greenland, suggests an introduction, and a plant so common on both coasts of the Atlantic might well have immigrated to Greenland before the coming of man.

12. **Carex rostrata** STOKES (*C. ampullacea* GOOD.) has been found in but three places in Greenland: Igaliko, Qagssiarssuk in Igaliko fiord and a valley north of Taserssuaq in Tasermiut fiord. All these are the sites of Norse farms founded by some of the most prominent chiefs. The plant grows in very wet swamps, and is abundant in the locality in Tasermiut where an extensive area is periodically flooded by the river. There it flowers, and it is probable that it also bears mature fruits. If it was introduced there it now seems perfectly naturalized.

In Atlantic N. Am. this species occurs from N.Y. and Ct. to Newfdl. and S. Labrador. In northern Scandinavia it is common and reaches high altitudes, becoming at the same time scarcer and often sterile (NORMAN, II, 545). In Iceland it is common in the whole country and is commonly cut for hay. It is there considered a valuable fodder plant, if cut before flowering.

In Arctic countries the protection of man's feet is an important item and many explorers' breakdown has come with freezing them. The reindeer nomades of Arctic Eurasia fill their soft leather boots with finely prepared "grass" which acts as a non conducting and moisture absorbent for the naked foot, and the Eskimo use grass as an intermediate layer between their sealskin boot and the furred "stocking". A good stuffing material must be very soft and pliable and, at the same time, tough.

In Arctic Europe *C. rostrata* (and *C. vesicaria*) are used for boot-stuffing, and large supplies are cut for this purpose, dried and prepared. If flowers and fruits are present they must be removed, but the supply is preferably taken before flowering (NOTØ: Kvænangen 346).

The plant is indifferent to culture or rather hemerophobous. Where boot-stuffing has been cut two or three years of regeneration are required to restore the growth (NOTØ).

The plant, being so stout and conspicuous, would easily attract the attention of the Eskimo in need of suitable "boot-grass", there is therefore but little probability of its finding new localities.

Everything considered an introduction to Greenland by the Norsemen seems probable.

13—16. The next four species, regarded by OSTENFELD and suggested by ROSENVINGE, as introduced by Norsemen, have so much in common that they may be discussed together.

All are small plants, in Greenland even smaller than usual, and, when not in abundance, easily overlooked. All are recorded from Igaliko and a few other places, playing a very unimportant roll in the vegetation and seemingly not at home. All are known from Iceland, Europe and N. Atl. Am., where they are temperate-boreal and lowland types, rather than arctic-alpine. All occur in wet places, preferably calcareous, or near the sea in brackish habitats. They are indifferent to culture or only slightly favoured, yet the two *Carex*-species are quite often anthropochorous.

	Greenland	Iceland
13. **Carex Oederi** RETZ. ab. 61° N.	Igaliko, 1828, J. V.; 1888, ROSENVINGE. "in one single bog, not far from houses and ruins" Qagssiarssuk, Igal. F. 1925. A. E. P. & M. P. P. "sandy shore of a pond"	in bogs near the sea and near the thermes; in all sections, but scarce.
14. **Carex panicea** L. 60°—62° N.	Igaliko, 1883, BERLIN; Unartoq, J. V. 1828. — 1889, N. H. Amitsuarssuk, 1828, J. V. Frederikshaab, 1888, ROSENV.	widely distributed in the whole country.
15. **Heleocharis uniglumis** (LINK) SCHULT ab. 61° N.	Igaliko fiord, 1828, J. V. Igaliko, 1888, ROSENV. "in one small bog only"	not common.
16. **Scirpus pauciflorus** LIGHTF. 60°30′—61° N.	Igaliko, 1888, ROSENV. "in ditches on peaty soil". Unartoq, 1889, N. H. Qagssiarssuk, Igal. F. 1925. P. & P. "on a pond shore".	common in the whole country, mostly in ditches and on peat.

All are common in N. Eur. and in Atl. N. Am. Mostly *Carex panicea* is considered as an introduced in America, though it is indigenous to Nova Scotia and St. Pierre and Miquelon.

The facts enumerated favour the theory of introduction by the Norsemen. On the other hand, all aquatic and semiaquatic plants in Greenland seem to have immigrated by leaps, and eventual range extensions of the species outside the Norsemen's area — as f. inst. *C. panicea* from Frederikshaab — will make the theory more doubtful.

17. **Juncus bufonius** L.

In 1828 J. VAHL found this cosmopolitan plant growing abundantly on foot-paths between the houses and the homefields at Igaliko. Sixty years later, ROSENVINGE, and nearly a century later, A. E. & M. P. P., found it still growing as described by VAHL. The specimens are very small, 1—2 cm high (var. *parvulus* HARTM. or var. *jadarensis* BRYHN), but at the border of a ditch we found them up to 5—6 cm high. At Narssaq, in Tunugdliarfik fiord, we found, in 1925, somewhat better

specimens. ROSENVINGE made a botanical survey of Narssaq in 1888 without finding the plant there; and we may assume it to have been brought here by a live cow with the subsequent introduction of cattle from Igaliko.

ROSENVINGE (Consp. III, 714; Sydl. 181) believes that this plant was "undoubtedly" introduced by the Norse, and so does OSTENFELD, Orig. 19. There are, however, other occurrences of the plant in Greenland which make this assumption unnecessary.

In 1918 A. E. & M. P. P. found *J. bufonius* near the head of Nordre Strømfjord, just south of the great rapids (Sarfarssuaq) leading into the Ugssuit-basin (67°49′ N. 50°28′ W.) see PORSILD: Disko, p. 61. And in 1927 C. O. ERLANSSON, of the HOBBS-Expedition, found it at the head of Søndre Strømfjord, 66°55′ N. 50°42′ W. Neither of these places have ever been inhabited. According to ERLANSSON's label his plants grew "in mud of seepage water". The place I visited was remarkable for the numerous huge planes of gneissic rock which had been heavily ground and polished by former ice action. The surrounding vegetation was a deep and soft carpet of mosses, mostly *Hypnaceae*, with herbs and *Vaccinium uliginosum*. On the rock flats grew nothing but *Verrucarias*; water would ooze out from the upper edge of the moss and rinse the flat, whereby fine dust accumulated along the lower edge. On this dust *Juncus bufonius* grew.

An introduction by man to these remote and rarely visited places must be regarded as precluded.

18. **Juncus filiformis** L.

ROSENVINGE (Sydl. 185) puts this plant in a group of which he says "they may be thought introduced by the Norsemen" and OSTENFELD lists it as introduced, giving its distribution as "west coast only, from 60°—61° N."; but I have found it on the east coast, at 60°4′ and on the west coast to 62°5′ N. (PORSILD: Stray p. 13). In Julianehaab district it is recorded from nearly all the places investigated, growing in natural associations only: meadows and swampy places along brooks in thickets.

This species is common in Iceland, N. Eur. and N. Am.; it is nowhere favoured by culture, but is often observed "where bogs and pasture land meet". Nothing in its occurrence in Greenland suggests introduction by man.

19. **Juncus nodulosus** WAHL. LINDMAN: Sv. Fan. fl. 2. edit. (*J. alpinus* Scand. Autt. olim, not *J. alpinus* VILL.).

Found at Igaliko by VAHL 1828, and by BERLIN 1883, not found by ROSENVINGE 1888, nor by P. & P. 1925.

Qagssiarssuk, Igal. F. by ROSENVINGE 1888, by P. & P. 1925. Eqaluit, Igal. F. 1925, by P. & P. Both places are regularly visited by people from Igaliko, collecting hay. Last summer it was also found in the Godthaab fiord, at Itivnera, 64°22′ N., i.e. the portage between this fiord and Ameralik (M. P. P.). It grows on wet sand, on pond- and lake-shores or periodically inundated places, and sometimes also on sea shores. It varies in size from 10—25 cm. The specimens from Godthaab bore fully matured seeds in great abundance.

The Greenland specimens are much darker than Icelandic and seem to belong to the alpine race var. *rariflorus* HARTM.

The plant is fairly common, but somewhat local, in Iceland and N. Scandinavia. According to HULTÉN, the plants in N. Am. called *J. alpinus* var. *insignis* FR., or *J. affinis* R. BR. apud RICHARDSON, or *J. Richardsonianus* SCHULT. should be identical with ours. The plant is of no use as a pasture plant, is not favoured by culture, but its seeds have a mucilaginous coat whereby they may stick to footgear and be dispersed along foot-paths. There is no necessity to assume the introduction of this plant by man.

20. **Juncus squarrosus** L. has been found in three localities on the east coast between 60°—60°30′ N. and in a few more on the west in the same latitudes. It has not been recorded from Julianehaab northern district, nor from any other place in Greenland. The plant is a strictly West-European type, occurring from Spain to W. Norway, is also on the Færoes, but is absent from Iceland. It is also absent from N. America, even as an introduced plant.

Thus its occurrence in S. Greenland becomes an abnormality in its geographical distribution. ROSENVINGE (Sydl. 185) finds an introduction by man probable, and OSTENFELD ascribes its introduction to the Norsemen. The section of the country concerned had not before quite recent years been navigated by ocean-going ships, this puts an introduction in our time out of question. An introduction by the Norsemen from Norway directly is conceivable, but then it certainly is strange to find it only on places where the Norsemen have left no traces of their former presence. The single exception is the locality at the hot springs of Ûnartoq where Norse ruins are found.

The range of *Juncus squarrosus* in Greenland coincides with that of *Nardus*, though the latter is more common. They may both be relics from a milder postglacial epoch.

21. **Luzula multiflora** (EHRH.) LEJ.

This name is here not used in its wider sense, as it was used by BUCHENAU and the authors of Conspectus Fl. Grl., but in its narrower

sense, as it is used by G. SAMUELSSON in LINDMAN'S flora. Our knowledge of the distribution of the species, thus restricted is mainly due to a revision of the materials in the Botanical Museum of Copenhagen, made by Professor SAMUELSSON. Specimens collected later than this revision are mostly within the range given, and exceptions will be specially mentioned. *L. frigida* (BUCH.) SAM., which formerly was united with it, and which is the only species in Greenland, with which it could be confounded, ranges much farther to the North on both coasts, and occurs in the same section as *L. multiflora*, but on somewhat different habitats.

Of specimens in the Copenhagen herbarium, confirmed by SAMUELSSON there is a fair number between 60°10′ N. on the east coast to somewhat over 61° N. on the west, which are just the figures given by OSTENFELD. But in addition there is a sheet from East Greenland at 65°37′ N. also verified by SAMUELSSON, and from Neria, 61°33′ N. on the west coast a native collector has several times sent me specimens. Last year I found it at Ujaragssuit in Godthaab fiord, 64°50′ N. For my own identifications I take the character derived from the mature seeds as the most important, leaving aside immature specimens.

The plant grows in thickets and lowland grassy slopes or amongst luxuriant talus vegetation, whereas *L. frigida*, which may grow in low thickets too, generally occurs on heathland and rocks.

The plant is common in N. Scandinavia, in Iceland and in N. Am. In Europe it is sometimes observed following culture (LINKOLA 148, CEDERCREUTZ 108, SYLVÉN: Kult. 136). On the other hand PALMGREN, in studying the immigration of plants to the Åland Islands in the Baltic, lists it amongst the original ("ursprünglich") species. In Greenland there is no evidence of the plant's being connected with former house-sites or with man's doings at all, and I see no reason for supposing it to have been introduced, as OSTENFELD did.

22. **Betula pubescens.**

There is a good deal of disagreement about the proper naming of the treeshaped birch of South Greenland and about its genetical status. OSTENFELD, Orig. 17 simply lists it as above, without quoting author's name or any limitation except that it should be absent from America. ROSENVINGE, Consp. III, 707, has it as *Betula odorata* BECHST. var. *tortuosa* (LEDEB.) emend. ROSENVINGE, with the variety *alpestris* (FR.) emend. ROSENVINGE. WINKLER (ENGLER'S Pflanzenreich IV, Nr. 61, 1904) calls it *Betula pubescens* EHRH. var. *tortuosa* (LEDEB.) KOEHNE, and includes *Betula davurica* LEDEB. and *B. odorata* var. *alpigena* BLYTT.

Some well selected specimens from most typical and best developed

trees in the nearly undisturbed forest within the lake Taserssuaq in Tasermiut fiord were in 1926 placed before Mr. J. G. GUNNARSSON, who has been studying the relationships and crossings of the Scandinavian birches for a generation, and who, in 1925 published a monograph on them (J. G. GUNNARSSON: Monografi över Skandinaviens Betulæ. Diagnoses in Latin. With abstract in German. Arlöv 1925). He identified them and others as **B. pubescens** × **tortuosa** f. *intermedia* GUNN., stating as his opinion that the Greenland stock of tree-birches, genetically, was no pure species, but a mixture of both specific units[1]).

In one thing, however, all authors seem to agree, namely that the Greenlandic and Icelandic stock of tree-birches are identical, and as GUNNARSSON in his book describes a *B. pubescens* and a *B. tortuosa* and their hybrids from North Scandinavia, we may safely conclude that some of the Scandinavian birches are identical with the Icelandic and Greenlandic.

But the identity stops when we come to further crossings. Iceland has only one other species of birches: *B. nana*, Greenland has *B. nana* but also the American dwarf-birch *B. glandulosa*, and Scandinavia has, according to GUNNARSSON, 6 elementary species of birches, amongst which are *B. nana* too. Generally, *B. glandulosa* in Greenland ranges from 60—63° N., *B. nana* from 63° northward. At the borderline they hybridize freely.

On a place like that mentioned from Tasermiut where a compact *Betula-Sorbus*-"forest" is found, with heaths close by, or with glades with heath-vegetation, with *B. glandulosa* as a characteristic shrub, it is evident, even to a non-expert, that where the species meet, we may likely find shrubs, larger than the dwarf-birch and smaller than the tree-birch, exhibiting intermediate characters in the leaves, in the covering of the twigs, and in the forms of the fruits and their scales. Mr. GUNNARSSON in consequence, labelled a great number of specimens from this and other localities of South Greenland as *B. pubescens* × *tortuosa* × *glandulosa*; in Iceland, however, the combination *B. pubescens* × *tortuosa* × *nana* occurs.

In a number of specimens thought by the present writer to be fairly representative of true *B. nana* Mr. GUNNARSSON was able to trace "wefts" ("inslag") of *B. pubescens* × *tortuosa*; from the localities:

Qeqertalik, 66°44′ N. 1914. A. E. P. & M. P. P.,
S. Kangerdluarssuk, 67° N. 1884. WARMING & HOLM,

[1]) About *B. tortuosa* LEDEB. it may here be said that the Russian Betula-expert W. SUKACZEW (whose writings were not taken into account by GUNNARSSON) also considers this a separate species, coordinate to *B. pubescens*, but a local, subalpine plant from the Altai region only (quoted from Bot. Centralbl. 120. 315).

Arfersiorfik, 68°3′ N. 1924. M. P. P.,
Godhavn, 69°15′ N. 1912. R.Th. P.,
Svartenhuk, 72°18′ N. K. J.V. Steenstrup.

We shall return to these hybrids later. Here may only be said that these localities, different as they are in latitude and remote as some of them are from the range of the tree-birch, have this in common, that they are especially favoured places of the latitude given, and that each of the specimens of birches mentioned has been growing in company with plants which were southerly types on the spot.

Ostenfeld gives 61°35′ N. as the northern limit of his *B. pubescens*, but I have also taken it in the fiords about 62° and I am convinced that it will be found at least to the Frederikshaab Glacier, at 62°30′ N. But according to Gunnarsson's identifications all specimens north of 61° are hybrids with *B. glandulosa*, whereby this combination would seem to cover what Rosenvinge had under the name *B. odorata* v. *alpestris*.

Finally comes the most interesting name in this connection. Fernald has recently said (Persistence p. 267), that what has passed in America as *B. papyrifera* var. *minor* Tuckerm., and is known from Labrador to New Hampshire, and westwards to Minnesota and Saskatchewan, is "inseparable from the Greenland shrub known as *B. odorata* var. *alpestris*. They may constitute a distinct boreal American species."

Ostenfeld puts *B. pubescens* at the top of his list of plants brought to Greenland by the Norse settlers, a supposition which, if upheld, will be pregnant with consequences. For if the south Greenlandic birch-forest should be found to date from only some few centuries back, the silvine herbs and ferns under the birches, as well as the mosses, lichens and fungi on their roots and bark, must be still younger. And amongst these are a considerable number of strictly American types.

When Eric the Red and his friends in 986, took S. Greenland in possession, they were, to mind and mood, vikings. The idea of vikings bringing forest seeds with them, intentionally or not, and successfully starting the forestation of a subarctic country, is thoroughly inconsistent with our general knowledge of viking behaviour. In Iceland, where the written historical records are so numerous, as compared with Greenland, and where the names of places, nay even of the single farms, have been kept from the first settlers times until to-day, we are fairly well informed about the extent of the Icelandic forests of the middle ages. Stefánsson, in Flóra Íslands, p. 85, says, briefly but categorically: "Hafa menn alt frá landnámstið gert alt til að eyða þeim". (From the

very beginning of settling people have done everything to destroy them, i.e. the woods). And HELGI JÓNSSON (Bot. Tidsskr. 20 p. 32 ff.) gives vivid descriptions of the devastating of the forests by reckless lumbering and excessive grazing, of how the undergrowth was destroyed, and how, by the joint action of wind and melting water even the accmulated humus was removed. For Greenland the literary records are few; but if, in looking at the environs of the Norse house-sites in Greenland as they are today we bear in mind HELGI JÓNSSON's descriptions, we need not resort to guesses at climatic changes to account for the barrenness that now prevails.

Fortunately we have one reliable written record. It is the famous inventory of the Greenland possessions of the church in about the middle of the 14. century, made by ÍVAR BÁRÐARSON. ÍVAR was a Norwegian priest, who was sent to Greenland in 1341 or 1342[1]). with the appointment of "steward" of the possessions of the bishop-see at Garðar (now Igaliko), ÍVAR returned to Norway in about 1363 or 1364. His description of the possessions of the church has, because of its exact statements and enumerations, been the main source from which old place names have been identified.

ÍVAR's original Norwegian text is lost, but there are preserved hand written copies of several more or less erroneous Danish translations, corrupted in the final paragraphs by unauthentical emendations. I am here quoting the latest critical recension by FINNUR JÓNSSON (Det gamle Grønlands Beskrivelse. Kbh. 1930) p. 25:

"och paa høigre haand som indseigles vdj fiordenn till domkirckenn, som stander ind vdj botnen ligger en stuor skoff och hører domkircken till, vdi den samme skoff haffuer domkircken alt sin fænet, bode stuore och smaa. Domkircken eger alle Eijnersfiord, och sammeledis den stuore öö, som ligger vdenn for Eijnersfiord och hieder Renöe, saa kaldis fordj om høsten løber ther vtallige rendiur, der er allmindeligh vedtzskaff, och tha icke vden bispens orluff, och paa then øø er beste thelliesteen....."

In translation:

When sailing into the fiord (Einarsfiord, now Igaliko fiord) to the cathedral, which is standing at the head of the fiord, a large forest is lying on the right hand, belonging to the cathedral. In this forest the cathedral has all its animals, large and small (i.e. cattle and sheep). The cathedral owns the whole of Einarsfiord, and also the large island lying outside Einarsfiord, which is called caribou-island (now Akia), named so, because in the autumn innumerable caribous are running there (in the rutting season), there is common hunting, though not without the bishop's permit, and on this island is the best soapstone.....

Of this "large forest" only the most deplorable ruins are now to be seen, mostly where willows have recovered the ground. The forest behind the lake in Tasermiut, however, is fortunately so far off that

[1]) His pass-port (in Latin) has been preserved, it is dated Bergen, Aug. 8. 1341.

it has suffered very little from the post-Norwegian population; it consequently shows fairly well how far a forest can recover. On the lowermost Mountain slopes, on both sides of the valley, it is an almost impenetrable jungle, with plenty of rejuvenating aftergrowth; but the horizontal alluvial valley bottom is so badly swamped, through the filling up of the river's bed and bad drainage, that the old birches are simply dying. Not a single seedling or young specimen was found here during the writer's visit in 1925. When ARÖE, in 1832—33 investigated the ruins roads were plainly visible running from the Norse house-sites through the valley to bridges or fords on the river. We thought, on our visit, that we too could see them, but ARÖE's words which were in mind may have fathered the thought.

The Norse population was forced to levy a heavy toll on the forests. Without roaring fires their houses, built as they were of stones and sods, would turn into veritable ice-caves during the Arctic winter. Even though the living rooms were of necessity small, there were other, larger rooms to be heated. The nave of the recently excavated cathedral at Garðar measured about 18 by 12 m; it had two fireplaces. And the festival hall in the bishop's residence was 16.75 by 7.8 m (NØRLUND: Medd. om Grl. 76). They made charcoal for forging, and burnt mussel shells for lime; and it has recently even been suggested (N. NIELSEN: Medd. om Grl. 76) that they were forced to extract iron from bog-ore.

In my opinion the tree-birch of South Greenland immigrated long before the time of ERIC THE RED, perhaps under a more genial climate than that of today. If the hybrids with *B. nana*, mentioned above, can be proved genetically, they would be remarkable relics of a former larger extension. But in this case I think we should find stumps in the bogs; such have hitherto never been observed.

23. **Rumex domesticus** HARTM. has been found several times in Julianehaab district near present habitations and Norse ruins, and in one case 700′ uphill, on a moist grassy slope, not far from a Norse ruin near the shore. Besides it has repeatedly been observed as a recent introduced weed at Ivigtut, and in one case on Disko, but all these were not flowering rosettes only.

PRINTZ (Veget. Sibir. Mongol. Frontier 1921) considers this species circumpolar, but this view is not in accordance with the thorough investigations of MURBECK, so PRINTZ' conception may take the name more collectively, including *R. fennicus*, *R. arcticus* and more species. HULTÉN (Fl. Kamtch. II, 46) even doubts its occurrence in Russia and Asia and considers its E. Asian occurrences to be adventive. Its home seems therefore to be Fennoscandia where its only natural occurrence is on the sea shore.

It is strongly favoured by culture and easily dispersed by man

and by domestic animals. As a weed it ranges southward to Switzerland. It is widely distributed in Iceland but seemingly bound to cultivated places. It is absent from Atl. America.

ROSENVINGE thinks its introduction by man probable and OSTENFELD lists it amongst the Norse plants. Leaving the recent introductions out of discussion, so much more, particularly since the identification of sterile specimens is somewhat uncertain, we may safely assume that this species was brought in medieval times first to Iceland, and later to S. Greenland.

24. **Rumex Acetosa** L.

ROSENVINGE says that this species is principally to be met with on manured spots near present and former habitations, and OSTENFELD places it among the plants introduced by the Norse. This assignment had already been suggested by GRAAH (Reise 1832, p. 135), probably prompted, it is likely, by his botanical companion J. VAHL, who at that time had seen it "in locis graminosis prope domicilios (sic!) Itibliarsuk inter Julianehaab et Lichtenau".

In Iceland *Rumex* grows (STEFÁNSSON: Flóra 2. ed.) (translated) "only in the fenced yards and on pasture land even if this is not cultivated", which would convey the impression that it was introduced there. But the statement is not in conformity with the descriptions of the vegetation of Iceland. HELGI JÓNSSON writes on East Iceland that the plant, outside of cultivated spots, grows in birch-woods (p. 26), in *Dryas*-heath (p. 41), amongst dwarf-willows (p. 43), on snow-flushes (p. 43), and on moist block-talus (p. 80). On Snæfellsnes he says of the plant: common on herby slopes (p. 54), common on islands, visited by birds and inaccessible to sheep (p. 57), on slopes with heather (p. 71), amongst heather on the lava-fields (p. 87). The largest specimens he ever saw, with leaves measuring 6 by 17 cm, grew on a lava-field, sheltered from wind, at the bottom of pits, 2—5 m broad and deep, which had originated from gas bubbles.

In South Iceland HELGI JÓNSSON finds it on gravel-flats (p. 13), on moist sand flats (p. 24), on gravel slopes (p. 26), on vertical rocks (p. 29), amongst herbage at the foot of hills (p. 32) in birch-woods (p. 46). In North Iceland OSTENFELD (Bot. Tidsskr. 27. 1905) found it on a horizontal löss-plain with *Elyna* as the dominant plant.

All authors agree in stating *R. Acetosa* to be strongly favoured by culture and to be easily dispersed by man's activities, but yet the same authors do not fail to admit that there are also numbers of wild occurrences. As one of the most instructive I quote HEINTZE's topographical observations from Åsele Lappmark II, p. 60 (translated):

....natural associations: birchwoods and willow thickets, rich in

herbs, brook- and river-banks, scarcer in woods with mosses and grasses as undergrowth, on snow-flushes, on springy soil and moist block-talus; also in swamped mixed woods, on blocks covered by spruce and herbs, in open pine-barrens, on moist rocks, on borders of sedge-marshes; frequency medium-low.

....culture associations: on hard pastures, rarer on *Phleum pratense* pastures, also on borders of cultivated soil and in irrigated meadows; frequency generally medium.

....alpine associations: willow thickets and brook shores, rich in herbs, snow-flushes, rarer on rocks, talus and moist slopes, covered with mossy heather, also in a bog; frequency medium — low.

An oligotropous, hydro-mesophilous and social species which can endure quite deep shades.

R. Acetosa occurs in West Greenland from 60° at least to 62° N. and probably to the Frederikshaab Glacier. It is true that it is often found near present or former habitations, which is just what we might expect of a plant so strongly hemerophilous. But it grows besides as much or more in natural associations, just as in Iceland or Scandinavia. For the theory of introduction by the Norsemen speaks only the fact of its absence from the East coast of Greenland and from Atl. N. Am., as a native plant. Against the theory is its common occurrence north of the Norse colony, where it is only known from natural habitats. The possibility of introduction may be admitted, but the probability of its immigration before the advent of Europeans is stronger.

25. **Sagina procumbens** L. is considered by Ostenfeld, but not by Rosenvinge, to be an "Old Norse" plant. It has been found by J. Vahl from 61° N. on the east coast to about the same latitude on the west and later investigations have brought home some more specimens within this range. Its occurrence in Greenland is near the sea, amongst grasses and seemingly not connected with habitations. But in other countries it is considered hemerophilous and it enters cultivated fields and gardens as an apophytic weed. This, however, would seem to refer to a more advanced cultivation and tilling than was practised by the Norsemen of the middle ages. From present day in Iceland the species is generally mentioned as in "wild" stations only. And those localities on the east coast in which it is known are totally uninfluenced by the Norsemen.

There is hardly any support for the theory to be found in Greenland.

Common in N. Eur., Iceland and Atl. N. Am.

26. **Sagina nodosa** L. is only found in a few places in the northern section of Julianehaab district. Rosenvinge thinks its introduction

by the Norsemen possible, and OSTENFELD lists it as introduced. It is common in Iceland, Scandinavia and N. America, but it is nowhere considered hemerophilous; LINKOLA p. 277, lists it as indifferent. NORMAN, II, 174, describes vividly its remarkable indifference, not only to the chemical properties of the soil, but to moisture. It occurs on fresh soil and on brackish soil, in bogs on limestone and on siliceous cliffs. It may be found associated with aquatic plants from the sea and with *Callitriche*, and it may be seen on the driest heath soil as well as on gravel, where, whilst other plants wither, *Sagina* is still green. NORMAN noticed it drifting with sea currents.

In support of the theory of its having been introduced to Greenland there is nothing to be said except its scarcity; and being so small and inconspicuous, the plant may easily have been overlooked.

27. **Cerastium caespitosum** GIL., incl. var. or subsp. *alpestre* (LINDBL.) is by OSTENFELD, not by ROSENVINGE, supposed to have been introduced by the Norse. From the south throughout the whole of Julianehaab district it has been found in all places investigated, growing in thickets of *Betula* or *Salix* or on luxuriant slopes, amongst herbs and grasses. North of the district it has been found in several places to over 62° N. (P. & P.).

The main form of this plant has become a cosmopolitan weed, even to subantarctic S. American. OSTENFELD lists it with a G. which means a circumpolar type, but, according to Gray, Manual and numerous articles in Rhodora consulted I find it only mentioned from America as an introduced plant. This may be a mere error in printing.

In Scandinavia and in Iceland it is very common, both as a wild plant and as an anthropochorous weed. In Iceland it is even found in the barren *Rhacomitrium*-heath (H. JÓNSSON).

J. & L. p. 241 assume its immigration to N. Europe to have taken place after the retreat of the ice, contemporaneously with the birch, and the same authors say that it gained its world-wide distribution as an impurity in commercial seeds, that could not have brought it to Greenland. Locally, the plant is dispersed by seeds and by stem-fragments.

In taking hay on board their ships the emigrating Norsemen might have brought along seeds and fragments of this plant, but yet, there were no cleared and prepared fields in Greenland to recieve them on their arrival, but on the contrary a stabilized subarctic vegetation. And the theory of introduction, not warranted by the plants' occurrence in Greenland now, seems unnecessary; the plant may well have immigrated with the birch a long time before the coming of man.

28. **Stellaria media** (L.) Cyr. grows on open soil, preferably in gardens and yards and it requires a good deal of moisture. When manured places are left untouched a dense growth of native grasses invade the place and *Stellaria* is crowded out. In favourable climates it sprouts, flowers, and matures aperiodically; and — like in *Poa annua* — the seeds are able to germinate immediately after maturing, without preceding periods of rest. The seeds germinate only near the surface; but they can keep life in deeper layers for several years and may pass the intestines of different animals without loosing their germinating power. It is by all these faculties that it has developed to become the widest distributed weed in the world. (J. & L.).

Rosenvinge thinks that is was brought to Greenland by man, and Ostenfeld lists it amongst the "Old Norse" plants. As was said in a former chapter, **I**, Nr. 27, it is now found as a weed, in and outside the gardens, wherever Europeans live and keep gardens, and it is introduced every year with garden seeds and chicken food. It has besides, been found on a couple of localities in S.E. Greenland, where there is now no human habitation and where no Norsemen had settled. Furthermore, it has been noticed and stated as "wild" from places which are quite distant from both present and former habitation sites. I have elsewhere (Disko p. 72) described such a place, the base of a bird cliff in Qeqertalik fiord, 66°44′ N. where it grew abundantly between herbs and willows. But from a later visit at the same place I have been obliged to change my opinion, for happening to arrive a few days after a party of natives had been there to collect *Archangelica*, and having seen the havoc worked on the vegetation by their trampling, I could not doubt that the natives had by previous visits transferred *Stellaria* to that place from the village. A similar transfer seems likely to have happened at other places too. About one of them, mentioned by Hartz p. 14, it was expressly stated to have been near an Eskimo camp-site.

According to J. & L. *Stellaria media* has in England been found in preglacial, interglacial and postglacial deposits (Reid). On the isolated Færoese islands Jessen found it in peat deposited in the Atlantic epoch, some 5000 years ago; and its immigration to Iceland, by natural ways seems therefore very likely, and to South Greenland at least possible. Norsemen going from Iceland to Greenland and having cattle and fodder on board could hardly have avoided taking seeds of *Stellaria* with them, but it may be questioned whether successfully introduced plants were able to survive on the left over farm sites with their subsequent thick carpets of grass. From 1775, when the colony of Julianehaab was founded, there have been Europeans with gardens and domestic animals living at different places in the district and there would seem

to have been time enough for the plants to have attained that distribution which they now show.

In Nuov. Giorn. Bot. Ital. 17. 1910 A. BÉGUINOT published "Ricerche intorno al polimorfismo della Stellaria media (L.) CYR. in rapporto alle sue condizioni di esistenza, in which two main varieties with several minor forms are defined: var. *trichocalyx* TRAUTV. and var. *subgymnocalyx* BÉG. Slightly modified, they have thus been incorporated in ASCHERSON-GRAEBNER: Synopsis Mitteleur. Fl. V, 1; Scandinavian writers, however, have considered these variations negligeable, as being seemingly without geographical value, and, as BÉGUINOT himself states, both are found nearly the whole world over. In the Bot. Mus. of Copenhagen I have seen specimens identified by BÉGUINOT. There is one called v. *trichocalyx* from Igaliko "circa domum Johanes Aug. 2. 1828" J.V., whereas nearly all remaining from Greenland were named var. *subgymnocalyx*. This would seem to be of some interest in our present problem. But, in the revising specimens not seen by BÉGUINOT by means of BÉGUINOT's paper, it turned out that my specimens from Qeqertalik, mentioned above, had in the collection from 1914, a totally glabrous calyx whereas the specimens taken in 1926, from exactly the same spot, were typical *trichocalyx!*

A definite solution of the problem of whether the Greenland stock of *Stellaria media* immigrated by natural ways during the Atlantic epoch, or was introduced by the Norse colonists of medieval times, or during the present colonisation, or whether it came about through all these means appears impossible.

29. **Atriplex** sp. (**longipes**?).

In 1889 HARTZ found in Tasermiut fiord, "in the neighbourhood of Tasermiutsiaq" an *Atriplex*, new to Greenland. The plants were mere seedlings, hardly 4 cm high, they were published as *A. Babingtonii* WOODS, as this species was known also to occur in Iceland and N. Atl. America. In 1925 A. E. PORSILD and I went to Tasermiutsiaq, but without finding the plant there. Not having much time for further searching we started seawards, when, on passing a botanically promising place, we made a brief stop and found the *Atriplex* growing plentifully in a salt marsh with *Puccinellias* and halophytic *Carices*. Our plants taken on July 28th were a little better developed, erect, with few branches, and flowering, but not yet with mature fruits. But, being an annual plant, it would undoubtedly attain maturity later.

In his paper "Origin" OSTENFELD has cancelled the former identification substituting — with a question mark — the suggestion that the proper name should be *A. longipes* (DREJ.) TURESSON.

A. longipes of DREJER was proposed in 1838 in his Fl. excurs.

Hafn. p. 107, and a picture was given in Fl. Dan. tab. 2714. This picture — which is not accessible to me here — HARTMAN has called "bad and doubtful". The plant has been treated in different ways by Scandinavian authors such as HARTMAN, LANGE and WESTERLUND, finally to disappear from the small sized handbooks of RAUNKIÆR and LINDMAN, 1st edition. But in LINDMAN 2nd edition G. TURESSON has revived the name and at the same time split it into 3 coordinate maritime subspecies, one of which is called *A. longipes* (DREJ.) TURESSON. In the taxonomical arrangement it is placed between *A. hastatum* and *A. litorale* and quite far from *A. glabriusculum* (= *Babingtonii*).

According to TURESSON this plant, in its narrowest sense, is at present known from the western coast of Sweden and adjacent parts of Denmark. The essential characters are taken from the fullgrown fruits and seeds and they cannot be studied on the Greenland material available.

OSTENFELD considers this plant as having been brought to Greenland by the Norsemen. If this supposition were right we might expect it to have spread by now beyond the one or two spots upon which it has been found. My finding it in but one place only proves, to be sure, nothing, for I was hurried and had to leave. But HARTZ, travelling in that leisure which the umiaq invites spent 11 days in Tasermiut fiord, where, having found that interesting novelty, the first wild *Atriplex* from Greenland, he continued in the direction of the head of the fiord. Before he had reached it he stopped, saw and investigated a large salt marsh, the largest he had seen in Greenland, which in appearence totally recalled those salt marshes on the west coast of Denmark, and where *Puccinellia maritima* was the characteristic plant. It was an ideal place for the growth of *Atriplex*, and certainly, if the plant had been there, Dr. HARTZ, with it so fresh in mind, would not have missed it.

Over a hundred years ago JENS VAHL investigated the flora of Tasermiut, also travelling in umiaq. In that manner he spent the 12th and 13th of July of 1828 and the 27th to 29th of August; and in the following year he stayed there from the 10th to 20th of August. This most able and trained collector did find all the rare and peculiar plants, which are characteristic of Tasermiut, and all the halophytic grasses and sedges too, except *Atriplex*. I think therefore that we are justified in concluding that it did not exist there in his days. The occurrence that I saw was quite limited in area, though in that crowded patch there may have been thousands of specimens. It appeared to be the beginning of a colonisation.

If the plant should prove to be *A. longipes* and the range of the species be not much extended beyond our knowledge of it now, an introduction by means of the regular traffic between Denmark and Greenland would suggest itself. But under that hypothesis we should

certainly expect to find it now growing at the main trading port, Julianehaab. Yet a very able amateur collector, Dr. G. MELDORF, lived and collected at Julianehaab for five years, without finding it.

Tasermiut fiord is uninhabited, and probably no seagoing ship has been there since medieval times. Thus the possibilities of an introduction by man are very small and we must suppose that this plant, like other maritime plants, has drifted in to Tasermiut, as a casual immigrant from over the sea, an occurrence analogous to that of the American *Ranunculus Cymbalaria* in Ameralik fiord and its quite recent immigration to the western shores of Norway and Sweden.

30. **Capsella Bursa pastoris** L. has been found once at Julianehaab; at Narssaq, 60°55′ N. by all collectors visiting the place; and at Ivigtut repeatedly but, however, as a recently introduced weed; further at Eqaluit in Ameralik fiord (a much used fishing place); and at a bird cliff Tâterât, 65°10′ N. Of its appearance at Tâterât the collector, S. HANSEN, remarks that it grew "quite as if it were wild". I do not doubt its introduction by man, but I can see no facts supporting the theory of OSTENFELD that the Norsemen brought it. In 1932 numerous vigorous and flowering specimens were seen near a house at Godhavn, and if it were searched for it would probably be found in most gardens and chicken yards of South Greenland. It is a common weed in all grain producing countries.

31. **Drosera rotundifolia** L. has been taken at two different places near Igaliko by ROSENVINGE, 1888, where it produces mature fruits. OSTENFELD lists it as introduced by the Norsemen, but I have never seen it mentioned in literature as hemerophilous nor seen a case of dispersal by man recorded. Common in N. Eur. and N. Am.; in Iceland common in some parts, scarce elsewhere (by scarcity of *Sphagnum*?).

32. **Rubus Chamæmorus** L. is listed by OSTENFELD, with a question mark, among the plants introduced by the Norsemen. It has been found on the latitudes 60°43′ N. and from 63°45′ to 64°15′ N. on the west coast only, all localities are on the very barren outlying islands where traces of the Norse never have been found. In some places only male plants have been seen, in others only female; consequently no mature fruits are produced. The plant is common in Scandinavia and Atl. N. Am., occurring in the subarctic to arctic regions, from the Gulf of St. Lawrence to Labrador and Hudson Bay. It is absent from Iceland. There is thus no support for OSTENFELD's assumption.

33. **Rubus saxatilis** L. was found near a Norse ruin at the head of Taserssuaq in Tasermiut fiord by VAHL in 1829 and found again on the

same place 60 years later by HARTZ. HARTZ' specimens were near maturity. The plant is absent from N. Am., but common in Iceland and Scandinavia. It is very rarely mentioned as occurring on pastures, outside its natural associations; it is by some authors considered a hemerophobous plant. Yet, it may have been brought over amongst hay or in cattle or horse dung. In Scandinavia it is known to be dispersed by mammals (HEINTZE).

34. **Lathyrus maritimus** (L.) BIG.

This sea-shore plant is quite common from 60°30′ N. on the east coast to about 61° N. on the west, occurring amongst *Elymus* and also at short distances from the sea in the glades of thickets. Curiously enough it has not been found in Tasermiut fiord. It is neither confined to the Norse places nor to any human dwelling site; in fact LINKOLA states it to be indifferent to culture.

It is common in N. Eur., Iceland and Atl. N. Am. It is effectively spread by sea currents, as the seeds will float for at least 10 months; its dispersal in Greenland, however, is undoubtedly handicapped by the absence of other *Papilionaceae*, or, rather of *Bacillus radicicola*, although the plants found have well developed root tubers. The plant is readily eaten by cattle and horses, which favours OSTENFELD's theory of its introduction, although a possibility of immigration over the sea may not be excluded. The Greenland plants are, like the plants of Arctic America and Arctic Russia, pubescent, whereas the plants of Iceland, Western Norway and Europe generally are glabrous.

35. **Vicia Cracca** L.

Occurs only at Igaliko on the former home-field (tún) of the bishop-see. The oldest specimens in the Bot. Museum in Copenhagen were taken by J. VAHL, but the plant has probably been noticed before. The localities given in Consp. I, are wrong, as we may see in Grl. Hist. Mindesm. III, p. 815.

All authors agree in supposing this plant to have been brought by the Norsemen; VAHL even thinks they had it under cultivation. By the Eskimo of the present days the field is mowed for hay and grazed by cattle, and the specimens are generally weak. Still they flower regularly and may produce ripe seeds, at least in favourable seasons. NORMAN II, 212, has compared seeds from Arctic Norway with those from South Norway and found that the size of the seeds was the same, but the number of seeds developed was decreasing in the North.

In Europe it is considered strongly hemerophilous, even though natural occurrences are common.

The remarkable fact that the plant has kept its place at Igaliko for centuries, but been unable to gain new area, can hardly be explained

by other causes than the absence of *Bacillus radicicola* in uninfected soils. NORMAN l. c. thinks it dispersed to outlying islands in Arctic Norway by sea-currents. It is known that the seeds may pass the intestines of horses and cattle without loosing their power of germination.

It is common in Europe and Iceland and is also native in Atl. N. Am.

36. **Geranium silvaticum** L. is listed by OSTENFELD as introduced by the Norsemen. Unfortunately it has been so far only found once, and in a place outside the Norsemen's area "in rupibus in dumetis Salicis glaucae, in recessu intimo sinus Kangerdluarssuk prope Frederikshaab" Aug. 15th, 1886 (TH. HOLM's original label). There are hundreds of Kangerdluarssuks in Greenland and several in the district of Frederikshaab, but HOLM has, in Geogr. Tidsskr. 9. 17, described his excursion. The place in question is not named in the maps, it is a small indentation on 62°53′ N. into the peninsula east of the island Igaussaq.

The plant is widely distributed in northern Europe and Iceland, and is frequently met with in subalpine or subarctic situations. It may be found at the border of pastures. It is absent from N. Am. where it is replaced by *G. maculatum* in the Atlantic parts, *G. erianthum* in the Pacific.

The plant must be regarded as a casual immigrant by natural ways or as a relic — but not as having been introduced by man.

37. **Viola montana** L. (*V. canina* s. l. OSTENFELD Orig. W.: 60°—61°30′ N.).

This plant is listed by OSTENFELD, but not by ROSENVINGE, as an "Old Norse" plant. It is common in the whole of Julianehaab district and around Ivigtut. Outside the Norse area it has been taken at Nerutusôq, by WORMSKJOLD. It grows on rather dry and warm places, amongst grass, heather and low shrubs. In other countries it is known as an indicator of meagre soil, needing lime.

In Greenland it is not connected with present or former dwellings, and it is not considered hemerophilous by Scandinavian writers — or, at most in a very slight degree — occurring on uncultivated pastures. It is common in Iceland and Europe, but not found in N. America. This last mentioned fact seems to be the only one favouring OSTENFELD's theory. But as we have other strictly European types in West Greenland, for instance *Archangelica*, *Alchemilla* etc., which everybody considers native, the *Viola montana* may be native as well.

38. **Epilobium palustre** L.

I have previously (Disko p. 108, Stray p. 19) mentioned the Greenland plants of this species as var. *labradoricum* HAUSSKN., but having

obtained American specimens of this variety, I shall have to correct my labels. The Greenland plants are to be considered typical or, at most, identical with f. *angusta* HARTM.

OSTENFELD lists this plant between those brought by the Norse — but with a question mark. It is quite common in the whole district of Julianehaab and has been reported from 5 localities in the Godthaab fiord-region. Outside the Norse area it has been taken many times at Neria 61°33′ N. and at Narssalik 61°37′ N., and from two localities 30 miles apart on South Disko, both at the outlet of "hot" springs, namely Engelskmandens Havn 69°15′ N. and Kûgssuaq, 69°27′ N. Finally some sterile specimens from Eqaluarssuit on the southern shore of N. Strømfjord (A. E. P.) seem to belong here.

The plant grows in springy places, in moss along brooks, and often under some cover of shrubs. OSTENFELD thinks that the plants on S. Disko "might very well have been carried from South Greenland by the wind". I do not think so. It does develop seeds on Disko, and with their hairtufts they should be well fitted for being carried by the wind. But why does that *Epilobium* not grow at all the other "hot" springs on South Disko, not even at one lying barely one mile from Engelskmandens Havn? I believe *Epilobium palustre* must be considered a native plant of Greenland.

39. **Ligusticum scoticum** L. has — also with a question mark — been listed by OSTENFELD as a Norse plant. Nothing in Greenland supports this view. It is very common from the southernmost part of Greenland through Julianehaab district and the environs of Ivigtut; and it is also found in Ameralik fiord and in the Godthaab fiord-system; outside the Norse area it appears in the Frederikshaab region. As has been said by ROSENVINGE, it prefers the inner parts of the fiords, and is not found on the outlying islands. Like other sea shore plants it is somewhat nitrophilous, which accounts for its casual occurrence at the foot of bird cliffs, or, in Norway, on the cliffs; but otherwise it is not reported as hemerophilous, and in Greenland it is never seen on house-sites.

Common in N. Europe, Iceland and Atl. N. America.

40. **Rhinanthus groenlandicus** CHABERT: Bull. Herb. Boiss. 7. 1899. *Alectorolophus groenlandicus* (CHAB.) OSTENFELD emend. Botany of the Færöes P. I. 1901, p. 51, fig. 22, 1—3, *Rhinanthus oblongifolius* FERNALD: Rhodora 1907, 24. and Rh. 1910, 143 (according to FERNALD: Persistence p. 269) inclusive the variety: var. *Drummond-Hayi* (BUCHANAN WHITE) OSTENFELD l. c. p. 55 fig. 4. *Rhinanthus Crista galli* L. var. *Drummond-Hayi* BUCHANAN WHITE: Scotl. Naturalist 1885—86 p. 324. *Alectoro-*

lophus borealis STERNECK: Ann. Conserv. Jard. Bot. Geneve 3, 1899 (incomplete material).

This plant is placed by OSTENFELD amongst the "Old Norse" plants. By a misprint he gives its northern limit as 63°10′ N., instead of 65°10′ N. It is common in Julianehaab district from the Nunarssuit Peninsula (Cape Desolation) on the west coast to Lindenow fiord on the east, and it is nearly as common from Nunarssuit northwards to Frederikshaab Glacier, 62°30′ N. On the botanically nearly unexplored stretch from 62°30′—64° N. it is found in one locality; in the Godthaab fiord it occurs in all branches. Its northernmost record, so far, is Taterait, 65°10′ N. (S. HANSEN)[1]). This last locality is also in an insufficiently explored section. Its favourite habitat are the open borders of *Betula-*, *Alnus-* and *Salix*-thickets, but it is often seen amongst grasses. I have also noticed it in a bog.

I have never seen it near human dwellings nor on manured or cultivated soil, nor found it reported from such places elsewhere. OSTENFELD himself l. c. p. 51 found it on the Færoes "on luxuriant terraces of basalt, hill slopes and ravines, rocky ledges, always to be clearly distinguished from *Rh. minor* (with which it was formerly united), both with regard to its habit and habitat".

(*Rh. minor* was, by the same author, found "in fenced yards and on waste places outside the enclosures").

Nearly the same is said by FERNALD (about *Rh. oblongifolius*) which he calls "the alpine *Rhinanthus*" in distinction to *Rh. Crista galli* (= *Rh. minor*) "from sterile fields and meadows, along roadsides etc.". Only HEINTZE: Åsele II, 31, after having given a long list of lowland and alpine natural associations, adds borders of pastures and moist meadows.

There is thus no support whatsoever for the theory of introduction.

When *Rh. groenlandicus* and *oblongifolius* are united, the range of the species will be from the Commander Islands on the Asiatic side of Bering Sea to the Aleuts, Alaska—Labrador, south to White Mountains, N. H., Greenland, Iceland, Færoes, Scotland and Arctic-Alpine Scandinavia and we may with HULTÉN: Fl. Kamtch. IV, 108, justly term it an American type, rather than a Norse.

41. **Galium triflorum** MICHX.

Grows in woods and thickets of all kinds and is common in all the fiords of Julianehaab district from 60°16′ to 61° N., as well as in the fiords around Ivigtut. The first record of it in Greenland was from Kuanerssôq, 62° N. (WORMSKJOLD, refound by P. & P.). The northernmost

[1]) FERNALD: Persistence p. 269 gives the northern range as 67°; there are no Danish records so far north.

localities so far known are Fiskenæs, 63°4′ N. and Kobbefjord 64°10′ N. (W. & H.)[1]).

There are serious objections to OSTENFELD's theory of the introduction of this plant by the Norse. As will be seen above, a good deal of its area is outside the Norse districts. It has never been found near house-sites nor been reported as favoured by man's presence, in fact it is considered in Scandinavia to be a hemerophobous plant (LINKOLA p. 281, CEDERCREUTZ p. 66, 133).

It is moreover absent from Iceland, where instead several hemerophilous *Galium*-species exist which were not brought to Greenland. It has a wide area in Northern Scandinavia, but its stations are widely separated, generally beginning at the heads of the fiords and not reaching high altitudes. The possibility of getting it in the hay collected by the emigrants was therefore very small. Outside of Scandinavia proper it is known from S. Finland, Ingermanland and from two relic-stations in the Swiss Alps. In N. Am., however, it is common from Labrador, Newfdl. and N. Sc. southward (see map in FERNALD: Persistence p. 319).

The plant belongs to the same boreal-subarctic element as *Sorbus decora*, *Streptopus amplexifolius*, *Coptis groenlandica*, *Anemone Richardsoni*, *Orchis rotundifolia*, *Carex pratensis* etc. etc. which immigrated to Greenland in postglacial time from America.

42. **Erigeron borealis** (VIERH.) SIMM. (formerly in Scandinavia confused with *E. alpinus* L. or with *E. neglectus* KERN.; *E. acris* var. *oligocephalus* FERN. & WIEG. p.p. Rh. 1910, p. 226). It grows in glades and in thickets along brook banks, on luxuriant slopes and in sheltered places. It is found on both coasts to 62° N, and on the west coast in a few places between 63°45′ and 65°12′ N., the localities lying in a section which is botanically insufficiently investigated. (All limiting records have been verified by Dr. VIERHAPPER).

In northern Europe it is a subalpine type, at home in the *Betula*- and *Salix*-zone of the mountains. It is common in Iceland and has recently been found in Newfoundland, Gaspé peninsula, and southern Labrador (FERNALD 1926, p. 237).

In Greenland it has never been reported as a weed either from present or from former habitations. Scandinavian authors generally report it from natural associations, only HEINTZE (Åsele II, 22) mentions occasional occurrences on pasture land and once on a foot path. STEFÁNSSON: Fl. Ísl. says "grows only on pastures, fenced or open", but this is not well in accordance with the writings of HELGI JÓNSSON,

[1]) By a slip OSTENFELD has omitted the last mentioned place and given the range as 60°27′ to 63°4′ N.

who has it from woods, natural slopes rich in grasses and herbs, moist talus, and vertical rocks; he only occasionally mentions it from the fenced fields.

There is nothing to support OSTENFELD's theory of its introduction, by the Norse settlers.

43. **Matricaria ambigua** (LEDEB.) KRYL. Fl. Alt. III. 1904. p. 625[1]) Syn.: *Chrysanthemum grandiflorum* HOOK. ap. PARRY: App. 2. Voy. 398. 1825; (not *C. grandiflorum* BOUSS. 1804), (is here described from two small islands, inhabited by birds, both on 69°30′ N. in the N.W. corner of Foxe Basin). — *Pyrethrum inodorum* and var. *nanum* HOOK: Fl. Bor. Am. I. 320. 1833; — *Matricaria inodora* var. *phaeocephala* RUPR.: Fl. Samojed. Cisural. Beitr. Pfl. Russ. Reich. 2. 42. 1845; LANGE: Consp. and most Scandinavian authors; — *Pyrethrum ambiguum* LEDEB.: Fl. Alt. IV. 1833 p. 118; — (?) *M. inodora* var. *borealis* HARTM.: Fl. Sc. ed. 5. 1849; — *M. grandiflora* BRITT.: Mem. Torr. Bot. Cl. 5. 340, 1894, not *M. grandiflora* POIR. 1813; — *M. inodora* var. *grandiflora* (HOOK.) OSTENFELD: Vidensk. Selsk. Skr. Chra. 1909. Nr. 8, 1910; — *Tripleurospermum Hookeri* SCH.-BIP.: Bonplandia I. 151. 1853; — *Chamomilla Hookeri* (SCH.-BIP.) RYDBERG: N. Am. Fl. 34. 231, 1916.

Until a final decision, obtained through genetical investigations and experimental cultures, can be obtained it seems most practical to keep the perennial, arctic, circumpolar plant as a separate species instead of uniting it with the annual weed *M. inodora*. It is nearer related to the perennial *M. maritima* L. which in several modern handbooks, f. inst. LINDMAN, HEGI etc. is kept separate, although this plant has a quite different geographical distribution: western Europe from Spain to Great Britain, and the southern shores of the Baltic Sea. As a species-name HOOKER's is the oldest; but as the combination *Matricaria grandiflora* is pre-emptied, the next valid species-name will be LEDEBOUR's. OSTENFELD has l. c. expressed some doubt about the identity of LEDEBOUR's plant with RUPRECHT's but this seems unnecessary, since RUPRECHT, who as OSTENFELD says, had the clearest and best understanding of the plant, expressly states their identity in another paper: "Inter *Matric. inodorae* var. *phaeocephalam* RUPR. et *Pyrethr. ambiguum* LEDEB. discrimen non perspicio "Consp. Fl. Insul. Now. Seml. Acta Horti Petrop. V. 1. Nr. 59, 1871. The same is said repeatedly in TRAUTVETTER's writings, and I have specimens, labelled *Matricaria ambigua* LEDEB., by R. POHLE, taken in 1904 "ad ostium fl. Dwina".

The oldest specimens from Greenland in the Bot. Museum at Copenhagen are labelled by J. VAHL: 1) "in locis fertilioribus humidiusculis in propinquitate litoris sinus Igaliko, distr. col. Julianehaab. Floret

[1]) Title quoted from PRINTZ, not seen.

Juli et Aug." and 2) "Igaliko, in glareosis 1828 Aug." which seems to show that he found them only on the sea shore and not at former or present habitations, for he would certainly have stated it, as was his usage. All later collectors have found it in Julianehaab district mostly as a weed on refuse and fencing walls around the gardens. It has also been found in a number of places between 60°4′ N. (EBERLIN) on the east coast to 61°15′ N. on the west (ROSENVINGE); some of the places were on the sea shore; in other places the plant was a weed. The southernmost locality and those on the east coast are not in the vicinity of Norse homesteads.

ROSENVINGE (Sydl. p. 186) says (translated) "*Matricaria* grows principally on manured spots which perhaps may be considered an indication of its having been introduced by man". This argument may be somewhat justified for the time it was written, but it is no more valid, as the very extensive, floristic and ecologic, literature published since has shown that nearly every boreal seashore plant is nitrophilous and able to develop to an anthropochorous weed.

OSTENFELD p. 18 places the plant among the "Old Norse" and gives as its range "W.: 61°—60°" only, whereby he unjustly neglects an occurrence in high-arctic N.E. Greenland. *Matricaria* was found on some Eskimo ruins at the head of Kjerulf fiord, 73°10′ N., the first time this place was visited by white man). In his summary of the distribution of Greenland plants, where the latitudes of plant occurrences are tabulated, OSTENFELD notes, on p. 62, this higher latitude for *Matricaria*, but with a question mark, in the corresponding column. But there is absolutely no reason for questioning this record. It was made by that unimpeachable authority, the late Professor A. G. NATHORST who, on the spot, was fully aware of the significance of the find, as may be seen in his work "Två Somrar i Norra Ishafvet" Vol. II, p. 254, 1900. It was listed in DUSÉN's paper and KRUUSE, who had seen the specimens, mentioned them in his enumeration of the plants of N.E. Greenland (p. 184)

In other countries of its range *Matricaria ambigua* is often found on manured spots. From Nov. Zeml. LYNGE says (Rep. Sc. Res. Norw. Exp. to Nov. Zeml. 1921. Nr. 13, "in the regions visited, almost restricted to the vicinity of human habitations or to rookeries"; and STEFFEN (Beih. Bot. Centralbl. 44, 1928. Abt. II, p. 323: "am liebsten in der Nähe menschlicher Siedlungen und Vogelfelsen, seltener auf der steinigen Tundra und an geschützten Hängen." Both authors, however, also mention occurrences under conditions uninfluenced by man.

Matricaria ambigua is also known from continental Arctic Russia and Scandinavia, parts, however, from which no Norse emigrations started.

The *Matricaria* of Iceland and the Færoese Islands occurs on sea

shores but is more common on bird rookeries and around human dwellings. It may be considered an archeophyte which has gained its present distribution after man's settling. If the plant of Iceland, Færoes and South Greenland, which by all writers, relying mostly in recent days, on the authority of OSTENFELD, passes as *Matr. inodora* var. *phaeocephala* or var. *grandiflora*, could instead be classified with the temperate *Matr. maritima* of western Europe, leaving the high-arctic occurrence in N.E. Greenland as the single record of *Matr. ambigua*, things would become much clearer. Lack of material prevents the present writer from more than suggesting that a revision be made.

All facts considered, the *Matricaria* of South Greenland may have been introduced by the Norsemen, or it may have immigrated before man's arrival as we have assumed for other marine species; but the *Matricaria* from N.E. Greenland must be considered a naturally immigrated plant.

44. **Achillea Millefolium** L. var. **nigrescens** E. MEY.: Pl. Labr. 65. 1830. *A. Millefolium* LANGE, ROSENVINGE, OSTENFELD and most authors on the flora of Greenland. — *A. nigrescens* (E. MEY.) RYDB. N. Am. Fl. 34, 3. 1916, 221; — *A. borealis* BONG. Mem. Ac. St. Petersb. VI, 2. 149, 1832, according to FERNALD: Persist. 269.

The Greenland specimens which I have seen are:

Ilua, 59°55′ N. cultivated from Frederiksdal (LUNDHOLM);

Frederiksdal, 60° N. 1828 (J. V.); 1883 (BERLIN); 1888 (LUNDHOLM); 1900 (MELDORF); 1925 (P. & P.);

Igaliko, 61° N., as a garden weed (P. & P.);

Ataneritsoq, 61° N., near a Norse ruin, 1888 (ROSENVINGE);

Qagssiarssuk, Tunugdliarfik fiord, 61°5′ N., 1829, (J. V.); 1880, (C. PETERSEN); 1925, (P. & P.);

Kiagtût, in a valley, 61°12′ N., 1900, (L. MATHIESEN);

head of Tunugdliarfik fiord, near a Norse ruin, 1888, (ROSENVINGE);

Fiskenæs, 63°5′ N., outside a garden (KORNERUP);

Godthaab, 64°11′ N., "in hortis", 1830, (J. V.); 1907, (S. HANSEN).

ROSENVINGE (Sydl. 181) writes (translated):—

"*Achillea Millefolium* is somewhat more widely distributed (than *Vicia Cracca* and *Juncus bufonius*); it is found on some inhabited places of the outlying coast where it may have been recently introduced. It is also found on several places in the interior parts of Tunugdliarfik fiord. I found it only near Norse ruins and on a single Eskimo camping place. Whether VAHL also found it only near the ruins is not evident from his (unpublished) diary. He there writes that, on the plain connecting Sangmigssoq (Qagssiarssuk?) with Sermilik fiord, he "saw good vegetation. And in several places, in the interior of the valleys, large

stretches grown with *Achillea.*" Since ruins are numerous in these parts, the growth of the Yarrow may have been connected with them. On the other hand, possibilities for dispersal have been especially favourable here, partly because of the great number of ruins, partly because of the extraordinary fertility of the soil. The words of VAHL suggest that a dispersal had taken place".

It may in this connection be remarked that two handwritten labels of VAHL, which presumably express his opinion correctly, contain no suggestion that he associated the plants with Norse ruins. VAHL writes: 1) "in locis graminosis"; 2) "in locis fertiloribus humidiusculis per pedes alpium", whereas he in the label for the Godthaab specimens expressly states "in hortis".

ROSENVINGE and OSTENFELD, both treating the Greenland plant as typical *Achillea Millefolium*, consider it undoubtedly introduced by Norse colonists. But all the specimens that I have seen from Julianehaab district belong to the variety *nigrescens* E. MEY., which again, according to FERNALD is identical with *A. borealis* BONG., constituting an American species, that ranges from E. Siberia across the American continent to the Atlantic coast, from N. H. and Newfdl. to Labrador and Hudson Bay.

The specimens from Godthaab and Fiskenæs are not at hand. They are, most likely recent introductions, and of the typical form.

In Iceland and N. Europe the typical form is widespread in natural associations and on cultivated soil. This form is everywhere strongly hemerophilous and possesses several successful ways of dispersal. It is supposed to have immigrated to Europe immediately after the retreat of the ice.

By J. & L. the typical form is said to have been introduced to N. Am. but, according to GRAY Manual and several modern writers, there are native occurrences too. About the behaviour of var. *nigrescens* to culture I have been unable to find direct information, but considering its near relation to the type it may be supposed to be hemerophilous also.

45. **Gnaphalium uliginosum** L. has been found three times: at Qagssiarssuk, Tunugdliarfik fiord, 1828, (J. V.) and Narssaq, 1888, by ROSENVINGE, 1900, by MELDORF. Most of the specimens were barely a couple of cm high.

Richly branching, flowering and fruiting specimens, 30 cm high, were found on Disko, at the Arctic Station. They appeared in flower-pots, having been introduced with seeds.

This plant belongs to a group of small, annual, nearly cosmopolitan weeds which frequently appear, when some moist soil is laid bare, for instance, on sea-, lake- or river-shores, or in dried out ponds; they easily disappear again. About its place of origin opinions disagree, we

do not even know whether it is native in Southern Scandinavia. J. & L. states it as introduced in N. Am., but GRAY Manual considers it native.

In Iceland it is found on a few places in the S.W., but only near the hot springs. It occurs in a similar way in Kamtchatka.

ROSENVINGE thinks it very likely introduced into Greenland by man, with which opinion we may readily agree. But for OSTENFELD's theory of an introduction by the Norsemen, we find no support.

46. **Leontodon autumnalis** L. is common in S.W. Greenland on grass-land and Carex-meadows near present and former habitations in Tunugdliarfik and Igaliko fiords, from Julianehaab inwards, 60°49′—61° N.; it has never been found outside this section. The numerous varieties and forms described in floristic handbooks seem not to be constant. The Greenlandic (and Icelandic) stock may perhaps be classed as var. *asperior* WAHL., which by SIMMONS: Kir. 143 is considered the native wild form in N. Scandinavia.

In Iceland and N. Europe the plant is common, both as a native and as a weed. In N. America it is considered only an introduced from Europe.

All facts considered, it is highly probable that, as held by ROSENVINGE and OSTENFELD, the plant was introduced to Greenland by the Norsemen.

47—51. **Hieracium.**

Greenland has not yet been visited by a botanist who specialized in this difficult genus; and in the collections of the large herbaria, the specimens of *Hieracium* from Greenland are somewhat scarce, owing to the fact that the species are late flowering, southern types, and difficult to obtain before that time when the collector must embark for home. Yet, as specimens brought to Europe during the last 50 years have brought no changes in the identifications, we may conclude that we know by now the number of the species existing here, even if their range probably may in the future be somewhat extended.

Regretting that our greatest outhority of north European *Hieracia*, Dr. DAHLSTEDT in Stockholm, who published such admirable papers about the Icelandic (Ark. f. Bot. 3, 10. 1910)[1]) and the Færoese *Hieracia* (Bot. of the Færöes II, 625, 1903), never has published this opinions about the relationships and probable age of the Greenland species I am obliged to guess briefly at the relations of the Greenlandic species, compared with the Icelandic and Scandinavian.

The following tabulated view shows the *Hieracium* flora of Greenland compared with that of Iceland.

[1]) A similar treatment, abridged for the purpose, is given by DAHLSTEDT in the new edition of STEFÁNSSON: Flóra Íslands 1924, which at the same time contains an additional plant of interest in our study, namely *H. hyparcticum* var. *Islandiæ* DAHLST. found once in N. Iceland.

HIERACIUM

Subgenus and Section	represented in Iceland by	Occurrence of Greenland species outside Greenland	represented in Greenland by	range
Subg. **Pilosella**	2 species		(absent)	
— **Archieracium** ..				
I. **Alpina**				
1. *Eualpina*	8 species	Iceld., arct.alp. Europe	1. **H. alpium** L. *genuinum* DAHLST.	W.: 60°-62°22′; E.: 60°45′; 71°
2. *Nigrescentia*	7 species	Iceld. v. *Islandiæ*	2. **H. hyparcticum** ALMQ.	W.: 60°-61°13′; E.: 60°4′-60°10′
3. *Depilata*	(absent)		3. **H. livido-rubens** ALMQ.	W.: 60°-67°10′: E.: 60°-61°37′; 65°-66°
II. **Cerinthoidea**	2 species		(absent)	
III. **Oreadea**	3 species		(absent)	
IV. **Vulgata**			(absent)	
1. *Silvaticiformia* ..	13 species		(absent)	
2. *Vulgatiformia*...	5 species			
V. **Rigida**	(absent)		(absent)	
VI. **Prenanthoidea**				
1. *Alpestria*	4 species	Newfdl. Antic. Labr.	4. **H. groenlandicum** ALMQ.	W.: 60°-67°, 69°35′; E.: 60°-65°, 66°-67°
2. *Euprenanthoidea*.	3 species		5. **H. amitsokense**(ALMQ.)DAHLST.	W.: 59°55′-60°18′; E.: 60°7′
VII. **Foliosa**	1 species	? Lappland[1])	6. **H. rigorosum** (LAEST.) ALMQ.	W.: 60°-61°33′

[1]) I cannot see, whether *Laestadius*' herbarium-name really refers to a Greenland plant, or to a Lapponian. The name is not entered in the Scandinavian manuals.

Of Iceland's 49 species of *Hieracium* only two are identical with plants outside Iceland, namely the widely distributed and undoubtedly preglacial *H. alpinum* and the supposed preglacial *H. thulense* (sect. Prenanth. Eupr.). Of *H. hyparcticum* (sect. Alp. Nigresc.) from Greenland there is a variety in Iceland. The remaining 46 species are so far endemic in Iceland.

Of these species twelve (namely 1 of Alp. Eualp., 3 of Alp. Nigr., 6 of Vulgat. Silv., 1 of Prenanth. Alp. and 1 of Prenanth. Eupren.) are not nearly related to any other species, known to Dr. DAHLSTEDT. He thinks they have originated at a very early postglacial epoch, from alpine or subalpine ancestors, now extinct.

The largest group, 24 species, are nearly related to Scandinavian alpine or subalpine species. They represent the sections Alp. Eualp. with 6 sp.; — Alp. Nigr. with 4 sp.; — Vulg. Silv. with 8 sp.; — Vulg. Vulg. with 3 sp.; — Pren. Alp. with 3 sp.; — and Fol. with 1 sp.

An Atlantic group of 7 species is related to Færoese, Scotch, or western Scandinavian species. Here come 2 sp. of the section Cerinthoidea, which ranges from Spain to Great Britain and the Færoes, 3 sp. of Oreadea which in S. Scandinavia inhabit the lower mountains, near the sea, or shores of the greater lakes, and finally 2 sp. of Vulg. vulg. which are widely distributed from temperate to boreal climates. This group is undoubtedly much younger in Iceland than the other, and Dr. DAHLSTEDT thinks that its occurrence in Iceland supports a theory of a late postglacial land-connection between Iceland, the Færoes and Scotland. A possible introduction by man is not considered in DAHLSTEDT's paper.

Returning to Greenland, we may safely regard *H. alpinum* as an old citizen of the flora. Its much larger area on the east coast than on the west indicates clearly whence it came. It flowers earlier than the remaining species of *Hieracium* and fruits abundantly; yet it seems to experience difficulties in gaining new area N. of the Frederikshaab Glacier.

OSTENFELD, of course, leaves this species out of his enumeration of the "Old Norse" plants; but he lists 4 species as introduced, omitting, merely by a slip, it seems, *H. amitsokense*. OSTENFELD thinks that all these are descendants of species, now extinct, that were brought in by the Norse settlers. They consequently, must be very young; and their occurrence "somewhat beyond the bounds of the original settlements", he explains as due to their having "achenes admirably adapted to be carried by the wind".

It may here be remarked that OSTENFELD's expression "somewhat beyond" must, in view of the facts, be taken to mean 6 to 7 degrees of latitude on both coasts, i.e. in northerly-southerly extent three times

that of the Norse settlement in the south; and in the range of one species, *H. groenlandicum*, the environs of Gulf of St. Lawrence must also be included. The ancestors of the Greenland species must have been plants of arctic-alpine habitats; this is shown by the sections to which they belong. The ships of the Norse settlers of Iceland and Greenland cleared almost exclusively from western Norway 59°—64° N., Bergen and Nidaros (Throndhjem) being the most important ports. And when they loaded fodder for their cattle, it was natural that they should take it from near the port of departure, rather than from the mountains. The likelihood of introducing arctic-alpine types would thus be very slight.

Moreover these types are nowhere recorded as hemerophilous, whereas the species of the subgenus *Pilosella*, and of the largest section *Vulgata* are known to be hemerophilous, favoured by, and often following, culture. If any *Hieracium* species were fit for introduction by man, we should certainly expect them to be amongst these groups; but they did not come over.

How difficult a transferring of *Hieracium* in Greenland may be is shown by a case reported in the III. chapter.

The *Hieracia* of Greenland grow in the birchwoods and in thickets of *Alnus*, *Sorbus* and *Salix*. They are never seen on ground in any way influenced by man.

We must also consider the fact of the not unimportant American range of *H. groenlandicum*: W. Newfdl., Anticosti, Mingan Islands and S. Labrador peninsula, where it is a strictly European type, not related with any American species.

To the present writer the nature of the occurrences of *Hieracium* in Greenland and the fact that one of them ranges to Atl. N. America, indicate an immigration at a far remoter time than the era of Norse settlement, and probably contemporaneously with the Birch and a great number of other southern types.

As a conclusion we may list the plants discussed above into groups according to the larger or smaller probability of an introduction to Greenland by the Norse settlers.

I. Plants probably introduced to Greenland by the Norse settlers.

Anthoxanthum odoratum, *Carex Lyngbyei*, *C. rostrata*, *Rumex domesticus*, *Vicia Cracca*, *Leontodon autumnalis*. **6 species.**

II. Plants for which an introduction by the Norsemen is possible but which may just as well have immigrated by natural ways.

Nardus stricta, *Agrostis stolonifera*, *Puccinellia maritima*, *Carex Goodenowii*, *Carex Oederi*, *Carex panicea*, *Heleocharis uniglumis*, *Scirpus pauciflorus*, *Juncus squarrosus*, *Sagina nodosa*, *Rubus saxatilis*, *Lathyrus maritimus*, *Viola montana*, *Matricaria ambigua* (N. B. in S. Greenland; the occurrence in N.E. Greenland being an immigration). **14 species.**

III. Plants undoubtedly introduced by man, and probably during the two centuries of the present colonisation. These species also may have been brought over by the Norsemen, but, bound to culture as they are, they could scarcely have survived the period that elapsed between the Norsemen's extinction and the resettling of Norse house-sites.

Poa annua, *Stellaria media*, *Capsella Bursa pastoris*, *Gnaphalium uliginosum*. **4 species.**

IV. Plants which have immigrated to Greenland by natural ways, probably during a more genial postglacial epoch. The hypothesis of introduction by the Norsemen is not supported by their occurrence in Greenland or adjacent countries.

Zostera marina, *Poa nemoralis*, *Carex polygama*, *Carex stylosa*, *Juncus bufonius*, *Juncus filiformis*, *Juncus nodulosus*, *Luzula multiflora*, *Betula pubescens*, *Rumex Acetosa*, *Sagina procumbens*, *Cerastium caespitosum*, *Atriplex* (?) *longipes*, *Drosera rotundifolia*, *Rubus Chamaemorus*, *Geranium silvaticum*, *Epilobium palustre*, *Ligusticum scoticum*, *Rhinanthus groenlandicus*, *Galium triflorum*, *Erigeron borealis*, *Achillea Millefolium* v. *nigrescens*, *Hieracium livido-rubens*, *Hieracium hyparcticum*, *H. groenlandicum*, *H. amitsokense*, *H. rigorosum*. **27 species.**

Thus the "Old Norse" element of the flora of Greenland must with some certainty be limited to 1.5 per cent. instead of 13 per cent. as given by OSTENFELD. By the uniting of groups I and II we obtain the highest possible percentage: 5 per cent.

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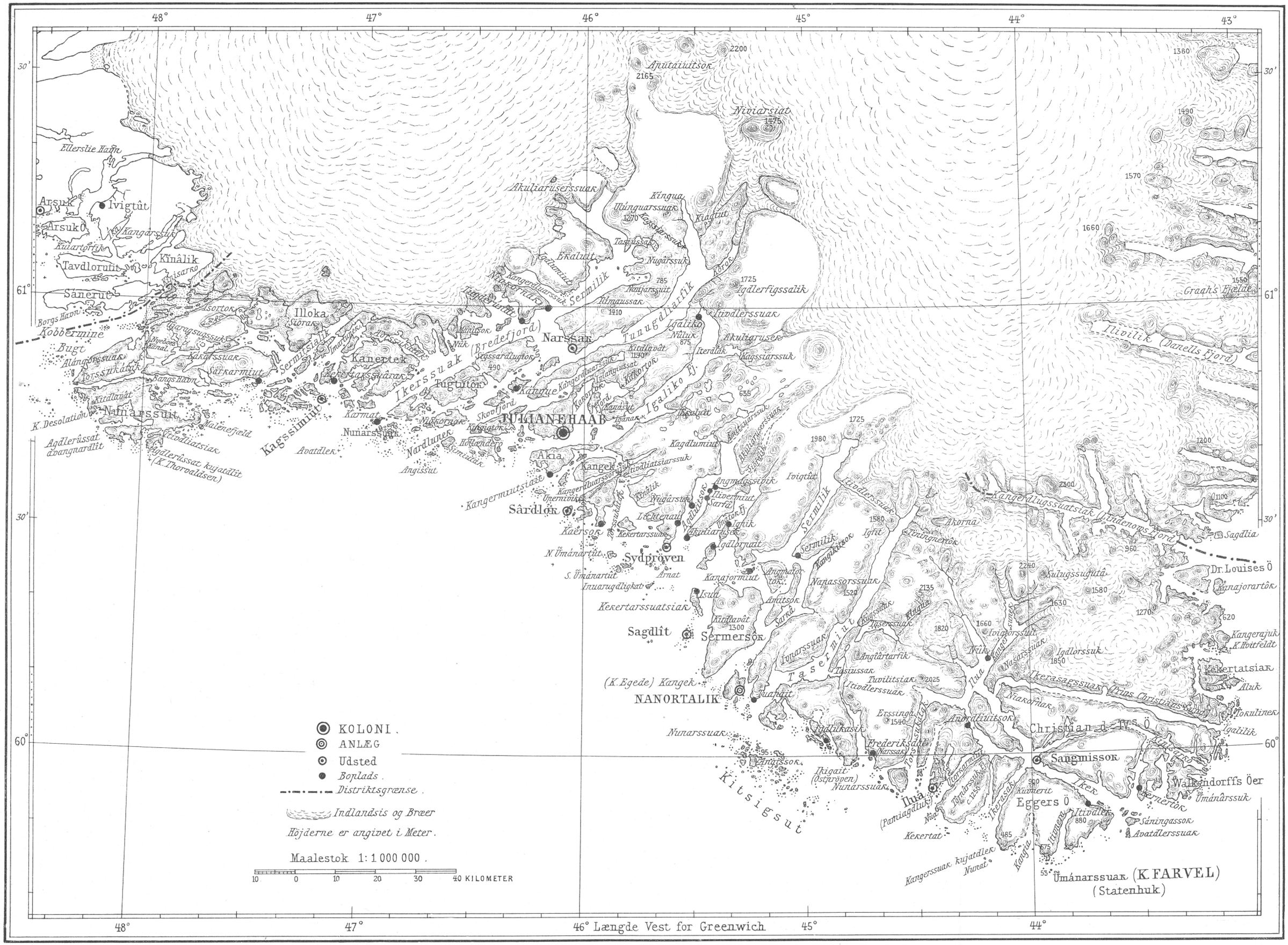
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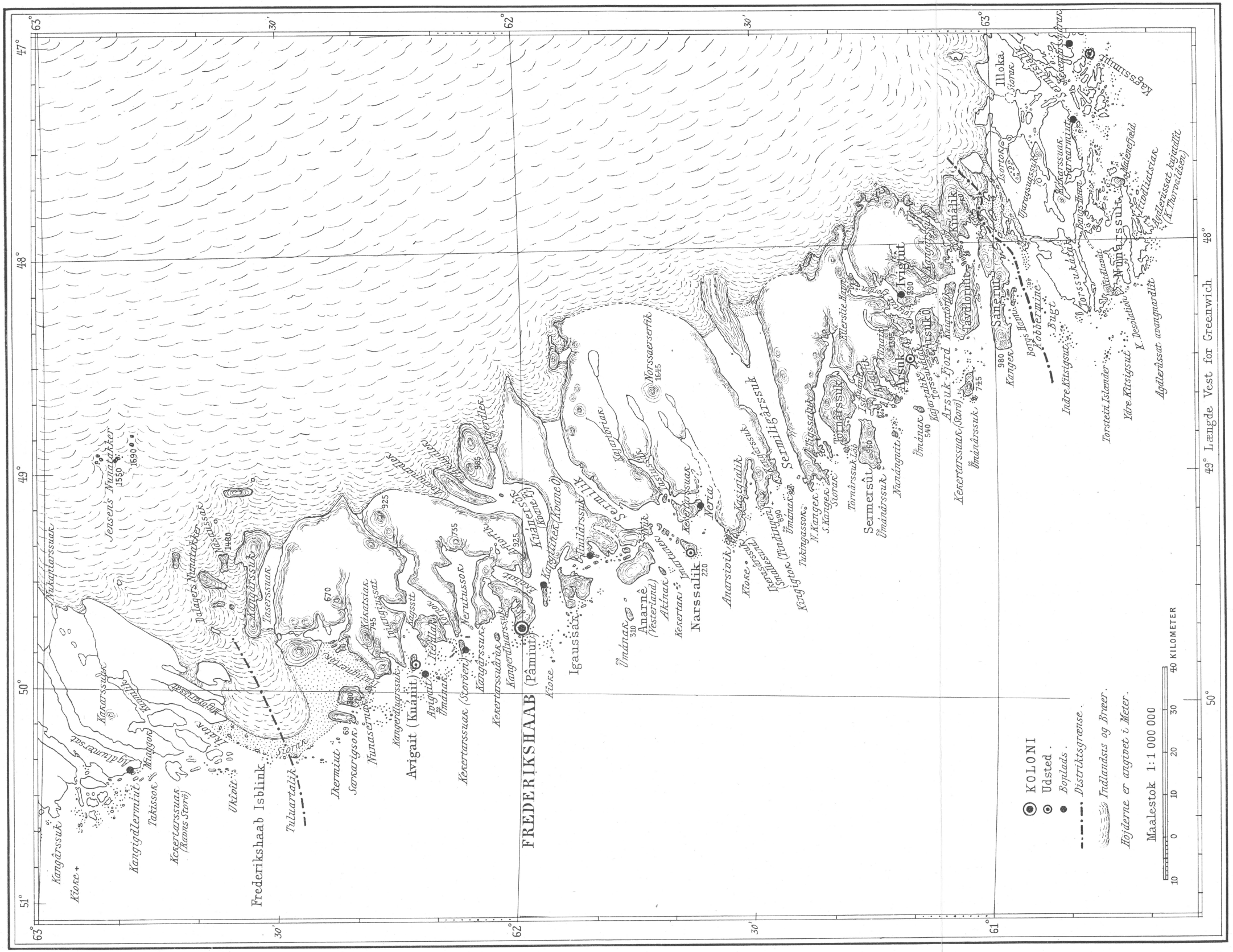
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48°
47°
46°
45°
44°
43°
30'
61°
60°
Ellerslie Havn
Arsuk
Ivigtût
Arsuk Ø
Kangârssuk
Kulartôrfik
Kinâlik
Tavdlorutit
Sânerut
Borgs Havn
Kobberminé
Bugt
Alângorssuak
Torssukátak
Nyeboes Kanal
Kakarssuak
Sârkarmiut
Bangs Havn
K. Kitdlavit
K. Desolation
Nunarssuit
Agdlerussat dvangnardlit
Agdlerussat kujatdlit (K. Thorvaldsen)
Malenefjeld
Tavdliatsiak
Kagssimiut
Illoka
Storø
Asortok
Imarugssuak
Nordre Kanal
Kanertek
Kangârssuarâra
Ikerssuak (Bredefjord)
Tugtutôk
Karmat
Nunarssuit
Avatdlek
Nardlunes
Skovfjord
Mikorajak
Kutsutôk
Hollænderø
Simiutâk
Angissut
JULIANEHAAB
Igaliko Fj.
Igaliko
Narssak
Tunugdliarfik
Sermilik (Bredefjord)
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(Statenhuk)
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ANLÆG
Udsted
Boplads.
Distriktsgrænse.
Indlandsis og Bræer
Höjderne er angivet i Meter.
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46° Længde Vest for Greenwich

The Frederikshaab District.


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Isortoq
Sermilik
Norssaersêrfik
1645
Kangârssuk
Kiâne
Kangigdlermiut
Tukissoc
Magtoq
Kexertarssuaq
(Kaoms Storø)
Ukinit
Frederikshaab Isblink
Tuluartalik
Storø
Ikermiut
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Sarkarigsoc
Nunasêrnigsât
Kangerdlugssuk
Avigait (Kuánit)
Kexertarssuaq (Storøen)
Kangârssuk
Kexertarssuârsuk
Kangerdluarssuk
FREDERIKSHAAB (Pâmiut)
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Igaussâk
Ûmánaq
Anarnê
(Vesterland)
Aktinaq
Kexertaq
Narssalik
220
Anarsivik
Kiâne
Ivigtut
Arsuk
Arsuk-Fjord
Kangârssuk
Kexertarssuaq (Storø)
Ûmánaq
Sermersût
Ûmánarssuk
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