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FLORISTIC AND ECOLOGICAL STUDIES IN MIDDLE WEST GREENLAND

BY

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WITH 12 FIGURES IN THE TEXT
AND 4 PLATES

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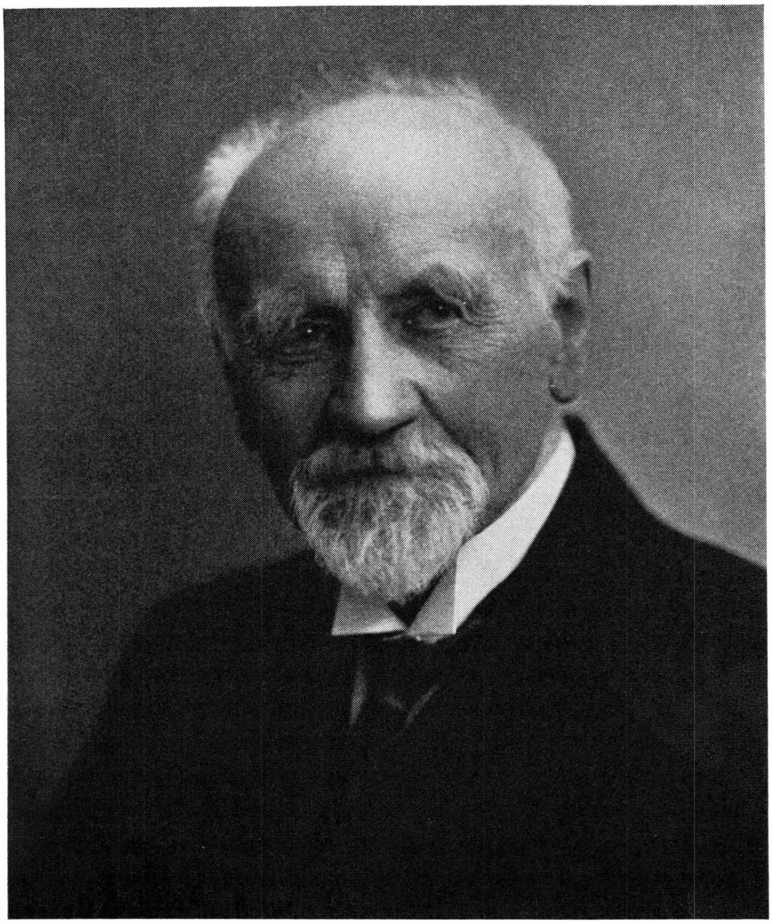

Morten Pedersen Porsild 1872—1956, leader of the Danish Arctic Station in Disko 1906—1946. On the occasion of his 80 years' birthday, the 1st September 1952. Phot. Alb. Schou jun.

1. INTRODUCTION

In August-September 1956 I had the opportunity of visiting the Danish Arctic Station in Disko, and from this place of undertaking excursions in the area near Godhavn, and further of making a long voyage by the small boat "A. Holck" belonging to the Station, along the coast of West Greenland to Søndre Strømfjord. On the journey it became possible to supplement the investigations made in 1946 by The Botanical Expedition to West Greenland (see Meddelelser om Grønland Vol. 147—148). The chief purpose of the voyage in 1956 was especially to acquire a better knowledge of the coastal mountains in the region adjacent to and north of the entrance to Søndre Strømfjord, and to find and examine the salt lake in the inland which by I. A. D. JENSEN (1884, pp. 59—60) was called "Tarajornitsok". In the boat trip participitated the limnologist ULRIK RØEN, M. sc., and Mr. ORLA JENSEN, on the permanent staff of the Arctic Station. I owe them both thanks for valuable assistance.

Apart from the collections and observations made by the author several older collections, which have not previously been mentioned in the literature, will be treated in this paper, viz. a large collection made by the previous leader of the station, Magister M. P. PORSILD, in the Sukkertoppen district 1937 and 1941, and two minor collections made by the zoologists Drs. AXEL HEMMINGSEN and FINN SALOMONSEN in 1954, who both worked at the station for a time. After his death, Magister M. P. PORSILD's collection was handed over to me by his son, Dr. phil. A. E. PORSILD, Ottawa. The names of the three collectors will in the following be abbreviated to P (M. P. Porsild), H (Axel Hemmingsen), and S (Finn Salomonsen). Most of the plants collected by M. P. PORSILD were labelled and determined.

I take the opportunity of commemorating the late Magister M. P. PORSILD by bringing a photo of him taken on his 80 years' birthday. The present paper deals with the last floristic investigations from Greenland made by him, further it deals with various investigations made with the station as basis. The Danish Arctic Station in Disko was founded in 1906 on the initiative of M. P. PORSILD, and it celebrated its fiftieth anniversary in 1956, the year in which the investigations treated in this paper were made. The number of publications sent out by the Station as *Arbejder fra Den Danske Arktiske Station på Disko* (Works from the Danish Arctic Station in Disko) fully show the great importance the establishment of this station plays to scientific research work. The station in Disko is a living monument to M. P. PORSILD and his life-work.

2. FLORISTIC INVESTIGATIONS

List of stations.

The collections made by M. P. PORSILD, HEMMINGSEN, and SALOMONSEN originate from 27 stations which are indicated by the letters a—ø. The author's own collections and observations made during the journey in 1956 were made at 20 stations in the following indicated by the numbers 1—20. The position appears from fig. 1.

a. Kangikitdleq, Disko Fjord, 69°26′ lat. N. (H).
b. Godhavn at Arctic Station, 69°16′ lat. N. ((H.) = 2—3 on p. 8).
c_1 Nordre Strømfjord, Nagssugtûtâ at Nûk, 67°44′ lat. N., 52°50′ long. W. (S).
c_2 — — north coast off Nûk, 67°47′ lat. N., 52°47′ long. W. (S).
d. — — Ulorssuit, Amitsuarssuk, 67°54′ lat. N. 52°7′ long. W. (S).
e_1 — — Spiret, Qeqertaussaq, 67°44′ lat. N., 51°50′ long. W. (S).
e_2 — — Nuerssorfiarqap avangnâtungâ, Qeqertaussaq, 67°46′ lat. N., 51°35′ long. W. (S).
f. — — Island off Siggut, 67°54′ lat. N., 51°15′ long. W. (S).
g. The neighbourhood of Holsteinsborg, 66°57′—56′ ((H) = 9—10 on p. 9).
h. Søndre Strømfjord, the north side, 66°27′ lat. N. (P).
i. — — the south side, 66°28′ lat. N. (P).
j_1 — — Itivdlínguaq, the east coast, 66°30′ lat. N. (P).
j_2 — — hinterland at Itivdlínguaq, 66°30′ lat. N. (P).
k. Evighedsfjord, the north side off Sermitsiaq, 65°56′ lat. N. (P).
l. — - - - Kangiussaq, 65°54′ lat. N. (P).
m. — Inorersut, 65°55′ lat. N. (P).
n. Kangâmiut island, 65°50′ lat. N. (P).
o. Sukkertoppen, 65°27′—28′ lat. N. (P. and H.).
p. Søndre Isortoq, the south side below Nukagpiaq, 65°23′ lat. N. (P).
q. — — the north side at 65°26′ lat. N. (P).
r. — — the north side, Nûp ilua, 65°27′ lat. N. (P).
s. Fiskefjord, Qíngua, 65°2′ lat. N. (P).
t. — Tasiussarssûp qingua, 65°1′ lat. N. (P).
u. — the north side, Sagdleq, 64°55′ lat. N. (P).
v. — the north side, Serquartoq, 64°55′ lat. N. (P).
w. — the south side, Tuapánguit, 64°53′ lat. N. (P).
x. Godthaab, 64°10′ lat. N. (H).
y. Godthaabsfjord, Kapisigdlit, 64°26′ lat. N. (H).
z. — Itivnera, 64°23′ lat. N. (H).
æ. Ameralik Fjord, interior part 64°13′ lat. N. (H).
ø. — Eqaluit pârdlít qingua (Præstefjord), 64°1′ lat. N. (P).

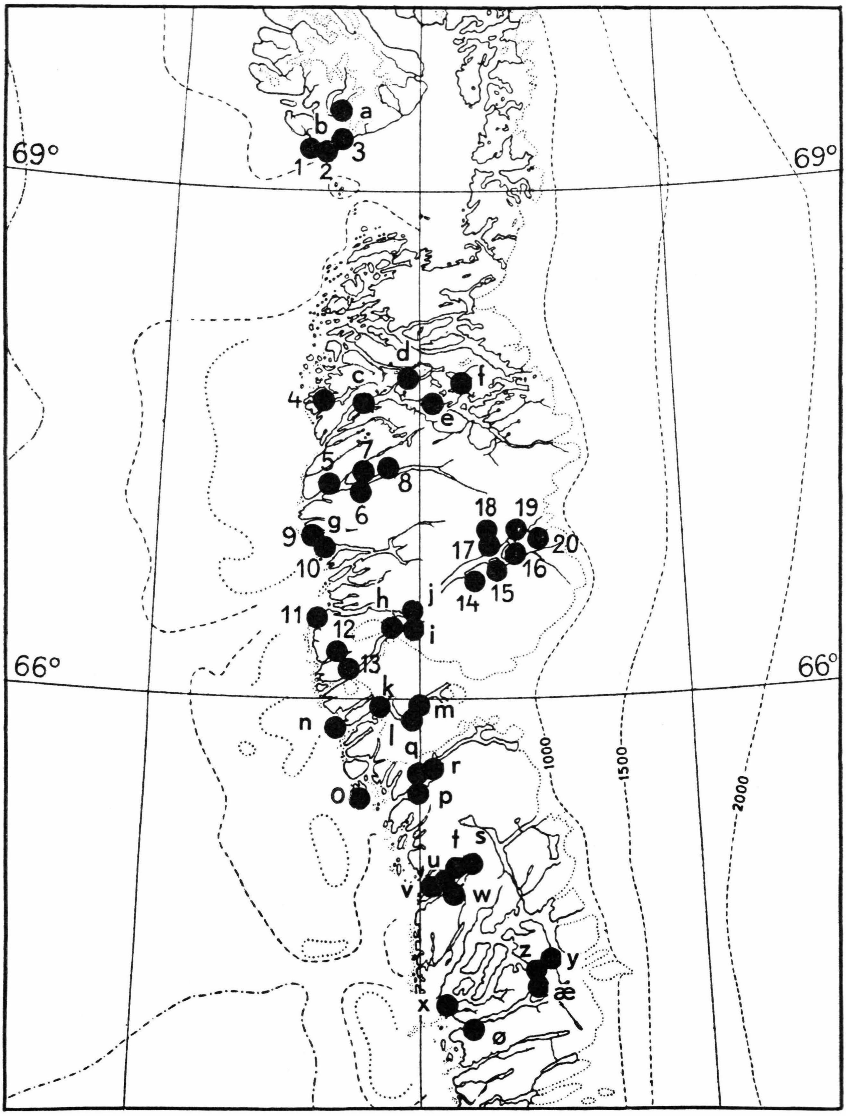

Fig. 1. The location of the stations mentioned in the present paper where botanical collections were made. The stations indicated by letters have been visited by others than the author; the numbers refer to the stations visited by the author in 1956.

1. Fortunebay, Disko, 69°16′ lat. N., 53°50′ long. W.
2. Godhavn, Disko, 69°15′—16′ lat. N., 53°33′ long. W. including Engelskmandens Havn, Lyngmarksbugten, and Østerlien.
3. Outer part of Blæsedalen and Skarvefjeld, 69°16′ lat. N. and 53°27′ long. W.
4. Ikerasârssuk, 67°43′ lat. N., 53°35′ long. W.
5. Nordre Isortoq, Íkardlugtûp qulâ, 67°16′ lat. N., 53°26′ long. W.
6. — — Akuliaruserssuaq, 67°18′ lat. N., 53°2′ long. W.
7. — — Iluliumanerssuaq, 67°14′—15′ lat. N., 53°4′ long. W.

8. Nordre Isortoq, Kûk, Qingartârqigsoq, 67°21′ lat. N., 52°37′ long. W.
9. Præstefjeldet at Holsteinsborg, 66°57′ lat. N., 53°42′ long. W.
10. Kællingehætten at Holsteinsborg, 66°56′ lat. N., 53°32—35′ long. W.
11. Anders Olsens Sund, 66°27′ lat. N., 53°37′ long. W.
12. Kangerdluarssugssuaq, Kinguleq, 66°20′ lat. N., 53°18′ long. W.
13. Søndre Strømfjord, Naqerdlup nûa, 66°10′ lat. N., 53°5′ long. W.
14. — — Angujartorfik, 66°44′ lat. N., 51°30′ long. W.
15. — — south coast of Umîvît, 66°51′ lat. N., 50°55′ long. W.
16. — — north coast of Umîvît, 66°53′ lat. N., 50°51′ long. W.
17. — — west of Strømfjordshavn (west of Pt. Brennan and north of Pt. Hancock on American sea map), 66°56′ lat. N. and 51′10′ long. W. (see map fig. 10).
18. — — Tarajornitsut, 67°0′ lat. N., 51°0′ long. W. (see fig. 10).
19. — — Hassells Fjeld, 67°1′ lat. N., 50°42′ long. W.
20. — — Store Saltsø, 66°59′ lat. N., 50°53′ long. W.

The below-mentioned list gives a survey of all the collections not previously mentioned from the above stations. Further, the list includes my observations of species which were not collected. After each specific name comes first a list of the stations from where the collections originate and were included in the Arctic Herbarium of the Botanical Museum, Copenhagen[1]), then—after a hyphen and the abbreviation"Obs"—the stations where the species was noted by me in 1956. It should in this connection be pointed out that for the stations of which a detailed description is given in Böcher 1952, only new findings or renewed observations are mentioned. It refers to stations 16, 19, and 20 corresponding to localities 9, 3, and 7, respectively, in my previous paper. As to the places visited by me collections and observations together may show something like flora lists though it should be remembered that these even at places thoroughly investigated do not, of course, pretend to be complete. But at any rate they represent a section of the flora full enough to give a clear appearance of the floristic character. For most of the stations indicated by the letters a—ø it is impossible from the available collections to determine the character of the flora.

List of vascular plants collected or observed at stations a—ø and 1—20.

(The succession and nomenclature in agreement with Böcher, Holmen & Jakobsen 1957).

Lycopodium selago; b, x.—Obs. 2—6, 10—13.
— *clavatum* var. *monostachyon*; s, ø.
— *annotinum*; z.—Obs: 1—6, 9, 12—13.
— *alpinum*; o, æ, 12—13.

[1])A number of specimens from stations b, g, o, x—æ were too small to be included in the collections of the museum.

Equisetum arvense; h, p, t, u, z, and Pá at 66° (P). Obs: 1—19.
— *scirpoides*; i, 6, 12.—Obs: 5, 7—9, 19—20.
— *variegatum*; b.—Obs: 4, 14, 16—17, 19—20.
Botrychium lunaria; b, k.—Obs: 2.
Woodsia glabella; i.
— *ilvensis*; k, l, q, u, ø, 12, 15.—Obs: 1, 5, 8, 9, 16—20.
— *alpina*; 4.
Cystopteris fragilis ssp. *fragilis*; q, 8.
— *fragilis* ssp. *dickieana*; j_1, r, 1, 12, 14, 15.
Lastraea phegopteris; n, o, q, 13.
— *dryopteris*; n, t, x, 13.—Obs: 5, 9, 12.
Dryopteris fragrans; h, i, j_1, 14.—Obs: 8, 15—20.
Polystichum lonchitis; g, k, o.—Obs: 2.
Juniperus communis var. *montana*; —Obs: 5—8, 10, 12—14, 16—19.
Coptis trifolia; p, 12.
Ranunculus hyperboreus; a, j_2.
— *lapponicus*; —Obs: 2, 3, 10, 16, 19, 20.
— *pygmaeus*; p.—Obs: 9, 13.
— *nivalis*; —Obs: 3.
— *acris*; —Obs: 9.
Anemone richardsoni; g, r, o, 9, 12.
Thalictrum alpinum; —Obs: 1—3, 9, 12—14.
Dryas integrifolia; b, l, p, æ. —Obs: 1—4, 9—11, 13—20.
Comarum palustre; o.—Obs: 9, 19.
Potentilla tridentata; f, g, n, o, x, æ.—Obs: 5, 7—10, 12—20.
— *egedii*; t, z.
— *pulchella*; collected at Ravneklippen between 19 and 20.
— *vahliana*; 3 (Observed several times at 9 on the top).
— *hookeriana* ssp. *hookeriana*; i, 7, 8, 14, 15, 17—20.
— *nivea*; c_1, j_2, k, r, 1, 2, 4, 8, 10.—Obs: 2—3, 14, 16, 19.
— *crantzii*; b, d, f, g, y, 2.—Obs: 1, 3, 5, 9, 10, 12.
Sibbaldia procumbens; b, x, 10.—Obs: 1—5, 9—13.
Alchemilla alpina; n, x, 5, 12, 13.
— *filicaulis*; q, u, 5, 9, 12.
— *glomerulans*; r, 3, 12, 13.—Obs: 1, 2, 5, 9.
Sedum rosea; j_1, 4.—Obs: 5, 7—13.
— *villosum*; 8.—Obs: 2.
Saxifraga nivalis; c_1, f, h, j_2, u.—Obs: 1—3, 9, 11.
— *tenuis*; Pá at 66° (P).
— *stellaris*; g, o, p.
— *foliolosa*; k, n, and Pá at 66° (P).—Obs: 2—3.
— *cernua*; b, e_1, p.—Obs: 1—3, 8—10, 17.
— *rivularis*; a, k, n, o, 11.—Obs: 2—3.
— *caespitosa*; b, g, n, p, x.—Obs: 1—3, 7—11.
— *tricuspidata*; b, d, l, m, r.—Obs: 2—20.
— *aizoides*; j_2, æ, 4.—Obs: 5, 18, 20.
— *aizoon*; e_1, u, 1.—Obs: 2—5, 8, 11—13, 16, 19.
— *oppositifolia*; j_2, r.—Obs: 1—5, 7, 9—10.
Chamaenerion angustifolium; d, 6, 8, 14.—Obs: 1—3, 5, 7, 9, 10, 12, 13.
— *latifolium*; æ.—Obs: 1—20.
Epilobium anagallidifolium; h, n.

Epilobium lactiflorum; 1, 2.
— *hornemanni*; o, 2, 3, 5, 9, 12, 13.—Obs: 1.
— *palustre*; n.
Myriophyllum spicatum ssp. *exalbescens*; 14.—Obs: 15.
Hippuris vulgaris; 5.—Obs: 10, 11, 14, 15, 18.
Papaver radicatum; b, h, j_2, 8, 10.—Obs: 1—3, 9.
Draba nivalis; j_2, 4, 8, 11.—Obs: 3.
— *cinerea*; i, j_2, 14.—Obs: 17, 19.
— *groenlandica*; j_2.
— *norvegica*; k, n, 4.
— *hirta*; b, c_1, e_1, j_1, 2, 15, 17.—Obs: 10,18, 19, 20.
— *lanceolata*; e_2, 14.
— *aurea*; e_1, k, 5, 6.—Obs: 7, 9, 16, 19.
Cochlearia groenlandica; b, z.—Obs: 4, 9, 11, 12.
Lesquerella arctica; j_1.
Braya linearis; 18, 20.
— *novae-angliae* var. *interior*; 18.
Cardamine bellidifolia; 2, 11.—Obs: 9.
— *pratensis* coll.; b, g.—Obs: 2.
Arabis alpina; a, b, m, p, y.—Obs: 1—3, 5, 9, 12.
— *arenicola*. Obs: 19 (and seed collections).
— *holboellii*; c_1, i, 2, 5, 6, 14.—Obs: 16—17.
Halimolobus mollis; c_1, c_2, d, i, 8, 14, 20.—Obs: 16—17.
Viola labradorica; s, t.
Callitriche anceps; 5 (Arnaq qavdlunâq).
Cornus suecica; o.
Angelica archangelica; u.—Obs: 1—3, 5, 6, 12, 13.
Salix herbacea; b, x.—Obs: 1—6, 9—13.
— *arctophila*; g, n, w, x, ø.—Obs: 4, 5, 10—13, 15—17.
— *glauca* ssp. *callicarpaea*; a, g, s, x, æ.—Obs: 1—20.
Betula nana; s, y, z, 7.—Obs: 1—10, 12—20.
Alnus crispa; l.
Koenigia islandica; a, b, n, (and Frederikshaab, SW. Greenland).
Oxyria digyna: b, o.—Obs: 1—3, 5, 9—13.
Polygonum viviparum; b, x, y, z, æ.—Obs: 1—20.
— *aviculare*; n.
Rumex acetosella; c_1, 5.
Montia fontana ssp. *fontana*; n, o.
Cerastium cerastoides; b, g, h, o.—Obs: 1—3, 11.
— *alpinum* ssp. *lanatum*; b, c_1, d, æ.—Obs: 1—20.
— *arcticum*; x.—Obs: 1—3.
Sagina intermedia; 11, 12.—Obs: 2—3.
Stellaria longipes; z, 4, 14, 17—19, and Strömfjordshavn.—Obs: 9, 20.
— *monantha*; b, c_2, g, n, 2, 7—10, 17—19.—Obs: 20.
— *crassipes*; 17.
— *ciliatosepala*; 10, 19.
— *humifusa*; a, 4 and island west of Serfat (S).—Obs: 5, 11—13.
— *calycantha*; n, p, 2.
Minuartia groenlandica; q.
— *rubella*; k, 8.—Obs: 2—4, 14—17, 19, 20.
— *biflora*; h, 1, 2.

Honckenya peploides var. *diffusa*; b.—Obs: 2, 3, 5—8, 12—13, 19.
Melandrium triflorum; b, i, j_1, j_2.—Obs: 7, 8, 10, 14—20.
— *affine*; b, c_1, d, j_2, 4.—Obs: 3, 20.
Viscaria alpina; b, c_1, g, l, o, æ.—Obs: 2—5, 7—10, 12, 13, 17.
Silene acaulis; b.—Obs: 1—5, 9, 11—13.
Primula stricta; j_1.—Obs: 17, 18, 20.
Armeria scabra ssp. *sibirica*; —Obs: 3, 10, 12, 18.
Pirola secunda var. *obtusata*; k.—Obs: 2.
— *minor;* n, o, 7, 11.—Obs: 9, 12.
— *grandiflora*; m, p, r, æ.—Obs: 1—6, 8, 10—12, 14—20.
Arctostaphylos alpina; r.
— *uva-ursi*; j_1, 14, 17.—Obs: 16, 19.
Cassiope tetragona; b, h, m, z.—Obs: 1—4, 6, 8, 10, 12, 13.
Harrimanella hypnoides; b, z.—Obs: 1—4, 6, 10—12.
Ledum groenlandicum; s, z, æ.—Obs: 12—13.
— *palustre* ssp. *decumbens*; g, l, r, s, x.—Obs: 1—10, 12—20.
Loiseleuria procumbens; b, n, o, x, z.—Obs: 1—3, 6, 11—13.
Phyllodoce coerulea; b, o.—Obs: 2—6, 11—13.
Rhododendron lapponicum; r, æ.—Obs: 2—3, 5, 7—9, 14—20.
Oxycoccus quadripetalus var. *microphyllus*; æ, ø.
Vaccinium vitis-idaea ssp. *minus*; y, æ.—Obs: 14—19.
— *uliginosum* ssp. *microphyllum*; b, x, y, æ.—Obs: 1—20.
Empetrum hermaphroditum; m.—Obs: 1—20.
Diapensia lapponica ssp. *lapponica*; b, o, x.—Obs: 1—4, 11, 13.
Gentiana nivalis; æ, 5.—Obs: 2, 9.
— *detonsa* var. *groenlandica*; 18, 19.—Obs: 17, 20.
— *aurea*; 14.—Obs: 16, 19.
— *tenella*; 20.
Lomatogonium rotatum; s.
Menyanthes trifoliata; u.—Obs: 14, 15.
Mertensia maritima; b.
Thymus drucei; k, ø, 9.
Veronica fruticans; k.—Obs: 2, 5, 9, 12.
— *alpina*; b, g, 2, 10, 12.—Obs: 1, 9, 11.
— *wormskjoldi*; g, 5, 10, 13.—Obs: 9.
Pedicularis groenlandica; ø.
— *lapponica*; b, g, h.—Obs: 2—5, 10, 12, 14—18.
— *labradorica*; æ.—Obs: 8, 15, 17—19.
— *flammea*; b, g, p.—Obs: 2—5, 7—13.
— *lanata*; i, j_2.—Obs: 2, 3, 18.
— *hirsuta*; b, g, h.—Obs: 2—4, 9—11, 13—17, 19.
Bartsia alpina; z.—Obs: 2—5, 7, 12, 13.
Euphrasia arctica; h, j_1, k, æ, 6, 8, 17.—Obs: 2, 5, 7, 18—20.
Pinguicula vulgaris; æ.—Obs: 2—3, 5, 7.
Plantago maritima ssp. *borealis*; j_1, t, 17.
Galium brandegei; v.
Campanula rotundifolia coll.; c_1, f, æ, 1, 8, 14.—Obs: 2—5, 7, 9, 10, 12—19.
— *uniflora*; h.—Obs: 2—3, 9, 10.
Erigeron compositus; e_1, i, j_1, 14.—Obs; 5, 7, 8, 16, 17, 19.
— *uniflorus*; b, h, m, q, ø, 2, 5, 10, 12, 13.
— *borealis*; k.
— *humilis*; b, h, 1, 2.

Antennaria canescens; b, h, o, p, q, r, 1—4, 6, 7, 12, 13.—Obs: 5, 9—11.
— *glabrata*; 10.—Obs: 3.
— *angustata*; 3, 10.
— *intermedia*; e_1, k, r, 5, 8, 12.
Gnaphalium norvegicum; b, n, 5, 13.—Obs: 1, 2, 9.
— *supinum*; n, o, 13.—Obs: 2—3, 5, 9—11.
Chrysanthemum alpinum; 2 (introduced and naturalized).
Arnica alpina coll.; b, f, h, 2.—Obs: 8—10.
Artemisia borealis; e_1, k, æ, 4.—Obs: 5, 7—10, 12, 14—20.
Hieracium hyparcticum; g, n, o, q, r, ø, 5, 10, 12, 13.—Obs: 9.
— *groenlandicum*; k.
— *rigorosum*; k.
— *acranthophorum* var. *isortoqense*; 5.
Taraxacum croceum coll.; c_1, n, p, r, u, x.—Obs: 1—5, 9—13.
— *lacerum*; j_1.—Obs: 14, 18.
Tofieldia pusilla; a, g, j_2, x, y.—Obs: 2—5, 7, 8, 11—14, 18.
Leucorchis albida var. *subalpina*; k, r.—Obs: 2.
Platanthera hyperborea; k, 5, 12.—Obs: 2.
Juncus trifidus; o, w, 7.—Obs: 2, 3, 5, 6, 11—13.
— *arcticus*; a, k.—Obs: 14—20.
— *castaneus*; a, b, 6, 11.—Obs: 7—8, 14—20.
— *triglumis*; k, 12.—Obs: 16, 19, 20.
— *biglumis*; o.—Obs: 2—3.
Luzula parviflora; b, 4, 9.—Obs: 1, 2, 5, 12, 13.
— *spicata*; b, g, o.—Obs: 2—6, 8, 13.
— *confusa*; b, k, p, q, 11.—Obs: 1—6, 10—13, 15.
— *multiflora* ssp. *frigida*; b, g, h, m, u, 4, 13.—Obs: 9—11.
— *groenlandica*; 8, 15, 19.
Eriophorum scheuchzeri; a, n, x.—Obs: 2—4, 10, 17, 18.
— *angustifolium*; b, g, 11.—Obs: 2—5, 10—15, 17.
Scirpus caespitosus ssp. *austriacus*; g, o, æ.—Obs: 5, 12, 13.
Kobresia myosuroides; h, i, j_1, j_2.—Obs: 8, 14—20.
— *simpliciuscula*; 14, 18.
Carex nardina; h, j_2, 4, 11.—Obs: 2—3, 10.
— *arctogena*; w.—Obs: 9.
— *capitata*; j_2, 8.
— *gynocrates*; u.
— *maritima*; j_1, 14.—Obs: 18.
— *glareosa*; a, 4.—Obs: 5, 11—13.
— *lachenalii*; a, b, g, k, p, u, ø, 4.—Obs: 1—3, 10, 11.
— *brunnescens*; g, s, w, ø.
— *curta*; o, v.
— *ursina*; a.
— *macloviana*; 2, 5.
— *rupestris*; i, j_2.—Obs: 1—3.
— *scirpoidea*; b, g, 4, 11, 12.—Obs: 5, 7, 8, 13—19.
— *supina* ssp. *spaniocarpa*; i, j_1, j_2, 1, 6, 8.—Obs: 7, 14—20.
— *deflexa*; l, n, w, ø, 11.
— *glacialis*; 18.
— *bicolor*; k.
— *stans*; b.
— *bigelowii*; g, h, o, p, v, x, ø.—Obs: 1—15.

Carex norvegica ssp. *inserrulata*; b, g, h, j_2, m, 4, 5, 11, 14, 17.—Obs: 10, 15.
— *atrata*; k.
— *holostoma*; j_2.
— *rariflora*; b, g, o, 4, 14.—Obs: 3, 10—17.
— *misandra*; j_2, m.—Obs: 2—3.
— *capillaris*; h, k, q, 6.—Obs: 5, 7.
— *capillaris* ssp. *robustior*[1]); 17.—Obs: 14, 16, 18, 19, 20.
— *microglochin*; 6.—Obs: 7.
— *saxatilis*; o (?), v, 14.—Obs: 15—18, 20.
Festuca brachyphylla; a, b, j_2, l, r, t, u, 2, 4, 6, 8, 11.—Obs: 5, 12—15, 18, 19.
— *vivipara* var. *hirsuta*; k, n, o, p, q, r, x, 5, 13.
— *rubra* coll; b, d, j_1, z, 2.—Obs: 1, 4, 5, 7, 11—14, 16.
Poa glauca; a, b, c_1, i, p, t, 14.—Obs: 1—8, 11—20.
— *arctica*; a, b, h.
— *pratensis*; a, b, t, 1—4, 6, 9, 11.—Obs: 8—20.
— *alpina*; a, b, e_1, q, 9.—Obs: 1—5, 7, 10, 12, 13.
Puccinellia langeana; p.
— *deschampsioides*; j_1, 17, 18.—Obs: 14, 16, 19, 20.
— *vaginata*; a, 2.
— *phryganodes*; a, 11.—Obs: 4, 12.
Phippsia algida; a.
Arctophila fulva; n, o.
Trisetum spicatum coll.[2]); a, g, 1, 6, 8.—Obs: 1—12, 17, 19.
Deschampsia flexuosa; t, u, ø, 12.
— *alpina*; g, n, 4, 11.—Obs: 12.
Vahlodea atropurpurea; 12.
Agrostis canina ssp. *montana*; 5.
— *borealis*; l, n, o, p, 6, 8, 11—13.—Obs: 2, 3, 5, 7, 9, 10.
Calamagrostis purpurascens; i, j_1, 6, 14.—Obs: 7, 8, 15—20.
— *langsdorfii*; d, e_1, e_2, g, o, p, z, 4, 5.—Obs: 9, 13—15.
— *lapponica* var. *groenlandica*; 7.—Obs: 8, 15, 18, 20.
— *neglecta* coll.; b, o, 13, 14.—Obs: 15, 16, 18—20.
Alopecurus alpinus; a.—Obs: 2—3.
— *aequalis*; 19 (collected by C. VIBE, 1953).
Phleum commutatum; h.—Obs: 5, 9, 12, 13.
Hierochloë alpina; g, p.—Obs: 2—6, 7—13.
— *orthantha*; 12.
Elymus arenarius ssp. *mollis*; a, z.—Obs: 2—4, 6—8, 12—14, 17.
Potamogeton filiformis; —Obs: 14, 18, 20.
Triglochin palustre; a.—Obs: 14, 18, 20.

The most important floristic results appearing from the above list may be summarized as follows:

(1) Northern limit shifted:

Lycopodium clavatum. PORSILD found this species both in Præstefjord (Ameralik) and in Fiskefjord. Previously it was only known from Ũmánaq (64°29′) and the southernmost part of Greenland, see BÖCHER 1938 map, fig. 18. The new northern limit is at 65°2′. The material

[1]) = *C. boecheriana*, see LÖVE, LÖVE & RAYMOND 1957.
[2]) Details about this complex, see BÖCHER 1959.

belongs to var. *monostachyon* Grev. & Hook, which by some, for instance MIŠKIN (1953 p. 25), was considered a species of its own, *Lycopodium lagopus* (Laest.) Zinserl.

Lastraea phegopteris and *Alchemilla filicaulis*. Small shiftings of the northern limits to 66°10′ and 67°16′, respectively.

Hieracium rigorosum. PORSILD's finding of this species shifts its northern limit from the vicinity of Ivigtut to the Evighedsfjorden (65°56′). The new station fills in the gap of the total distribution for the section *Foliosa* seen on fig. 3 in BÖCHER 1957. To the north there is only the station for the closely related species *H. acranthophorum* at Nordre Isortoq. The latter is here represented by a special variety which is described in detail in the paper just quoted.

Carex deflexa. Minor shifting of the northern limit to 66°27′, compare distribution map in BÖCHER 1952 fig. 30.

Carex atrata. PORSILD's finding of this species at Evighedsfjord (65°56′) is much more northerly than the nearest growing-places of the species at Frederikshaab (62°5′). It is not likely that the new station is connected with the continuous area of the species in South Greenland, it is rather an isolated station as the one at Tugtilik in East Greenland (66°20′), compare map in BÖCHER 1938, p. 222.

Festuca vivipara var. *hirsuta*. This variety which no doubt ought to be promoted to the rank of a species was found northwards as far as the Sukkertoppen (see map in BÖCHER 1938 fig. 116). In 1946 it was observed to the north as far as Kangâmiut, and in 1956 as northerly as at Nordre Isortoq, 67°16′. Apart from the localities mentioned in the list, the collections left by PORSILD include numerous specimens from Neria (61°33′) collected by J. Eugenius 26 July 1931.

Vahlodea atropurpurea. The northern limit was previously at the Sukkertoppen (see map fig. 14 c in BÖCHER 1954), but now it has moved north at any rate to Kangerdluarssugssuaq, 66°20′. AXEL HEMMINGSEN's collections include a specimen gathered either at Holsteinsborg or at Sukkertoppen. In future therefore this species should be looked for at Holsteinsborg.

Hierochloë orthantha. As far as this species is concerned the northern limit has likewise shifted from the vicinity of Sukkertoppen to Kangerdluarssugssuaq, 66°20′, compare the distribution previously given by SØRENSEN 1954 and the mentioning of it on page 43.

(2) Southern limit shifted:

Lesquerella arctica. Was found by me in 1946 at two stations at the head of Søndre Strømfjord. Now PORSILD's finding at Itivdlínguaq has shifted its southern limit half a latitude.

Stellaria ciliatosepala. Found with certainty at Holsteinsborg and in the area round the air base Søndrestrøm, consequently to the south as far as 66°56′. The collections from the latter area are especially interesting because they also comprise specimens with scattered hairs below along the margin of the sepals (intermediate form between *S. ciliatosepala* and *longipes*) and plants with scattered hairs also on the surface of the sepals (by which they approach *S. laxmanni*). Intermediate forms between *S. ciliatosepala* and *longipes* have also been observed at the southern limit of the species in N. America, see BÖCHER 1951 a. Intermediate forms between *S. ciliatosepala* and *S. monantha* are contained in the collections from stations 7 and 9.

Stellaria crassipes. Only found at station 17 at Søndre Strömfjord. Both species of *Stellaria* were formerly not known south of Disko-Nugssuaq.

(3) Important new stations for rare species (the stations indicated in brackets):

Woodsia alpina (4)
Anemone richardsoni (12)
Sedum villosum (8)
Braya linearis (18)
— novae-angliae var. interior (18)
Callitriche anceps (5)
Pirola secunda var. obtusata (k)
Arctostaphylos uva-ursi (14, 17)
Oxycoccus quadripetalus var. microphyllus (æ, ø)
Gentiana aurea (14)
Galium brandegei (v)
Erigeron humilis (h)
Carex capitata (j_2, 8)
— gynocrates (u)
— macloviana (5)
— glacialis (18)
— bicolor (k)
— microglochin (6, 7)
Arctophila fulva (n, o)
Alopecurus aequalis (19)

The new stations fill in gaps in the known distribution especially in the case of *Anemone richardsoni* (see map fig. 5 in BÖCHER 1951 b), *Galium brandegei*, and *Carex gynocrates* (map figs. 28 and 34 BÖCHER 1952). As to *Carex capitata* the finding at Nordre Isortoq and at Itivdlínguaq means an essential extension of the area which so far only comprised the area surrounding the head of Søndre Strømfjord.

(4) Refindings of rare species:

PORSILD's collection includes very pretty specimens of *Pedicularis groenlandica* from Eqaluit at Ameralik fjorden, compare PORSILD (1946).

The flora of bird-cliffs.

Dr. FINN SALOMONSEN's small collection from various bird-cliffs at Nordre Strømfjord (Stations c—f) is in many respects interesting.

In the first place, some of the species seem to be especially frequent on the manured soil, namely *Halimolobus mollis*, *Melandrium affine*, *Draba hirta*, *Calamagrostis langsdorffi* etc., secondly, several of the species occur as mere giant individuals. On the south side of the mountain called Spiret (Station e_1), a birdcliff only 20 m high, a specimen of *Erigeron compositus* was collected on a ledge, reaching the height of 31 cm and with lots of heads; at the same place *Draba aurea* reaches a height of 48 cm, *Saxifraga cernua* 34 cm, and *S. aizoon* 25—31 cm. At this locality a record was also made of *Stellaria media*. I found this species in 1946 together with some *Halimolobus mollis* in a cave in the Ravneklippen at the base Søndrestrøm. It suggests that both these species are spread by birds. *Stellaria media* is assumably spread to the bird-cliffs from its growing-places at the Greenland towns. On the occurrence of *Halimolobus* on a bird-cliff at Nordre Isortoq see p. 39.

Comparison between the floras of two skerry localities.

On my journey in 1956 the opportunity was given to investigate the flora of two typical skerry localities, both in the bed-rock area, but situated on lat. 67°43′ (4. Ikerasârssuk) and 66°27′ (11. Anders Olsens Sund), respectively. The figures of precipitation for the entrance to Søndre Strømfjord and for Holsteinsborg (1 and 2 on the map fig. 3 in Böcher 1954) show a considerable difference, so that we can reckon with a yearly precipitation of abt. 800 mm at Anders Olsens Sund and hardly 300 mm at Ikerasârssuk. So the oceanity decreases considerably from south to north in this area. Both localities had abt. the same number of species (70 species at Ikerasârssuk, and 64 at Anders Olsens Sund), but the composition of the flora showed distinct differences:

Only found at Ikerasârssuk (Station 4):

Betula nana
Cassiope tetragona
Ledum palustre decumbens
Lycopodium annotinum
Equisetum variegatum
Woodsia alpina
Saxifraga aizoides
Saxifraga oppositifolia
Minuartia rubella
Potentilla nivea s. str.
Artemisia borealis
Luzula parviflora
Calamagrostis langsdorfii

Only found at Anders Olsens Sund (Station 11)

Pirola minor
Oxyria digyna
Cerastium cerastoides
Sagina intermedia
Veronica alpina
Gnaphalium supinum
Carex deflexa
Juncus trifidus

The species only found at the southern locality belong to the snow-patch flora as well as the floras of the oceanic heaths and fell fields. Conversely, among the plants there are several species with a continental distribution only found at Station 4, and also a couple of species which are somewhat calciphilous (especially *Saxifraga aizoides* and *Woodsia alpina* of which the latter is very rare). Finally the list for Station 4 includes both northern and southern species.

Of course, it cannot be determined with certainty whether the species mentioned are all really totally absent on the skerry locality where they have not been found, but it is certain that they are rare. It is most characteristic that the three heath scrubs *Betula nana*, *Cassiope tetragona*, and *Ledum palustre* do not grow in the oceanic, southern skerry locality.

The flora of coastal and inland stations.

Nordre Isortoq. The collections made at the 4 stations (5—8) show considerable floristic differences between the outer coastal mountains (Station 5) and the three inland stations. The dry south slope (Station 7) has a marked inland flora, while the north slope at the other side of the fiord (Station 6) has several maritime species (e. g. *Loiseleuria procumbens*, *Juncus trifidus*). The floristic conditions at Stations 6—7 taken as a whole remind of those at Itivdlínguaq at Søndre Strømfjord (Stations 10—11 in BÖCHER 1952 and i—j in the present paper).

Søndre Strømfjord. The investigations from 1946 are here extended to comprise several new stations of which 13 and h are outer coastal stations. If localities 11 and 12 are also looked upon as outer coastal stations within the Søndre Strømfjord area, the four stations together will highly heighten the flora contrast which already in the previous investigations of the area made itself felt. PORSILD's collections at station h show a meeting between a marked inland plant (*Dryopteris fragrans*) and several outer coastal species (*Epilobium anagallidifolium*, *Minuartia biflora*, *Cerastium cerastoides*, *Phleum commutatum*, *Luzula multiflora* ssp. *frigida*, *Antennaria canescens*, *Erigeron uniflorus*, and the northern *E. humilis* which are all absent in the innermost part of the fiord). None of these species have been collected at the PORSILD stations i—j immediately east to h, but a great many inland species (e. g. *Primula stricta*, *Erigeron compositus*), while *Sedum rosea* is here the only one to represent the coastal flora. It is worth noticing that we succeeded in finding *Chamaenerion angustifolium* as far into the fiord as Station 14 (see page 44), which is a distinct inland station with a continental flora.

Evighedsfjord. Stations k, l, m, n. The four stations cover a fiord area of about the same length as those in Nordre Isortoq, but even the innermost stations (m, l) have many coastal plants (e. g. *Arabis alpina*, *Erigeron uniflorus*, *Carex deflexa*) and only a few continental ones (e. g. *Carex supina* ssp. *spaniocarpa*). PORSILD's collections from this area are not comprehensive enough for one to draw conclusions of any importance, but it seems as if the flora of the innermost part of Evighedsfjord is less continentally marked than that at Itivdlínguaq situated north of this place at Søndre Strømfjord. It appears also from the fact that *Alnus crispa* occurs in Evighedsfjord. This species is termophilous, but will no doubt need ample humidity, also humidity of the atmosphere which is very small in the inland at Søndre Strømfjord.

Søndre Isortoq and Fiskefjord. None of the stations have floras of a continental type as far as the collections show. But at the head of Fiskefjord species have been collected which are markedly termophilous, for instance *Lycopocium clavatum* var. *monostachyon* and *Viola labradorica*. Individuals of *Betula nana* reach here a thickness of up to 42 mm at the base.

From these investigations it distinctly appears that a floristic limit between one district with a continental flora and one with a maritime and oceanic flora in the middle West Greenland may be drawn from Station 6 south between h and i—j and further on east of stations m—l, and east of r and s in the direction of the innermost part of Godthaabsfjord close to and along the inland ice, compare the course of this limit (the limit between the flora provinces CW and SW) in BÖCHER 1952 and BÖCHER, HOLMEN & JAKOBSEN 1957 and 1958.

3. DESCRIPTION OF SOME OF THE PLACES INVESTIGATED DURING THE JOURNEY 1956 WITH REMARKS ON THE VEGETATION AND THE ECOLOGICAL CONDITIONS

Fortunebay (Station 1).

At Tuapagssuit there is a spring with *Angelica* and *Alchemilla glomerulans*. Further to the west there is a scree below a steep basalt wall above the lakes on the small peninsula at the bay. As in East Greenland, in the same latitude, the most luxuriant vegetation is found close under the basalt escarpment. But at Fortunebay no water is dripping or seeping down the walls as is the case in East Greenland and at several places at Godhavn, and therefore the vegetation becomes very dry. On the warm escarpment *Saxifraga aizoon* and *Woodsia ilvensis* occur in abundance, and in the dry gravel uppermost in the scree they also occur together with *Potentilla nivea*, *Papaver radicatum*, *Carex rupestris*, *Poa glauca*, *Dryas integrifolia*, and *Campanula rotundifolia*. Next follows a willow community, (*Salix glauca* ssp. *callicarpaea*), poor in species, but 20—25 cm high, too low to have the character of a scrub. Only in lengthy depressions in the scree at runnels which in the early summer are constantly wet from melt water, herb field communities take the place of the willow community, or they occur together with it, see Table 4 Nos. 6—10. This type of herb field is downwards replaced by patches of dense *Alchemilla glomerulans*.

Below the high basalt wall, closer to sea-level, there are many different kinds of heath (see Table 5 No. 1) and snow-patches. A characteristic type of willow vegetation, for instance, was seen on big tussocks with small irregular mossgrown runnels in between. *Salix glauca callicarpaea* was dominating with a dense ground flora of *Salix herbacea; Luzula parviflora* rose above the willow branches, and here and there were *Carex bigelowii*, *Equisetum arvense*, *Poa pratensis*, *Taraxacum croceum*, *Chamaenerion latifolium*, *Polygonum viviparum*, and *Pedicularis flammea*.

Among the snow-patch types an unusually fine specimen of a *Salix herbacea-Harrimanella* vegetation, rich in lichens, was examined (Table 1,

Table 1.

Salix herbacea-Harrimanella type. Sociation rich in Cladonia ecmocyna.—Disko, Fortunebay.—Slope: 20—25°. Exposure: W, Soil: pH 4.7, percentage of organic matter 32, conductivity[2] 202.

Analysis[1] No.	1	2	3	4	5
EG[3] Salix herbacea	4	4	5	4	4
— Harrimanella hypnoides	4	4	+		1
— Sibbaldia procumbens	1				
Cl[3] Taraxacum croceum coll.					1
Hb[3] Minuartia biflora		+		+	
— Carex lachenalii		+			
Carex bigelowii	1	1	+	+	+
Equisetum arvense	+	1	1	1	+
Luzula confusa			+		+
Lycopodium annotinum pungens	+				
Poa pratensis coll.		+	+		+
Polygonum viviparum	+				
Trisetum spicatum coll.					+
Barbilophozia hatcheri, Lophozia alpestris, and ventricosa, Ptilidium ciliare	+	1	1	1	1
Brachythecium reflexum					+
Dicranum fuscescens	1	2	2	2	1
Drepanocladus uncinatus	+	+	+		+
Polytrichum alpinum	1	1	2	2	2
Webera nutans	+	+	+		+
Cetraria islandica	1	1	+	+	1
Cladonia bellidiflora	+	1	+	1	+
— carneola	+				
— coccifera			+		
— ecmocyna	3	4	4	5	5
— macrophyllodes	1				
— mitis			+	+	+
Ochrolechia frigida	+				
Peltigera malacea					1
— rufescens	1	1			1
Psoroma hypnorum	+				
Rinodina roscida	+	+			
Stereocaulon alpinum	2	2	1	+	+

1 5 quadrates each 1 sq. m. — Degree of cover according to the Hult-Sernander scale.
2 Electric conductivity, $\varkappa_{20°} \times 10^6$ (1 portion of soil with 4 portions of water see p. 53).
3 EG: Ecogeographical guiding species, — Cl: Climatic indicators — Hb: Ecological differential species (or "Habitatspecies"), see BÖCHER 1954, p. 10.

1—5) fig. 2. It had developed on acid soil rich in humus on a moraine by one of the lakes on the small peninsula at the bay.

Fig. 2. *Salix herbacea-Cladonia ecmocyna* sociation at Fortunebay in Disko. Moraine rich in boulders, west slope. TWB phot. 6th September, 1956.

Surroundings of the Danish Arctic Station (Stations 2—3).

Floristically the vicinity of the Danish Arctic Station is no doubt the best known in Greenland thanks to Magister M. P. PORSILD's many years' botanical activity. Among his works is also a description of the vegetation of Disko (1902) with some remarks on the vegetation at the entrance of Blæsedal and at Skarvefjeld, and a more detailed account of the luxuriant vegetation more westerly at Engelskmandens Havn. A later work on the preservation of nature in Greenland (1915) contains a list of all the southern species partly at the Engelskmandens Havn, and partly at the Østerlien immediately behind the station; both places were made nature reserves on the initiative of PORSILD. More modern analyses of the vegetation in illustration of the interesting and varying communities at the station are, however, wanted. During my stay there I found time to make some analyses of a few communities which

Fig. 3. West exposed slope near Rødeelv in Blæsedalen. See further the text. TWB phot. 7th September, 1957.

were of special interest as standard of comparison with corresponding communities from areas farther south in Greenland, and of which analyses were available. As an introduction a profile-transect is represented from Blæsedalen below a very steep basalt wall (fig. 3). From the place close to the rock and downwards to faintly sloping level near Rødeelv the following communities occur in belts:

(1) Narrow strip with loose gravel (behind the stick and to the right on the picture): *Poa alpina* sociation with abundant *Potentilla nivea* s. str., and scattered *Carex rupestris*, *Minuartia rubella*, *Cerastium alpinum*, *Campanula rotundifolia*, *Euphrasia arctica*, *Taraxacum* sp. and a few lichens.

(2) Narrow strip (in front of the stick on the picture) with heath of *Salix glauca callicarpaea-Empetrum hermaphroditum.*

(3) Fairly broad belt of a very low scrub of *Salix glauca callicarpaea;* here *Lycopodium annotinum pungens* and *Equisetum arvense.*

(4) More faintly sloping: snow-bed with *Sibbaldia-Salix herbacea* soc.; here scattered *Taraxacum croceum*, *Alchemilla glomerulans*, *Equisetum arvense.*

(5) Still more faintly sloping: heath of *Empetrum*, *Vaccinium uliginosum microphyllum*, *Lycopodium annotinum pungens* and *Phyllodoce coerulea.*

(6) *Vaccinium ulig. microphyllum-Betula nana* heath rich in lichens and with some *Empetrum.*

(7) Almost plane; distinct influence of strong winds: *Carex rupestris* soc. rich in lichens with scattered *Vaccinium ulig. microphyllum.*

This distribution is rather typical of the locality. Uppermost below the steep rocks there is generally a strip with thin gravel on rock. Here the soil is exposed to strong dessication. In many places, f. ex. at Fortunebay (see above), *Potentilla nivea* and other arctic xerophytes occur, but in places where the exposure and other conditions are more favourable as uppermost in the Østerlien and uppermost below the rocks behind the Lyngmarksbugten, the species of *Potentilla* disappears, while *Arabis holboellii* and, in company with it, several southern species make their appearance. This vegetation (Table 2 Nos. 1—10) is either dominated by *Poa alpina* as in the profile-transect or by an arctic race of *Festuca rubra* or *Arabis holboellii* which is here particularly represented by the diploid var. *tenuis* Böch. The southern and oceanic species *Veronica fruticans* may also dominate in spots (No. 10), which highly support the idea that this vegetation is a mixed type with guiding species from oceanic as well as continentally marked rock and talus-slide vegetation. Examples of continental vegetation with *Arabis holboellii* are discussed later on page 47.

The most important communities of the Østerlien is a willow scrub 60—80 cm in height and a herb field the yellow-green colour of which gives the Østerlien its character. The colour arises from the dense vigorous cover of *Alchemilla glomerulans* meadows. Although these two communities alternate on the same slope, the willow scrub on somewhat dryer soil, the *Alchemilla* field on the somewhat moister soil which in winter is covered with an especially thick layer of snow, they are floristically very different. Only a few of the characteristic, oceanic-arctic species of the herb field are found in the willow scrub which then is rich in *Lycopodium annotinum* var. *pungens* and *Pirola secunda* var. *obtusata* Turcz, the latter being very rare in most parts of West Greenland. This plant behaves as a sub-arctic subspecies, rather with a continental tendency, and it is absent in the western parts of Eurasia. At any rate, the willow scrub in which it occurs cannot be referred to the *Alchemilla-Phyllodoce—Scirpus austriacus* complex (Böcher 1954 p. 53); there is rather a relationship with certain continental willow scrubs (see f. inst. Table 37 in the paper just quoted). Table 4 Nos. 1—5, shows 5 quadrates from places where the above-mentioned *Pirola secunda* variety was frequent.

Table 3 shows the composition of the *Alchemilla glomerulans* sociation. On account of the extensive covering of the dominant the number of species is not high; there is not even room for moss although the soil does not dry out. I have seen similar East Greenland *Alchemilla glomerulans* sociations but also with a far greater number of species; here, however, the soil was more unstable, and the sociation had not yet reached its final development (cp. Böcher 1933, Tables 5, and 8 No. 11).

Table 2.

Sociations belonging to a mixed type of dry rock- and talus-slide vegetation.—Disko, Østerli (1—7) and Lyngmarksbugt (8—10).—Narrow strips of vegetation in front of south- or southwest-facing rocks. Soil: pH 6.9, percent of organic matter 6.3, conductivity 56.—EG (1), Cl (1): Continental. EG (2), Cl (2): Oceanic, see footnote on p. 21.

Analysis No.		1	2	3	4	5	6	7	8	9	10
EG (1)	Arabis holboellii var. tenuis	3	2	1	1	1	2	1	2	2	
Cl (1)	Saxifraga tricuspidata	1	1	+	1	+	+		+		
EG (2)	Veronica fruticans			1							3
Cl (2)	Arabis alpina						1	1			
—	Antennaria canescens						+				
—	Viscaria alpina						+				
—	Luzula spicata						+	+			
— (sylv.)	Chamaenerion angustifolium	+	2	1	+	+	2	2		+	+
Hb	Minuartia rubella				+	+					
	Campanula rotundifolia coll.		+	1		+	+				
	Carastium alpinum coll.	1	1	+	1	1	2	1	1	+	1
	Equisetum arvense									1	
	Festuca rubra arctica	1	3	2	1	+	1		1	2	1
	Poa alpina	1	1	+	1	+	3	3	+	1	1
	— glauca	+	+	+	+	1			+		
	Polygonum viviparum					+	+				
	Salix glauca callicarpaea	1		+	1	1		+	1	+	1
	Taraxacum sp.						1	+			
	Trisetum spicatum coll.						+				1
	Vaccinium ulig. microphyllum								2		
	Desmatodon latifolius						+				
	Schistidium apocarpum		1		+			+	+		

Table 3.

Alchemilla vulgaris-Phleum commutatum-type, Nos. 1—10. Alchemilla glomerulans-sociation.—Disko, Østerli.—Slope: 30—40°, Exposure: SW, Soil: pH 5.5. percent of organic matter 25, conductivity 203. No. 11. Sibbaldia herb field, Engelskmandens Havn, Disko.

	Analysis No.	1	2	3	4	5	6	7	8	9	10	11
EG	Alchemilla glomerulans	4	3	5	5	4	4	4	4	3	4	1
—	Taraxacum croceum coll.	4	1	2	1	+	2	1	3	2	1	2
—	Gnaphalium norvegicum	1	+	+		2	1	1	2	2	1	2
—	Gentiana nivalis											+
—	Leucorchis albida subalpina											1
—	Polystichum lonchitis											1
— (sylv.)	Chamaenerion angustifolium		+									
Cl	Arabis alpina		+	+		1			1	+	+	
—	Potentilla crantzii	2										
—	Sibbaldia procumbens		2	1	+			2				3
—	Veronica alpina	+	1	1	+	1	1	1	1	+	+	1
—	Erigeron uniflorus		+									
—	Antennaria canescens											+
Hb	Carex macloviana	+								1		
—	Epilobium lactiflorum											1
—	Thalictrum alpinum											1
—	Bartsia alpina											+
	Campanula rotundifolia coll.		+									+
	Cerastium alpinum coll.	1	1					+		+	+	
	Equisetum arvense	2	2	2	1	2	2	2	1	2	3	+
	Oxyria digyna	1	+	+	1	2	+	1	1	+	1	
	Poa alpina	1	2	2	1	+	2	2	+	2	3	1
	— glauca	+										
	— pratensis		1	+	+			+			1	+
	Salix glauca callicarpaea			+			+			1		1
	Trisetum spicatum coll.	1	2	+				1		1		

The heaths of the area vary a good deal. On this subject there is a number of elaborate modern analyses of *Dryas* heaths rich in lichens worked out by GELTING (1955). The small transect mentioned above shows moreover that *Carex rupestris* is the type dominant on soil more or less unprotected by snow. One may start the heath series with sociations rich in *Carex rupestris* and end with marked snow-bed heaths dominated by *Harrimanella*. The majority of types of heaths are found in Blæsedalen.

A *Carex rupestris—Vaccinium uliginosum microphyllum*—lichen heath (dominated by *Cetraria nivalis*, *Alectoria ochroleuca*, and *Ochrolechia frigida*) had here as subordinate species *Dryas*, *Diapensia*, *Rhododendron lapponica*, *Salix glauca callicarpaea*, *Potentilla vahlinana*, *Pedi-*

Table 4.

Nos. 1—5. Low willow copse with Pirola secunda var. obtusata. Disko, Østerli. Slope: 30—40°. Exposure: SW.—Nos. 6—10. Disko, Fortunebay. Low heathlike willow vegetation and herb field sociations in south-facing talus slope. Inclination 40°. No. 10 with Sibbaldia as a dominant on SW-slope. EG (1), Cl (1): Continental. EG (2), Cl (2): Oceanic.

	Analysis No.	1	2	3	4	5	6	7	8	9	10
?EG (1)	Cystopteris fragilis dickieana						2	2	2	1	2
? —	Pirola secunda obtusata	1	1	2	2	1					
Cl (1)	— grandiflora			1		+					
—	Stellaria monantha	+	+	1							
—	Draba hirta	+				+					
—	Saxifraga tricuspidata					+					
EG (2)	Taraxacum croceum		1		+		1	1	1	1	2
—	Alchemilla glomerulans								1		
—	Gnaphalium norvegicum						1	1	1	2	2
—	Potentilla crantzii							1			1
— (sylv.)	Chamaenerion angustifolium	1		1			3	1	2	5	1
Cl (2)	Sibbaldia procumbens						3	3	2		4
—	Antennaria canescens						+				
—	Erigeron uniflorus							1			
—	Veronica alpina						+			1	1
—	Arabis alpina								+		
Hb (2)	Epilobium lactiflorum						+	+	1		
—	Thalictrum alpinum						+			2	
—	Lycopodium annotinum pungens	3	4			2					
	Campanula rotundifolia coll.						+			1	
	Carex bigelowii							1			
	Cerastium alpinum coll.	+	+	+	+	+					+
	Empetrum hermaphroditum		+			1					
	Equisetum arvense	1	2	1	1	+	1	1		2	1
	Festuca rubra arctica						+			1	
	Poa alpina					1	1	2	+	1	+
	— pratensis				1	+		1		+	1
	Polygonum viviparum						1	1	+	3	2
	Salix glauca callicarpaea	5	5	5	5	5	4	4	3	1	2
	Saxifraga cernua							+			
	Trisetum spicatum coll.								+	+	1
	Brachythecium reflexum							1			+
	— salebrosum							1			+
	Bryum sp.							+			
	Tortula norvegica							+			+
	Cladonia fimbriata							+			

cularis lanata, *Carex misandra*, and *Saxifraga tricuspidata*. The next stage was seen on less exposed soil both in Blæsedalen and at Lyng-

Fig. 4. The south slopes of Skarvefjeld. In the foreground mixed *Cassiope tetragona* heath rich in *Salix glauca callicarpaea* (Table 5 No. 9) alternating with *Vaccinium uliginosum microphyllum-Betula nana* heath rich in lichens on dry projecting parts (here *Dryas*, *Carex rupestris*, *Rhododendron lapponicum*). By the runnel seen obliquely through the vegetation in the centre of the picture low willow scrub. TWB phot. 5th September, 1956.

marksbugten. The ground was faintly influenced by solifluction. The vegetation was now a *Vaccinium ulig. microphyllum* heath rich in *Carex rupestris* and with some lichen species (particularly *Alectoria ochroleuca*, then *Cetraria nivalis*, *Ochrolechia*, *Stereocaulon alpinum*, and *Dactylina arctica*) with subordinate dwarf scrubs as *Empetrum*, *Dryas*, *Betula nana*, and *Salix glauca callicarpaea*, further *Pedicularis lanata*, *P. lapponica*, *Tofieldia*, *Polygonum viviparum*, *Luzula confusa*, *Silene acaulis*, and *Pirola grandiflora*. The following stages were distinguished by the same dominant and a similar lichen flora, and the large-leaved willow was now showing an increasing and *Dryas* a decreasing tendency, while the dwarf-willow, *Equisetum arvense*, *Pedicularis flammea* together with greater density of *Pirola* and *Empetrum* suggested a higher degree of moisture and snow protection.

If the exposure is favourable and the moisture of the soil is middle-dry, the next stages will be a low-growing willow vegetation as the one described from Fortunebay or a low scrub as in Østerlien, but where the soil is moist enough and more rich in humus, it will be an *Empetrum-Vaccinium* heath with *Phyllodoce* and *Lycopodium annotinum*. *Cassiope tetragona* may find a place here, but the typical *Cassiope* heath is found where the exposure is less favourable, and the solifluction more pronounced.

An opportunity was given to analyse some *Cassiope* heaths of varying composition (Table 5, Nos. 1—13). A floristic variation similar to that of the *Cassiope* heaths at the head of Søndre Strømfjord (Böcher 1954 Table 18) could be ascertained. The two soil analyses from heaths in Disko with and without *Dryas*, and especially the widely different conductivity values, indicate a similar variation also with regard to the chemical conditions of the soil. *Dryas* and *Pedicularis lanata* prefer the somewhat richer soil (Nos. 12—13). Where the snow cover is of long duration, *Harrimanella* will occur as co-dominant (Nos. 10—11).

A comparison between the *Cassiope* heaths in South Disko and at the head of Søndre Strømfjord shows that there are several differences of which those mentioned below (p. 31) may be the most significant.

Table 5.

Cassiope tetragona heaths and related communities at Godhavn: No. 1: Fortunebay, Nos. 2—8: Blæsedal, No. 9: Skarvefjeld, Nos. 10—11: Østerlien, Nos. 12—13: Rødeelv. Slope and Exposure: No. 1: 5° towards south, Nos. 2—7: 10—15° towards west, No. 8: 15° towards southeast, No. 9: 20° towards south, Nos. 10—11: 35° towards southwest, Nos. 12—13: faintly sloping towards west. Soil: pH 5.4 (No. 3), 5.9 (Nos. 10—11), per cent organic matter 25 (Nos. 3), 30 (Nos. 10—11), conductivity 83 (No. 3), 256 (Nos. 10—11). — EG (1) and Cl (1): Continental; Cl (2): Oceanic.

Analysis No.	1	2	3	4	5	6	7	8	9	10	11	12	13
EG (1) Cassiope tetragona	3	4	3	3	4	5	5	5	4	3	3	3	3
— Luzula arctica	+	1	+	+			+	1					
— Poa arctica								+				+	+
Cl (1) Ledum palustre decumbens	2	+			2		+						
— Dryas integrifolia									+	2	2		
— Pedicularis lanata										+	+		
— — lapponica							1		+				
— Armeria scabra sibirica						+							
— Pirola grandiflora	+		+	+	+	+	+	+	2	1	+		
— Stellaria monantha				1	+			+	+				+
— Carex rupestris			1	+		1							
Cl (2) Salix harbacea		1	+	2								3	3
— Harrimanella hypnoides												4	3
— Phyllodoce coerulea		1		2							2		
— Loiseleuria procumbens	2												
Betula nana	+	+		+			2	+		1			1
Carex bigelowii	1			+	+		+					2	2

(*continued*)

Table 5 (continued).

Analysis No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Cerastium arcticum							+			+			1
Diapensia lapponica	+				+								
Draba nivalis									+				
Empetrum hermaphroditum	3	1	2	4	+	2	+	+	2	1	1		
Equisetum arvense		1	+	+			1	+	1				
Minuartia biflora													+
Lycopodium annotinum pungens		+				3							
Luzula confusa		1		+	+				+	+	+	+	+
Lycopodium selago		1	+		+		+					1	1
Pedicularis flammea												+	
— hirsuta				+				+	+				
Poa pratensis coll.							+			+	+		
Polygonum viviparum				+		1		+		+	+	+	1
Salix glauca callicarpaea	1	2		1	+	2	2	2	3	2	1	+	
Silene acaulis							+						
Tofieldia pusilla							1			+	+		+
Vaccinium ulig. microphyllum	2		4	2	4	2			2	4	4		
Barbilophozia hatcheri	+	+	+	+	+	+	+						+
Cephalozia pleniceps													+
Diplophyllum taxifolium												+	+
Gymnomitrium concinnatum					+							+	
Lophozia alpestris				+								+	+
— — major							+	+	+			+	
Orthocaulis kunzeanus		+	+				+					+	
— quadrilobus							+	+					
Plagiochila asplenioides								+					
Ptilidium ciliare	1		+	2	+	+	+	+					
Scapania cfr. hyperborea							+						
Temnoma setiforme	+				+								
Aulacomnium palustre										+	+		
— turgidum							1	+	+	+	+		
Bryum sp.							+	+					
Ceratodon purpureus											+		
Cnestrum schistii										+			
Conostomum tetragonum												1	+
Desmatodon latifolius									+				
Dicranoweissia crispula		+	1										
Dicranella subulata					+								
Dicranum fuscescens	1	+	+	1	1							1	
— majus								1					
— scoparium		1		2		2				+	+	1	1
Ditrichum flexicaule					+								
Drepanocladus uncinatus		+	+	1	+	1	+	+	1		+	+	1
Hylocomium splendens		1		+		2	4	4	1				
Myurella julacea										+	1		
Polytrichum alpinum					+	1	+					2	2

(continued)

Table 5 (continued).

Analysis No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Polytrichum piliferum					+								
— sp.												2	
Rhacomitrium canescens							+						
— lanuginosum	+				1								
Tomenthypnum nitens						1	1	4	2	1	+		
Tortella fragilis										+	+		
— tortuosa										+	+		
Webera nutans									+	+	+		
Alectoria nigricans					1								
Cetraria crispa	+	+			1				+	+		+	
— islandica				1		+	+						
— delisei												3	1
— nivalis	+		+		2							+	
Cladonia acuminata (?)										+			
— alpestris		5	5										
— bellidiflora	+											+	+
— ecmocyna		+					+					+	
— mitis	1		1		2							+	
— pyxidata									+			+	
— rangiferina	+				+								
— gracilis chordalis			+	+									
Lopadium pezizoideum					+								
Nephroma expallidum				+			1	1	1	1	+		
Ochrolechia frigida	1				1				+			+	+
Peltigera aphthosa								1	1	1	+		
— scabrosa		+	+				1						
Pertussaria sp.													+
Psoroma hypnorum	1								+	+			
Sphaerophoron sp.					1		+						
Stereocaulon alpinum	1		+	+		+	+		+	+	1	+	
— paschale		+		+									

South Disko: Greater frequency for *Luzula arctica*, *Salix herbacea*, and *Lycopodium selago;* occurrence of *Harrimanella*, *Loiseleuria*, and *Phyllodoce*, which are all absent at the head of Søndre Strømfjord.

Søndre Strømfjord: Greater frequency for *Rhododendron lapponicum*, *Dactylina*, and *Aulacomnium turgidum*, possibly *Ledum palustre decumbens* (does not appear from the analyses); occurrence of *Vaccinium vitis-idaea minus.*

It is worth noticing that *Loiseleuria procumbens* near its northern limit as at Disko, or its continental limit (see p. 34) advances into the snow-covered heath; assumably it here finds the most suited soil, assumably it is the higher degree of humidity of the atmosphere that makes it dependent on these conditions. About the same applies to

Juncus trifidus seen at the Lyngmarksbugten in *Salix herbacea-Harrimanella* snow-beds the composition of which appears from Table 6 No. 4.

Special kinds of heath are found on the skerry terrain consisting of gneiss rocks west of Godhavn. Generally it is heath fragments and fragments of *Rhacomitrium lanuginosum* heath in crevices and on small ledges. Most frequent is *Empetrum* and *Vaccinium ulig. microphyllum*, while *Betula nana*, *Diapensia*, and *Ledum palustre decumbens* are sparse. Among other vascular plants *Lycopodium selago*, *Festuca brachyphylla* and in spots *Salix herbacea*, *Luzula confusa*, and *Agrostis borealis* are frequent. Dominating mosses and lichens are especially *Rhacomitrium lanuginosum*, *Dicranum fuscescens*, and *Cetraria delisei*, further there is also an abundance of *Alectoria ochroleuca*, *A. nigricans*, *Cetraria nivalis*, *Sphaerophoron sp.*, *Ochrolechia frigida*, *Cladonia amaurocraea*, *C. cp. alpicola*, *Barbilophozia hatcheri*, *Orthocaulis quadrilobus*, *Ptilidium ciliare*, *Sphenolobus minutus*, *Temnoma setiforme nemoides*, compare also Table 6, No 5 and fig. 7.

Ikerasârssuk (Station 4).

A narrow sound between low, rounded rocks. A lagoon at an inlet on the east side was encircled by salt marsh of *Puccinellia phryganodes*, *Carex glareosa*, or at a higher level of *Festuca rubra*. The non-halophilous vegetation consisted of *Empetrum-Betula nana* heath rich in lichens or tussocky stretches of boggy land with much *Carex rariflora*, *C. norv. inserrulata*, *C. bigelowii*, *Eriophorum angustifolium*, *Salix arctophila* etc. Ample *Luzula parviflora* might occur between the tussocks, while *L. multiflora* ssp. *frigida* occurred on top of them. On moist soil, among the tussocks, *Deschampsia alpina*, *Equisetum arvense*, and *variegatum* might be observed. The lichens might occur as small patches of heath on dry soil rich in humus, and here *Rhacomitrium lanuginosum* might also be of importance. But lichens also played the role as dominants in certain snow beds, thus a *Harrimanella-Cladonia ecmocyna* sociation was seen at several places, but not so prettily developed as at Fortunebay.

The vegetation richest in species was found along a south-facing rock wall. In spite of the maritime location species like *Artemisia borealis*, *Melandrium affine*, and *Potentilla nivea* might occur here in company with *Sedum rosea* and *Viscaria alpina*. *Sedum rosea* was further observed as northerly as on rocks at Aqigsserniaq 67°53′ Lat. N.

Nordre Isortoq (Stations 5—8).

From this big fiord there are some collections formerly made by VAHL in 1832 and L. K. ROSENVINGE in 1886, but apart from a few notes by ROSENVINGE (1887 pp. 210—211) no description of the vegetation is available. Such would however be of great significance as the pronounced flora contrast between coast and inland would make the fiord a school example of a West Greenland fiord (compare p. 18 and the list pp. 9—14).

Íkardlugtûp qulâ is situated on the north side abt. 20 km from the entrance and abt. 7 km east of the place where ROSENVINGE went ashore. A precipitous scree below steep rocks exposed to the sun, uppermost dry in late summer, at the base moist especially round springs. From the steep rock at an altitude of 150—200 m and downwards four belts of vegetation could be distinguished:

(1) Dry gravel immediately below the rock. Important: *Poa alpina*, *Trisetum*, *Rumex acetosella*, *Artemisia*, subordinate but at times prominent: *Chamaenerion angustifolium*, *Hieracium acranthophorum* var. *isortoqense* (see BÖCHER 1957), *Arabis holboellii*, *Viscaria*, *Veronica fruticans*, *Sedum rosea*, *Cerastium alpinum coll.*, *Alchemilla alpina*, *Draba aurea*, *Luzula spicata*, *Agrostis canina montana*, and *Festuca vivipara hirsuta.* Distinctly related to the vegetation uppermost in Østerli (Table 2), but richer in species.

(2) Medium dry herb fields, large areas: *Alchemilla filicaulis* sociation with *Sibbaldia*, *Gnaphalium norvegicum*, *Chamaenerion angustifolium*, *Phleum commutatum*, *Epilobium lactiflorum*, *Campanula rotundifolia*, and *Carex bigelowii.* On still drier soil: *Alchemilla alpina* sociation with *Poa alpina*, *Carex scirpoidea*, *C. macloviana*, *Veronica fruticans*, *Juncus trifidus*, *Luzula spicata*, *Festuca rubra*, *Viscaria*, *Antennaria intermedia* etc.

(3) Large areas with *Salix glauca callicarpaea* sociation, as at Fortunebay a kind of "heath". *Empetrum* often co-dominant. Also pure *Empetrum* heath with almost the same species as in the willow vegetation: *Chamaenerion angustifolium*, *Hieracium hyparcticum*, *Poa glauca*, *P. alpina*, *Juniperus*, *Luzula spicata*, *Veronica fruticans*, and even *Arabis holboellii* as scattered individuals.

(4) Moist herb fields especially by brooklets: *Alchemilla glomerulans* sociation rich in mosses with *Angelica*, *Phleum commutatum*, *Platanthera hyperborea*, *Calamagrostis langsdorfii*, *Luzula parviflora*, *Bartsia*, *Veronica wormskjoldi*, and *Thalictrum alpinum.* Luxuriant heaths rich in mosses with an abundance of *Phyllodoce* and *Lycopodium annotium pungens.*

Iluliumanerssuaq on the south side of the fiord at a small branch flanked on one side by 13—1600 m high mountains with many minor firns. Very luxuriant vegetation, mainly varied heath. Heaths rich in mosses with snow-cover of medium duration distinguished by *Empetrum* or *Empetrum-Betula nana* (Table 6 No. 1). In the driest places was lichen heath with *Hierochloë alpina* and on a rock wall *Juniperus.*

The place is situated 37 km from the entrance, but due to the exposure and accumulation of snow the vegetation generally belongs to the coastal mountain area. There is an ample occurrence of *Phyllodoce*, *Loiseleuria*, *Juncus trifidus*, and *Salix herbacea* very near sea-level. Both *Juncus trifidus* and *Loiseleuria* occur as fell field species farther to the south, compare Böcher 1954, pp. 30 and 38. However, they are here at their continental limit; they may occur on dry or more or less barren soil on moraines and gravelly slopes (Table 6, No. 3), but hardly on soil which in winter is bare of snow. Even at Iluliumanerssuaq *Loiseleuria* was not common on dry soil, but was now and again found in rather moist vegetation characterized by snow-cover of long duration, thus in a *Gymnomitrium*-snowbed (Table 6, No. 2) and in a *Loiseleuria-Phyllodoce-Cassiope tetragona* sociation rich in mosses occurring in small ravines with steep slopes covered with vegetation.

Akuliaruserssuaq is situated on the north side near a place which on the map is called Kuánit. Nevertheless, no Angelica occurred here, but then the place is at the sunny side, and there are not many spots where one would think that an Angelica might grow. A comparison between the two stations 6 and 7 (see list of vascular plants) on either side of the fiord shows a striking contrast between a southerly and a northerly exposure. At Akuliaruserssuaq the dry heath is prevailing and is often dominated by *Juniperus* together with *Chamaenerion angustifolium*. Above in the scree, on projecting rocks and erosion slopes at dried up brook beds there are many steppe plants, thus *Arabis holboellii*, *Artemisia borealis*, *Erigeron compositus*, and *Carex supina*. At water-bearing brooklets there are willow scrub or moist heath of *Empetrum-Betula nana—Vaccinium ulig. microphyllum* with an abundance of *Ledum palustre decumbens*. Where eutrophic ground water oozes out at rocks, *Carex scirpoidea* is the dominating species, or there are patches with *Carex microglochin*, *C. capillaris*, *Juncus castaneus*, *Tofieldia pusilla*, *Pinguicula*, *Euphrasia*, and *Agrostis borealis*. Near such places *Rhododendron* is often very frequent.

Here on the sunny side there was nothing left of the snow-bed flora, and *Sedum rosea* and *Chamaenerion angustifolium* were the only representatives of the typical coastal flora.

Kûk, Qingartârqigsoq is also situated on the sunny side 55 km from the entrance of the fiord, so far into it as it was possible to go by the small boat "Holck", and then only at the highest tide. The whole scenery reminds much of the inland at Søndre Strømfjord, and it is evident that the inland around this fiord and N. Isortoq belongs to the same plant-geographical area; compare fig. 5.

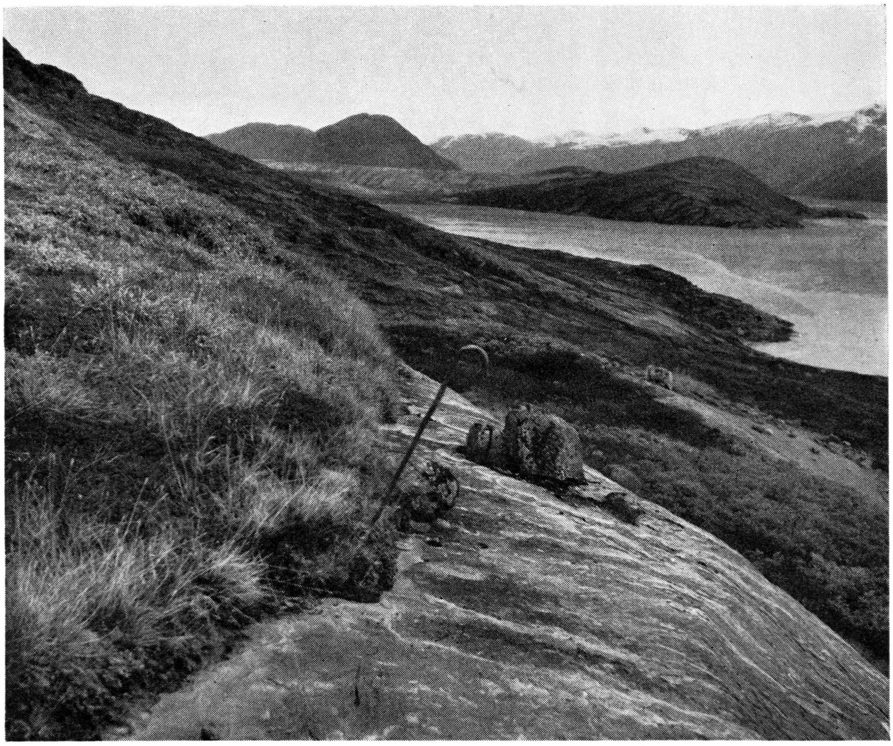

Fig. 5. View to the east from Qingartârqigsoq over the big valley which is a continuation of Nordre Isortoq as far as the ice cap. Seepage vegetation at projecting rock. Stripe of *Carex scirpoidea*, *Sedum villosum*, *Euphrasia arctica* etc. along the edge of the rock. Behind: *Betula nana* heath with *Kobresia myosuroides*, *Hierochloë alpina*, and *Campanula rotundifolia*. TWB phot. 13th September, 1956.

At the outlet of a brooklet there was a willow scrub, 2 or 3 m high, with *Pirola grandiflora* or *Empetrum* as ground vegetation. The very slope was overgrown with dry heath or *Juniperus* scrub alternating with spots dominated by *Kobresia myosuroides* (Table 7) or a *Poa glauca* sociation rich in lichens with species as *Sedum rosea*, *Saxifraga tricuspidata*, and *Luzula spicata*. In several places there was typical *Carex supina* steppe in shallow loess soil on rock. Where a thin layer of soil was moist on account of seeping water, there was a seepage-vegetation of *Sedum villosum*, *Juncus castaneus*, *Euphrasia arctica*, and *Carex scirpoidea*, *Luzula groenlandica*, and mossy cushions of *Bryum pendulum* and *Ceratodon purpureus*. On the examination the 13th September there was no oozing water, and *Sedum villosum* was completely faded.

Snow-beds are not found in the lowland so far into the fiord on the sunny side. At the highest levels there are patches with heath rich in mosses on shady rock walls or on plane ground along projecting

Table 6.

Nos. 1—3: Iluliumanerssuaq, Nordre Isortoq (1: Heath exposed to the north in the hollow of a brook. 2: Snow bed on level ground in depression, 3: Gravelly erosion slope at brooklet). No. 4: Disko, Lyngmarksbygten. Snow bed on level ground. No. 5: Anders Olsens Sund. Rock exposed to strong winds. Cl (1): Oceanic. Cl (2): Continental.

	Analysis No.	1	2	3	4	5
Cl (1)	Phyllodoce coerulea	3	+	+	1	
	Loiseleuria procumbens		1	2		
	Harrimanella hypnoides				3	
	Salix herbacea		2		4	1
	Juncus trifidus			2	2	
	Agrostis borealis					1
Cl (2)	Cassiope tetragona	1	1			
	Ledum palustre decumbens	1				
	Hierochloë alpina	+				1
	Betula nana	3			+	
	Carex bigelowii	+			2	
	Empetrum hermaphroditum	3	1	+	+	+
	Luzula confusa				+	
	Lycopodium annotinum pungens	2				
	Poa glauca					+
	Polygonum viviparum				+	
	Salix glauca callicarpaea	2				1
	Tofieldia pusilla				+	
	Vaccinium uliginosum microphyllum				+	1
	Barbilophozia hatcheri	+				+
	— lycopodioides					+
	Gymnomitrium concinnatum		5		+	
	Lophozia alpestris				1	
	Antitrichia curtipendula					+
	Conostomum tetragonum		3			
	Cynodontium sp.					+
	Dicranum fuscescens	1			2	4
	Hylocomium splendens	1				
	Pleurozium schreberi	1				
	Polytrichum alpinum					+
	— piliferum			+		
	— strictum	+			3	
	Rhacomitrium lanuginosum					5
	Rhytidium rugosum					1
	Alectoria lanea					+
	— ochroleuca					1
	Cetraria delisei		1		1	
	— nivalis					+
	Cladonia amaurocraea					1

(continued)

Table 6 continued.

Analysis No.	1	2	3	4	5
Cladonia bellidiflora			+		
— coccifera			+	+	
Caldonia ecmocyna	+			+	
— lepidota		1	+		
— mitis					1
— rangiferina					+
Cornicularia aculeata					1
Ochrolechia frigida		2			2
Peltigera aphthosa	1				
— malacea			+		
— rufescens				+	
Pertusaria sp.				+	+
Psoroma hypnorum				+	
Solorina crocea		+	+		1
Sphaerophoron sp.					1
Stereocaulon alpinum	+		4	+	1
— sp.					+
Boletus scaber	+				

Table 7.

Kobresia myosuroides sociation from the interior of Nordre Isortoq (Kûk, Qingartârqigsoq). Belonging rather to a mixed type, compare Kobresia myosuroides sociation in Table 22 i B. 1954.—1 quadrate on dry soil near rock. Cl (1): Continental Cl (2): Oceanic.

Cl (1)	Carex supina spaniocarpa	1
—	Kobresia myosuroides	3
—	Saxifraga aizoon neogaea	2
Cl (2)	Luzula spicata	1
—	Sedum rosea	+
	Campanula rotundifolia coll.	+
	Cerastium alpinum lanatum	+
	Poa glauca	1
	Polygonum viviparum	1
	Vaccinium uliginosum microphyllum	+
	Aulacomnium turgidum	+
	Orthotrichum killiasii	+
	Rhacomitrium canescens	3
	Cladonia pyxidata	+
	— sp.	+
	Peltigera rufescens	1
	Stereocaulon alpinum	3

Table 8.

Herb field and snow-bed community, Præstefjeldet at Holsteinsborg. 1: Very moist border at foot of vertical rock; exposure to southeast. 2: Slope 40°; exposure N; soil: pH 4.8, percent. organic matter 27, conductivity 207.—3: Moist soil near mossy bogs; slope 20; exposure S.—4: By brooklet, weak inclination towards southeast; soil: pH 6.1, percent. organic matter 4, conductivity 105.—5: Near water fall; slope 20°; exposure SE.—6: Slope 25°; exposure S.—7: Slope 20°; exposure S. EG (1) and Cl (1): Oceanic (montane-oceanic); Cl (2): Continental.

Analysis No.		1	2	3	4	5	6	7
EG (1)	Alchemilla glomerulans			4	4	4	3	
—	Chamaenerion angustifolium	2	+	+		1	+	1
—	Epilobium hornemanni	1		+	+		+?	
—	Gnaphalium norvegicum					2	+	1
—	Phleum commutatum			1				
—	Pirola minor	1	+	+	+			
—	Taraxacum croceum	3	+	2	2	1	1	
—	Veronica wormskjoldi	1	+	+	1	1	1	
Cl (1)	Antennaria canescens						+	
—	Cnaphalium supinum	1						+
—	Potentilla crantzii						2	
—	Salix herbacea	1	5		1		2	
—	Sedum rosea	1				2	+	
—	Sibbaldia procumbens			+			4	1
—	Veronica alpina	+						
—	— fruticans							2
—	Thymus drucei							1
—	Viscaria alpina							1
Hb	Anemone richardsoni	5	3	2	2	1		
—	Ranunculus acris				1	2		
—	Thalictrum alpinum	1		+	1		+	
Cl (2)	Arnica alpina coll.							1
—	Equisetum scirpoides				+			+
—	Stellaria monantha		+					
	Calamagrostis langsdorfii	1						
	Campanula rotundifolia coll.						+	
	Carex bigelowii		1	+	+			
	Cerastium alpinum-arcticum		+	+		+	1	2
	Chamaenerion latifolium				1	2		
	Empetrum hermaphroditum							1
	Equisetum arvense	+	2	2				
	Luzula multiflora ssp. frigida		1					
	— parviflora		+	1	1	2	1	
	Oxyria digyna	2			+	+		
	Poa alpina				1	+	1	
	— pratensis coll.		+	1				2
	Polygonum viviparum	2	1	+	2	1	2	+
	Salix glauca callicarpaea			3	2			

(continued)

Table 8 (continued).

Analysis No.	1	2	3	4	5	6	7
Saxifraga cernua	+						
Silene acaulis							1
Trisetum spicatum coll.						+	1
Barbilophozia hatcheri		+					
Blepharostoma trichophyllum	+						
Leiocolea muelleri	+						
Marchantia alpestris			3	1			
Ptilidium ciliare	+	+					
Tritomaria quiquedentata	+						
Brachythecium salebrosum	1						
— rivulare		1	2	2	+		
— reflexum							+
Dicranum scoparium	1						1
— fuscescens							+
Drepanocladus aduncus	1	2				+	+
Philonotis tomentella				1			
— fontana				1			
Polytrichum alpinum	1	1		1			
— piliferum							2
Webera nutans							+
Cladonia elongata		1					
— bellidiflora + deformis		+					
— mitis							1
Peltigera aphthosa		2					
— canina	1						1

rocks. Here *Empetrum-Betula nana-Ledum palustre decumbens* would form communities together with mosses, *Peltigera aphthosa*, *Calamagrostis lapponica*, *Poa pratensis* var. *iantha*, and *Pirola grandiflora* just as at the head of Søndre Strømfjord. In *Betula-nana* heaths less influenced by snow there was an ample occurrence of *Pedicularis lapponica* and *Boletus scaber*, several puffballs and a few well developed individuals of *Psalliota* sp.

Below a vertical bird-cliff at a river gorge a shelf was found with an exceedingly luxuriant vegetation of *Festuca rubra*, *Elymus mollis*, *Halimolobus mollis*, *Chamaenerion angustifolium* (very tall) and *Melandrium triflorum*. On dry rock walls there were *Dryopteris fragrans* sociations or spots with *Woodsia ilvensis* and *Saxifraga aizoon*.

Holsteinsborg (Stations 9—10).

From the neighbourhood of this town there are from earlier time some descriptions, especially of the vegetation from the Præstefjeldet

Fig. 6. Herb field by brook on Præstefjeldet at Holsteinsborg. Alchemilla glomerulans, Taraxacum croceum, Ranunculus acris, (top right-hand corner) and Brachythecium rivulare (to the left). A couple of scapes with fruits of Anemone richardsoni are seen against the background of the dark stripe originating from the shadow in the deeply carved brook-bed. TWB phot. 29th August, 1956.

(Warming 1886, pp. 190—191, 1888, Hartz (1894, pp. 31—32)) and many collections made by various botanists and amateurs.

My observations from the Præstefjeldet (Station 9) only comprise the lowland up to an altitude of 250 m, where particularly the habitat type of *Anemone richardsoni* was analysed (Table 8). Besides, analyses were made from a dry herb field at several places typically developed on south-facing slopes built up of loose material. The vegetation of the terrain at the foot of Præstefjeldet consisted otherwise of varying *Empetrum* heath with *Betula nana* or *Vaccinium uliginosum microphyllum* as co-dominants. *Ledum palustre decumbens* was observed but was of secundary importance.

The occurrence of *Anemone richardsoni* is reduced to the moist herb fields on the margin of springs or snow beds of rather different types, either very moist below steep rocks where considerable snow masses accumulate but with a southern exposure (Table 8, No. 1), or with a northern exposure (Table 8, No. 2), but then on strongly sloping ground inserted as a belt between low scrub or heath and *Salix herbacea* snow beds rich in mosses. On the upper part of the northern slope the vegetation consisted of *Empetrum* heath rich in mosses, and at the base of it followed first the *Salix herbacea*-moss rich in species then, outside its shadow, an *Alchemilla glomerulans* sociation with *Luzula parviflora* and *Phleum commutatum*, and finally on the opposite south-facing slope *Salix glauca callicarpaea* with *Chamaenerion angustifolium.* The anemone had on the north-facing slope large leaves, but was without flowers. On the other hand it was still flowering on the 29th August in the vegetation Table 8 No. 1. This vegetation will no doubt thaw out of the snow very late.

The most frequent way of occurrence, according to my observations, is illustrated by the three examples given in Table 8 Nos. 3—5, which are all moist *Alchemilla* fields by brooklets or small falls. No. 5 was growing partly in the shade of a low willow scrub, in other places by this scrub anemones were found still deeper in the shade together with *Lastraea dryopteris* and *Arabis alpina.* In these moist herb fields the anemone had almost ripe fruits.

A somewhat drier herb field where *Alchemilla glomerulans* is decreasing and *Sibbaldia* reaching dominance, Table 8 No. 6, would from my experience be without *Anemone richardsoni*, and in the very dry herb fields as illustrated in Table 8 No. 7 it is lacking. The last-mentioned community was found especially on shallow soil on south-facing rocks and besides the species mentioned in the example it also often contained *Hieracium hyperboreum* and *Potentilla tridentata.*

East of Holsteinsborg where one goes up to the Kællingehætten (Station 10) through a ravine, there is on the sunny side of this ravine the same dry herb field flora with ample *Hieracium hyparcticum* and *Chamaenerion augustifolium*, at times lichens in abundance (*Stereocaulon alpinum*, *Cladonia* sp.) and besides species as *Artemisia borealis*, *Potentilla nivea*, *Arnica*, *Saxifraga tricuspidata*, *Hierochloë alpina*, and *Carex nardina.* As a glaring contrast to this stand on the shady side the many snow bed types and snow-marked heaths, among others *Harrimanella* sociations and *Cassiope* heaths on mossy ground, sometimes also with *Dactylina arctica.*

On a steep northwest-facing slope on the Kællingehætten at an altitude of abt. 550 m a snow bed was found with a strongly localized mass occurrence of *Antennaria glabrata* and *angustata.* These species so closely related were also found in the Blæsedalen in Disko within a small area which may indicate that one of the species is formed by the other in different places as a consequence of an inclination to mutate in a certain direction. In fact about the same as suggested with regard to certain *Hieracium* species in Greenland (Böcher 1957).

Fig. 7. Lake in the skerry locality at Anders Olsens Sund. In the background Nagtoralínguaq, reaching an altitude of 1000 m above sea-level. Vegetation of *Hippuris* in the lake, bogs rich in *Carex rariflora* round the lake, and *Rhacomitrium lanuginosum* heath on the dry rocky slope in the foreground. TWB phot. 16th September, 1956.

Troldfjeldshalvøen (Stations 11—13).

The large triangular peninsula, cut off by Søndre Strømfjord south of Itivdleq and only connected with the Greenland continent by the narrow Itivdlínguaq at 66°30′ lat. N., is one of the wildest mountainons regions in West Greenland. Unfortunetely the area is rather unknown botanically, and it definitely ought to be examined closely in the future.

Anders Olsens Sund (Station 11) is surrounded by low rounded rocks which form a belt abt. 10 km broad at the foot of the high mountains in the interior of the peninsula (fig. 6). *Empetrum* heaths rich in lichens or mosses alternate with *Salix herbacea* snow beds and stretches with mossy tussocks. The tussocks were overgrown with *Salix arctophila* and sedges (*Carex rariflora* and *bigelowii*); between the tussocks

Deschampsia alpina and *Sagina intermedia*. On dry rocks *Rhacomitrium lanuginosum* heaths occurred, see Table 6, No. 5 and fig. 7.

Kangerdluarssugssuaq (Station 12). The visit to this place on the 16th September was short, and the work was much hampered by snow-storm. The base of Kinguleq up to an altitude of abt. 200 m is covered with enormous heaths dominated by *Empetrum*, *Vaccinium ulig. microphyllum*, *Betula nana*, *Ledum groenlandicum*, or in patches by *Phyllodoce*. In this varying heath terrain the finding was made of two noteworthy southerly grasses, namely *Vahlodea atropurpurea* and *Hierochloë orthantha*. At the margin of a snow bed there was moreover a dense mat of *Deschampsia flexuosa*, and there were also willow scrub and xerophilous field vegetation close under south-facing rock projections. In such places *Alchemilla alpina*, *Chamaenerion angustifolium*, *Potentilla tridentata*, *Saxifraga aizoon*, *S. tricuspidata*, *Veronica fruticans*, *Carex deflexa*, and *Juniperus* were growing. The natural conditions much reminded of those on the Præstefjeldet (Station 9); thus, also water courses were seen with thick moss along the banks and *Angelica-Epilobium hornemanni* sociations or *Alchemilla glomerulans* sociations. Such a place would be an ideal growing-place for *Anemone richardsoni* which was also found here. It was observed in the following communities: 1) Moist willow scrub rich in mosses together with *Salix herbacea*, *Equisetum arvense*, *Lycopodium alpinium*, *Lastraea dryopteris*, *Alchemilla glomerulans*, and *Phleum commutatum*. 2) Pure moss snow bed together with *Salix herbacea-Sibbaldia-Polygonum viviparum*. 3) In thick moss cushions at springs together with *Alchemilla glomerulans*.

Exterior part of Søndre Strømfjord. (Station 13). Here the outer part of the valley of Naqerdloq kitdleq was first examined. It seemed to be a place where a local glacier had withdrawn a comparatively short time ago. In the deserted valley bottom and among the rocks only 35 vascular plants were observed and not a single floristic object of interest. On the other hand, the south-facing slope east of Naqerdlup nûa proved to be rich in plants (abt. 70 species). This place is, however, protected as the firns on the top may previously have been drained through glaciers to the valley just mentioned. East of Nûa there was thus quite stabilized and dense vegetation. This comprised 1—2 m high willow scrub with *Lastraea dryopteris* or against a warm rocky wall amounts of *Lastraea phegopteris* (northern limit). There were heaths likewise with lots of *Ledum groenlandicum*, and along water courses the combination of *Angelica-Alchemilla glomerulans-Epilobium hornemanni*. In places with seeping water spots were seen with *Scirpus caespitosus austriacus* and *Carex scirpoidea*.

The oceanic nature of the area was reflected in the flora, amongst

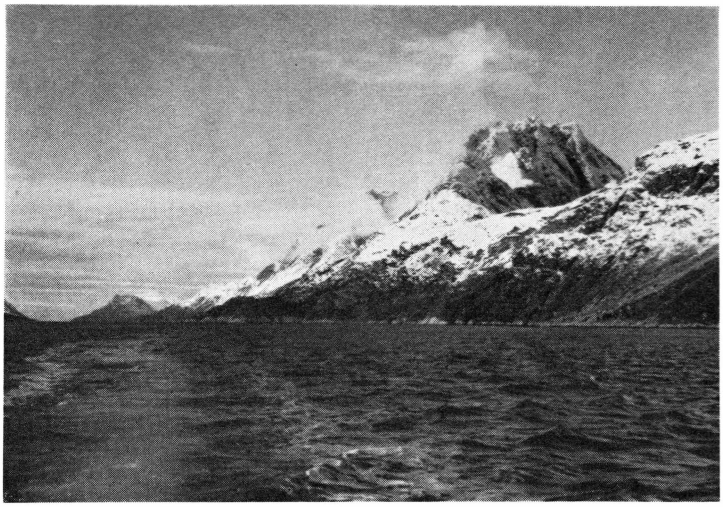

Fig. 8. The south side of Søndre Strømfjord at Naqerdlup nûa seen from the east. The lowland, up to 200 m above sea-level, again bare of snow after the first snow-storm of the winter on the day before. The high mountain (1120 m) lies west of the entrance to Naqerdloq kitdleq. TWB phot. 17th September, 1956.

other things by the occurrence of species as *Alchemilla alpina*, *Gnaphalium norvegicum*, and *Festuca vivipara hirsuta*. It was no doubt a typical feature that the snow-cover reached as far as the lowland (fig. 8) while on the same day the 17th of September, farther into the fiord, it only stayed as far as abt. 500 m above sea-level, and in a thin layer.

Head of Søndre Strømfjord (Stations 14—20).

The more detailed account will comprise stations within the area between 50°55′ and 51°30′ long. W., i.e. Stations 14—15, 17—18; the other stations lie innermost near the airport from where thorough investigations are available, so only a few supplementing observations were made here, and a rather detailed investigation at Store Saltsø (Station 20).

Angujartorfik (Station 14). Angujartorfik is a branch on the south side of the fiord. The place was visited in 1884 by I. A. D. Jensen who collected some plants, among others *Lomatogonium rotatum* (Lange 1886). The scenery and the flora was almost in full agreement with the areas more easterly along the ice cap. Only a single species belonging to the flora of the coastal mountains, *Chamaenerion angustifolium*, reached here a marked continental locality. The plant was vigorous enough, but its inflorescence was faded all over, and the leaves were almost dry and dark red.

Fig. 9. Angujartorfik branch of Søndre Strømfjord. Uppermost dry slope with steppe characterized by *Arabis holboellii-Halimolobus* and behind this (behind the head of the person and to the right at the top) an area with willow scrub and steppe not too dry with *Gentiana aurea*. The area sometimes receives seeping water from a lake 300 m above sea-level. On the picture below: Mosaic of willow vegetation with *Juniperus* and steppe of *Calamagrostis purpurascens-Potentilla chamissonis-Artemisisa borealis* with *Erigeron compositus*, *Carex supina spaniocarpa*, *Festuca rubra arctica*, and *Cerastium alpinum lanatum* as subordinate elements. On the fiord is seen "Holck". TWB phot. 18th September 1956.

The investigation was concentrated on the sunny side below a small lake at an altitude of about 300 m. The lake is mesotrophic with ample *Menyanthes trifoliata* and *Myriophyllum spicatum exalbescens*, *Potamogeton filiformis* and *Hippuris* and with *Triglochin palustre*, *Juncus castaneus*, *Tofieldia pusilla* etc. on the bank. This was often shaped like an ice rampart (see BELKNAP 1941, BÖCHER 1949, p. 19—21), behind which a fenn or bog vegetation had developed on the level area barred by the rampart.

The water from the lake runs first through a small stretch of bog with *Calamagrostis langsdorfii* along the water courses, and otherwise *Carex norvegica inserrulata* and *saxatilis* in knee-high tussocks as well as *Calamagrostis neglecta* and *Eriophorum angustifolium*. From the bog the water continues in the stony bed of a brooklet down the south slope towards the fiord. But the water never reaches the fiord, which is a new and very interesting witness of the extreme and continental climate of this region. At some places the water oozes into the earth and evaporates through the vegetation which here below the brooklet consists of 2 m high willow scrub, big patches with *Juniperus* and a very vigorous kind of steppe with dominating *Gentiana aurea* (Table 9 No. 1). This somewhat rare species also grows at Station 19 under similar conditions. It is considered faintly halophilous which agrees well with the fact that at places as this an ascending movement of soil-water must be assumed to take place which results in a certain accumulation of salts. Under all circumstances, the water course must be regarded as a kind of wadi, as only in spring after the melting of the snow, and in autumn after a limited rainfall during the summer together with a falling temperature and evaporation the water level of the lake is high enough for the water to run out of it. The conditions remind of what GRAVELIUS (1914) calls a "Blindthal" ending in an "Endsee", but in this case the valley is only a runnel, and the lake a sloping flat at the end of the runnel with scrub and luxuriant steppe. In the western part of the San Juan province in the Argentine I saw a water course which ended in a completely dried-up lake. The water came from the mountains, and in high summer the lake was a clayey plain cracked in polygons. In fig. 8, uppermost in the background, the area which at times received water appears as a darker section. In the foreground extremely dry, gravelly bottom grown with a varied steppe in which *Arabis hoboellii* and *Halimolobus mollis* were absolutely dominating (Table 9 Nos. 2—6). The same vegetation was observed immediately west of the Vandfaldskløften on Station 16, here in scree with boulders and most often developed as a *Poa glauca* sociation with *Melandrium triflorum*, *Arabis holboellii* and *Calamagrostis purpurascens* as subdominants and otherwise *Halimolobus*, *Artemisia*, *Carex supina*, *Campanula rotundifolia* coll., *Cerastium alpinum lanatum* or in spots *Dryopteris fragrans*.

Table 9.

Table 9. Dry steppe sociations at Anjugartorfik (1—6) and Store Saltsø. (7—11), Head of Søndre Strømfjord.—1: weak inclination towards south. 2—6: Abt. 35° to the south. Soil (No. 2): pH 8.5, conductivity: 151.—7—10: Slope 25—30° to south-southwest; Soil (Nos. 9—10): pH 6.7, conductivity 88.—11: Level loess cover at the salt lake.

	Analysis No.	1	2	3	4	5	6	7	8	9	10	11
EG	Carex supina spaniocarpa			+	1		4	2	2		1	
—	Calamagrostis purpurascens	2						2	+	1	2	1
—	Potentilla hoookeriana ssp. hookeriana						1	3	2	2	2	
—	Artemisia borealis	+	1	1	1	2		1	+	1	1	+
—	Arabis holboellii		2	3	1	2	2					
—	Halimolobus mollis		+		3	+		+	+			1
—	Puccinellia deschampsioides		2	+	+	2						+
Cl	Gentiana detonsa groenlandica									1	1	
—	Melandrium triflorum						+	1	+			1
—	Potentilla nivea	1										
—	Draba cinerea											+
	Campanula rotundifolia coll.	1						+			2	
	Cerastium alpinum lanatum	+						1	1		+	1
	Festuca brachyphylla		+			1				1?		
	— rubra arctica (cryophila)	1										
	Gentiana aurea	4										
	Juniperus communis montana	1										
	Poa glauca	+				2		2	3	2	2	5
	Salix glauca callicarpaea									1	1	
	Trisetum spicatum coll.									1		
	Cyanophyceae and Cephaloziella on the surface of the soil		+	+	+							
	Barbula recurvirostris	+										
	Bryum pendulum									2	2	
	Distichium capillaceum	+										
	Thuidium abietinum	1										
	Tortula ruralis	+					+					
	Caloplaca citrina		+	1	1	+						
	— elegans				1							
	Cetraria nivalis						+			+		2
	Cornicularia aculeata						+			+		
	Physcia muscigena		+	+								
	Peltigera rufescens	1										
	Yellow and grey lichen crust											1

The south coast of Umîvit branch (Station 15). An area covered with heath (especially *Betula nana* and *Betula nana-Ledum decumbens* heath) round some lakes. The larger one of these lakes had water rich in humus and was meso-oligotroph with species like *Menyanthes trifoliata* in abundance, *Hippuris* and *Myriophyllum spicatum exalbescens*. In the region of the outlet from the lake there was a considerable willow scrub, $1^1/_2$ to 2 m in height, with much *Calamagrostis langsdorfii*. The xerophilous species in the list originate from the sunny side of a low ridge which separates the larger lake from the fiord.

The Vandfaldskløften (Station 16). Only a few investigations were made at this place to supplement those available from 1946 (see p. 46 and Table 10).

The northwest coast at Strømfjordshavn (Station 17). The place lies west of Pt. Brennan and north of Pt. Hancock on the American map. The limit of my previous locality at Strømfjordshavn (5 in BÖCHER 1952, 1954) is indicated by broken line in fig. 10.

Flora and vegetation correspond fully to that found in the neighbourhood of Strømfjordshavn. On the shore there are several large areas with *Elymus mollis*. Farther into the country a clayey place was found which at times is flooded with water, but often dries up so that the earth cracks into polygons. Here *Plantago maritima juncoides* and *Puccinellia deschampsioides* occurred in abundance. As at Station 14 there were spots with *Arctostaphylos uva ursi*. In my opinion this rare species is rather common locally, namely from and including Station 19 and westwards as far as Itivdlínguaq where both PORSILD and I found it. Somewhat similar applies to *Arabis holboellii* and *Halimolobus*. Also these two species were found here at Station 17.

Tarajornitsut (Station 18). On account of incomplete maps and very little information in I. A. D. JENSEN (1884) it was not possible during the expedition in 1946 to find the salt lake described by JENSEN under the name Tarajornitsok. According to the map-sheet 67 V2 (1952) by the Geodetical Institute the whole area is called Tarajornitsut which is a good designation for the large basin with salt lakes without outlet. Together with the limnologist, cand. mag. ULRIK RØEN I undertook on the 21st September an excursion to this exceedingly interesting lake district. The three salt lakes were named Brayasø, Limnæasø, and Hundesø, and these names have now been acknowledged by the Place-Name Committee.

Brayasø (b in fig. 10, b—b Plate 1). This lengthy lake receives three small tributaries all with a very sparse water-bearing. The largest comes from the lake called d on the map; it has a very irregular contour. It is an alkalinotrophic lake which in some places is full of *Drepanocladus aduncus* on the bank (d on the above-mentioned figure). Another tributary is a small runnel which carries water from two small alpine lakes farther to the east. Still more easterly a little water may ooze from

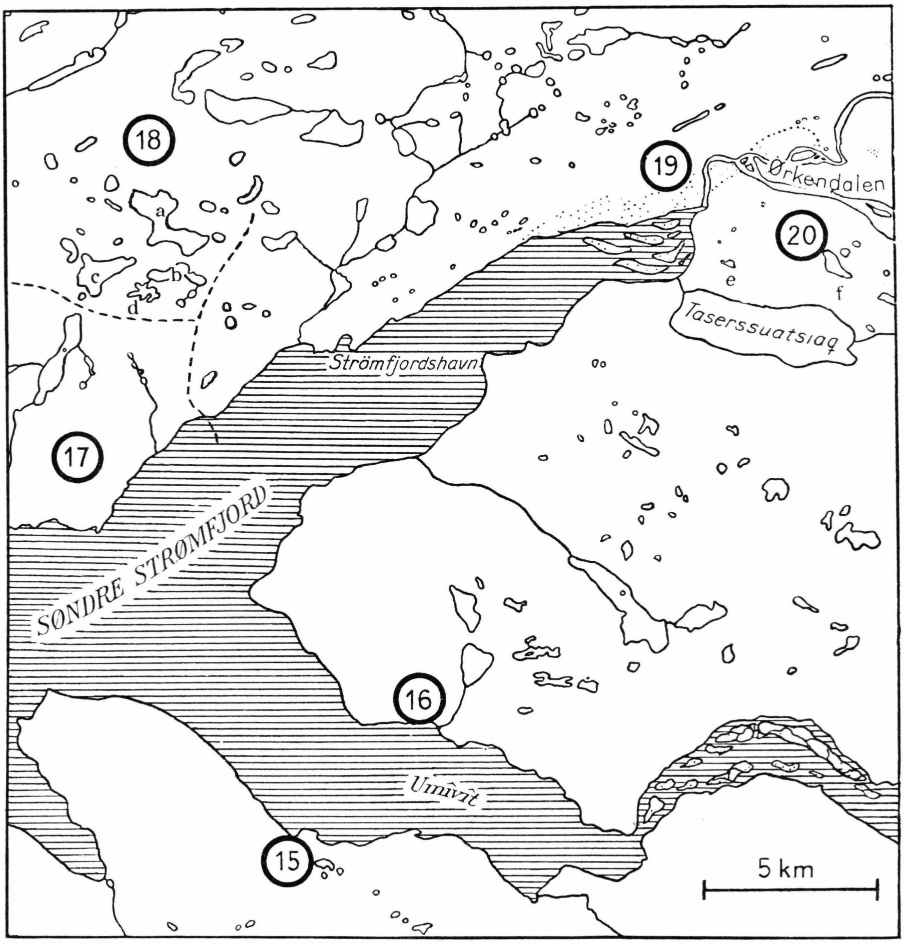

Fig. 10. Survey map of the interior part of Søndre Strømfjord with Stations 15—20. Salt lakes are especially found within Stations 18 (Tarajornitsut) and 20. The lakes treated in this paper are indicated by the letters a—f. a Hundesø, b Brayasø. c Limnæasø, d lake with Drepanocladus near Brayasø, e Lille Saltsø, f Store Saltsø. Aerial view of the district of Stations 17—18 is found on Plate 1.

a small puddle lying east of the stippled line on fig. 10 and close to the slightly salty lake near Strømfjordshavn which is described in B. 1949 p. 49—50, (e—e Plate 1). It is assumably these tributaries which cause that Brayasø is not so salt as Limnæasø. Røen found a conductivity in Brayasø of 3100, while Limnæasø had a conductivity of 4500, see Table 11, p. 56. Further, a large sample of water was taken of Brayasø which DGU (Danish Geological Survey) has kindly analysed (Table 11). It proves to be somewhat salter than a sample taken from Store Saltsø at the same time (Station 20).

In particular, it contains more chloride and sulphate. Contrary to Limnæasø and the still larger Hundesø (which is considered to have the same salt content as Limnæasø) a macroscopic plant life was found in Brayasø in the form of some *Potamogeton filiformis* and *Rhizoclonium riparium*, some *Spirogyra*, *Zygnema*, *Mougeotia*, and *Oedogonium*. Finally, the sample of algae which Tyge Christensen, M. sc., kindly analysed also contained representatives of the species *Synedra*, *Closterium*, *Cosmarium*, and *Nostoc*.

At the western end of Brayasø there are three low terraces and a vegetation marked by calciphilous species, chiefly *Rhododendron- Dryas* heath with *Vaccinium ulig. microphyllum*, and a *Dryas-Kobresia simpliciuscula* sociation with *Braya linearis* (Table 13). More easterly, facing the south-westerly inlet of Hundesø, there is a clayey surface with big boulders. Here there is an abundance of *Braya novae-angeliae* which is partly included in a vegetation as the one described in Table 13, No. 7, partly in a *Puccinellia deschampsioides-Primula stricta* sociation with *Plantago maritima*, *Triglochin palustre*, *Gentiana detonsa*, *Carex boecheriana* etc.

Limnæasø (c in fig. 10, c—c on Plate 1). This lake corresponds best with the description of 'Tarajornitsok' given by I. A. D. Jensen (Jensen 1884, p. 59). There are several points of evidence: 1) The high salt content (conductivity 4500) corresponds well with the figures in Jensen's statement (see Böcher 1949b, Table 16). 2) The water level was on the 21st September 1956 abt. 25 cm higher than normally. Thus, the lake may very well, in the height of summer when Jensen visited it, have been without vegetation on its banks if part of the sea bottom was dried up. 3) On the bank were, according to Jensen, lots of snails washed up. This was also the case in 1956, but at the same time it could be ascertained that the snail shells (according to U. Røen *Limnaea wormskioldii* (Beck) Mörch and *Planorpis arcticus*, compare Posselt 1898) are being washed out of a deposit of a somewhat similar type as the one described from Store Saltsø (B 1949), and they are not living in the lake in our time. Nor is there any plant life in it apart from a possible phyto-plankton.

The slopes towards Limnæasø are mostly covered with heath. In the places we visited, it consisted of *Rhododendron-Dryas* or *Betula nana-Rhododendron*. Scattered among the dwarf scrub stood species like *Pedicularis lanata*, *Tofieldia pusilla*, *Primula stricta*, and *Saxifraga aizoides*. On the very salt loess terraces at the end of the lake (fig. 11) a series was found of halophilous and calciphilous communities. The terraces were low, but of distinct configuration as at Store Saltsø. In the following profile transect from the eastern end of the lake the terraces are designated by letters A—E (A the lowermost terrace, see fig. 11).

Fig. 11. The eastern end of Limnæasø with the lowermost terrace in the deposit which here consists of loess with *Limnaea* shells and some *Drepanocladus aduncus*. On the surface of the terrace is seen some *Salix glauca callicarpaea* and *Puccinellia deschampsioides* and salt crusts. TWB phot. 21st September, 1956.

A. Narrow terrace. Especially *Puccinellia deschampsioides* sociation (Table 13 No. 9 and mentioned on p. 55). In spots *Armeria scabra* sociation (Table 13 No. 8). Large salt crusts and accumulations of snail shells which have been washed out of the deposit.

B. A little broader terrace. Outermost towards A with *Salix glauca callicarpaea*. Patches with *Triglochin palustre*. Inwards towards C *Dryas-Kobresia simpliciuscula* sociation with *Kobresia myosuroides*. Salt crusts rich in CaO and SO_4, see Table 12.

C and D. Two small terraces. Both covered with *Dryas-Kobresia simpliciuscula* sociation with *Saxifraga aizoides*, *Tofieldia pusilla*, *Pedicularis lanata* and lichens.

E. Broad, flat terrace. Outermost towards D with *Dryas-Kobresia simpliciuscula*, then a belt with *Betula nana*, and innermost towards

F marsh with *Carex saxatilis* and *Calamagrostis neglecta* as dominants.

F. Uppermost terrace near the threshold of Hundesø.

The deposition consists in particular of loess, while the *Drepanocladus aduncus* moss strata, in contradiction to the terraces at Store Saltsø, are very shallow. A single especially distinct moss layer can be seen immediately above the water level on the projecting "point" in the foreground in fig. 11. At the eastern end one goes over a small distance across terrace F to a threshold from where the terrain slopes down towards the southwestern inlet of Hundesø. The Limnaea shells are also found quite near to the threshold. A similar threshold is found between Hundesø and Brayasø facing the southeastern inlet of the former lake.

Hundesø (a in fig. 10, a—a in Plate 1). The contour of the lake resembles a dachshund, from this its name (dog lake). It receives a small tributary from a lake at the western end, and through low valley systems it is almost connected to a lake at the eastern end and two small lakes north of this. Besides there is a valley at the southeastern inlet with easy admission to Brayasø. The water level of Brayasø should only be raised a few metres in order that Hundesø might be furnished with water through this valley.

At the above-mentioned transition place between Limnæasø and Hundesø above the terrace system at Limnæasø both *Braya linearis* and *B. novae-angliae* occur. In the *Dryas* heaths at Hundesø *Carex glacialis* was frequent (compare the occurrence of this plant at another salt lake mentioned in B. 1954). Other species found here were *Carex maritima*, *Gentiana detonsa*, and *Euphrasia arctica*. A spot of vegetation with dominating *Braya novae-angliae* is mentioned in Table 13 No. 10.

As is the case with Limnæasø, Hundesø is surrounded by 6 terraces. They stands out very clearly on the heath-covered slope at the southwestern inlet, and are also seen in several places along the north side. The water tastes salt, but it is hardly any salter than that of Limnæasø.

To all appearances it seems as if, at some time before the terraces were formed and the water level lowered, the three lakes were connected to each other surrounding a peninsula the point of which to-day lies between the southwestern and southeastern inlet of Hundesø. The three terraces at Brayasø are no doubt in agreement with the three uppermost at the two other lakes. Brayasø receives as mentioned above several tributaries and is rather small and less salt, and its water level seems to lie a little above those of the two other lakes. By raising the water level it will first give water to Hundesø.

All three lakes and Store Saltsø were on the 21st September, 1956, ice-free, while the other lakes including the faintly salt lake at Strømfjordshavn and Lille Saltsø, which is also only faintly salt, were covered with ice.

The heaths on the northern slopes dominated by *Betula-nana-Aulacomnium turgidum* possibly with *Ledum palustre decumbens* (see B. 1954) were already frozen stiff on the surface, while the steppes at the southern slopes were thawed out on the surface. In the middle of the day the air temperature ranged between + 4 and —1.5° C. Species as *Dryopteris fragrans*, *Woodsia ilvensis*, *Ledum*, *Empetrum*, *Arctostaphylos uva-ursi*, and *Vaccinium vitis-idaea* would no doubt at the end of September be in full activity in the middle of the day. Willow and dwarf-birch were soon leafless, and *Vaccinium uliginosum* displayed a foliage of the most vivid autumn colours. In the lakes *Hippuris* was still green and unaffected by frost and ice, while *Menyanthes* had collapsed and was in decay. Moss and algae were green below the limpid ice, which no doubt acted as a greenhouse pane. Below it a swarming life of daphnias was observed at many places.

Hassells Fjeld (Station 19). This area near the airport was thoroughly examined in 1946 (loc. 3 in B. 1949, 1954). In 1956 only supplementing observations and collections were made.

On the 24th September the loess soil on the sunny side of the mountain was also here thawed on the surface in the middle of the day. Several species of the steppe vegetation on the loess soil were unaffected by the autumn, thus, *Potentilla hookeriana-* ssp. *hookeriana* and *P. nivea*, the latter being in flower at several places. A loess sample together with a sample from Station 16 were analysed as to pH, conductivity, humus, and particle size (Table 10). In Table 5 in B. 1949b there are some analyses of loess soil from the area, but no mechanical analyses to show the particle size of the fine material (below 0.1 mm in diametre of soil particles). The two new analyses show rather good mutual agreement, although the soil from Station 19 has the greatest frequency for particles between 0.06 and 0.1 mm, while the sample from Station 16, lying somewhat farther from the ice margin, contains the greatest amount of particles ranging from 0.06 to 0.02 mm and relatively much of the smallest fractions. The samples contain 87 and 97 per cent, respectively, of particles below 0.1 mm in diametre.

Values for pH and specific conductivity expressed as $\varkappa_{20^\circ} \times 10^6$ correspond well with that previously found in the same type of soil (BÖCHER 1949b). It must however be noticed that the figures for conductivity in this paper are measured in a suspension of 1 part of soil to 4 parts of water. The ratio previously used was 1:9 (STENBJERG's method) and was expressed as $\varkappa_{20^\circ} \times 10^4$ (Lt.).

Table 10.

Loess soils from the head of Søndre Strømfjord.

		Station 16	Station 19
pH		7.6	7.8
$\varkappa_{20^\circ} \times 10^6$		110	107
Humus (loss on ignition)		4.9	1.4
particle size	> 2.00 mm	2.6	0.2
	2.00—0.60 —	2.8	0.3
	0.60—0.20 —	2.0	0.6
	0.20—0.10 —	0.9	0.5
	0.10—0.06 —	26.6	51.7
	0.06—0.02 —	38.2	35.3
	0.02—0.006 —	9.3	4.5
	0.006—0.002 —	3.8	1.2
	0.002—0.000 —	8.9	4.3
		100.0	100.0

Store Saltsø (Station 20) Plates 2—4. The area round Store Saltsø was visited on the 20th September 1956 and investigated by me in cooperation with U. RØEN. As to previous investigations see BÖCHER 1949b (pp. 53—56) and 1954 (pp. 208—214, 229, 244—247, 252, and 256).

At the northwestern end of the lake above the strange moss-loess deposits there is a south-southwest exposed rock, and below it a small scree consisting of erosion material and loess. Here a variant was observed of the *Carex supina* steppe distinguished by dominance of *Potentilla hookeriana* ssp. *hookeriana* and scattered *Halimolobus* (Table 9, Nos. 7—8). There was also a community rich in *Gentiana detonsa* and a *Bryum* species (Table 9, Nos. 9—10). The latter was condioned by faintly oozing ground water, and might in other places than where the two quadrates were analysed contain *Euphrasia arctica* and *Primula stricta*. In 1946 no oozing water was observed in high summer, while at the end of September such could be ascertained everywhere where *Gentiana detonsa* and the *Bryum* species occurred on the south slopes.

The water level of the lake was estimated to be 20—30 cm higher than at high summer time in 1946. The salt content was also somewhat lower in 1956 (Table 11). There was a distinct decrease of the amount of carbonate ions.

To supplement previous analyses of vegetation 5 quadrates were examined near the lake belonging to the *Puccinellia deschampsioides-Braya linearis* group (B. 1954, p. 207). Dominants were *Braya linearis* or *Calamagrostis purpurascens*, see Table 13, Nos. 1—5.

Fig. 12. Patch covered with vegetation near Store Saltsø. To the right a flat rock projecting through the moss-loess deposit which is seen in the background and to the left. At the rock and in the area in the top left-hand corner of the picture there is loess enough that continuous vegetation may develop. This consists of *Salix glauca callicarpaea*, *Calamagrostis purpurascens*, *Primula stricta*, *Gentiana tenella*. *Carex maritima*, *Luzula groenlandica*, and *Puccinellia deschampsioides*. TWB phot. August, 1956.

The soil below quadrate No. 5 at Store Saltsø and No. 9 in corresponding vegetation at Limnæasø (p. 50) was examined for pH and conductivity. pH was measured to be respectively 8.8 and 7.8, $\varkappa_{20^\circ} \times 10^6$ to 610 and 2804. So far the last-mentioned value is probably the highest found in Greenland (compare Table 7 in Böcher 1949b) and in arctic regions as a whole. But the soil in question was also found on the low bottom terrace at Limnaeasø where salt crusts were often observed on the surface of the earth.

In some places at Store Saltsø the moss-loess deposit is overlaid by a pure loess deposit several centimetres thick which is exposed to strong desiccation (Plate 3, fig. 2). From such places *Braya* will disappear and the dominance shift in favour of *Poa glauca*. It is also characteristic that *Halimolobus* may occur (see Table 9, No. 11); evidently this species shuns places with *Braya* and *Gentiana detonsa*.

At the northwestern end of the lake a rough measuring was made of the terraces, the four of which are easily distinguished. As at Limnæasø

(p. 51) the terraces are designated by the letters A—F so that the lowermost terrace which is taking shape at present, will be given letter A. G is not yet clearly shaped as terrace.

Table 11.

Samples of water from salt lakes at the head of Søndre Strømfjord (the samples from Sept., 1956, analysed by K. Skousböll Hansen, D.G.U. (Danish Geological Survey)).

	Store Saltsø				Tarajornitsup			
	8th Aug., 1946[1]		20th Sep., 1956		Limnæasø(?) August, 1884[1]		Brayasø 21st Sept., 1956	
	mg/l	Millival/l	mg/l	Millival/l	mg/l	Millival/l	mg/l	Millival/l
CO_3^{--}	408	13.60	234	7.80	983 (CO$_3$ + HCO$_3$)	32.77 (CO$_3$ + HCO$_3$)	174	5.80
HCO_3^-	875	14.40	964	15.80			767	12.60
SO_4^{--}	45	0.94	40	0.83	91	1.90	123	2.56
Cl^-	708	19.97	570	16,07	903	25.47	1240	34.97
NO_3^-			0				0	
PO_4^{---}			0				0.4	
Anions		48.91		40.50		60.14		55.93
Ca^{++}	32	1.60	30	1.50	0	0.00	15	0.75
Mg^{++}	236	19.41	182	14.97	308	25.30	180	14.80
Fe^{++}			<0.1				<0.1	
NH_4^+			0				0	
Na^+	514	22.35	553[2] (Na + K)	24.03 (Na + K)	824	35.84	929[2] (Na + K)	40.38 (Na + K)
K^+	206	5.27			66	1.68		
Cations		48.63		40.50		62.82		55.93
SiO_2	10		4.4		0		1.2	
Consumption of oxygen ...	47		44.8		—		26.3	
Conductivity $\varkappa_{20°} \times 10^6$ [3] ..			3300		4500[4]		3100	
pH	ab. 9.5		9.05				8.95	

[1]) Samples collected by the present writer or I. A. D. JENSEN, compare B. 1949 b.
[2]) The figure appears according to calculation.
[3]) Measurings carried out by ULRIK RØEN.
[4]) Measured in sample collected 21st September, 1956.

A. Height abt. 120 cm. Extension abt. 20—25 m (Plate 3, fig. 1).
B. Height abt. 60—70 cm. Extension abt. 27—29 m.
C. Height abt. 110—120 cm. Extension abt. 36—40 m.
D. Height abt. 200—220 cm (Plate 3, fig. 2). Extension abt. 30—32 m.

E. Height abt. 100—120 cm. Extension abt. 66 m to the next distinct erosion slope with *Betula nana* heath. Other places narrower, but difficult to delimit towards F.

F. Height abt. 20—50 cm. Extension abt. 43 m. Soil in places consisting of loess and moss, but in other places it is mineral and mixed with humus from dwarf scrubs etc.

G. Terrace not clearly shaped. Soil mineral.

Compared with the terrace system at Limnæasø (p. 21) the altitude of the terraces is very high. Further the deposit at Limnæasø contains very little moss, and it is firm to walk on, while the deposit at Store Saltsø is soft and must rather be considered a peat deposit in alkaline environment. First when the soil becomes mineral on Terrace F and G, larger areas with vegetation will appear. On the other terraces there are only patches with vegetation at places where the amount of loess is considerable in proportion to the moss. The moss forms a porous, dry deposit which is no good for plants to grow on (fig. 12).

Also in 1956 salt crusts were collected from the terraces, namely terrace B and C (innermost towards D). These were analysed by D.G.U. (Danish Geological Survey) (Table 12).

Table 12.

Salt crusts from surroundings of salt lakes at the head of Søndre Strømfjord, collected Sept. 1956, analysed by K. Skouböll Hansen, D. G. U. (Danish Geological Survey).

	Store Saltsø		Limnæasø Terrace B
	Terrace C	Terrace B	
Insoluble rest	52.1	64.7	40.6
Ferric oxide, Fe_2O_3	0.7	1.0	0.8
Aluminium oxide, Al_2O_3	0.6	0.7	0.4
Calcium oxide, CaO	4.9	3.5	19.3
Magnesia, MgO	8.4	4.7	1.3
Sulphate, SO_4	0.0	0.0	12.8
Chloride, Cl	0.0	0.0	0.0
Carbon dioxide, titrated (CO_2)	11.9	7.5	8.0
Ammonia, NH_4	0.0	0.0	0.0
Loss on ignition	16.0	15.0	12.3
pH	10.35	8.60	9.85

As the salts were little soluble in hot water, the salt samples were treated with hot hydrochloric acid. After filtering of the insoluble part, iron, aluminium, calcium, magnesium, and sulphate were determined in the filtrate. Chloride was determined in an aqueous extract, while a

Table 13.

Vegetation near salt lakes at the head of Søndre Strømfjord (belonging to the Puccinellia deschampsioides-Gentiana detonsa type). Nos. 1—5 from Store Saltsø, Nos. 6—7 from Brayasø, Nos. 8—9 from Limnæasø, and No. 10 from Hundesø.— All on level or faintly sloping ground.—Soil: No. 5, pH 8.8, conductivity 610 (effervescing with acid); No. 6 pH 6.9; No. 9 pH 7.8; conductivity 2804 (effervescing with acid).

Analysis No.	1	2	3	4	5	6	7	8	9	10
EG Puccinellia deschampsioides	2	2	+	+	2			1	5	
— Gentiana detonsa groenlandica	1	+	1	2	3					
— Braya linearis	3	4	3	2	2	1				
— — novae-angliae interior							1	+	1	4
— Calamagrostis purpurascens	+	2	3	3	1			1		1
— Potentilla hookeriana		+	1							
— Draba hirta				+		+	+		+	
Cl Armeria scabra sibirica								4		
— Dryas integrifolia						5				
— Kobresia myosuroides							5			1
— Melandrium triflorum										1
— Pirola grandiflora							+			
— Carex boecheriana[1])						+	1			
— Gentiana tenella[1])		+								
— Kobresia simpliciuscula[1])						3				
— Primula stricta[1])	3	1	+	2	2		+	1		
Cerastium alpinum lanatum				+						+
Poa glauca				1						2
Salix glauca callicarpaea	1	1	2	1	+		2	1	1	2
Saxifraga aizoides						+				
Tofieldia pusilla						1				
Bryum sp., Tomenthypnum nitens and Tortella fragilis						+				
Alectoria lanea and ochroleuca						+				
Candelariella sp.									+	
Cetraria crispa						1				
— cucullata						3				
— nivalis				+		2			+	1
Cornicularia aculeata						1				
Physica muscigena and Rinodina									1	

[1]) Species from the Ranunculus pedalifidus-Kobresia simpliciuscula type.

separate estimation was made for carbon dioxide, ammonium, loss on ignition, and pH.

By the calculation of the equivalents it was found that there is a somewhat greater amount of cations than of anions which no doubt is due to the fact that some of the cations have been liberated from the silicates by the acid treatment. No determination of the alcali metals was made, as these according to the composition of the salts as a whole can only be present in small portions.

The samples from Store Saltsø consist of carbonates, while the one from Limnæasø contains some gypsum. A salt sample from the surrounding areas of Store Saltsø taken in the height of summer (B. 1949b, Table 11) contained both Cl, Na, and K. As the water level of the lakes was relatively high in September, 1956, some rain must have fallen, and then all the soluble salts have assumably been washed out of the crusts by this rain.

4. RADIOCARBON DATING OF THE MOSS-LOESS DEPOSIT AT STORE SALTSØ

AND ATTEMPT OF GIVING AN ACCOUNT OF THE ORIGIN OF THIS DEPOSIT AND OF THE LATEST CLIMATIC HISTORY OF THE VICINITY

Two samples of the deposit at Store Saltsø taken out of the erosion slopes of terrace A and D (Cp. p. 56 and Plate 3) were kindly examined at the Radiocarbon Dating Laboratory of the Nationalmuseet by Dr. Henrik Tauber. Two most important statements could hereby be ascertained: (1) That the deposition took place in the period from abt. 1000 B.C. to abt. 1000 A. D. (2) That the oldest strata of the deposit are found in the uppermost terraces farthest from the lake.

The sample from terrace A, which for the moment is exposed to erosion, was determined to originate from 870 A.D. ± 120, while the sample from terrace D could be determined to originate from 380 B.C. ± 120. Thus, there is an interval of abt. 1250 years between the two samples. To this period should then be added the space of time in which the deposition is assumed to take place in terrace E and the uppermost part of terrace D, presumably 500—600 years, and the time it has taken to form the part of terrace A which is beneath the present water level of the lake (possibly 100—200 years).

In Böcher (1949b, p. 60) the possibility was mentioned that the deposition at Store Saltsø might have taken place on the bank successively as the water level of the lake lowered on account of the dry climate. This statement was supported by the observation that *Drepanocladus aduncus*, of which the majority of the deposit is composed, to-day lives on and close to the banks of alkalinotrophic or slightly salty lakes where it may develop into a very dense vegetation which dries up in the height of summer and is exposed to loess depositing. In the same paper the formation of the terraces is explained by the assumption that after the drying-up period there was first a period when the surface of the water rose to a level higher than the uppermost terrace slope, then a period with lowering of the water level during which the erosion slopes were formed as a result of climatic stability in certain intervals of the new drying-up period.

Renewed studies on the locality and the radiocarbon dating showed that a discussion of the formation of the deposit and the terraces had to be reconsidered, and previous theories partly to be given up.

The datings show clearly that the deposit has been formed successively with the lowering of the water surface of the lake. But it is not very probable that the process of deposition took place on the very bank and close to it. Against this may be said that the single terrace displays many strata, one on top of the other (Plate 3). Assumably they have arisen in the way that the moss vegetation of *Drepanocladus* close to the bank has died in the autumn and then loosened (among other things on account of the erosion by the winter ice in spring) and sunk to the bottom at some distance from the bank on deeper water. During the summer time it has been exposed to the fall of dust, and in some summers this fall has been so heavy that a pure loess layer has settled on top of the moss layer. In this way the deposit consists of alternating moss and loess layers.

It is now clear that the individual terraces must be built up of layers in which the oldest lie beneath; on the other hand, on account of lowering of the water surface the place of deposition has shifted outwards and downwards, for which reason the terraces from the top and down the slope towards the lake are getting gradually younger. The erosion slopes of the terraces mean either a stagnation in the lowering of the water level as a result of climatic stability, or that the water surface may even in periods have risen a little again. At some time the salt content of the lake increased to such an extent that *Drepanocladus aduncus* died out and only loess was deposited. As previously assumed there is probably no reason to imagine that the water surface after the deposition period should have risen considerably, and that the terraces were formed during another lowering.

In Böcher 1949b only four terraces are mentioned at Store Saltsø, but a more thorough investigation shows that almost all the way round it is possible to distinguish six as in Tarajornitsup (p. 57 and Plate 2). The four of them are however particularly distinct and may perhaps correspond to four clearly outstanding terraces along the river in the western end of Sandflugtsdalen.

In Böcher 1956 is discussed a line of an ice margin west of the present one. This is marked by erosion forms and moraines and is supposed to have had its course from the western end of the Langsøerne to the mountain Keglen in Sandflugtsdalen, and from this place east of Store Saltsø farther on in a west-southwesterly direction to the head of Umîvît branch. From this ice margin a number of local glaciers must have forced their way west through the valleys. A huge glacier may have continued in the direction of Langsøerne towards west-northwest, two minor glaciers may have forced their way down on each side of Keglen, a larger one down into the western end of Ørkendalen and one to the western end of the lake Taserssuatsiaq. Finally, one may imagine a glacier tongue penetrate into the valley which separates the Nákajanga penisula in a westerly and an esaterly part, and a very large one to the head of Umîvît branch. The lateral moraines of the latter can be seen in our time (BÖCHER 1956, fig. 9). It is characteristic that enormous loess deposits in the form of a thick cover on the lowermost part of the talus of the mountains are found west of the abovementioned ice margin, thus at the foot of Hassells Fjeld, at Strømfjordshavn, and at Vandfaldskløften in Umîvît branch. Another characteristic feature is that the river terraces only begin west of Keglen in Sandflugtsdalen and most westerly in Ørkendalen.

At the time when this ice margin was stationary, the small basin round Store Saltsø may have received melt water from it. The basin must have had an outlet through the depression northeast of the lake which contains two small pools (Plate 2, fig. 2), or if this depression was ice-dammed, in the depression to the east towards the western end of Taserssuatsiaq or, if this was ice-dammed, too, towards northwest to the head of Søndre Strømfjord. But as soon as the climate forced the ice margin towards east, the small basin only received water in the form of precipitation, which in the present time only amounts to somewhat above 100 mm yearly and thus quite insufficient to fill up the basin to the threshold. The consequence is the formation of a salt lake the surface of which has lowered little by little.

Thus, there are certain indications that the ice margin in question may have been stationary to abt. 1000 B.C. What has then made it withdraw towards east is not quite clear. It might be assumed that the local climate, apart from the periods of stagnation, when the erosion slopes were formed, had become drier and warmer. But such a change agrees very badly with the climatic changes of northwest Europe where the transition period between the rather dry and warm subboreal period and the cooler and moister subatlantic one is assumed to be abt. the age of Christ. Nor does this correspond to the development of the interior part of Godthaabsfjord, where IVERSEN (1953, p. 94) puts forward the statement that a climatic deterioration took place abt. 500 A.D. which corresponds to GRANLUND's change of climate at Ry II. Perhaps it might not seem so strange if the climate of the most pronounced continental West Greenland had not developed parallel to the climate of north Europe, but it is strange that the cessation of the post-glacial warm period is not reflected in the deposit at Store Saltsø seeing that it is distinctly recognized in the interior part of Godthaabsfjord only abt. 250 km more southerly.

For these reasons it is perhaps more probable that the assumed shifting of the ice margin towards east is not so much due to local climatic changes but first and foremost must be considered in connection with the whole activity or economy of the ice cap (accumulation of ice and outflows + melting) which is again a reflection of the climatic conditions prevailing in very large parts of Greenland. Thus, the climate of the interior of Søndre Strømfjord need not have undergone any changes of importance, but on the other hand it cannot be taken for granted that changes have not taken place, or we would not have found corresponding terraces at the salt lakes in Tarajornitsut lying at quite a good distance west of the assumed ice margin which means that they probably cannot have received melt water as one may think have been the case with Store Saltsø. Further, the considerable loess deposits west of the assumed ice margin indicate that the climate was also very dry when this margin was stationary. But even with the double amount of the yearly precipitation of to-day the climate must be designated very dry. We do not know the critical values for precipitation, temperature, and the relative moisture of the atmosphere which for this region may involve that some of the lakes will be without outlet and withdraw into the depressions. Perhaps these values are near to the present figures so that only a minor alteration is necessary to give rise to salt-lake formations.

If the withdrawal if the inland ice from the assumed ice margin began abt. 3000 years ago, it will for this be a distance of up to 10 m a year which is not improbable compared with the rates of withdrawal ascertained at various places in West Greenland during the last 100 years (compare Weidick 1958). Further, it is of interest to find that the vegetation to-day is stabilized close to the recent lateral moraines at the ice margin (Böcher 1949 a). This suggests stagnation, and it may agree with the fact that erosion at present takes place in the lowermost terraces at the salt lakes.

In my work 1949 b is referred to an observation by Dr. H. Ramberg to the effect that the uppermost terrace in the Tarajornitsut area should lie 100 m above the present water level and higher than the ridge which separates the lakes from the fiord. So the lakes should have been ice-dammed along the side of the fiord when the uppermost terrace was formed. I tried in 1956 in vain to catch eye of the high lying terrace, but if it is 100 m above water level it must be a terrace which is above the 6 terraces found by me, and it is then quite clear that the uppermost one have been formed when a huge glacier in late-glacial time filled the interior part of Søndre Strømfjord. Observations through stereoscope of aerial photographs of Tarajornitsut (Plate 1) suggest that the lakes in case of a rise of 50 m will get oulet towards south from Limnæasø to the large, protracted lake south of this (fig. 10). So, no doubt the six terraces in the Tarajornitsut area closest to the surface of the lakes correspond to the terraces at Store Saltsø.

As to the question of survival of plants during the last Ice Age on continental refuges in the area, the datings are of no decisive importance. However, it is almost clear that the former line of the ice margin discussed above is only a postglacial line of stagnation (compare discussion in BÖCHER 1956 p. 31). The many rare plants mentioned in the same work and which have been observed only west of the line, may possibly not have had time to spread eastwards to the comparatively recently uncovered area. Where the ice margin has been lying during the last Ice Age is still in the obscure. Perhaps most parts of the *roche moutonné* landscape were submerged, while only the high coastal mountains as far as the Itivdlínguaq area were ice-free, i. e. only covered by local firns and glaciers. Particularly in the Itivdlínguaq area it can be assumed that there have been small ice-free pockets (south slopes, tranverse valleys, and parallel valleys) where even plants of a continental trend may be assumed to have survived.

From the discussion above it appears that many questions concerning the salt lake formation and the history of the ice margin region are still unsolved. Therefore, it is very important to notice that the United States Air Force recently at suggestion from the Society for the Conservation of the Nature of Denmark has restricted the area around Store Saltsø in order to preserve this lake in its present condition. Thus, in future studies of the deposit and the limnological and historical problems may be continued without being restrained or prevented by military activities.

5. SYNOPSIS OF PLANT COMMUNITIES

Below is given a survey of the plant communities which have been treated in detail in this paper. Most of them can summarily be referred to vegetational types previously treated, based on the number of oceanic and continental guiding species (EG-species).

Oceanic vegetational types

(1) *Veronica fruticans-Sedum annuum type* (talus-slide vegetation), Table 2 No. 10, Table 8 No. 7. Belonging to a mixed type, rather affiliated to it, is the Arabis holboellii-Chamaenerion angustifolium sociation, Table 2 Nos. 1—9.

(2) *Alchemilla vulgaris-Phleum commutatum type* (herb field vegetation). To this belongs Alchemilla glomerulans sociation, Tables 3 and 8 Nos. 3—5. Further the Anemone richardsoni sociation, Tabel 8 No. 1, the Chamaenerion angustifolium sociation, Table 4 No. 9, the Sibbaldia sociation, Table 8 No. 6, Table 4 No. 10, and the Salix glauca callicarpaea sociation, Table 4 Nos. 6—8.

(3) *Phyllodoce coerulea-Lycopodium alpinum type* (low arctic chionophilous heath vegetation). Phyllodoce coerulea-Betula nana-Empetrum sociation, Table 6 No. 1.

(4) *Salix herbacea-Harrimanella hypnoides type* (snow-bed vegetation). Salix herbacea-Harrimanella-Cladonia ecmocyna sociation. Table 1 Nos. 1—5, Salix herbacea sociation with Juncus trifidus, Table 6 No. 4, Salix herbacea sociation with Anemone richardsoni, Table 8 No. 2, Salix herbacea-Gymnomitrium-Conostomum sociation, Table 6 No. 2, and finally Salix herbacea sociation with Cassiope tetragona, Table 5 Nos. 12—13, the last-mentioned rather a "mixed type".

Continental vegetational types

(5) *Cassiope tetragona-Dactylina type* (arctic chionophilous heath vegetation). Cassiope tetragona sociations in Table 5 Nos. 1—9. Vaccinium ulig. microphyllum-Cassiope-Dryas sociations Table 5 Nos. 10—11.

(6) *Carex supina-Potentilla chamissonis type* (low arctic steppe vegetation). To this belong Carex supina sociation, Table 9 No. 6, Potentilla hookeriana sociation, Table 9 Nos. 7—10 (Nos. 9—10 with Gentiana detonsa), Poa glauca sociation, Table 9 No. 11, and Arabis holboellii-Halimolobus sociation, Table 9 Nos. 2—5. Affiliated to it is also, as a moister variant, Gentiana aurea sociation with Calamagrostis purpurascens, Table 9 No. 1. On the contrary Kobresia myosuroides sociation in Table 7 is member of a "mixed type".

(7) *Puccinellia deschampsioides-Gentiana detonsa type* (low arctic salt steppe vegetation). Puccinellia deschampsioides sociation, Table 13 No. 9, Braya linearis-Calamagrostis purpurascens sociation, Table 13 Nos. 1—5, Braya novae-angliae sociation, Table 13 No. 10, Kobresia myosuroides sociation, Table 13 No. 7, Armeria scabra sibirica sociation, Table 13 No. 8. Further: Dryas integrifolia-Kobresia simpliciuscula sociation, Table 13 No. 6, and mentioned in the profile transect on p. 51.

Communities the classification of which is uncertain

Rhacomitrium lanuginosum sociation, Table 6 No. 5 (oceanic, probably to Juncus trifidus-Minuartia groenlandica type) and willow copse (low) with Pirola secunda obtusata, Table 4 Nos. 1—5 (continental type or mixed).

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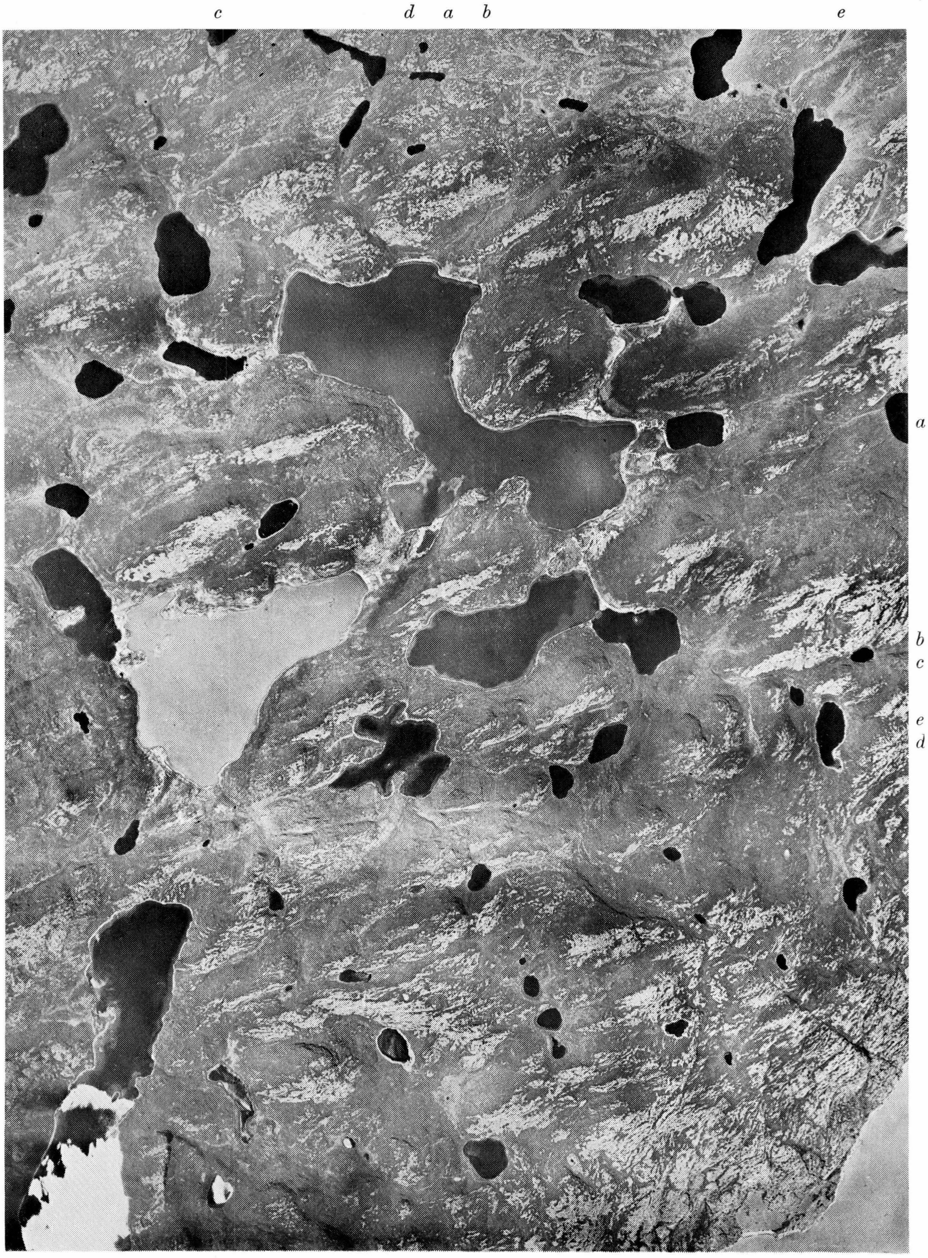
PLATES

Plate 1.

Aerial view of the salt lakes in Tarajornitsut (vertical photographing). In the bottom right-hand corner the north coast of Søndre Strømfjord at the boundary between Station 17 and Strømfjordshavn, see fig. 10. Limnæasø (c-c) of a lighter shade than the other lakes. Hundesø (a-a) is the big lake in the upper half middle of the picture. Below it Brayasø (b-b) and „lake with Drepanocladus" (d-d). The slightly salty lake at Strømfjordshavn mentioned in Böcher 1949 („Eyrycercus-sø") is seen against e-e. The system of terraces is particularly distinctly developed along the north coast of Hundesø and the north and south coast of Limnæasø. The greyish areas on the mountains are dry sunny slopes, which at the foothills nearest to the fiord are covered with loess and overgrown with steppe. The dark shade on the remaining part of the picture is especially due to the varying heath vegetation. Aerial view A 42 H/121. Geodetical Institute, Copenhagen. Copyright.



c
d
a
b
e
a
b
c
e
d

Plate 2.

Fig. 1. Store Saltsø seen from nertheast. Farthest to the right (b-b) four distinct terraces A, B, D, F, and two less distinct, namely the third and fifth from below (C and E). On account of the autumn weather puddles are produced in front of the erosion slopes of the terraces where these are formed in the moss-loess deposit (a-a). The puddles appear as long light stripes. At c-c the beginning of the transverse valley leading to the threshold of the Ørkendalen is visible. At d-d the valley leading east to an alkalinotrophic lake with a much reduced outlet, but raised about 50 m above the salt lake. In the foreground low willows and heath rich in grasses. TWB phot. 20th September, 1956.

Fig. 2. The terrain between Store Saltsø and Ørkendalen where the locality Bredesand is vaguely seen at a-a. At b-b a light line of the water level is visible of the small lake lying a little below the threshold between the Ørkendalen and the basin with Store Saltsø. The threshold itself is at c-c and elevated about 30 m above the surface of Store Saltsø. At d-d two or three terraces are seen at the entrance of the valley leading to this threshold. The light area to the right of it at e-e is covered with *Puccinellia deschampsioides*-soc. or *Carex maritima*-soc. on soil which is cracked and sometimes covered with salt crusts. In the foreground *Betula nana* heath to the right of the rock. In the background the ice cap. TWB phot. 20th September, 1956.

Fig. 1.

Fig. 2.

Plate 3.

Fig. 1. The lowermost terrace (A) at the northwestern end of Store Saltsø. Layers of *Drepanocladus aduncus* and loess are distinctly visible in the foreground. Along the south-exposed rock seen in the background to the right steppe rich in *Potentilla hookeriana* and patches with *Gentiana detonsa*, compare Table 9 Nos. 7—10. TWB phot. 8th August, 1946.

– 2. Terrace D, the highest of the terraces at Store Saltsø. The stick placed close to the foot of the terrace. In front of this, at a lower level, there is a moist area innermost on terrace C; lowermost against this the deposit is drenched with water (dark contours at the bottom of the figure). The stratification in the upper dry part of the terrace stands out distinctly. Uppermost a small cap of pure loess with *Poa glauca* and *Puccinellia deschampsioides*. TWB phot. 20th September, 1956.

Fig. 1.

Fig. 2.

Plate 4.

Aerial view of the vicinity east of Store Saltsø which is seen lowermost in the centre of the picture between Ørkendalen and the eastern end of Lake Taserssuatsiaq. The moss-loess deposit with the four most distinct terraces is visible. The lake on the threshold between Ørkendalen and Store Saltsø is seen as a light ring north to (to the left of) the salt lake (cp. b-b on Plate 2 fig. 2). After Böcher 1949 b. Geodetical Institute, Copenhagen. Copyright.