

MEDDELELSER OM GRØNLAND

UDGIVNE AF

KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND

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THE SCORESBY SOUND COMMITTEE'S 2ND EAST GREENLAND
EXPEDITION IN 1932 TO KING CHRISTIAN IX.s LAND

LEADER: EINAR MIKKELSEN

PHYTOGEOGRAPHICAL STUDIES OF THE
GREENLAND FLORA

BASED UPON INVESTIGATIONS OF THE COAST BETWEEN
SCORESBY SOUND AND ANGMAGSSALIK

BY

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WITH 13 FIGURES IN THE TEXT AND 1 PLATE

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On the Scoresby Sound Committee's 2nd East Greenland Expedition I had the opportunity to undertake botanical investigations and collections along the coast, partly in the area between Cape Dalton and Kangerdlugssuak (Blosseville's Coast from lat. 69°26' to about lat. 68°.) partly in Lake Fjord (66°20') and Angmagssalik (65°37').

The collections chiefly consisted of land plants, phanerogams and cryptogams. Only in Kangerdlugssuak, and then even within a sharply defined period, was it possible to undertake dredgings of marine algæ, and besides these a few plancton hauls were made in the various fjords.

The ecological investigations consisted in a floristic-statistic examination of the most important communities of plants within the area visited. These will be published in a separate article.

Finally I have fixed the flower-buds of various plants for a cytological investigation of certain interesting genera.

Until the Scoresby Sound Committee's 2nd East Greenland Expedition the distance between Scoresby Sound and Angmagssalik was undoubtedly the part of Greenland which, from a botanical as well as from other points of view, was least known. In this district (No. IV east) the only material at the disposal of OSTENFELD (1926) for his list of species found, were the investigations and collections undertaken in 1900 by KRUUSE and HARTZ at Cape Dalton, Turner Sound and Turner Island (KRUUSE and HARTZ 1911), and by AMDRUP on his boat-expedition in 1900 (KRUUSE 1905). From later years a Norwegian expedition to Kangerdlugssuak (1931) supplied OSTENFELD's list of species with one (*Diapensia lapponica*), LID (1932), raising the sum total to 130 species. However, in this list Ostenfeld included about 15 species "which are not actually recorded from here, but occur both to the north and south", and as several of these have not yet been found in the area, they should, pending further finds, be left out of consideration, the number of species known before 1932 thus being 115.

The following list of plants gives the distribution of the species, not only in the area investigated, but also, for comparison, in the two adjoining districts, Angmagssalik (III) and Scoresby Sound (V). The letter prefixed to the name of the species indicates its geographical type of distribution, according to OSTENFELD (1926).

A₁ = higharctic species, which are almost entirely limited to arctic regions and are able to live under very hard conditions.

A₂ = arctic species which are generally found in arctic regions, but also occur outside these.

S = subarctic species, the chief distribution of which is outside the arctic regions, but which now and then are to be found high up in the arctic regions.

Where alterations have been made in the specifications of OSTENFELD I have put an *.

The letters above the other columns indicate the localities along the coast, the boundaries of which will be discussed in detail in the following; + means that the species has been found in the area, but gives no information as to whether it is of common or rare occurrence. Wherever possible, I have by a series of figures (from 5 to 1) tried to illustrate the more or less common occurrence of the species within the area in question. By using this procedure, also in other parts of Greenland, it will be possible gradually to ascertain what is the chief area of distribution of the species.

5: very common (important constituent of several closed formations).

4: common (more scattered occurrence, rarely dominating).

3: here and there (intermixed in formations).

2: rather rare (rarely met with in the area).

1: very rare (found once or twice in a carefully investigated area).

The figures from Angmagssalik and Scoresby Sound are based upon the indications of KRUUSE (1912) and HARTZ (1895).

When the figure in locality A and N is given in italics, it means that the species is only found in the interior of the country.

Localities. (See Plate I).

- A: Scoresby Sound, OSTENFELD's district V.

B: 69°35'—69°55', Turner Sound and Island. (KRUUSE and HARTZ 1905).

C: 69°20'—69°35', the Cape Dalton region. (KRUUSE and HARTZ; BÖCHER 1932).

D: 69°10'—69°20', Barclay Bay — Knighton Bay.

E: 69°—69°10', d'Aunay Bay.

F: 68°48'—69°, the region round Store Glacier. (AMDRUP 1900, WAGER 1932).

G: 68°35'—68°48', the Cape Daussy region.

H: 68°25'—68°35', the region round Cape Ravn.

The Kangerdlugssuak area:

I: Mikis Fjord 68°10', the valley between Mikis Fjord and Watkins Fjord.

J: Kangerdlugssuak, outer part, about 68°—68°10' cf. the map, Fig. 2.

K: Kangerdlugssuak, inner part, about 68°10'—68°40'.

L: 66°30'—68° (KRUUSE).

M: 65°55'—66°30' (KRUUSE, BÖCHER) northern fjords in Angmagssalik

N: 65° — about 65°55' southern Angmagssalik District.

OSTENFELD's district IV

OSTENFELD's district III.

List of Plants.

		A	B	C	D	E	F	G	H	I	J	K	L	M	N
Equisetum arvense.....	S	4	..	4	3	3	..	4	3	4	..	..	?	+	3
Equisetum variegatum	A ₂	4	+	+	..	..	..	..	..	5	..	..	..	+	2
Lycopodium alpinum.....	A ₂	2	..	..	..	..	..	..	3	..	2	2	?	4	4
Lycopodium annotinum	S	3	..	..	..	..	..	..	..	..	..	3	..	3	3
Lycopodium Selago	A ₂	4	+	+	..	..	..	1	4	3	3	4	3	4	4
Botrychium lunaria	S	1	..	..	..	..	..	..	3	..	..	..	..	..	2
Botrychium lanceolatum.....	S	..	..	..	..	..	..	..	2	..	..	..	..	..	1
Asplenium viride	S	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Cystopteris fragilis.....	S	4	+	3	..	4	+	3	4	4	4	4	?	4	4
Dryopteris fragrans	A ₁	2	..	..	..	..	..	..	..	..	..	..	..	..	..
Dryopteris phegopteris	S	..	..	..	..	..	..	..	..	..	..	..	..	..	3
Dryopteris Linnæana.....	S	..	..	..	..	..	..	..	..	..	..	..	..	2	3
Polystichum lonchitis	S	..	..	..	..	..	..	..	1	..	..	..	..	2	3
Woodsia glabella.....	A ₁	2	..	..	..	..	..	..	1	..	..	..	..	..	2

		A	B	C	D	E	F	G	H	I	J	K	L	M	N
<i>Woodsia ilvensis</i>	S	4	+	..	..	..	+	..	3	4	4	4	4	4	4
<i>Juniperus communis</i>	S	..	..	..	..	..	..	..	..	..	..	..	?	4	4
<i>Betula nana</i>	A ₂	5	4	?	..	..	..	..	..	..	..	..	..	2	4
<i>Callitriche anceps</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	1
<i>Callitriche verna</i>	S	3	..	..	..	..	..	..	..	..	..	..	..	..	3
<i>Arenaria ciliata</i> ssp. <i>pseudofrigida</i>	A ₁	3	4	+	..	..	..	..	..	..	..	..	..	..	..
<i>Cerastium alpinum</i>	A ₂	4	4	5	4	5	+	4	4	5	4	4	4	4	5
<i>Cerastium trigynum</i>	A ₂	4	+	4	3	4	+	4	5	5	5	4	4	4	5
<i>Honckenia peploides</i>	S	4	..	..	..	..	..	..	..	..	..	..	..	..	4
<i>Melandrium apetalum</i>	A ₁	3	+	2	..	..	..	..	..	..	..	..	..	..	..
<i>Melandrium triflorum</i>	A ₁	4	?	?	..	..	..	..	..	..	..	..	..	..	..
<i>Minuartia biflora</i>	A ₂	4	4	4	4	4	+	4	4	4	4	4	4	4	4
<i>Minuartia rubella</i>	A ₂	4	4	3	..	..	..	3	..	..	..	3	..	3	3
<i>Minuartia stricta</i>	A ₂	1	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Sagina caespitosa</i>		..	..	..	..	..	..	..	..	..	..	..	..	..	2
<i>Sagina intermedia</i>	A ₂	?	+	..	..	..	+	3	3	4	..	4	+	3	3
<i>Sagina Linnæi</i>	S	..	..	..	..	..	+	..	3	3	+	..	..	..	3
<i>Silene acaulis</i>	A ₂	5	4	4	4	4	+	4	5	4	4	5	4	5	5
<i>Stellaria borealis</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	3
<i>Stellaria humifusa</i>	A ₂	4	4	..	..	..	..	..	..	..	..	..	..	3	4
<i>Stellaria longipes</i>	A ₁	4	+	3	..	..	..	..	..	..	..	..	..	..	..
<i>Viscaria alpina</i>	A ₂	4	..	..	..	..	3	3	4	4	4	4	4	4	4
<i>Sedum acre</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	2
<i>Sedum annuum</i>	S	..	..	..	..	..	..	..	4	3	..	..	?	3	3
<i>Sedum roseum</i>	S	4	+	4	2	4	+	1	5	5	4	3	4	5	5
<i>Sedum villosum</i>	S	..	..	..	..	+	..	2	3	..	..	?	2	3	3
<i>Arabis alpina</i>	A ₂	4	+	4	3	4	..	4	4	3	3	2	3	4	4
<i>Arabis Holboelli</i>	A ₂	4	+	..	..	..	..	..	..	..	..	..	..	..	..
<i>Braya glabella</i>	A ₁	3	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Braya purpurascens</i>	A ₁	3	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Cardamine bellidifolia</i>	A ₂	4	+	+	3	..	..	4	3	4	4	3	4	3	4
<i>Cardamine pratensis</i> var. <i>augustifolia</i>	S	3	..	..	..	..	..	2	3	..	..	..	..	..	2
<i>Cochlearia officinalis</i> var. <i>grønlandica</i>	A ₂	3	2	2	..	..	..	..	..	..	..	..	2	..	4
<i>Draba alpina</i>	A ₁	4	4	4	4	3	..	3	..	..	..	..	..	..	?
<i>Draba aurea</i>	A ₂	4	..	..	..	..	..	..	..	..	..	..	2	..	3
<i>Draba cinerea</i>	A ₁	+	..	(+)	..	+	..	..	..	..	..	..	..	..	(+)
<i>Draba cinera</i> × <i>rupestris</i> ?.....		..	..	..	..	..	..	..	..	..	+	..	..	..	..
<i>Draba crassifolia</i>	A ₂	3	..	3	..	..	..	..	..	3	3	2	..	..	1
<i>Draba crassifolia</i> × <i>lactea</i> ?.....		..	..	..	+	..	..	..	..	..	..	..	..	..	..
<i>Draba crassifolia</i> × <i>nivalis</i> ?.....		..	..	..	+	..	..	..	..	..	..	..	..	..	..
<i>Draba daurica</i>	A ₂ ?	4	..	3	..	..	..	..	..	..	..	..	..	..	..
<i>Draba incana</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	2
<i>Draba lactea</i>	A ₁	4	+	+	..	+	..	..	..	..	..	..	..	..	..
<i>Draba lactea</i> × <i>rupestris</i>		..	..	..	..	..	..	..	+	..	..	..	..	..	..
<i>Draba nivalis</i>	A ₂	4	+	3	3	..	..	..	3	..	..	+	3	2	3

		A	B	C	D	E	F	G	H	I	J	K	L	M	N
<i>Draba nivalis</i> × <i>rupestris</i>		..	..	+	..	+	..	..	..	..	..	..	..	..	..
<i>Draba repens</i>	A ₂	3	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Draba rupestris</i>	A ₂ *	?	..	3	..	..	..	3	3	4	4	4	4	4	4
<i>Draba subcapitata</i>	A ₁	+	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Lesquerella arctica</i>	A ₁	4	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Subularia aquatica</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	1
<i>Empetrum nigrum</i> var. <i>hermafroditum</i>	A ₂ *	3	2	2	1	2	+	5	5	5	5	5	5	5	5
<i>Hippuris vulgaris</i>	S	3	..	..	..	..	..	..	..	..	..	..	..	..	2
<i>Chamænerium angustifolium</i>	S	..	..	..	..	..	..	..	..	..	..	..	?	3	5
<i>Chamænerium latifolium</i>	A ₂	4	+	1	2	3	..	4	5	5	5	4	3	4	5
<i>Epilobium arcticum</i>	A ₂	3	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Epilobium anagallidifolium</i>	S	..	..	..	(1)	..	..	..	4	..	2	..	?	3	3
<i>Epilobium Hornemanni</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	2	3
<i>Epilobium lactiflorum</i>	S	..	..	..	(1)	..	..	..	4	3	..	..	?	2	3
<i>Epilobium palustre</i>	S	..	..	..	(2)	..	..	..	..	..	..	..	..	..	..
<i>Papaver radicatum</i>	A ₂	4	+	3	2	..	+	..	2	..	..	1	1	..	1
<i>Koenigia islandica</i>	A ₂	3	+	+	..	..	..	2	..	..	..	..	2	2	3
<i>Oxyria digyna</i>	A ₂	5	5	5	4	4	4	4	5	5	5	5	5	5	5
(<i>Polygonum aviculare</i> ; introduced)	S	..	..	..	..	..	..	..	..	..	..	..	..	..	+
<i>Polygonum viviparum</i>	A ₂	5	5	5	5	5	5	5	5	5	5	5	5	5	5
<i>Rumex acetosella</i>	S	3	..	..	..	..	..	..	..	..	..	..	..	..	2
<i>Coptis grönlandica</i>	S	..	..	..	..	..	..	..	..	..	..	..	?	3	3
<i>Ranunculus acer</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	3
<i>Ranunculus affinis</i> ¹⁾	A ₁	2	..	+	..	..	..	1	..	..	..	..	..	..	..
<i>Ranunculus glacialis</i>	A ₂	4	4	4	4	4	+	4	2	4	4	4	4	3	3
<i>Ranunculus hyperboreus</i>	A ₂	3	..	+	..	..	..	..	..	..	..	..	..	2	3
<i>Ranunculus pygmaeus</i>	A ₂	4	+	4	3	?	+	4	5	4	4	4	4	4	4
<i>Ranunculus nivalis</i>	A ₂	3	..	+	..	..	..	..	..	..	..	..	..	..	..
<i>Ranunculus reptans</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	1
<i>Ranunculus sulphureus</i>	A ₁	3	..	2	..	..	..	..	..	..	..	..	..	..	..
<i>Ranunculus trichophyllus</i>	S	2	..	..	..	..	..	..	..	..	..	..	..	..	1
<i>Thalictrum alpinum</i>	S	3	..	3	..	..	..	..	2	5	..	..	?	4	5
<i>Alchemilla alpina</i>	S	..	..	..	..	..	..	..	5	5	2	..	?	5	5
<i>Alchemilla acutidens</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	2
<i>Alchemilla filicaulis</i>	S	..	..	..	(1)	..	..	..	3	5	4	..	?	5	5
<i>Alchemilla glomerulans</i>	S	1	..	..	..	..	..	..	5	5	..	..	?	4	5
<i>Alchemilla pseudomicans</i> sp. n. . .	S	..	..	..	..	..	..	..	?	..	2	..	..	..	..
<i>Comarum palustre</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	3
<i>Dryas integrifolia</i>	A ₂	2	..	..	..	..	..	..	..	..	..	..	..	3	3
<i>Dryas octopetala</i>	A ₂	5	+	2	..	2	..	..	..	..	..	..	..	..	..
<i>Potentilla anserina</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	3
<i>Potentilla emarginata</i>	A ₁	4	+	+	..	..	..	..	2	..	..	..	..	..	1
<i>Potentilla Crantzii</i>	S	4	+	4	2	5	?	2	4	4	4	3	+	4	4
<i>Potentilla nivea</i>	A ₁	4	+	+	..	..	..	..	..	..	..	..	..	..	1
<i>Potentilla pulchella</i>	A ₁	3	+	..	..	..	..	..	..	..	..	..	..	..	..
<i>Potentilla tridentata</i>	S	..	..	..	..	..	..	..	..	..	1	..	3	?	3

¹⁾ In KRUSES collections from Cap Dalton THORV. SØRENSEN found *Ranunculus auricomus* var. *glabrata*. Lynge.

		A	B	C	D	E	F	G	H	I	J	K	L	M	N
<i>Sibbaldia procumbens</i>	A ₂	4	+	3	3	4	?	3	4	5	5	4	4	5	5
<i>Salix arctica</i> (Hybrides)	A ₁	5	+	4	4	..	..	+	+	..	+	+	..	..	..
<i>Salix arctophila</i> (Hybrides) ¹⁾	A ₂	+	+	+	+	+	+	4	4	5	5	5	5	5	5
<i>Salix glauca</i> (Hybrides) ¹⁾	A ₂	+	+	+	+	+	+	4	5	5	5	5	5	5	5
<i>Salix herbacea</i>	A ₂	5	5	5	5	5	5	5	5	5	5	5	5	5	5
<i>Saxifraga aizoides</i>	A ₂	3	..	..	..	..	..	..	..	1	2	..	2	2	3
<i>Saxifraga aizoon</i>	A ₂	3	..	..	..	..	2	..	..	3	2	3	2	3	4
<i>Saxifraga cernua</i>	A ₂	4	4	4	4	4	4	4	4	5	5	4	4	4	4
<i>Saxifraga caespitosa</i>	A ₂	4	4	4	4	4	4	4	4	4	4	4	4	4	4
<i>Saxifraga hieraciifolia</i>	A ₂	3	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Saxifraga nivalis</i>	A ₂	3	..	3	3	4	+	4	4	4	4	4	4	4	4
<i>Saxifraga niv. var. tenuior</i>	A ₂	+	..	+	..	+	+	4	+	4	+	+	..	..	3
<i>Saxifraga oppositifolia</i>	A ₂	4	4	4	4	4	4	4	4	4	4	4	4	4	4
<i>Saxifraga rivularis</i>	A ₂	4	4	4	3	?	?	4	5	4	4	4	4	4	4
<i>Saxifraga stellaris</i>	S	..	..	..	..	..	..	..	..	..	..	..	3	3	4
<i>Saxifraga stell. var. comosa</i>	A ₁	4	4	4	..	..	..	..	..	..	..	..	..	..	..
<i>Saxifraga tricuspidata</i>	A ₁	2	2	2	2	..	..	..	..	..	..	..	..	..	..
<i>Angelica Archangelica</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	?	3
<i>Viola palustris</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	?	4
<i>Mertensia maritima</i>	A ₂	..	..	..	..	..	..	..	..	..	..	..	..	..	1
<i>Campanula rotundifolia</i>	S	4	+	3	3	3	..	3	5	5	4	4	4	4	4
<i>Campanula uniflora</i>	A ₂	3	+	+	..	..	..	..	..	..	..	..	..	..	2
<i>Antennaria alpina</i>	A ₂	4	4	4	4	4	4	4	4	4	4	4	4	4	4
<i>Antennaria alpina var. glabrata</i> ..	A ₂	3	+	3	..	4	..	..	..	(+)	..	..	..	..	1
<i>Antennaria grønlandica</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	1
<i>Arnica alpina</i>	A ₁	4	4	3	..	4	..	..	..	..	..	2	..	..	1
<i>Erigeron compositus</i>	A ₁	3	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Erigeron eriocephalus</i>	A ₁	+	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Erigeron unalaschensis</i>	A ₂	+	+	4	..	4	..	3	+	4	4	+	+	+	+
<i>Erigeron uniflorus</i>	A ₂	?	..	..	+	..	..	..	+	4	+	..	+	+	+
<i>Gnaphalium norvegicum</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	?	4
<i>Gnaphalium supinum</i>	A ₂	..	..	..	..	..	..	..	3	4	3	3	?	+	4
<i>Hieracium alpinum</i>	S	3	+	..	..	3	..	..	4	5	4	5	5	5	5
<i>Hieracium grønlandicum</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	2
<i>Hieracium hyparcticum</i>	S	..	..	..	..	..	..	..	..	..	..	..	?	3	4
<i>Taraxacum arcticum</i>	A ₁	+	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Taraxacum brachyceras</i>	A ₂	+	..	..	..	..	..	..	..	..	..	4	..	..	..
<i>Taraxacum croceum</i>	S	4	+	4	3	5	?	3	5	5	4	4	5	5	5
<i>Taraxacum phymatocarpum</i>	A ₁	3	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Diapensia lapponica</i>	A ₂	4	..	..	..	..	..	..	..	..	..	4	+	4	4
<i>Arctostaphylos alpina</i>	A ₂	4	+	+	..	3	..	3	..	..	..	..	..	..	..
<i>Bryanthus coeruleus</i>	A ₂	3	+	+	..	3	..	3	4	4	3	4	+	4	4
<i>Cassiope tetragona</i>	A ₁	5	5	5	5	4	..	..	..	1	1	4	..	..	1
<i>Cassiope hypnoides</i>	A ₂	3	+	3	2	3	+	4	4	4	4	5	4	4	4
<i>Loiseleuria procumbens</i>	A ₂	..	..	..	..	..	..	..	..	2	..	3	4	5	5
<i>Rhododendron lapponicum</i>	A ₂	4	+	..	..	..	..	..	..	..	..	3	..	3	3
<i>Vaccinium uliginosum var. micro-</i> <i>phyllum</i>	A ₂	5	5	5	5	5	5	5	5	5	5	5	5	5	5

¹⁾ At Cape Daussy a *Salix*-individual was collected whose general appearance suggests intermixture with *Salix uva ursi*. (det: G. SEIDENFADEN).

		A	B	C	D	E	F	G	H	I	J	K	L	M	N
<i>Vaccinium uliginosum</i> var. <i>genuina</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	3	+
<i>Gentiana aurea</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	..	+
<i>Gentiana nivalis</i>	S	?	..	..	..	..	..	4	3	2	..	..	3	3	
<i>Gentiana tenella</i>	A ₂	1	..	..	..	..	..	..	..	..	..	..	..	?	
<i>Thymus arcticus</i>	S	..	..	..	..	..	..	..	..	..	..	?	4	4	
<i>Pinguicula vulgaris</i>	S	1	..	..	..	..	..	3	..	..	2	..	2	3	
<i>Pirola grandiflora</i>	A ₂	4	..	+	3	2	..	2	..	..	..	..	..	1	
<i>Pirola minor</i>	S	..	..	..	..	..	..	1	4	..	..	?	3	4	
<i>Plantago juncooides</i> var. <i>glauca</i> ...	S	..	..	..	..	..	..	..	..	..	..	..	..	1	
<i>Armeria vulgaris</i> var. <i>sibirica</i>	A ₂	3	..	..	..	..	..	..	..	..	..	..	..	2	
<i>Galium Brandegii</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	1	
<i>Bartschia alpina</i>	A ₂	..	..	..	..	..	1	3	4	4	4	4	4	4	
<i>Euphrasia latifolia</i>	A ₂	3	+	+	3	3	..	..	..	3	3	..	?	3	
<i>Pedicularis flammea</i>	A ₂	4	+	+	..	..	2	4	4	4	3	?	3	4	
<i>Pedicularis hirsuta</i>	A ₁	4	4	4	2	..	+	4	4	4	4	4	3	3	
<i>Pedicularis lapponica</i>	A ₂	4	..	+	..	4	..	..	..	..	..	..	..	..	
<i>Veronica alpina</i>	A ₂	3	+	4	3	4	?	3	4	5	4	4	+	4	
<i>Veronica fruticans</i>	A ₂	2	+	..	2	3	+	4	4	4	2	..	3	3	
<i>Carex alpina</i>	A ₂	1	..	..	..	..	1	..	..	..	..	..	..	..	
<i>Carex atrata</i>	S	..	..	..	..	..	..	..	..	..	..	..	1	1	
<i>Carex atrofusca</i>	A ₂	+	..	..	..	..	..	..	..	..	..	..	..	..	
<i>Carex bicolor</i>	A ₂	1	..	..	..	..	..	..	..	..	..	1	..	..	
<i>Carex brunnescens</i>	S	..	..	..	..	..	..	..	..	..	..	..	..	1	
<i>Carex capillaris</i>	A ₂	4	+	..	2	..	..	3	..	3	4	2	2	2	
<i>Carex capitata</i>	A ₂	..	..	..	..	..	..	..	..	..	..	1	..	1	
<i>Carex glareosa</i>	A ₂	+	..	+	..	..	..	..	3	3	..	3	4	4	
<i>Carex incurva</i>	A ₂	3	..	..	..	..	..	..	..	..	..	..	..	..	
<i>Carex Lachenalii</i>	A ₂	4	..	+	..	3	..	4	4	4	4	3	3	3	
<i>Carex Macloviana</i>	A ₂	2	..	..	..	..	..	2	..	..	..	..	..	3	
<i>Carex microglochin</i>	A ₂	2	..	..	..	..	..	..	..	..	..	..	2	2	
<i>Carex misandra</i>	A ₁	+	..	..	..	..	..	..	..	..	1	..	..	..	
<i>Carex nardina</i> var. <i>Hepburnii</i>	A ₂	4	4	4	3	4	?	5	4	4	4	5	4	4	
<i>Carex parallela</i>	A ₂	2	..	..	..	..	..	..	..	..	..	..	..	..	
<i>Carex pedata</i>	A ₂	3	+	..	..	..	3	3	..	3	3	1	..	..	
<i>Carex rariflora</i>	A ₂	3	..	?	..	..	..	..	..	..	..	?	4	5	
<i>Carex rigida</i> ¹⁾	A ₂	5	+	5	3	4	?	5	5	5	5	5	5	5	
<i>Carex rotundata</i>	A ₂	1	..	..	..	..	..	..	..	..	..	..	..	2	
<i>Carex rufina</i>	A ₂	..	..	..	..	..	..	..	..	..	..	..	1	1	
<i>Carex rupestris</i>	A ₁	5	+	3	..	..	..	..	..	..	2	..	2	1	
<i>Carex saxatilis</i>	A ₂	5	..	..	..	..	..	..	..	..	..	..	..	..	
<i>Carex scirpoidea</i>	A ₂	3	+	3	3	4	?	4	5	5	5	5	5	5	
<i>Carex subspathacea</i>	A ₂	3	+	..	..	..	..	..	..	..	..	..	3	4	
<i>Carex supina</i>	S	3	..	..	..	..	..	..	..	..	..	..	2	2	
<i>Carex ursina</i>	A ₂	2	+	..	..	..	..	..	..	..	..	..	..	..	
<i>Elyna Bellardii</i>	A ₂	4	..	..	..	..	..	..	..	..	4	..	..	2	
<i>Cobresia bipartita</i>	A ₂	2	..	..	..	..	..	..	..	..	..	..	..	..	
<i>Eriophorum polystachyum</i>	S	4	..	..	..	..	..	..	..	..	..	..	..	..	

¹⁾ *Carex rigida* forma *Biglovii* was found in Loc. I, K, M and N.

		A	B	C	D	E	F	G	H	I	J	K	L	M	N
Eriophorum Scheuchzeri.....	A ₂	5	..	+	..	..	..	..	..	..	..	3	..	4	5
Scirpus caespitosus var. austriaca..	S	..	..	..	..	..	..	..	4	..	..	4	+	+	4
Agrostis borealis.....	A ₂	2	..	..	..	..	..	..	4	5	5	5	?	+	5
Agrostis canina.....	S	..	..	..	..	..	..	..	..	..	..	..	..	..	3
Alopecurus alpinus.....	A ₁	4	+	..	..	..	..	..	..	..	..	..	..	..	..
Alopecurus aristulatus.....	S	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Arctagrostis latifolia.....	A ₁	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Calamagrostis purpurascens.....	A ₂	4	+	..	..	..	..	..	..	..	..	..	..	..	..
Calamagrostis neglecta.....	S	3	..	..	..	..	..	..	..	..	..	..	..	3	4
Phippsia algida.....	A ₂	4	4	4	4	3	?	4	4	4	4	4	4	3	3
Deschampsia alpina.....	S	..	..	..	..	..	..	..	..	..	..	..	?	3	4
Deschampsia flexuosa.....	S	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Festuca ovina (var.).....	A ₂	4	+	3	..	..	..	4	3	4	4	4	+	4	4
Festuca rubra.....	S	4	..	..	..	..	?	..	..	..	..	..	..	3	4
Hierochloë alpina.....	A ₂	5	..	..	..	..	..	..	..	..	..	3	..	..	..
Pleuropogon Sabinei.....	A ₁	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Phleum alpinum.....	S	..	..	..	..	..	..	..	4	4	..	3	?	4	5
Poa abbreviata.....	A ₁	?	..	..	..	..	..	..	..	..	..	..	..	..	..
Poa alpina.....	A ₂ *	4	+	3	3	4	+	5	5	5	4	4	4	5	5
Poa alpina f. vivipara.....	A ₂	..	..	+	+	..	..	+	+	..	..	..	..	..	..
Poa alpigena.....	A ₂ *	4	..	..	..	..	..	..	3	3	..	..	+	4	4
(Poa annua; introduced).....	S	..	..	..	..	..	..	..	..	..	..	..	..	..	(4)
Poa arctica (rigens).....	A ₁	4	4	4	4	4	?	4	3	4	4	4	+	4	5
Poa glauca.....	A ₂	4	4	4	..	+	..	4	5	5	4	4	4	5	5
Poa nemoralis.....	S	..	..	..	..	..	..	..	..	..	..	..	..	1	3
Puccinellia angustata.....	A ₁	3	..	..	..	..	..	..	..	..	..	..	..	..	2
Puccinellia phryganodes.....	A ₂	4	+	..	..	..	..	..	..	..	..	..	..	3	5
Puccinellia retroflexa.....	S	..	..	..	..	..	..	..	..	..	..	..	..	..	3
Puccinellia Vahlia.....	A ₁	3	..	..	..	..	..	..	..	..	..	..	..	..	..
Trisetum spicatum.....	A ₂	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Juncus arcticus.....	A ₂	4	..	..	..	..	..	..	..	..	..	..	..	..	1
Juncus biglumis.....	A ₂	4	..	..	..	..	..	1	1	..	..	..	..	1	2
Juncus castaneus.....	A ₂	3	..	..	..	..	..	..	..	..	..	..	..	..	1
Juncus supinus.....	S	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Juncus trifidus.....	S	3	+	..	2	4	?	4	4	4	5	5	5	5	5
Juncus triglumis var. albescens...	A ₂	3	+	..	..	..	..	..	..	..	..	..	..	..	1
Luzula arcuata ssp. confusa.....	A ₂	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Luzula frigida.....	A ₂	2	..	..	..	..	..	..	..	..	..	..	..	2	3
Luzula nivalis.....	A ₁	3	..	..	..	..	..	..	..	..	..	..	..	..	..
Luzula spicata.....	A ₂	4	+	3	3	4	?	4	4	4	5	4	4	5	5
Triglochin palustris.....	S	..	..	..	..	..	..	..	..	..	..	..	..	..	+
Tofieldia coccinea.....	A ₁	2	..	..	..	..	..	..	..	..	..	..	..	..	..
Tofieldia palustris.....	A ₂	2	..	..	..	..	..	..	4	4	4	4	+	3	4
Habenaria albida.....	S	..	..	..	..	..	..	..	..	..	..	..	..	..	3
Habenaria hyperborea.....	S	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Potamogeton filiformis.....	S	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Sparganium affine.....	S	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Total...		169	86	87	58	59	47 (35)	67	91	82	76	82	96 (73)	121 (118)	181
		169	150										181		

As appears from the list of plants, there are a number of species which have an equal distribution and occur with the same frequency along the whole coast, from 72° to 65°. On the other hand, at least as many have an unequal distribution within the area. In the following the distribution of these species will be explained in detail, and it proves that they can be grouped in the following manner:

S. I. Species with their northern limit in the coastal zone of Scoresby Sound.

It already appeared from the investigations made by SEIDENFADEN (1931) that a great number of species extend some distance farther north than Scoresby Sound, and when the botanists spending the winter there have finished their work, the result, it is to be expected, will be that only a very small number of species have their actual northern boundary in the coastal zone of Scoresby Sound. Their number will hardly exceed 15, examples of these being *Taraxacum croceum*, *Diapensia lapponica*.

S. II. Species with their northern limit on the coast between 66° and 69°, but which in the north keep to the interior of the country.

1. Northern limit on the coast at about 69°, farther north only in the interior.

Veronica fruticans. Jack. Gaaseland in Scoresby Sound, Turner Sound, the coast south of Cape Barclay 69°15'.

Bryanthus coeruleus. (L) Dippel. Inner part of Scoresby Sound, Turner Sound, the coast south of 69°25'; frequently occurring south of 68°31'.

Hieracium alpinum. (L) Backh. Most frequent in the inner part of Scoresby Sound; of frequent occurrence only in the coast land south of 68°31'.

Juncus trifidus. L. Inner part of Scoresby Sound, Turner Sound, the coast south of 69°15'. Of frequent occurrence only south of 68°31'.

2. Northern limit on the coast at 68°30'—68°50', farther north only in the interior.

Gentiana nivalis. L. The inland north of Scoresby Sound (TH. SØRENSEN 1933). From 68°31' and towards the south of common occurrence in the coast land.

Viscaria alpina. (L) Don. Inner part of Scoresby Sound. From 68°48' (Store Glacier) and towards the south of common occurrence in the coast land. Farther north, however, found in a single locality at the coast. (VAAGE 1932.)

<i>Lycopodium alpinum</i> . L.	} Inner part of Scoresby Sound — coastal zone south of 68°50'— 68°30'.
<i>Botrychium lunaria</i> (L) Sw.	
<i>Alchemilla glomerulans</i> . Bus.	
<i>Saxifraga aizoon</i> . L.	
<i>Pinguicula vulgaris</i> . L.	
<i>Agrostis borealis</i> . Hartm.	
<i>Carex Macloviana</i> . D'Urv.	

3. Northern limit on the coast between 66° and 68°; then inland.

Lycopodium annotinum. L. Inner part of Scoresby Sound, inner part of Kangerdlugssuak, from Lake Fjord (66°20') also in the coast land.

Draba aurea. M. Vahl. Inner part of Scoresby Sound, Cape Warming 67°01' (KRUUSE), Angmagssalik.

Carex microglochin. Wg. Inner part of Scoresby Sound, Lake Fjord 66°20', Angmagssalik.

S. III. Species with their northern limit on the coast between 68°30' and 68°50'.

<i>Sedum villosum</i> . L.	Northern limit: Store Glacier. 68°48'.
<i>Bartschia alpina</i> . L.	— Cape Daussey. 68°48'.
<i>Botrychium lanceolatum</i> . (Gmel) Ångstr.—	Cape Ravn. 68°31'.
<i>Polystichum lonchitis</i> . L.	— — —
<i>Sedum annuum</i> . L.	— — —
<i>Alchemilla alpina</i> . L.	— — —
<i>Gnaphalium supinum</i> . L.	— — —
<i>Pirola minor</i> . L.	— — —
<i>Scirpus cæspitosus</i> . L. (var. <i>austriaca</i>)	— — —
<i>Phleum alpinum</i> . L.	— — —

<i>Epilobium anagallidifolium</i> . Lam.	} isolated occurrence in the north, near a hot spring in Knighton Bay (69°18'). Actual northern limit at 68°31'.
<i>Epilobium lactiflorum</i> . Hausskn.	
<i>Alchemilla filicaulis</i> . Bus.	

Sagina Linnæi. Presl. Isolated occurrence in the north, near a hot spring about 68°52', then from Cape Ravn 68°31' and farther south.

J. LIND (1932), who has prepared the micromycetes collected, gives Cape Ravn as the most northerly locality on the east coast, where *Uromyces Alchemillae* was found.

S. IV. Species with their northern limit at Kangerdlugssuak about 68°10'.

Potentilla tridentata. Soland. Only one locality behind Skærgaard Peninsula; Lille Island about 67°, Lang Island, Cape Warming (KRUUSE), Angmagssalik.

Loiseleuria procumbens. (L.) Desv. 68°15' at the head of Watkins Fjord, 68°10' Mikis Fjord; of common occurrence south of Kangerdlugssuak.

Alchemilla pseudomicans sp. n. The continent at Uttental Sound see p. 16.

S. V. Species with their northern limit in the area between Lake Fjord (66°20') and North Aputitek (67°48').

Saxifraga stellaris. L. Northern limit: Lille Island at 66°58' (KRUUSE).

Carex capitata. Soland. Northern limit: Lille Island at 66°58' (KRUUSE).

With this group might also — though not in the subsequent summing up of the material — be classed the following species which, it is true, have not been found north of 66°20', but which up to this latitude occur with great frequency, this very frequency making it probable that they extend somewhat farther north; my investigations north of Kangerdlugssuak show that a quantity of common species in Angmagssalik, even with great numbers of individuals, extend as far as 68°31'. Further, it must be borne in mind that this coast area (66°20'—68°) is still very little known from a botanical point of view. The species in question are:

Juniperus communis, *Chamænerium angustifolium*, *Coptis grönlandica*, *Thymus arcticus*, *Deschampsia alpina*, *Hieracium hyparcticum*¹⁾.

S. VI. Species with their northern limit in the northern Angmagssalik District.

Dryopteris Linneana, C. Chr. northern limit in Lake Fjord, 66°20'

Carex atrata. L. — — — — —
also found by KRUUSE in Sarfakajik, 65°38'.

Carex rufina. Dreyer. Lake Fjord 66°20', otherwise found in Kingorsuak (Angmagssalik), det: TH. SØRENSEN, and at Umivik and Skjoldungen (BJØRLYKKE 1932).

According to KRUUSE (1912) also *Epilobium Hornemanni* and *Poa nemoralis* have their northern limit here.

S. VII. Species with their northern limit in the southern Angmagssalik District.

As appears from the list of plants a great number of species have their northern boundary in this locality, although several of these beyond a doubt extend somewhat farther north. The species in question are about 30 in number. Examples: *Ranunculus acer*, *R. reptans*, *Comarum palustre*, *Galium Brandegii*, *Deschampsia flexuosa*, *Habenaria albida*, *H. hyperborea*, *Angelica Archangelica* etc.

¹⁾ See p. 19, footnote.

A. I. Species with their southern limit in the Scoresby Sound area.

Although perhaps a couple of species extend somewhat farther south, the number of species belonging to this group will be about 25 (see List of Plants). Examples: *Braya purpurascens*, *B. glabella*, *Draba subcapitata*, *Taraxacum arcticum*, *T. phymatocarpum*, *Tofieldia coccinea*.

A. II. Species with their southern limit at about 69°35'.

<i>Arabis Holboelli</i> Hornem.	} according to HARTZ and KRUSE (1911).
<i>Potentilla pulchella</i> R. Br.	
<i>Carex ursina</i> . Dew.	
<i>Alopecurus alpinus</i> . Sm.	
<i>Calamagrostis purpurascens</i> R. Br.	

A. III. Species with their southern limit between 69°25' and 68°43'.

Melandrium apetalum. (L.) Fenzl. Southern limit: Cape Dalton 69°25'.

Arenaria ciliata ssp. *pseudofrigida*.

Ostf. et Dahl.	—	—	—
<i>Stellaria longipes</i> . Goldie.	—	—	—
<i>Ranunculus nivalis</i> . L.	—	—	—
<i>Ranunculus sulphureus</i> . Soland.	—	—	—
<i>Saxifraga stellaris</i> var. <i>comosa</i> . Retz.	—	—	—
<i>Draba daurica</i> . D. C.	—	—	—
<i>Saxifraga tricuspidata</i> . Rottb.	—	Cape Barclay 69°15'.	—
<i>Salix arctica</i> (× <i>glauca</i>) (nearly pure)	—	—	—
<i>Dryas octopetala</i> . L.	—	d'Aunay Bay 69°05'.	—
<i>Draba cinerea</i> . Adams.	—	—	—
<i>Draba lactea</i> . Adams.	—	—	—
<i>Pedicularis lapponica</i> . L.	—	—	—
<i>Ranunculus affinis</i> . R. Br.	—	Cape Daussy. 68°45'.	—
<i>Draba alpina</i> . L.	—	—	—
<i>Arctostaphylos alpina</i> . (L.) Spring	—	—	—
<i>Carex alpina</i> . Sw.	—	—	—

The distribution of *Carex alpina* in East Greenland may perhaps be divided into two areas, a northern (Northeast Greenland—Scoresby Sound—Cape Daussy) and a southern (Skjoldungen, Umanak) (BRØR-LYKKE 1932).

A. IV. Species which are common in the north and occur on the northern part of the coast between Scoresby Sound and Angmagssalik, but farther south only in special inland localities¹.

¹) Continental species cf. SEIDENFADEN 1933.

- Taraxacum brachyceras*. Dahlst. Scoresby Sound (HAGERUP) Kangerdlugssuak, of common occurrence in the interior.
- Carex misandra*. R. Br. Scoresby Sound. Inner part of Kangerdlugssuak.
- Potentilla nivea*. L. From Scoresby Sound to Cape Dalton, 66°08' Kingorsuak.
- Campanula uniflora*. L. Scoresby Sound—Cape Dalton, rather common; Angmagssalik: KRUUSE: "very rare, high up in the mountains on the shady side in the interior. The west side of Kingorsuak, Amaga in Sermilik".
- Woodsia glabella*. R. Br. Scoresby Sound: Hurry Inlet, Røde Island. 68°31' Cape Ravn. 66°—66°10' Misutok, Kingorsuak in the Angmagssalik inland. Anoritok 61°32'. (SEIDENFADEN 1933).
- Potentilla emarginata*. Pursh. Of common occurrence from Scoresby Sound to Cape Dalton. 68°31' Cape Ravn. 66°08' Kingorsuak.
- Antennaria alpina* (L) Gärt. var. *glabrata*. Scoresby Sound—Cape Dalton common; d'Aunay Bay common (69°05'); Mikis Fjord?; 66°08' Kingorsuak.
- Arnica alpina*. (L) Olin. Scoresby Sound—Cape Dalton, common, d'Aunay Bay, common. Kangerdlugssuak, inner fjord area, east coast. Kingorsuak 66°08'.
- Cassiope tetragona*. (L) Don. Scoresby Sound—Cape Dalton, common. Cape Dalton—68°48' common. Lacking farther south in the coast land.
Kangerdlugssuak, common in the interior. 66°08' Kingorsuak "Cassiope Mountain".
- Pirola grandiflora*. (DC) Rad. Scoresby Sound—Cape Dalton—Cape Barclay—Cape Daussy (68°43'). 66°08' Kingorsuak.
- Draba crassifolia*. Graham. Scoresby Sound—Cape Dalton. Kangerdlugssuak: Mikis Fjord, Skærgaard Peninsula, inner part of the fjord. Kingorsuak 66°08'.
- Papaver radicatum*. Rottb. Scoresby Sound common, particularly in the coastal zone. (HARTZ.)
Turner Sound—Cape Barclay (69°15') common.
68°48' Store Glacier (AMDRUP).
Wiedemann Mountains (inland at Cape Ravn).
Cape Vedel (AMDRUP).
Nunatak in the nepheline-syenite area in the inner part of Kangerdlugssuak.
Lang Island, Jagos Fjord about 67°.
Kingorsuak 66°08'
- Carex rupestris*. All. Scoresby Sound—Turner Sound—Cape Dalton. Kangerdlugssuak, inner part of the fjord. 66°19' Cape Wan-

del. 66°20' Lake Fjord. Angmagssalik: KRUSE: rare "in table land in the interior." Kingorsuak.

Hierochloë alpina R. and S. Scoresby Sound. Kangerdlugssuak inner part. Southeastern Greenland; compare SEIDENFADEN (1933).

A. V. Species with their southern limit at about 67°—68°.

Carex pedata. Wbg. Rather common on the coast between Scoresby Sound and Kangerdlugssuak. 68°.

Lang Island 67°05' southern limit (KRUSE).

Carex bicolor. All. Scoresby Sound: Jameson Land.

N. Aputitek 67°48' (KRUSE).

A. VI. Species with their southern limit at Angmagssalik.

(Excluding the species which have their southern limit in the inland, see A. IV.) The number is not great and can at most be put at five species: Eks.: *Ranunculus glacialis*, *Pedicularis hirsuta*, *Alchemilla acutidens*, *Sedum acre*). The two latter are perhaps endemic of Angmagssalik.

Rare species.

Epilobium palustre. L. New to East Greenland. Ca. 50° C. hot spring in Knighton Bay, about 69°18'.

Epilobium palustre is common and characteristic of the vegetation near many hot Icelandic springs (THORODDSEN in "Botany of Iceland" I). PORSILD (1932) writes about its occurrence on the west coast: "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 Godthaabfjord-region. Outside the Norse area it has been taken many times at Neria 61°33' and at Narsalik 61°37' and from two localities 30 miles apart on south Disko, both at the outlets of hot springs, namely Engelskmandens Havn 69°15' and Kugssuaq 69°27'. OSTENFELD thinks that the plants on south Disco "might very well have been carried from South Greenland by the wind"; I do not think so". After this find on the east coast the probability of OSTENFELD's theory is further weakened. (See also SEIDENFADEN (1933).

Alchemilla pseudomicans sp. n. Kangerdlugssuak: Uttental Sound. Kuttit, Annat and s. w. of Cap Trolle south of Angmagssalik (see SEIDENFADEN 1933).

The characters of this plant agree with those of *Alchemilla micans* Buser, but it differs from this in general appearance and by its geographical distribution. (*A. pseudomicans* has not been found on Iceland, *A. micans* in Denmark only common in the southern parts, KN. JESSEN 1926).

Description: Leaf-stalks and stems, excepting the last, uppermost

ramifications of the inflorescence, have thick coverings of hairs which are more or less upright to nearly adpressed, but never stand out at right angles. The calyx smooth. The full-grown summer-leaves are hairy on the upperside, the hairs being adpressed. The stipules of the rosette leaves are purple. The corolla is 4—5 mm broad. The rosette-leaves with 9 lobes, central lobe with 7 denticles on either side (cf. LINDMANN 1926). Ecologically it differs from *A. glomerulans* by growing in drier soil. The general impression of the plant is that it is smaller and not nearly so succulently green as *A. glomerulans*. There was a great resemblance between the above-mentioned *Alchemilla*-type and a type from a nunatak region behind Cape Ravn, which however differs from the former by the leaves having more rounded lobes and by their upper sides being less strongly haired.

On Blosseville's Coast conditions are very bad for strand plants. There is practically no sheltered seashore, the mountains generally coming right down to the fjord without a foreshore. Therefore, it is not strange that so many strand-plants are rare or have not been found at all, and so it is not quite safe to include them in the flora of the area, as it is very possible that they do not occur there at all. Examples are: *Honckenia peploides*, *Stellaria humifusa*, *Puccinellia phryganodes*. See: List of Plants.

About the same is the case with the freshwater plants. The coast generally yields bad conditions for the formation of swamps, as there are hardly any level areas where the water can stagnate. This is partly due to the fact that the basalt terraces generally incline outwards. At Cape Dalton they incline inwards, and for that reason a number of freshwater plants have only been found in the swamps there.

Examples: *Callitriche verna*, *Hippuris vulgaris*, *Ranunculus trichophyllus*, *Koenigia islandica*. See: List of Plants.

It is curious that OSTENFELD should mention *Eriophorum polystachyum* as occurring both in districts III and IV east. It is not mentioned from this place anywhere in the existing literature, and all I saw of *Eriophorum* in Angmagssalik belonged to *E. Scheuchzeri*.

Finally, a number of species are rare, because they seem to prefer the drier inland. *Betula nana* is mentioned by KRUSE as one of the very species which prefer the inland, and the same holds good of *Rhododendron lapponicum*. They have both only been found inland in the area of Turner Sound or inner Kangerdlugssuak. About the same holds good of *Elyna Belardii* and *Hierochloë alpina*. *Dryas integrifolia* has not been found in district IV, but this is presumably caused by the fact that, owing to the limited time in a summer expedition, I was only able to ascend heights of 3—500 m above sea-level. As to its occurrence

in Angmagssalik it is said: "In table land rather rare, high up on the mountains and most often on the shady side, not observed below 300 m above the level of the sea" (KRUUSE). It never plays any part in the vegetation at Angmagssalik. Finally *Rumex acetosella* has not been found between Scoresby Sound and Angmagssalik.

After this examination of the most important conditions of distribution, I shall briefly summarize the species found in district IV east (OSTENFELD), but which have not formerly been recorded from there (see introduction).

Lycopodium alpinum, *L. annotinum*, *Botrychium lunaria*, *B. lanceolatum*, *Polystichum lonchitis*, *Woodsia glabella*, *Sagina Linnæi*, *Sedum annuum*, *S. villosum*, *Cardamine pratensis*, *Draba rupestris*, *Epilobium anagallidifolium*, *E. lactiflorum*, *E. palustre*, *Ranunculus sulphureus*, *Alchemilla alpina*, *A. filicaulis*, *A. glomerulans*, *A. pseudomicans*, *Gnaphalium supinum*, *Erigeron uniflorus*, *Taraxacum brachyceras*, *Gentiana nivalis*, *Pinguicula vulgaris*, *Pirola minor*, *Carex alpina*, *C. Macloviana*, *C. misandra*, *Elyna Bellardi*, *Agrostis borealis*, *Hierochloë alpina* and *Phleum alpinum*.

The following species are not mentioned by OSTENFELD, although recorded by KRUUSE: *Arenaria ciliata* ssp. *pseudofrigida*, *Melandrium apetalum*, *Stellaria longipes*, *Dryas octopetala*, *Arctostaphylos alpina* and *Pedicularis lapponica*. New to the Angmagssalik District is *Carex rufina*.

When subtracting the species mentioned in the Introduction, which up to the present are not known to occur, and adding those included in the list given above, one arrives at the result that 150 species are known from this district. When adding to these the six or more species mentioned in group S. V., it appears that the figures arrived at, when comparing the 169 Scoresby Sound species and the 181 Angmagssalik species, are no longer improbably small.

KUPFFER (1925) introduced the term Florengefälle or "floristic decline", and he explains it in the following manner: "die Zahl, welche angibt, wie viele Pflanzenarten im gegebenen Gebiet durchschnittlich auf je eine Längeneinheit der betrachteten Richtung, ca. auf je 100 km, verschwinden." Where the floristic decline is great, there is a floristic boundary conditioned by climatic or edaphic causes. In a country like Greenland the most practical proceeding will be to compute the floristic decline in two succeeding circles of latitude. The floristic decline which KUPFFER found in the east-baltic area was conditioned by the transition from a suboceanic to a subcontinental climate. In order to carry out the computation of the decline in a northerly and southerly direction, one must first of all realize whether in Greenland there is not also a decline

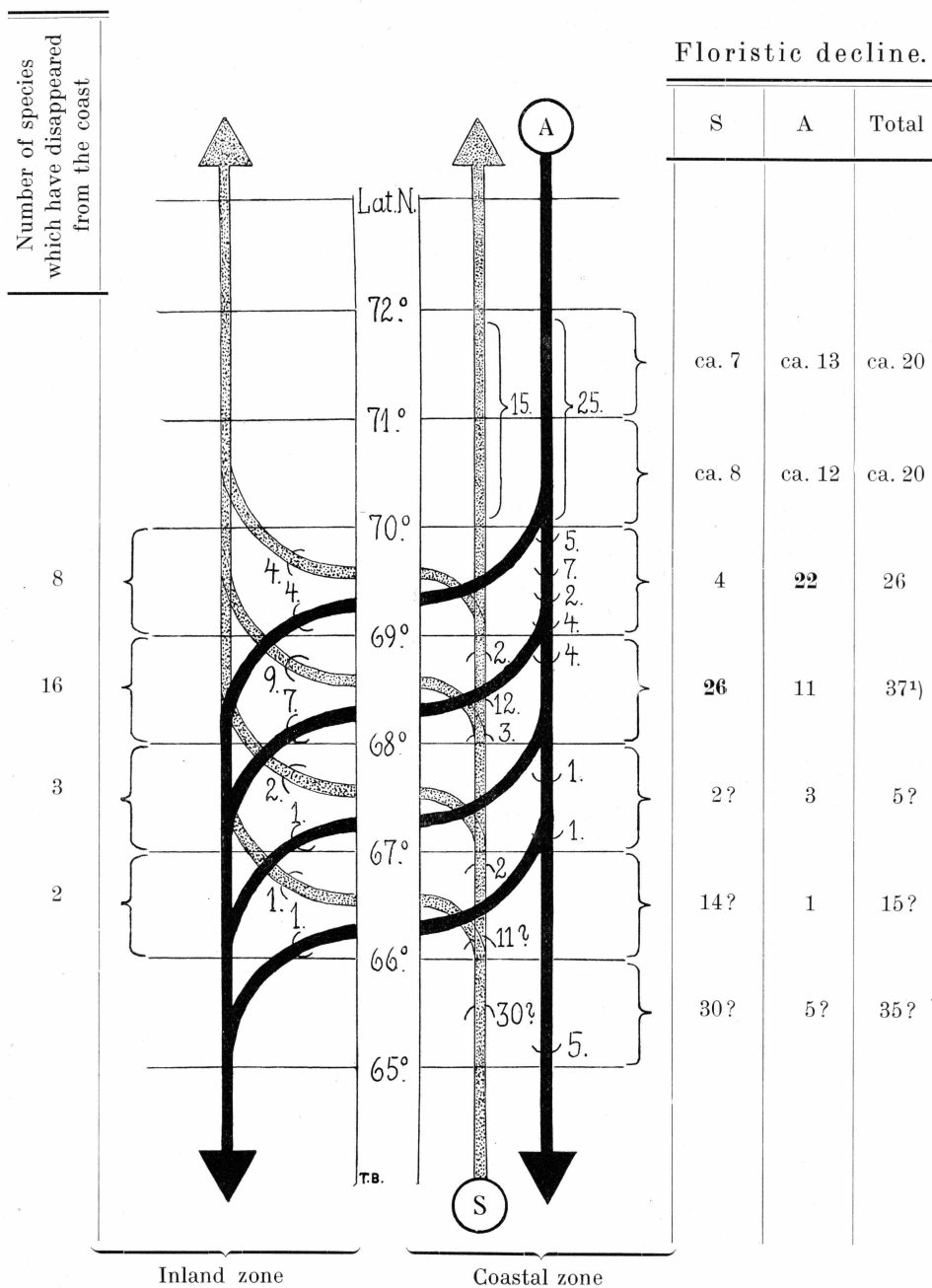


Fig. 1.

¹⁾ After having finished my MS. I learn that "The British Air Route Expedition" in Kangerdlugssuak found the northern limit of *Asplenium viride* and *Thymus arcticus*. Besides, being new to district IV, *Juniperus communis* and *Deschampsia alpina* which were found between Angmagssalik and Kangerdlugssuak, two of the very species which on p. 13 were mentioned as probably extending farther north. The conditions found make the decline in the flora greater between 68° and 69°, and smaller between 65° and 66°. 2*

in the flora in a westerly and easterly direction, or rather at a right angle with the coast and the margin of the inland ice. That this is the case appears very distinctly from the many demonstrations of the great floristic difference between the coastal zone and the inland of Greenland. (See in particular ROSENVINGE 1896, HARTZ 1895, A. E. PORSILD 1926), my investigations in the Kangerdlugssuak Fjord pointing in the same direction (see later). It is, therefore, clear that when computing the floristic decline in a northerly-southerly direction, regard can only be had to the coastal zone.

In fig. 1 I have summed up in tabular form the above-mentioned examinations of the distribution of the species between Scoresby Sound and Angmagssalik. The black arrow indicates the A-type, the lighter one the S-type. Both northerly and southerly species show, at the margin of their area of distribution, a tendency to seek the interior of the country. The reason is surely that the southerly species towards the north prefer the warmer inland, and that the northerly ones towards the south avoid the oceanic coast land. Thus ROSENVINGE (1896) demonstrated that the subarctic flora in the southern coast land is almost exclusively to be found in the interior, and he adds: "Still, also some species with an essentially northern distribution occur within the country of the south coast, only or by preference far inland — — Without a doubt the distribution of these species in the most southerly part of Greenland depends upon their avoiding the moist coastal climate, in the same manner as is, according to BLYTT, the case with the arctic elements of the flora in Central Norway." This, however, is not of general application; for instance, according to an article by SERNANDER (1908, p. 262) it does not hold good of such species as *Dryas octopetala*, *Loiseleuria procumbens*, *Salix herbacea* and others. The region between 68°30' and 69°30' shows an almost equal floristic decline in both directions. It appears that the northern and southern limits (indicated by small semi-circles) approach very nearly to one another and occur in great numbers round this part of the coast, the northern boundaries in the northerly, the southern boundaries in the southerly part. It appears from the figures that there is a particularly strong floristic decline in the flora between 68° and 69°, the total number of vanishing species in a northerly and southerly direction amounting to 37. At Angmagssalik (65°—66°) the total decline in the flora is about 35; but when considering the infinitesimal floristic decline of the two northern areas (66°—67° and 67°—68°), and bearing in mind that a more thorough investigation is highly needed in these regions (particularly Kialinek) it seems very likely that some of the northern boundaries of Angmagssalik should be distributed over these two areas. Pending further investigations, it must be left an open question whether there is a floristic boundary at Angmagssalik. One thing may

however be said already at this early stage: in the coast land of Angmagssalik a floristic decline will only take place in a northern direction, and from a phytographic point of view a strong decline in both directions is much more significant. It thus appears that there is a pronounced floristic boundary between 68° and 69° . The transition is not gradual; one may find oneself in a pronounced high-arctic vegetation in d'Aunnay Bay $69^{\circ}05'$, whereas one finds oneself in a more southerly zone in the fjord north of Cape Ravn $68^{\circ}31'$. I place the boundary in the region north of Cape Daussey, in the immediate vicinity of Store Glacier $68^{\circ}48'$. The floristic decline will naturally be the greater, the more complete the coincidence of the area investigated with the boundary area. When computing the decline in the flora between $68^{\circ}30'$ and $69^{\circ}30'$, it appears that in this place 14 northern boundaries meet with 17 southern ones, and that 13 species vanish from the coast in a northerly, 8 in a southerly direction. All in all 52 species share in this process or one fifth of the total number of species of East Greenland. For future investigations in this field the area $68^{\circ}30'—69^{\circ}30'$ might therefore fittingly be used as a starting point.

It is a matter of course that northerly and southerly limits in a country of such enormous dimensions cannot be exact, fixed quantities; nevertheless, I do not think that the main result will be changed, but rather strengthened by future investigations which will naturally move the boundaries of the areas of species.

This sudden transition appears very clearly, when one computes the percentages of $A_1—A_2$ and S-species (according to OSTENFELD, 1926) in the two coastal areas north and south of the boundary mentioned above, and compares the result with the percentages of the same three types of distribution, computed for the coastal zones in Scoresby Sound and Angmagssalik. The result appears from Table I. It should be borne in mind that the two southernmost coastal zones are not contiguous, there being an uninvestigated area ($66^{\circ}30'—68^{\circ}$) between them, but in spite of this the per cent figures agree.

Table I.

	A_1	A_2	S
Scoresby Sound, coastal zone	25	57	18
The coast $68^{\circ}48'—70^{\circ}$	20	70	10
The coast $68^{\circ}—68^{\circ}44'$	4	65	31
Angmagssalik coastal zone	2	51	47

With regard to OSTENFELD's types of distribution I have made a few corrections, which I shall explain in the following. I have changed

the designations of *Draba rupestris*, *Empetrum nigrum*, *Poa pratensis* and *Poa alpina* from S to A₂, and besides there are several others which will have to be changed, when further investigations have been undertaken. The species mentioned are all so widely distributed in the arctic area that, for this reason only, one is in doubt about their being S-types. Add to this that in more recent times (HAGERUP 1927) it has proved possible to divide *Empetrum* into two genotypically different varieties, with a different chromosome number; that again *Poa alpina* is not a unity, but according to TURESSON (1932) consists of a series of ecotypes, alpine, sub-alpine, lowland type, and finally that *Poa pratensis* in the north has been replaced by another species, viz. *Poa alpigena* (LINDMANN 1926), and I think there is every reason to designate the northern ecotypes of these three species with A₂. *Draba rupestris* is according to LINDMANN's flora (E. EKMAN) a highland type. On Blosseville's Coast it does not occur as a pronounced Sydberg plant¹⁾, but frequently in the inclement localities. OSTENFELD himself realized this weakness in the S-type when writing: "Some of them get along very well in the arctic regions (which is probably connected with the fact that they consist, properly speaking, of several minor specific units)". He takes the same step as I do, when he designates *Festuca ovina* var. and *Vaccinium uliginosum* var. as A₂. (Compare HAGERUP 1933). As long as the species have not been proved to be divided into minor species and only occur as pronounced Sydberg plants, there is no reason to alter anything. Of species which, it is thought, might be altered in the future as the result of a more thorough investigation of ecotypes in Greenland, I will just mention: *Campanula rotundifolia*, *Cardamine pratensis* and *Equisetum arvense*, all being altered from S to A₂. Finally the species *Papaver radicatum* undoubtedly contains several types, both A₁ and A₂. Compare NORDHAGEN (1931) on the Scandinavian races of this species.

Besides the absolute northerly and southerly limits there are many species, the frequency of which north and south of the floristic boundary mentioned above differs very much, e. g. *Empetrum nigrum*, *Cassiope hypnoides* and *Draba rupestris* (see List of Plants). It is a matter of course that these indications of frequency are entirely dependent upon the personal judgment of the writer, but I think that most investigators will judge rather alike, when it is only a question of so few (five) degrees.

It is frequently not the floristic decline, but the area boundaries of a few important species which are used for fixing the limits of the different

¹⁾ Literally: south mountain plant, a term used in Sweden to designate that the plant is only found on the southern slope of a mountain.

floristic areas. Thus GRANLUND (1925) builds his "phytogeographic boundary through southern Sweden" on the conditions of distribution of *Erica tetralix* and *Ledum palustre*. In Slesvig-Holstein WILLI CHRISTIANSEN (1926) speaks of a "bündelung von Grenzen", which in this area coincides with the western limit of *Fagus sylvatica*. The floristic decline is here greatest in the region where the beech wood ceases. It would be interesting if the above-mentioned floristic boundary in East Greenland coincided with the area boundaries of certain important species. One must, however, pay great attention to the character of the species used as the foundation of such a boundary line. We are here approaching the difficulty emphasized by Swedish scientists; thus, FRÖDIN (1911) divided the mountain plants into species which were genuine and those which were not, the former having a downward temperature-limit above, the latter below the limit of forest. To the genuine plants belong species such as *Cassiope tetragona*, *Arnica alpina* and *Pedicularis hirsuta*. TURESSON (1932) has now shown that the important factor in the distribution of the species is their greater or smaller abundance in ecotypes, and he concludes his work in the following manner: "Je ökotypenreicher eine Art ist, um so schlechter eignet sie sich als Klimaindikator, je ökotypenärmer sie ist, um so idealer ist sie als Klimaindikator". In a subsequent chapter it will be shown that the floristic boundary mentioned above is climatically conditioned. Seeing that species like *Cassiope tetragona* and *Arnica alpina* are of the "genuine" mountain plants which are poor in ecotypes, the area boundaries of two such species, if they coincide with a limit determined by a great decline in the flora, will substantiate and prove the value of such a limit. It proves that the two said species rather suddenly disappear from the coast land at the above-mentioned boundary locality, viz. Store Glacier (F.), and then only recur in special inland localities. Thus they substantiate both the limit which appears from the floristic decline in a direction north-south, and a limit parallel with the coast, based upon a decline at a right angle with the coast. Finally, the occurrence of *Alchemilla glomerulans* appears to be a southerly species, which is an indicator of a warm climate (occurrence in the coastal zone from 68°30' and southwards, to be found in the inner, warmer part of Scoresby Sound, but lacking in the inner dry and in many ways more arctic Kangerdlugsuak Fjord).

The next problem to be dealt with is that of a decline in the flora at a right angle with the coast. In this context it will be natural, first of all, to mention the works of HARTZ from Scoresby Sound

(1895). A number of species are here characteristic of the warm inland, whereas others keep to the coast.

Scoresby Sound.

Inland.		Coast land.	
<i>Lycopodium alpinum.</i>	A ₂	<i>Ranunculus glacialis.</i>	A ₂
<i>Lycopodium annotinum.</i>	S	<i>Potentilla pulchella.</i>	A ₁
<i>Botrychium Lunaria.</i>	S	<i>Alopecurus alpinus.</i>	A ₁
<i>Callitriche verna.</i>	S	<i>Arctagrostis latifolia.</i>	A ₁
<i>Alchemilla glomerulans.</i>	S		
<i>Viscaria alpina</i>	A ₂		
<i>Draba aurea.</i>	A ₂		
<i>Arabis Holboelli.</i>	A ₂		
<i>Saxifraga aizoon.</i>	A ₂		
<i>Pinguicula vulgaris.</i>	S		
<i>Carex paralella.</i>	A ₂		
<i>Carex microglochin.</i>	A ₂		
<i>Carex Macloviana.</i>	A ₂		
<i>Agrostis borealis.</i>	A ₂		
<i>Juncus trifidus.</i>	S		

Of the 15 species mentioned as characteristic of the inland 0 are A₁, 9 A₂ and 6 S-species. Of the 4 species characteristic of the coast land 3 are A₁, 1 A₂ and 0 S-species. It is clearly the difference in temperature, which conditions this difference. With regard to the two important heath-plants, *Cassiope tetragona* and *Empetrum*, it is worth noticing what KRUSE wrote (1905) of their occurrence in Scoresby Sound: "On the coast *Cassiope* cedes to *Empetrum* while it is dominant in the heath of the interior. It does not form here any thick plantagion as *Empetrum* — — The limit between this and the heath of *Empetrum* may often be very sharp."

If we look at conditions in the large fjord Kangerdlugssuak, situated farther south (68—68°30'), it appears that the conditions of distribution to a large extent do not correspond with those which we know from Scoresby Sound. The results are based upon the investigation of 14 localities in the Kangerdlugssuak area including Mikis Fjord, the latter being connected with the eastern area of Kangerdlugssuak, viz. Watkins Fjord. On the map (Fig. 2¹) the different localities are given in Roman numerals. Though future investigations in this locality will possibly, to a certain extent, alter the boundaries of the species, the results will hardly be much changed: It is by preference in the inner

¹) The map is drawn after the map published in 1930 by the British Arctic Air Route Expedition, as the Danish map is not quite finished (compare nevertheless Plate I).

part of the fjord that the higharctic species occur, while the southern ones keep to the coast. Only in a single inland locality (IV) the vegetation bears the stamp of the greater heat inland, corresponding with conditions in Scoresby Sound.

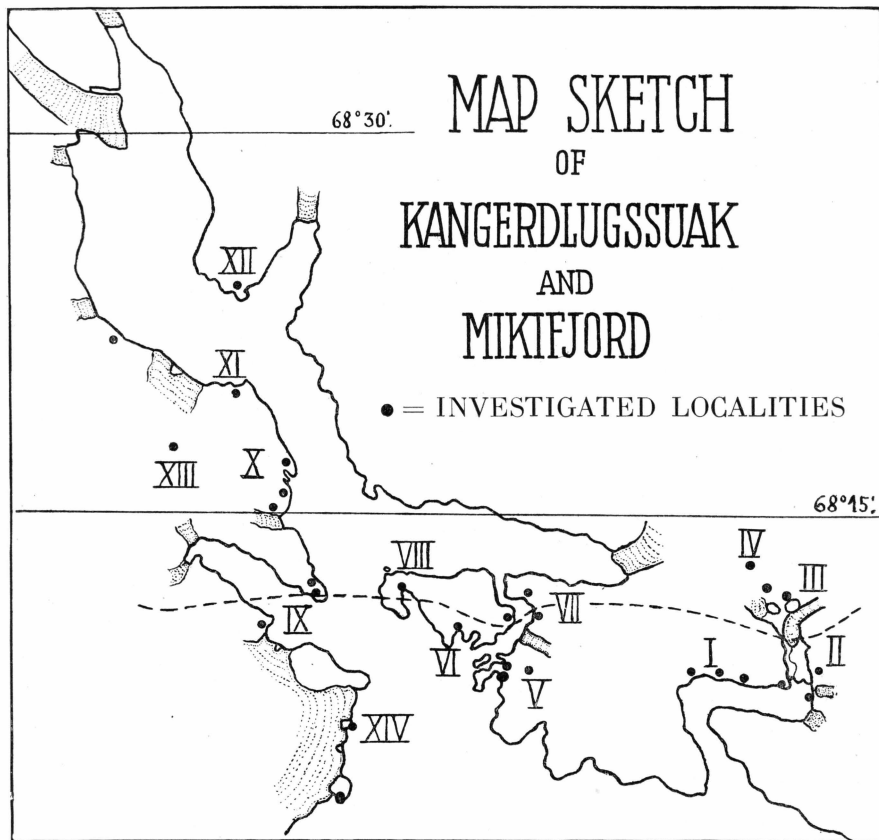


Fig. 2. I—II Mikis Fjord, III—IV Inland east of Watkins Fjord, V Skærgaards Peninsula, VII Uttental Sound, VI, VIII Kraemers Island, IX Amdrups Fjord, X—XII Kangerdlugssuak, inner part, XIII and XIV Nunatak-localities.

1. Only found in the inland behind the head of Watkins Fjord. (Locality IV).

<i>Lycopodium annotinum.</i>	S
<i>Pinguicula vulgaris.</i>	S
<i>Scirpus cæspitosus</i> var. <i>austriaca.</i>	S

2. Only found in the inland.

<i>Papaver radicum.</i>	A ₂	Localities
<i>Arnica alpina.</i>	A ₁	XIII.
<i>Taraxacum brachyceras.</i>	A ₂	X.
		VII, X, XII.

<i>Diapensia lapponica</i> .	A ₂	{III, IV, VII, VIII, X, XII.
<i>Cassiope tetragona</i> .	A ₁	VII, IV, III, X, XII.
<i>Rhododendron lapponicum</i> .	A ₂	IV, XII.
<i>Carex rupestris</i> .	A ₁	XII.
<i>Carex misandra</i> .	A ₁	X.
<i>Elyna Bellardi</i> .	A ₂	VIII, X.
<i>Eriophorum Scheuchzeri</i> .	A ₂	X, XII.
<i>Hierochloë alpina</i> .	A ₂	X.

3. Only found in the coast land.

<i>Equisetum arcense</i> .	S	I.
<i>Equisetum variegatum</i> .	A ₂	I, II.
<i>Sagina Linnæi</i> .	S	I.
<i>Sedum annuum</i> .	S	I.
<i>Sedum villosum</i> .	S	I, II.
<i>Epilobium anagallidifolium</i> .	S	V.
<i>Epilobium lactiflorum</i> .	S	I, II.
<i>Thalictrum alpinum</i> .	S	I, II.
<i>Alchemilla alpina</i> .	S	I, II, VI.
<i>Alchemilla filicaulis</i> .	S	II, VI.
<i>Alchemilla glomerulans</i> .	S	I, II.
<i>Alchemilla pseudomicans</i> .	S	VII.
<i>Potentilla tridentata</i> .	S	V.
<i>Saxifraga aizoides</i> .	A ₂	II, IX.
<i>Erigeron uniflorus</i> .	A ₂	II.
<i>Gentiana nivalis</i> .	S	I, II, VI.
<i>Pirola minor</i> .	S	I, II.
<i>Veronica fruticans</i> .	A ₂	I, VI.
<i>Poa alpigena</i> .	A ₂	II.

4. A few species have finally only been found in the coast land and in the warm inland at localities III and IV.

<i>Phleum alpinum</i> .	S	I, II, IV.
<i>Loiseleuria procumbens</i> .	A ₂	I, III, IV.
<i>Lycopodium alpinum</i> .	A ₂	IX, VII, IV.

It appears that the 3 species which were only found in the inland and at the head of Watkins Fjord all belong to the S-type, while the 11 species which are otherwise characteristic of the inland are all either A₁ or A₂, and finally it appears that of the 19 species which have only been found in the coastal zone 0 are A₁, 5 A₂ and 14 S-species. There is here a considerable floristic decline at a right angle with the coast; it amounts to 14 in a south-easterly direction and to 19 in a north-westerly direction, or in both directions a total of 32. The boundary between the inland and

the coastal flora I rather draw as a line connecting the extreme localities of *Cassiope tetragona* (See the map fig. 2, dotted line).

We will now proceed to examine what is the reason of this great difference between Scoresby Sound and Kangerdlugssuak. The most striking feature of Kangerdlugssuak is the very great quantities of ice which lie closely packed throughout the fjord, consisting partly of colossal icebergs, and partly of smaller broken-off fragments of the latter. The ice comes from the huge glaciers, which are to be found at the head



T. B. phot.

Fig. 3. Terrace-vegetation in Mikis Fjord. Western slope.
In the foreground low willow-copse.

of the principal fjord as well as of Watkins Fjord and Amdrup Fjord (IX). It may be said that Kangerdlugssuak with its branches is one of the chief producers of ice in Greenland; it is an icefjord, which is not the case with Scoresby Sound. The vegetation in the interior parts is very sparse and bears the stamp of a pronounced drought. I do not believe that it is much warmer there than at the mouth of the fjord, for the wind may blow without hinderance down the fjord from the inland ice itself. In the days August 17—20, 1932, there was a strong, cold, and dry wind right down the fjord; everywhere in localities facing north the vegetation bore the stamp of this harmful northwind proceeding from the inland ice,

where as is well known the mean August temperature in the middle of the inland ice is $\div 17,7^{\circ}$ (GEORGI, the Wegener Expedition). It is then surely first and foremost the drought and the cold winds which condition the fact that the many southern species do not penetrate further than to protected southern slopes in the outermost part of the fjord. The above-mentioned warm inland locality (IV) is also protected towards the north by a low mountain-range. Add to this that there is a great difference in the geological underground between the coast land and the inland, and these conditions together seem to explain the great



MÖHL-HANSEN phot.

Fig. 4. Polished gneiss-rocks in Kangerdlugssuak.

floristic decline. Thus, L. WAGER, the geologist of our expedition, proved that Mikis Fjord and the coast land consisted of a Basalt-Gabbro-area, while the greater part of Kraemers Island and the inland consisted of granite, gneiss and nepheline-syenite. There is no doubt that the basalt is a better soil than the gneiss (Ca!); further, the basalt forms terraces, thus providing excellent conditions for herb-field (snow-cover, drainage) (Fig. 3). The gneiss parts were, as contrasted with the basalt parts, very polished and generally quite devoid of vegetation (fig. 4). That it is not the geological difference, which excersises the greatest influence on the distribution of the vegetation, appears i. a. from the fact that *Cassiope tetragona* in Fennoscandia avoids gneiss and granite, but keeps to slate

(THORE FRIES, 1917). It is the different climate in the inner and outer part of the fjord which conditions the floristic decline, and here again it is the inland drought which is the decisive factor, as appeared in the course of an excursion through the valley between Mikis Fjord and Watkins Fjord, the valley in question testifying to the fact that the precipitation in this place was considerable. The bottom of the valley was full of vegetation, partly vegetation round the numerous rivers intersecting it, partly extensive snow-patch communities (locality II). In the adjoining inland localities III and IV the vegetation was limited to a few green spots and a single strip of vegetation on a southern slope, where owing to a small depression at the top of the mountain some snow had been able to gather in the course of the winter. Otherwise this inland was a stony desert, where only a single *Luzula arcuata* ssp. *confusa* and a few other hardy species were able to live between the boulders. It was characteristic that wherever in the inland there were suitable conditions for herb-field (locality IV), the latter never consisted of *Alchemilla glomerulans*-Associations, which beyond a doubt require great atmospheric moisture, and the willow-copses found in the same inland locality had a xerophilous subvegetation, whereas the copses found in Mikis Fjord had a subvegetation chiefly consisting of *Pirola minor* and *Thalictrum alpinum*.

If we sum up the list of species for the Kangerdlugssuak area, we find that about 100 species have been found there (82 in Mikis Fjord, 76 in the outer and 83 in the inner part of Kangerdlugssuak). When computing the biological spectrum for the outer part plus Mikis Fjord and the inner part, it appears that the chamæphyte percentage rises the farther one gets into the interior of the fjord (Table II).

Table II.

	Ch	H	HH	G	Th
Kangerdlugssuk, outer part of the fjord + Mikis Fjord . . .	34	58	0	5	3
Kangerdlugssuak, inner part of the fjord	38	56	1	4	1

The fact of the chamæphyte percentage being so high is due to the low number of species within this smaller area (RAUNKJÆR 1911).

Against such geophysical boundaries the objection may perhaps be raised that the species, in their migration, should not have reached the maximum distribution, either owing to natural obstacles or for historic reasons. This factor may naturally be of some importance, but in this case it must be a subordinate one, seeing that the coast is uniform, without larger areas where plant-life is excluded, and as soon as the conditions, for instance for southerly species, (i. e. hot springs) occur in the

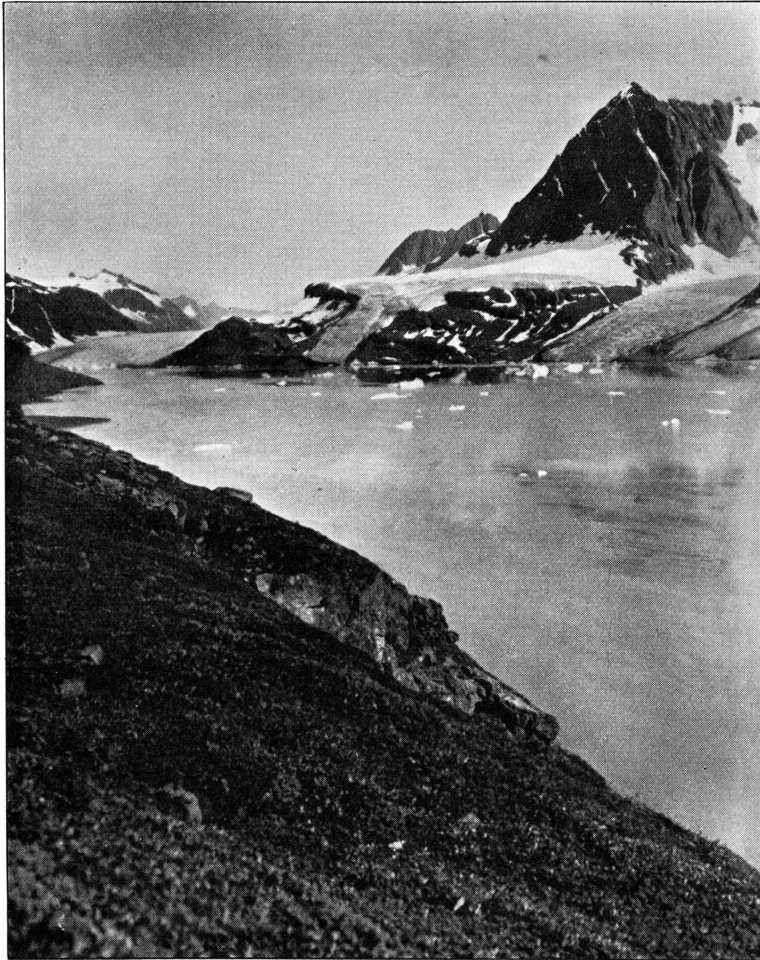
northerly coastal area, the plants appear at once. I therefore think that there are a considerably greater number of southerly species in the inner part of Scoresby Sound, which will presumably be established by a more detailed investigation of this area. In this context I shall call attention to the distribution of *Sedum annuum* and *Alchemilla filicaulis* in Greenland. Both are common on the east coast already from 68°31', but on the west coast the northern limit of *Alchemilla filicaulis* falls at 66°44' (Qeqertalik, Naujarsuit. leg. PORSILD, det. BÖCHER) and that of *Sedum annuum* at 65°15'. It is, I think, to be presumed that both of them are able to live far higher north on the west coast; if this is the case, their distribution points towards their having immigrated from Iceland.

Further, it might be objected that the northern limits established were mostly for plants which were only found on the southern mountain slopes, and that it is a very likely supposition that the higharctic species keep to the inclement northern slopes. However, it appeared that the higharctic species, for instance *Cassiope tetragona*, had really disappeared even from the mountains peaks ascended by the geologist of the expedition. A list of plants from a mountain part with a northern exposure and situated at the inner fjord basin of Kangerdlugssuak (0—100 m above sea-level) — in an area where there are otherwise many A₁ species, for instance, *Cassiope tetragona* — shows that even here it is the widely distributed A₂-types which occur.

The north side of Notched Mt. in Kangerdlugssuak. (Loc. XI).

<i>Salix arctophila</i> × <i>glauca</i> .	A ₂
<i>Salix herbacea</i> .	A ₂
<i>Oxyria digyna</i> .	A ₂
<i>Luzula confusa</i> .	A ₂
<i>Empetrum nigrum</i> .	A ₂
<i>Saxifraga oppositifolia</i> .	A ₂
<i>Saxifraga nivalis</i>	A ₂
<i>Saxifraga cernua</i> .	A ₂
<i>Sagina intermedia</i> .	A ₂
<i>Silene acaulis</i> .	A ₂
<i>Cerastium alpinum</i> .	A ₂
<i>Polygonum viviparum</i> .	A ₂
<i>Ranunculus glacialis</i> .	A ₂
<i>Chamænerium latifolium</i> .	A ₂
<i>Trisetum spicatum</i> .	A ₂
<i>Phippsia algida</i> .	A ₂
(<i>Carex rigida</i> .)	A ₂
(<i>Erigeron unalaschensis</i> .)	A ₂
(<i>Antennaria alpina</i> .)	A ₂

The last-mentioned three species did not grow on the northern slope itself, and *Chamænerium* was exclusively vegetative. Fig. 5 shows the difference between the north and the south coasts in Mikis Fjord.



T. B. phot.

Fig. 5. In the background the coast facing north,
in the foreground *Empetrum-Vaccinium*-heath.

It is on this kind of southern slope with luxuriant heath and herb-field that the southern flora element belongs. It was most pronounced in the fjord north of Cape Ravn, whereas in Mikis Fjord there were also slopes facing west and east, on which southern vegetation was to be found (fig. 3). The following list of species from a pronounced Sydberg at the head of the fjord north of Cape Ravn is interesting as compared with the list given above:

× <i>Polystichum lonchitis</i> .	S
<i>Cystopteris fragilis</i> .	S
× <i>Lycopodium selago</i> .	A ₂
<i>Arabis alpina</i> .	A ₂
<i>Cerastium alpinum</i> .	A ₂
<i>Cerastium trigynum</i> .	A ₂
× <i>Viscaria alpina</i> .	A ₂
<i>Polygonum viviparum</i> .	A ₂
<i>Oxyria digyna</i> .	A ₂
<i>Ranunculus glacialis</i> .	A ₂
<i>Ranunculus pygmæus</i> .	A ₂
× <i>Thalictrum alpinum</i> .	S
<i>Sibbaldia procumbens</i> .	A ₂
× <i>Alchemilla glomerulans</i> .	S
× <i>Alchemilla alpina</i> .	S
× <i>Sedum annuum</i> .	S
× <i>Sedum villosum</i> .	S
× <i>Sedum roseum</i> .	S
<i>Saxifraga nivalis</i> .	A ₂
<i>Saxifraga niv.</i> var. <i>tenuior</i>	A ₂
<i>Saxifraga cæspitosa</i> .	A ₂
<i>Saxifraga cernua</i> .	A ₂
<i>Salix herbacea</i> .	A ₂
<i>Salix arctophila</i> × <i>glauca</i> .	A ₂
<i>Empetrum nigrum</i> var.	A ₂
<i>Vaccinium uliginosum</i> var.	A ₂
× <i>Bryanthus cœruleus</i> .	A ₂
<i>Chamænerium latifolium</i> .	A ₂
× <i>Epilobium lactiflorum</i> .	S
× <i>Veronica alpina</i>	A ₂
× <i>Veronica fruticans</i> .	A ₂
× <i>Bartschia alpina</i> .	A ₂
× <i>Pinguicula vulgaris</i> .	S
× <i>Gentiana nivalis</i> .	S
× <i>Hieracium alpinum</i> .	S
<i>Antennaria alpina</i> .	A ₂
<i>Erigeron unalaschensis</i> .	A ₂
× <i>Taraxacum croceum</i> .	S
× <i>Tofieldia palustris</i> .	A ₂
× <i>Scirpus cæspitosus</i> .	S
<i>Carex rigida</i> .	A ₂
× <i>Carex scirpoidea</i> .	A ₂
<i>Carex Lachenalii</i> .	A ₂

× <i>Luzula spicata</i> .	A ₂
<i>Luzula arcuata</i> .	A ₂
<i>Poa alpina</i> .	A ₂
<i>Trisetum spicatum</i> .	A ₂

Of these 47 species 0 are A₁, 33 A₂ and 14 S-species. The 22 species marked × occur, in the area investigated, nearly exclusively on the southern slopes of the mountains. ROSENVINGE (1896) mentions from South Greenland the great influence exercised by the exposure on the distribution of the copses. Beyond a doubt all species near their northern boundary must largely be Sydberg plants. The floristic boundary established is then largely conditioned by the fact that the Sydberg flora here suddenly receives a large new contingent of southerly species, and that the high-arctic species disappear from the lower-lying parts of the mountains of the coast land. That the latter species do not find a home on the northern sides is perhaps due to conditions connected with the light.

The distribution of the chief associations in relation to the floristic boundaries mentioned above.

A considerable floristic decline has frequently some bearing upon the fact that an important plant community ceases in the place in question (WILLI CHRISTIANSEN, 1926). We will now consider the distribution of the associations in this area, taking as our starting point a tabularization of a similar kind as the one used by THORE FRIES (1917) in his regional division of the high mountains in Fennoscandia.

1. *Empetrum-Vaccinium*-heath. (*Empetretum-Vaccinietum*.)
2. *Cassiope tetragona*-heath. (*Cassiopetum tetragonae*.)
3. Willow-copse. (*Salicetum glaucae*.)
4. *Altherbosa*¹⁾ (Rübel 1930) (often consisting of several strata).
5. Herb-field ("matten"). (*Taraxacetum crocei*.)
6. Grass-field (chiefly monocotyledons). (*Caricetum rigidae*.)
7. Snowpatch associations. (*Salicetum herbaceae*.)
8. *Carex rigida*-*Salix herbacea*-tuft vegetation.
9. *Carex rariflora*-Association, rich in mosses. (*Caricetum rariflorae*.)
10. Associations on moving soil.

¹⁾ *Altherbosa* i. e. field with high perennials (*Alchemilleta*, *Archangelietum*).

Table III.

	1	2	3	4	5	6	7	8	9	10
Angmagssalik, 65°37' coast land . . .	!	..	!	!	+	+	+	+	!!	..
Lake Fjord, 66°20'	!!	..	+	*	*	..	+	!	..	..
Mikis Fjord, 68°10'	!	..	+	+	!	..	!	..	..	*
The fjord north of Cape Ravn, 68°31'	!	..	*	+	!	..	+	..	..	*
68°43'—68°48'	+	..	..	..	..	..	+	+	..	!
d'Aunay Bay 69°05'	..	+	*	..	+	..	+	..	..	+
Barclay Bay 69°15'	..	+	..	..	..	..	..	..	..	!
Cape Dalton 69°25'	..	!	..	..	+	..	+	..	..	+
Scoresby Sound, outer part of fjord	*	!	..	..	+	..	+	?	?	+
Scoresby Sound, inner part of fjord	..	!!	+	*	+	..	?	?	?	?
Scoresby Sound, outer part of fjord	*	!	..	..	+	..	+	?	?	+
Kangerdlugssuak, inner part of fjord	+	+	+	..	..	..	!	+	*	*
Kangerdlugssuak, outer part of fjord	+	..	..	..	+	*	!	..	..	..

!: frequently occurring.

+: present.

*: occurring as a fragment of the association.

It appears from Table III that the occurrence of *Cassiope tetragona*-heath, Fig. 6, *Empetrum-Vaccinium*-heath, willow-copse, *Altherbosa* and associations on moving soil are evenly distributed according to the limits mentioned. The *Empetrum*-heath is not so selective as the *Cassiope*-heath; therefore, it is also particularly developed in the coastal zone at Scoresby Sound (KRUUSE), but plays no part whatsoever in relation to the *Cassiope*-heath in this place (HARTZ). The most northerly willow-copse which I found in the coastal zone was in Mikis Fjord (68°10'); in Scoresby Sound HARTZ only found willow-copse in the interior west of Danmarks Island. When I speak of *Altherbosa* I am thinking of the *Archangelica*-Association (cf. RÜBEL 1930 p. 266) or the *Alchemilla glomerulans*-Association, both of which can be compared to the "Hochstaudenwiesen" of the Alps. An *Alchemilla*-Association of this kind is a type of vegetation with a very distinct southern stamp. A biological spectrum of such an association from Mikis Fjord shows 61 per cent H, 22 per cent Ch and 17 per cent G; further, there are in the same association 0 per cent A₁-, 54 per cent A₂- and 46 per cent S-species. As to the herb-field there is a very pronounced difference between the herb-field north and south of 68°43'—68°48'. This difference is also expressed in the far greater number of species within the community south of this boundary area (cf. PALMGREN 1925, pp. 31—32). In the course of my ecological investigations I thus found, within this community, from 18 to 25 species in the northern area, whereas in the southern I found from 22 to 36 species. The occurrence of moving soil and plant com-

munities growing in this kind of soil, such as SEIDENFADEN (1931) mentioned for Northeast Greenland, only occurred in the northern fjords.

This proves that the same zones which THORE FRIES (1917) identified in a vertical direction in the high mountains of Fennoscandia can be identified in Greenland, though in a horizontal direction. FRIES



Fig. 6 *Cassiope tetragona*-heath. Cape Dalton 10. July, 1932. T. B. phot.

demonstrated that it was as a rule the upper regions which were occupied by the *Cassiope tetragona*-Associations: "Obgleich solche Pflanzengesellschaften durchaus nicht selten in den allerniedrigsten Teilen der *regio alpina* vorkommen, hat man jedoch Ursache zu behaupten, dass sie einen besonderen Charakterzug der Vegetation des wirklichen Hochgebirges bilden." (This is clearly shown by 11 profiles out of 21). At the same time FRIES shows that "Wiesenweidengebüsche" and "Hochstaudenwiesen" are characteristic of the lower parts of the alpine region. He concludes his work by dividing *regio alpina* into two zones, an upper and a lower one. "Immer werden wir einen durchgehenden gemeinsamen Zug finden, der die niedrigeren Teile der *regio alpina* von den höheren

unterscheidet: ein deutlicher subalpiner Einschlag in der Vegetation, welches auch ihr synökologischer Charakter sein mag, innerhalb eines Gürtels, der sich von der Waldgrenze ein gutes Stück in die regio alpina hinauf erstreckt." It was such a subalpine "Einschlag", which I was able to identify in the East Greenland flora at Cape Ravn. FRIES calls the lower zone *regio alpina* I and the upper *regio alpina* II. We might appropriately call the corresponding horizontal zones *regio arctica* I and II.

In the same manner DU RIETZ (1925, 1930) distinguishes between several zones within the alpine area:

"Die niedere alpine Stufe oder die Stufe der alpinen (*Empetrum*)-Ericaceenheiden (sinkt in Nordskandinavien und Spitzbergen fast bis zum Meeresspiegel hinab)."

"Die mittlere alpine Stufe oder die Stufe der alpinen *Carex-Juncus*-Grasheiden und *Cassiope*-Heiden (sinkt in Spitzbergen bis in die Nähe des Meeresspiegels hinab)."

"Die hochalpine Stufe oder die Stufe der alpinen Flechten- und Moosphytocoenosen (sinkt im nördlichen Spitzbergen bis zum Meeresspiegel hinab)."

"Die mittlere alpine Stufe" most nearly corresponds with FRIES' regio alpina II.

In regio arctica I one should then be able to distinguish between a regio alpina I and II in a vertical direction, and when at the limit of forest in the southern coast land it should be possible to speak of a regio subalpina, alpina I and alpina II. KRUSE (1912) writes about "Cassiope Mountain" in the interior of the Angmagssalik country: "The low *Empetrum-Betula*-heath continues up along the slopes of Cassiope Mountain, at the same time becoming more like fell-field and still more stunted in appearance than close to the surface of the sea. At a height of 160 m occasional individuals of *Cassiope tetragona* are met with, but grey, faded, half or wholly dead and lichenized, being evidently the extreme outposts, which are hardly able to maintain themselves, even against the greatly weakened *Empetrum*. Already at a height of 200 m conditions were reversed — — At a height of 250 m the associations chiefly consisted of *Cassiope*, while *Empetrum* was quite subordinate — — finally at a height between 300 and 800 m the heath almost exclusively consisted of *Cassiope*." At Kangerdlugssuak there were two small heights which tell the same story.

1. Mountain ridge at one of the lakes between Watkins Fjord and Mikis Fjord.

The lake about 300 m above sea-level.

Southern slope from 300 to 350 m height:

Empetrum-Vaccinium-heath.

Plateau on top, 350—375 m height, often exposed to the north: *Cassiope tetragona*-heath.

2. Mountain ridge in the valley which forms the continuation of Watkins Fjord. Southern slope, with moisture.

300 m: *Empetrum-Vaccinium*-heath.

330 m: Small willow-copse, herb-field, *Empetrum*-heath.

440 m: Luxuriant *Empetrum-Vaccinium-Diapensia*-heath; *Carex rigida*-tuft-moor, *Scirpus cæspitosus-Pinguicula*-Association.

470 m: *Empetrum-Vaccinium* heath, in dry places *Loiseleuria-Vaccinium*-heath, a few specimens of *Cassiope tetragona*.

500 m: The plateau on top: *Cassiope tetragona*-heath.

In Kaugerdlugssuak I did not see *Cassiope* forming associations below a height of 100 m, although it occurred in scattered individuals almost all the way down. There is surely *Cassiope*-heath on the peaks of many mountains in Kangerdlugssuak. It did not occur in Mikis Fjord below 300 m, but unfortunately I did not find time to ascend to higher levels there.

In this context the specifications given to HARTZ (1895) of the limits of the growth of the vegetation in Scoresby Sound are interesting; he found *Cassiope* right up to a height of 1200 m and fell-field, to a height of 1570 m; in 70° the vegetation thus ceases at a height of about 12—1500 m, whereas in the interior of Danmarks Fjord (80°) it ceases at a height of 300 m (EJNAR MIKKELSEN, 1914 p. 157). After this, it is not to be wondered at that there are 62 per cent A_2 -, 38 per cent S- and 0 per cent A_1 -species at 700 m on Kakarsuak Mountain near Narsak (60°55'), or still at this height apparently not in regio alpina II (the percentages calculated after the lists of ROSENVINGE 1896). It is, however, not certain that every high mountain in South Greenland should on its top have a large contingent of A_1 -species, the latter perhaps lacking for historical reasons. Here one must beyond a doubt first and foremost keep to the distribution of communities. Farther north WAR-MING (1888) on Præstefjeldet at Holstensborg found 76 per cent A_2 -, 4 per cent S- and 20 per cent A_1 -species at a height of 600 m, and on Lyngmarksfjeldet at Godhavn on Disko 70 per cent A_2 , 0 per cent S- and 30 per cent A_1 -species. The two latter localities must be said to lie in regio alpina II (cf. the percentage in Table I). It is impossible to say anything for certain as to the height at which one zone ceases and the other begins in the various latitudes of Greenland; for one thing, the

information at hand is too sparse, for another the mountains are too uneven as to situation (coast and inland), geological structure, declivity and exposure (cf. THORE FRIES, 1917). Even though the indicator species, in this case *Cassiope tetragona*, does not occur in a region, it must still be possible on a given mountain to distinguish between the two zones by an investigation of the floristic decline and according to the THORE FRIES method (1919), seeing that willow-copse and herb-field, which occupy the lowest parts, shelter a number of species which cease simultaneously with these associations.

Before I proceed with my investigations of the phytogeographical boundary found in a horizontal north-south direction, I should like to call attention to the relation between the zoogeography and climatology and my results.

Zoogeography: The zoologist of the expedition, M. DEGERBØL, was able to prove that the northern and southern limits of certain species of animals fell near the area $68^{\circ}43' - 48'$. Thus, the southern limit of the Polar hare and the collared leming, and the northern limits of a number of insects and lower animals, for instance the land snail *Vitrina angelica*, which is associated with the *Alchemilla*-Association, from $68^{\circ}31'$ and southwards, and the insects: *Bembidium grapei*, *Byrrhus fasciatus*, *Otiorynchus arcticus* et al. The reader is, however, referred to the detailed treatment of the zoological material.

Climate: On a summer expedition like ours it was naturally impossible to collect such a large material of climatic observations as to be able to form an exact basis towards understanding the above-mentioned floristic-ecological boundary on Blosseville's Coast. Still, observations from one summer are better than none, and as climatic conditions in the summer of 1932 agree very well with the botanical results, there is a possibility that the climatic conditions of this summer are of a more general character.

Table IV*).

	Jan.	Febr.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature:												
Scoresby Sound	-17,9	-19,6	-17,3	-12,9	-4,6	1,8	4,1	3,2	-0,7	-6,9	-12,4	-15,6
Angmagssalik..	- 8,5	-10,0	- 7,8	- 4,5	0,8	4,9	6,6	5,8	3,0	-1,3	- 5,3	- 7,0
Precipitation:												
Scoresby Sound	45	43	14	38	7	25	14	11	27	28	26	39
Angmagssalik..	83	51	62	61	61	53	49	60	94	144	84	70

*) I am much obliged to the Meteorological Institute of Copenhagen for their kind permission to use this material.

When considering the climate at the stations of Scoresby Sound and Angmagssalik (Table IV), it appears that the climate between these two stations must undergo a very considerable change. Scoresby Sound has 3 months with a positive mean temperature, whereas Angmagssalik has 5 months. The July mean temperature of Angmagssalik is 2,5 ($^{\circ}$ C) higher than that of Scoresby Sound. Still greater is the difference in the yearly precipitation, Angmagssalik having 872 mm, whereas Scoresby Sound has 317 mm, or very nearly the ratio of 3 to 1. As to precipitation Angmagssalik is only surpassed by Ivigtut in South Greenland, which has 1167 mm as its yearly precipitation, but it is the station in the whole of Greenland which has the greatest number of days with precipitation. (HELGE PETERSEN: *The Climate of Greenland*. Greenland I.)

If the July mean temperature at Scoresby Sound is compared with the same quantity at the stations of the west coast, it proves that it is only at the northernmost locality that similar conditions of temperature are found. In Scoresby Sound we have a high-arctic cold and comparatively dry climate, whereas in Angmagssalik there is an arctic, warmer and more moist oceanic climate. We pass from a central-arctic type of climate to a tundra climate type and, having regard to the distribution of these types, from the central-arctic climate province to the north-atlantic polar province (PHILIPSEN 1925). Does this climatic transition come about as abruptly as the corresponding transition in the vegetation? In order to answer this question, one must first of all consider the factor which decides the difference. This factor is the East-Greenland Current with the ice carried along by the same. From former expeditions (e. g. that of AMDRUP) it is known how difficult ice conditions may be along this coast; there are summers, when the greater part of the coast is practically blocked by the pack-ice. The picture which it presented in the summer of 1932 was, however, quite a different one; one could not during this summer speak of pack-ice, except in scattered floes south of a bar of ice at Cape Rink and Cape Stephensen, in about lat. $68^{\circ}20'$. South of this area the Danmark Strait was practically open. There are many facts which point in the direction of these conditions not being unique. Thus the bar of ice seemed to have arisen in the manner that the icebergs along the coasts had grounded (on the comparatively low submarine ridge between Iceland and Greenland) and pressed the floes of the pack together. At Cape Daussy in $68^{\circ}43'$ the expedition noticed that the beach consisted of very large walls of boulders eroded by the sea, and at the mouth of Kangerdlugssuak rocks were observed which were likewise greatly eroded by the sea. In this context it should also be mentioned that the East Greenland Current, as is well known, divides in the Danmark Strait and meets the warmer Irminger Current. (I. N. NIELSEN: *The Waters round Greenland*. Greenland I). See also RUDOLF AHRENS

(1927) who in Fig. 1 presents a map of ice-conditions round the Pole, and places the boundary between "Sommerlückeneisküsten" and "Wintereisküsten" north of Kangerdlugssuak near $68^{\circ}20'$, such as was the case this year.

It is interesting to notice what was the character of the weather north and south of this bar of ice. From table V it appears that there was a sudden change in the July climate (to the north) to the August climate (to the south).

Table V.

	July north of bar	August south of bar
Fog, haze	25 per cent	16 per cent
Overcast weather	6 — —	6 — —
Rain	0 — —	39 — —
Clear weather	69 — —	39 — —
Mean height of barometer	760	754

As long as the pack-ice is lying outside the coast, it is either clear weather or foggy; farther south the weather becomes much more rainy. In Mikis Fjord (lat. $68^{\circ}10'$) at the end of August it rained almost incessantly for 5—6 days, and one day we registered about 60 mm of

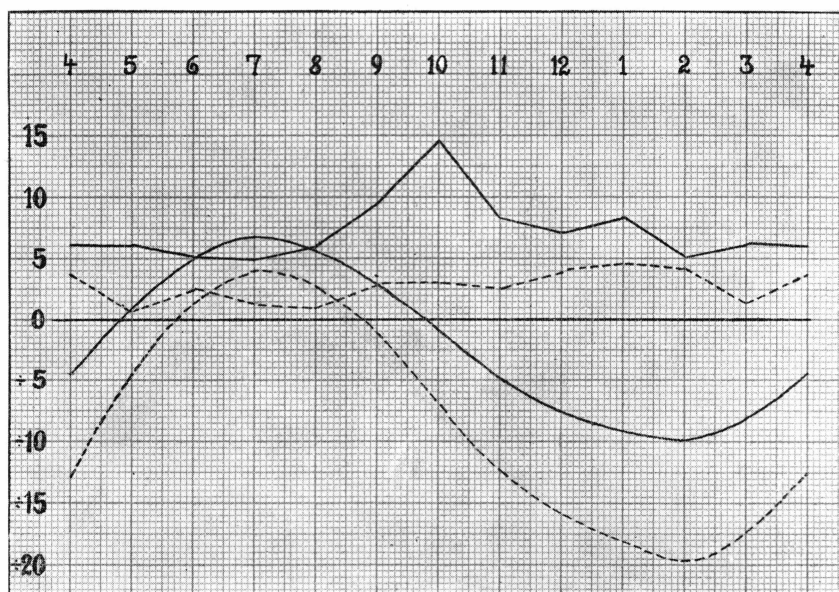


Fig. 7. Hydrotherm curves. Angmagssalik: —, Scoresby Sound: -----.
Abscisse: the months. Ordinate: temperature in degrees of celcius,
precipitation in cm.

rain. According to this a station like Kangerdlugssuak, situated midway between Scoresby Sound and Angmagssalik, ought at any rate to have climatic conditions which were almost a mean value between these two stations, a July mean temperature of about 5.4° and a yearly precipitation of about 600 mm. This agrees very well with the fact that the July isotherm 4° — 5° forms the boundary between the central-arctic climate province and the north-atlantic polar province (PHILIPSEN 1925), or between a high-arctic and a low-arctic zone (VAHL and HATT 1922), and this must be the climatic boundary corresponding with the floristic-ecological one which I demonstrated on the east coast of Greenland.

The two hydrotherm curves for Scoresby Sound and Angmagssalik (Fig. 7) are a graphic representation of Table IV. They clearly show the difference between the more continental Scoresby Sound and the more atlantic Angmagssalik, Angmagssalik having its rainy season in the autumn, after the breaking up of the pack-ice, while in Scoresby Sound the precipitation is practically the same all the year round. There may naturally be some small changes in the mean values given, when investigations covering a greater number of years are available. It should also be emphasized that there is a great difference between the climatic conditions of the various years as corresponding with ice conditions.

It appeared from the preceding that *Cassiope tetragona* on the east coast seems well qualified as an climatic indicator; this is also the case on the west coast where, however, its occurrence cannot be used as an indicator species for the boundary between the two zones. This is because *Cassiope*, like *Arnica* and several other higharctic species, must be said to be more closely associated with a certain degree of continentality than with certain degrees of heat. We, therefore, see that a number of species extend further south on the warm and dry west coast, whereas they do not extend so far south on the east coast. *Cassiope* is mentioned by PORSILD (1920) as the heath-plant, which after *Empetrum* is most important on Disko. He further says: "The southern limit is about 64° where the plant only occurs in alpine inland stations. Already in the fjords between 66° and 67° scarcer on the sunny slopes than on the northern; observed, however, locally down to the shore." One might call *Cassiope* a continental-arctic species, but for further particulars the reader is referred to the subsequent chapter, where the types of distribution will be discussed.

The conditions on the west coast which should prove a boundary line of a similar kind as the one on the east coast, must in the first place be a similar floristic decline, as associated with the cessation of certain of the same important communities. In order to form an idea of this problem, I have made some preliminary calculations based upon OSTENFELD's lists of plants from the various districts. As my starting point

I naturally choose Scoresby Sound and Angmagssalik. By counting up the species which these two areas have in common, and then subtracting this value from the total number of species in the areas, one learns how many species are lost in the intermediary area. This quantity, given in percentages of numbers of species, is comparable with corresponding quantities from the west coast, seeing that OSTENFELD has chosen to make the west and east coast districts rather uniform in extent and situation. Between Scoresby Sound and Angmagssalik the decline from north to south is 31 per cent, from south to north 36 per cent. Between Godthaab and Jacobshavn-Disko, which distance on the west coast nearly corresponds with the distance between Angmagssalik and Scoresby Sound, the decline from north to south is 21 per cent, from north to south 22 per cent. When adding up these figures it appears that the total decline on the west coast is 43 per cent as against 67 per cent on the east coast. Between Disko-Jacobshavn (V) and the most northerly district (VI) there is only a smaller floristic difference, and it is worth noticing that there are no southern boundaries between these districts. If, on the other hand, we compare Disko-Jacobshavn with district VII (Thule), we find a decline of 55 per cent in a northerly and of 10 per cent in a southerly direction, that is, a total decline of 65 per cent, a quantity which amounts to the same as that between Scoresby Sound and Angmagssalik, but cannot be compared directly with the latter, as on the west coast it is particularly a decline in a northerly direction. This again shows that many higharctic species are often able to live comparatively farther south on the west coast than on the east coast. Nevertheless the boundary between regio arctica I and II must be looked for north of Disko on the west coast. ROSENVINGE (1896) touches this problem (p. 110) when finding a greater difference between the real high-arctic regions, with ericaceous heath and herb-field as the highest forms of vegetation and Central Greenland with its willow-copse, than between Central Greenland and the southern coast land with its birch-copse. He writes: "There will, therefore, be every reason to distinguish between the arctic region proper and the willow-region (WAHLENBERG; WARMING) or with DRUDE between a high and a low-arctic mountain region — —". ROSENVINGE is of the opinion that the boundary is at the Nugssuak peninsula between 70° and 71° "where there is also a pronounced floristic boundary". There are, however, southern species which are able to live some distance farther north than the actual copses extend, and it would be natural to put the boundary where the greatest floristic decline takes places, in which manner many limits of areas will coincide with the former. The floristic decline can thus also be applied on the west coast; on the other hand, it proved that one could not make a direct comparison between the floristic decline of the west

coast and that of the east coast, so that it might be a matter of doubt, whether the two boundaries had any connection with each other. It must, therefore, be admitted that only the floristic decline, which is conditioned by the same climatic factor — in this case the heat — can be used when looking for the further course of such boundaries. This floristic decline will then principally consist of northern boundaries. It will be the distribution of the southern species (boundaries of areas) as well as the boundaries of the southern communities which are the decisive factor. Such a boundary — determined in this manner — must follow isotherms and biochores. An agreement between the individual points of investigation of such boundaries can naturally only be approximate, seeing that the climate is never the same in two different localities; thus, one would beyond a doubt find great differences in the different places, if one tried to follow and establish the limit of forest. It is then of importance to have so many elements as possible for comparing the individual places. What isotherms and biochores and limits of the areas of species show in rough features, the investigation of the floristic decline will be able to supply in detail.

ROSENVINGE demonstrated the clearly defined floristic boundary, which divides the land of the south coast from the remaining parts of Greenland (from 61° on the west coast to 60°30' on the east coast); further, a couple of less clearly defined boundaries at 63° and 64°. It is natural that a number of boundaries of areas coincide in this place, seeing that in this very locality, for instance in point of precipitation, we reach the same altitude, which on the east coast seems to cause the disappearance of a number of high-arctic species. In this very latitude (64°) falls the southern boundary of *Cassiope tetragona* and *Arnica alpina*.

THORE FRIES writes that the material at hand is now sufficient to determine whether one ought to divide regio alpina II into an upper and a lower region, and he adds: "Präliminär möchte ich als Arbeitshypothese innerhalb der r. a. II zwei von einander mehr oder weniger scharf geschiedene Abteilungen aufstellen: a) einen unteren Teil mit mehr geschlossener Vegetationsdecke, und b) einen oberen, fast sterilen, charakterisiert durch Block- und Scherbenmeere, wo Steinflechten, Moose, kleinere inselförmige Flecke mit Phanerogamenvegetation oder einzelne Phanerogamen vorkommen können, oder wo jede Vegetation fehlt." Compare DU RIETZ 1925, 1930 (previous quotation p. 36).

In North Greenland OSTENFELD (WULFF) 1923 found that there was almost exclusively fell-field. Here there is an ecological difference in the direction of the country situated to the south, which it may perhaps have its value to emphasize, but there is presumably no sharp floristic boundary determined by the floristic decline.

The flora of Greenland, which is conditioned by the great difference

in climate on the different parts of the coast of Greenland, consists of different elements. Just as there are different climatic areas, in the same manner there are different phytogeographic areas which are limited towards one another by the limits of the areas of certain species and communities, the boundary being drawn where the floristic decline is greatest. The climatic provinces are in particular these four: the inland-ice; the area north of the 4—5° July isotherm (the central-arctic area); the area south of this isotherm (the north-atlantic polar province) and finally a subarctic province in the interior of the south coast land, where the mean temperature in July reaches 10° C. Also, it will be possible inside the coast area to distinguish between an inner and an outer land, corresponding with the fact that the isotherms do not pass right across Greenland, but bend upwards in the warmer inland (compare: GUNNAR ANDERSSON, 1902). The most important phytographic areas would then be associated with these provinces.

We are still lacking a detailed description of the distribution of all the Greenland species along the lines followed in the preparation of the results of the topographical-botanical investigation of Denmark (KNUD JESSEN, 1931). In this manner one would realize the different types of distribution in Greenland. The most important of these types would then, according to the preceding, be the following:

1. High-arctic species. Associated with the central-arctic climate and with regio arctica (alpina) II. Examples: *Saxifraga flagellaris*, *Pleuropon Sabinei* (Fig. 13.)
2. High-arctic-continental species. Associated with r. a II, but besides towards the south with continental regions in the inland or in the coast land, when the precipitation does not become too strong (West Greenland). Examples: *Cassiope tetragona*, *Arnica alpina* (Fig. 11 and 12.)
3. Widely distributed species within the arctic area. Compare PORSILD and OSTENFELD. Examples: *Luzula arcuata*, *Trisetum spicatum*, *Saxifraga cernua*. Both in r. a. I and II.
4. Subarctic species associated with r. a. I and the land of the south coast. Besides in the warm inland of Scoresby Sound. Examples: *Botrychium Lunaria*, *Alchemilla glomerulans*, *Pinquicula vulgaris*, *Scirpus cæspitosus*, *Bartschia alpina* (Figs. 8, 9 and 10.)
5. Subarctic species associated with the land of the south coast, and perhaps occurring, in particularly favorable localities, in r. a. I. Examples: *Lycopodium clavatum*, *Drosera rotundifolia*, *Parnassia Kotzebui* (Fig. 13.)

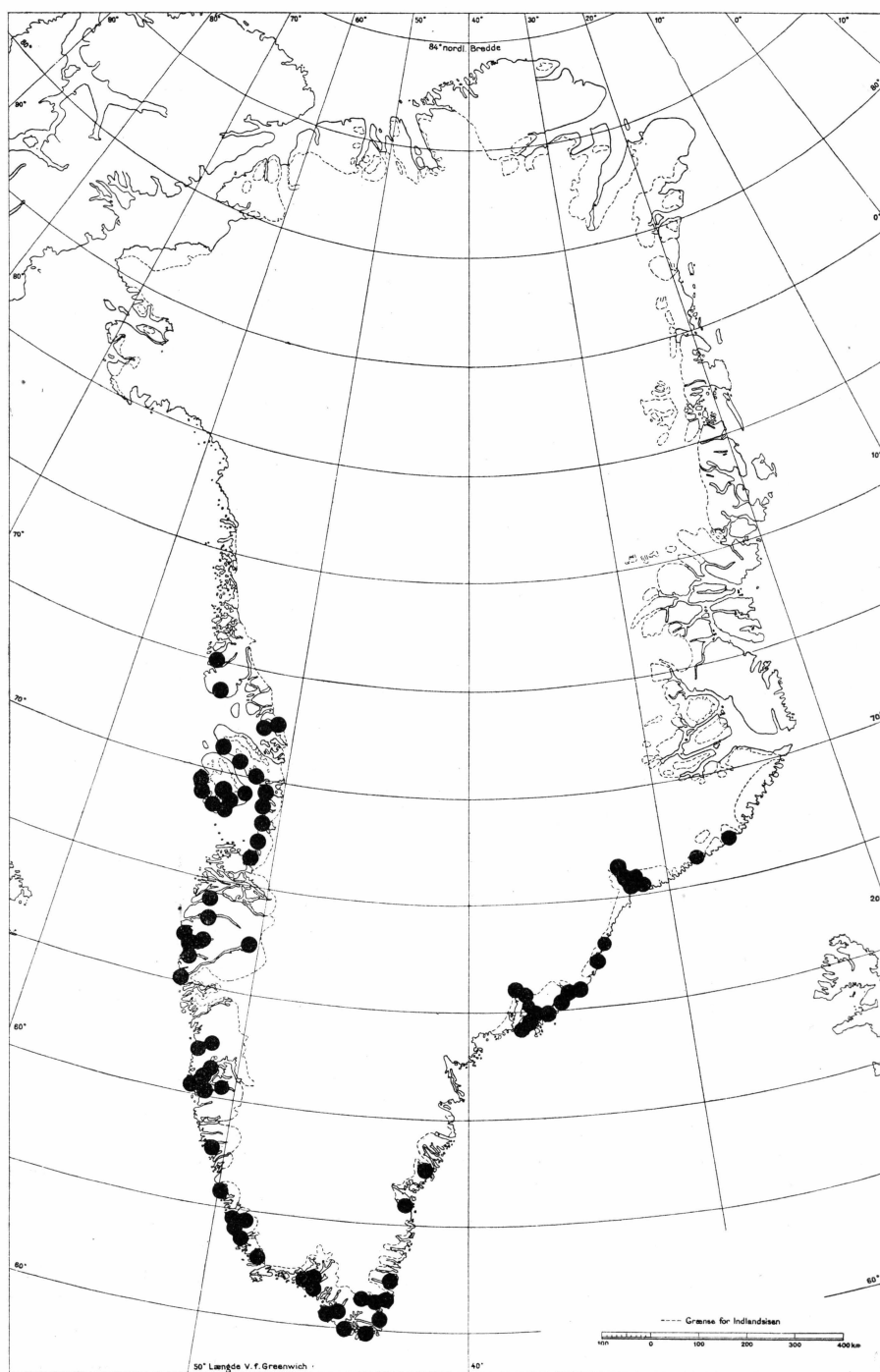


Fig. 8. The distribution within Greenland of *Bartschia alpina*.

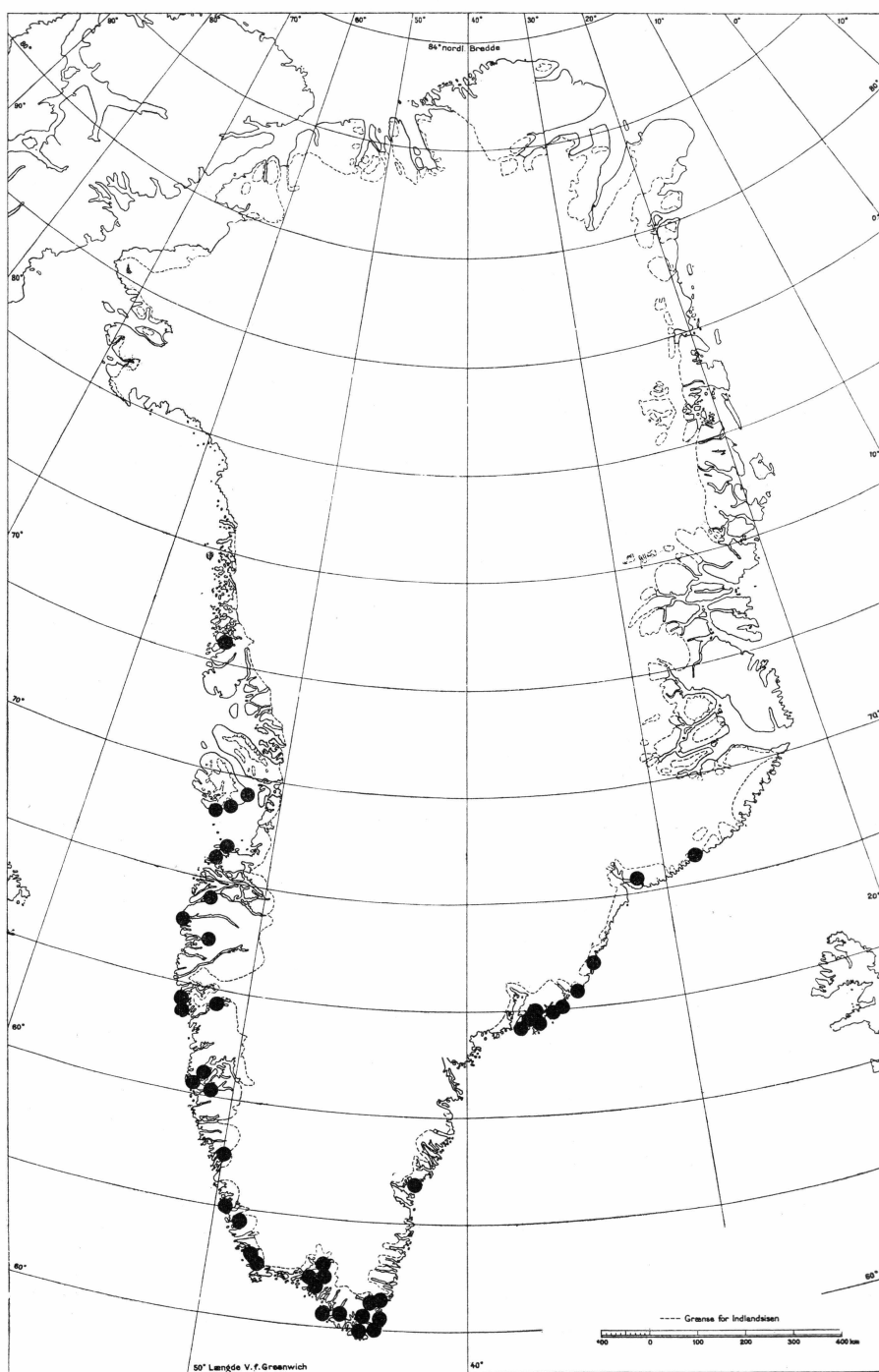


Fig. 9. The distribution within Greenland of *Scirpus caespitosus* var. *austriaca*.

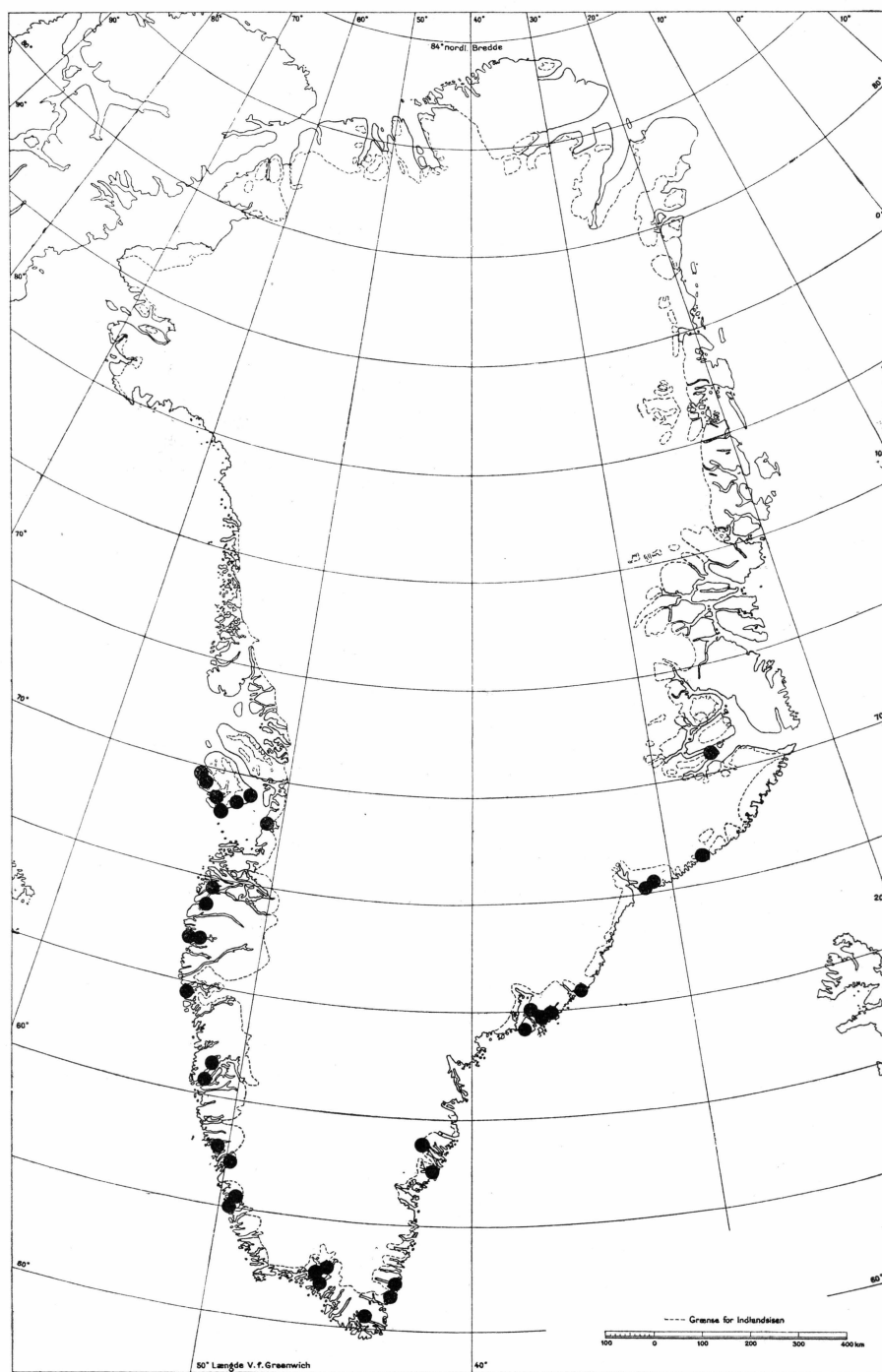


Fig. 10. The distribution within Greenland of *Alchemilla glomerulans*.

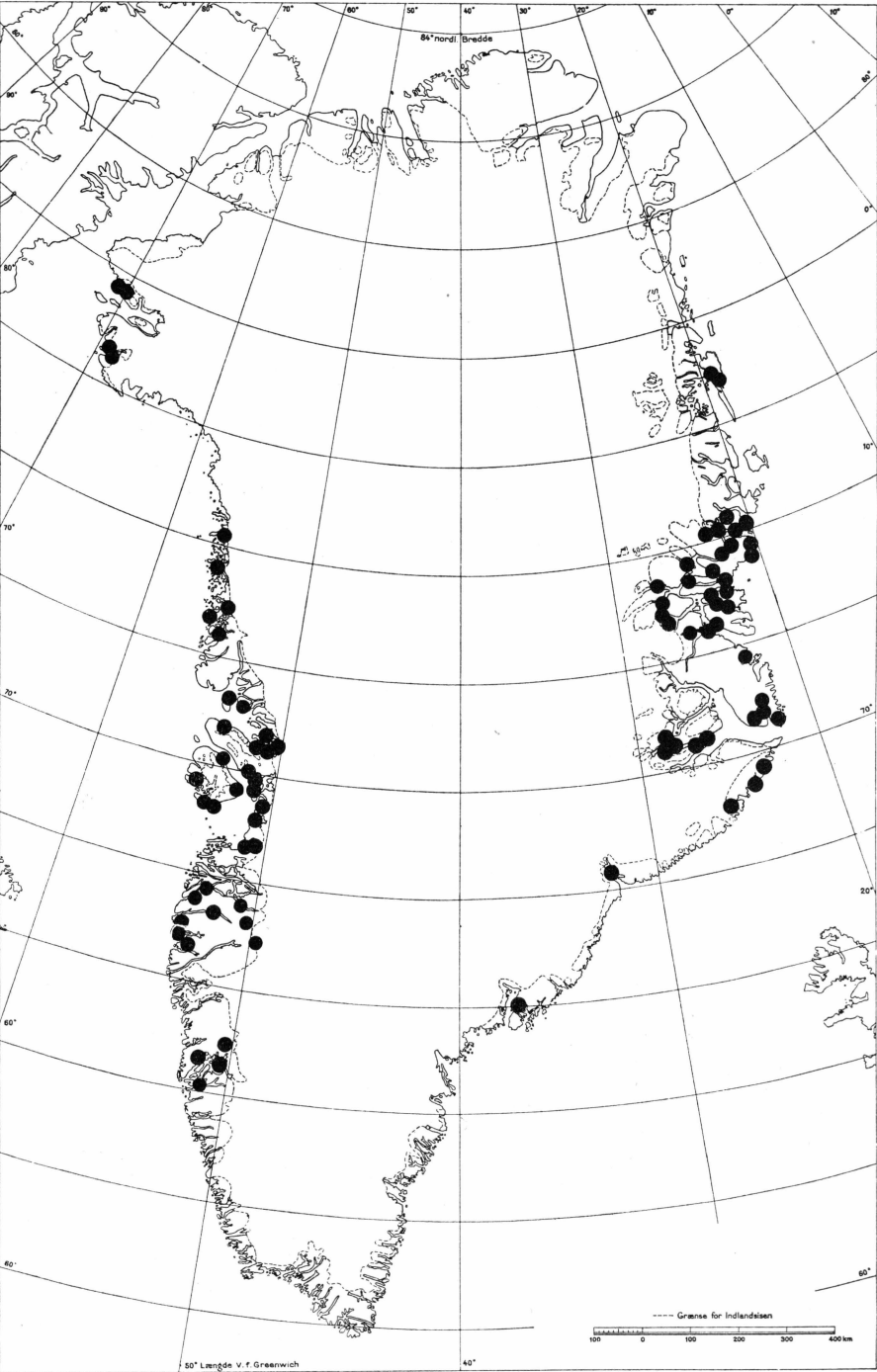


Fig. 11. The distribution within Greenland of *Arnica alpina*.

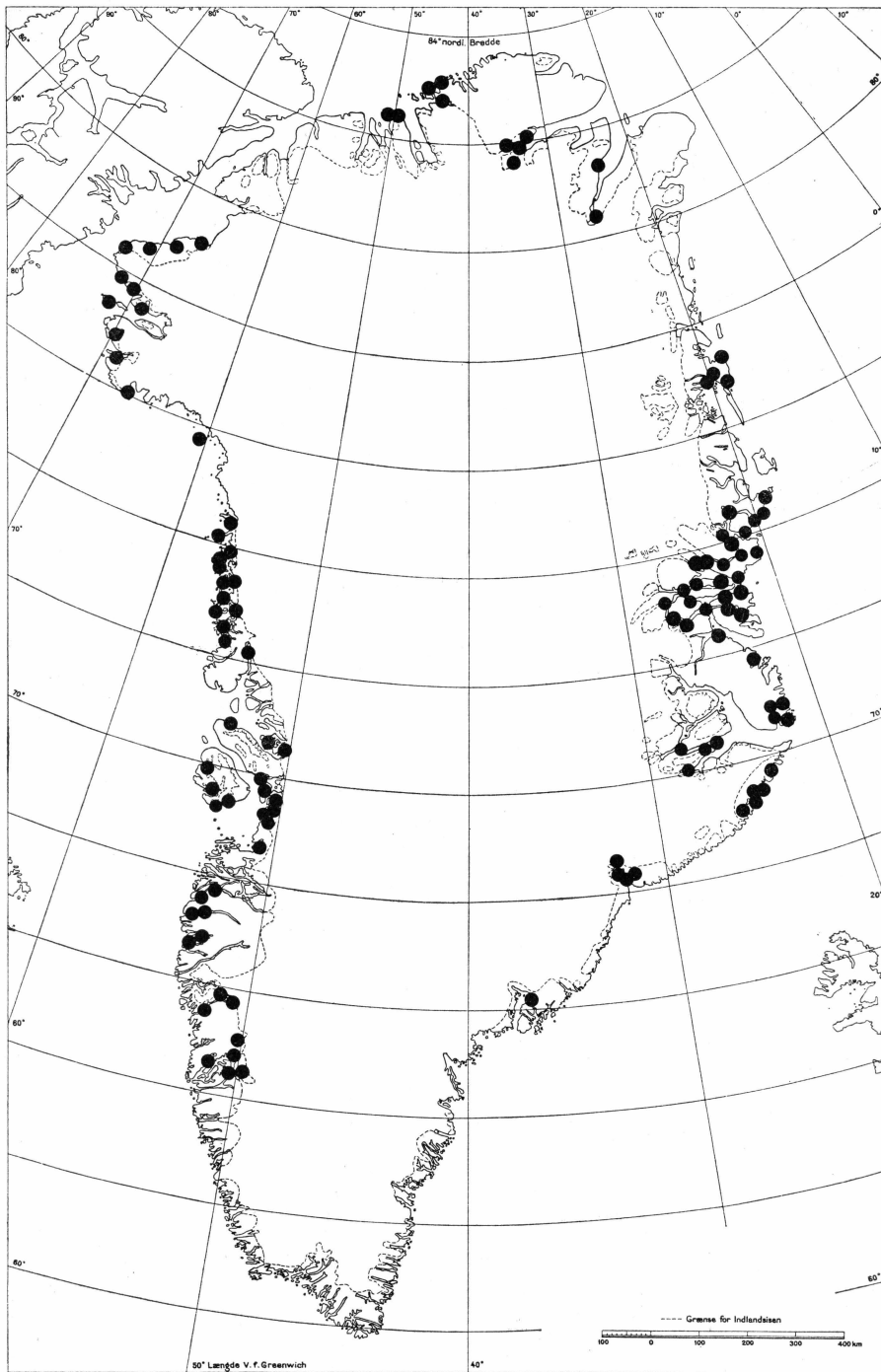


Fig. 12. The distribution within Greenland of *Cassiope tetragona*.

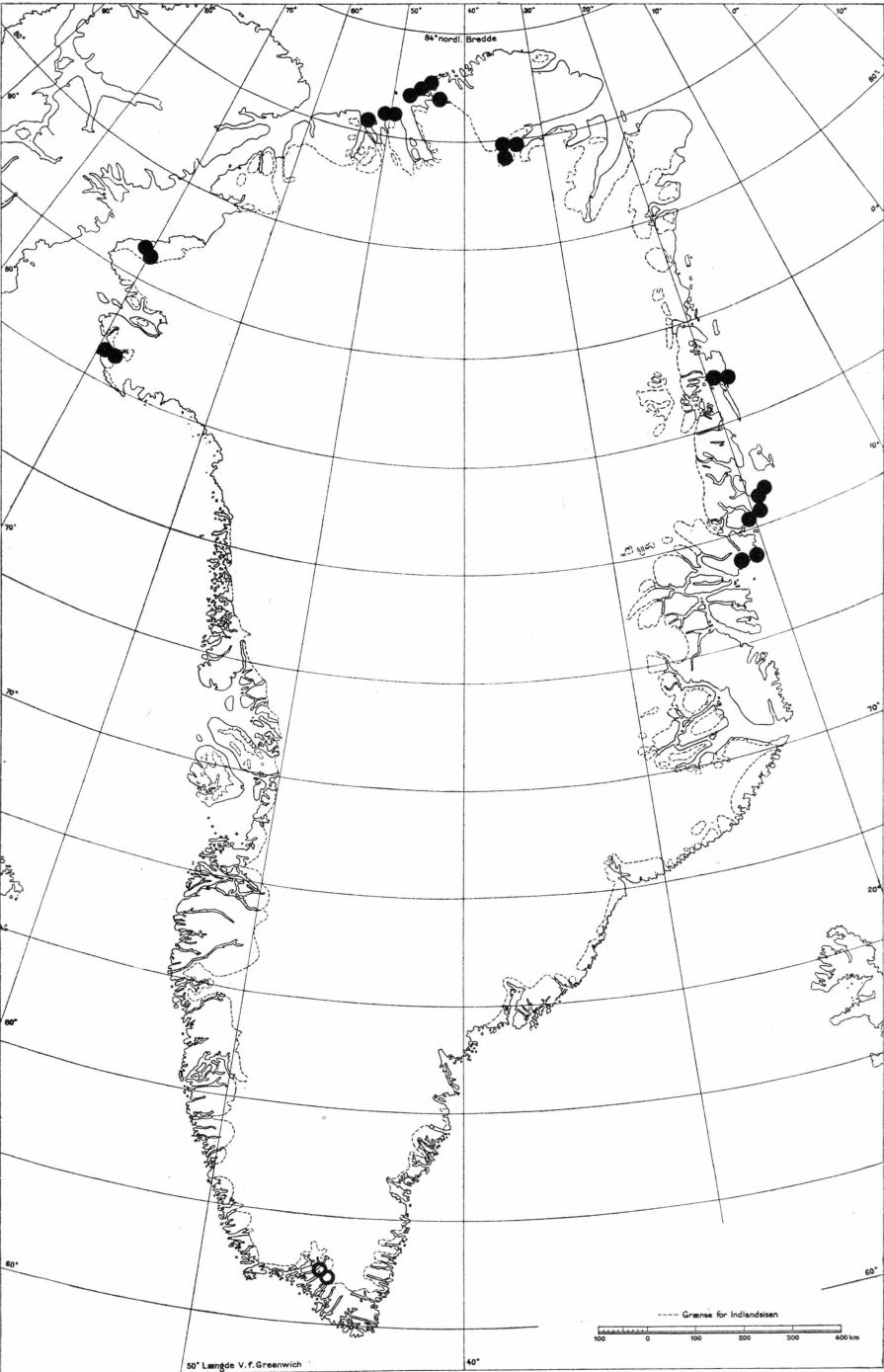


Fig. 13. The distribution within Greenland of *Saxifraga flagellaris* (●) and *Parnassia Kotzebui* (○).

1 and 2 correspond with OSTENFELD's A_1 , 3 with A_2 and 4 and 5 with S. Besides these types there must be species which are associated with the interior or the coast land within regio arctica I or II.

Round the boundary between regio arctica I and II species of the groups 1, 2 and 4 should have their distribution, group 2, however, only on the east coast. The maps (Figs. 8—13)¹⁾ show some particularly important examples of such distributions.

Bartschia alpina, *Scirpus caespitosus* var. and *Alchemilla glomerulans* are all associated with r. a. I; the area boundary of *Bartschia alpina* is almost as I imagine the boundary between r. a. I and II. That *Alchemilla glomerulans* does not occur farther north than Disko on the west coast, is beyond a doubt rather due to historical reasons (immigration from Iceland) than to a possible lower degree of atmospheric moisture in a northerly direction. *Cassiope tetragona* and *Arnica alpina* are two typical examples of high-arctic species, which are associated with a continental climate and, therefore, towards the south prefer the dry inland. *Saxifraga flagellaris* seems entirely associated with r. a. II and *Parnassia Kotzebui* with the subarctic area in the land of the south coast. There are naturally a number of species which it is difficult to place in such groups — chiefly species which are restricted to one or more districts — but the thing which is of importance in this connection is to indicate the most important types of distribution. Further, I refer to the existing divisions of the arctic flora, viz. PORSILD 1920, OSTENFELD 1926, MÖLHOLM HANSEN 1930, p. 19. See also STEFFEN 1924.

By many scientists the arctic zone is regarded as a phytogeographical-climatical unity. Thus KÖPPEN (1901, 1931) speaks of an "arctic tundra climate", where the vegetation consists of „Moos- und Flechtentundren, mit Oasen von Blütenpflanzen". Compare also RIKLI 1913. As early as in 1878 KLINGGRÄFF showed that the European polar zone might be divided into two sub-zones. He writes: "Bei der Armuth und Einförmigkeit der hochnordischen Flora pflegt man für ihr ganzes Gebiet nur eine Zone, die arktische, anzunehmen. Doch lassen sich, wenigstens in ihrem europäischen Antheil, zwei Unterzonen unterscheiden — — Wollte man ein umfassendes, anschauliches Naturgemälde der arktischen Zone Europas liefern, so könnten die beiden Unterzonen nur gesondert geschildert werden." Klinggräff's classification is adapted by ENGLER (1879), who characterizes the lower southernmost zone in the following manner: "Das arкто-tertiäre Element tritt mehr hervor." For Greenland WARMING attempts a special classification when he writes: "We may roughly distinguish between the following forms of vegetation which,

¹⁾ The maps are prepared after an examination of the arctic herbarium in the Botanical Museum at Copenhagen. I am greatly indebted to the Museum for the kind permission to use the collections, as also for the printing of the maps for this purpose.

partly by the order in which they are mentioned, indicate a gradually decreasing strength in accordance with the climate, and which must further be classed as sub-departments of the alpine region. 1. Willow-copse-zone. 2. Ericaceous heath zone. 3. Fell-field zone. A somewhat similar classification is made by GUNNAR ANDERSSON (1902) who has two zones, *viz.* a tundra-zone and a fell-field zone; he writes: "Meines Wissens besitzen die arktischen Länder zwei grosse Gruppen von klimatischen Pflanzenvereinen" (Compare SCHIMPER). A division into two zones is also used by the geographers, see the climatic chapter. What is new in my investigations is then only the demonstration of the fact that by investigating the floristic decline and the distribution of communities in arctic regions it may prove possible to fix the boundary between regio arctica I and II, the existence of which was known to earlier scientists, and further that this transition between the zones mentioned does not always take place gradually.

An entirely new point of view in phytogeography was set up by RAUNKIÆR, who showed that it was possible to draw biochores throughout the whole of the circumpolar area, biochores being lines which connected places having the same biological spectrum with one another. RAUNKIÆR (1908) elected to follow the biochores 10, 20 and 30 per cent Ch. According to the course of the latter he divided the geographical area, in the same manner as the geographers divide it by the 10° and 5° July isotherm. It is now clear that a biochore, which nearly coincides with the boundary between regio arctica I and II, would have a great practical and theoretical significance, seeing that it might be used as a guide in a division between these two zones. For this purpose it might be desirable to choose the expedient of computing the spectrum north and south of the boundary 68°43'—68°48'. However, RAUNKIÆR (1911) shows that small areas are apt to have too high a Ch percentage, and this being the case with the two areas in question (RAUNKIÆR 1908), it is natural to compute the spectra for the coast land of Angmagssalik plus the adjoining coastal zone to the north as far as the boundary, and for the Scoresby Sound coast land plus the coast situated towards the south as far as the boundary, thus computing the spectra of floristic-ecologically uniform stretches of land. Table VI shows that north of the boundary there are 30 per cent chamaephytes, as against 25 per cent to the south of it.

Table VI.

	Ch	H	G	HH	Th
The coast 72° to 68°43'—48'	30	58	8	2	2
The coast 68°43'—48' to 65'	25	59	7	5	4

Between these two Ch per cent biochores the boundary must then be looked for. It is consequently interesting to see that district VI and VII on the west coast (MÖLHOLM HANSEN 1930) has 30 and 31 per cent Ch, while Disko (V) has 25 per cent. It was north of Disko that the boundary should be drawn, if one considered the floristic decline. On Novaia Zemlia it also proves that in the place, where the floristic decline is greatest, the Ch percentage rises to 25 and 30. In this context I should like to quote part of one of RAUNKIÆR's tables (1908).

Table VII.

Novaia Zemlia	N	Ch	H	G	HH	Th	number of species
75—76°	0	31	69	..	..	..	16
74—75°	2	25	63	10	..	..	49
73—74°	2	22	62	11	2	1	128
72—73°	2	20	60	12	3	3	130
71—72°	3	20	64	11	2	..	130

In a vertical direction the zones, which here are apt to divide, also seem to be bounded by a biochore lying about 25—30 per cent Ch. Thus, MÖLHOLM HANSEN (1930) on Iceland could establish a lowland zone with less than 20 per cent Ch., a lower highland zone between 20 and 25 Ch, an upper highland zone from 25 to 40 per cent Ch and, finally, a nival zone with 40—50 per cent Ch.

Unfortunately the various authors rather disagree as to the percentages of N, Ch and H.

SUMMARY

By the work done in the course of the expedition the number of known species in OSTENFELD's district IV east was increased from about 115 to 150 known species.

These species are distributed within the area in question, in such a manner that by computing the floristic decline in a northerly and southerly direction, one arrives at the result that there is a pronounced floristic boundary on Blosseville's Coast in about 68°43'—68°48'.

In this computation regard was only had to the coast land, it being proved that a floristic decline also took place at a right angle with the coast in Scoresby Sound and Kangerdlugssuak.

The distribution of the communities of plants, as well as the evidence supplied by zoogeography and climatology, agrees with the conditions found.

It proved by comparing the investigations made with the literature on the subject that the boundary found was a boundary between a high- and a low-arctic zone, corresponding with two different climatic areas. Vertically it corresponds with the boundary between regio alpina I and II (THORE FRIES). The two zones were, therefore, called regio arctica I and II.

Then the further possible course of the boundary was mentioned, regard being had to the literature on the subject. On the west coast it will presumably lie in about 71° . In this manner a preliminary review of the phytogeographical division of Greenland was arrived at, and the most important types of distribution were made subject to discussion.

Finally it was made probable that a biochore situated between the 25 and 30 per cent Ch-biochore would be of special importance, as coinciding with the boundary mentioned.

To conclude I beg to thank the leader of the expedition, Capt. EJNAR MIKKELSEN, for his great help, both on the expedition itself and later in the preparation of this article. I am also greatly indebted to my comrades on the expedition for assistance rendered on numerous occasions.

Mrs. ELISABETH EKMAN has been so kind as to determine my collections of *Draba*, for which I take this opportunity to express my sincere thanks. Further I owe a great debt of gratitude to Professor KNUD JESSEN, Dr. sc. and JOHS. GRØNTVED M. sc. for much valuable information and assistance, as well as for the loan of literature on the subject.

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