MEDDELELSER OM GRØNLAND
UDGIVNE AF
KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND
Bd. 150 · Nr. 2

STUDIES IN THE MACROLICHEN FLORA OF SOUTH WEST GREENLAND

BY

EILIF DAHL

WITH 7 PLATES AND 1 MAP

KØBENHAVN
C. A. REITZELS FORLAG
BIANCO LUNOS BOGTRYKKERI
1950

In memory of my friend and teacher

Professor BERNT LYNGE

CONTENTS

	Page
Preface	5
Introductory chapter	7
Geographical introduction	7
History of the lichenological exploration of South West Greenland	10
List of localities	15
On methods in lichen systematics	19
The microchemical methods	26
Enumeration of the lichens	29
Dermatocarpaceae	29
Pyrenidiaceae	32
Sphaerophoraceae	32
Chrysothricaceae	33
Ephebeaceae	34
Pyrenopsidaceae	36
Collemaceae	44
Heppiaceae	48
Placynthiaceae	49
Pannariaceae	57
Stictaceae	60
Peltigeraceae	62
Cladoniaceae	70
Umbilicariaceae	118
Parmeliaceae	127
Usneaceae	141
Teloschistaceae	149
Physciaceae	150
Concluding remarks	155
References	169
Index	171

PREFACE

In the year 1937 the RASK-ØRSTED Fond granted the necessary money for a botanical expedition to South West Greenland. One of the chief aims of the expedition was to bring home a collection of lichens as complete as possible from the district, which from the lichenological point of view was insufficiently explored since the days of JENS VAHL, about 1830. Having worked as an assistant with Professor LYNGE and participated in an expedition to Spitsbergen the previous year, I was offered the opportunity to participate with the special task of collecting lichens.

The expedition set out from Copenhagen during the last half of June and came to Ivigtut on July the 1st. Leader was magister JOHS. GRØNTVED and assistant the Danish hunter, POUL POULSEN. The expedition went southwards along the coast and into the fjords of the Julianehaab district as far south as Agdluitsoq. Afterwards the expedition again went north to Ivigtut from where it departed during the latter half of September for Denmark

For a period of $2^1/_2$ months we had ample opportunity to travel through the beautiful fjords and work in the field. To my comrades on the expedition and all the people of Greenland whom we met, Greenlanders as well as Danes, I want to give my sincere thanks for an unforgettable summer.

The collections of lichens were brought to Oslo for mounting and determination. During this work I had every support and possible help from my friend and teacher, Professor LYNGE. The loss, both to lichenology as a science on the whole and to Arctic lichenology in particular, was great when Professor LYNGE died in January 1942. Without his kind help, his "breeding" of young lichenologist as he used to say, this work would never have come into being.

Owing to the war I was compelled to leave the country in the autumn 1942, and the work could not be continued till 1946. In May 1946 I had an opportunity of visiting the Copenhagen herbarium and examine the collections of macrolichens from Greenland kept there.

The term, macrolichen, has been used in the sense in which it was used in most of Professor LYNGE's more recent works, including also the cyanophilous lichens.

During the work I was offered the best possible conditions both by "Universitetets Farmasøytiske Institutt" and by "Universitetets Botaniske Museum". Financial support was given from the NANSEN Fond and from the "Videnskabelige Forskningsfond av 1919". The microphotographs of the lichen acid crystals are taken by mag. scient. JOHAN BASBERG; the photographs of the lichens by Miss MAURITZ, and the map is drawn after: Grønland i 200-året for HANS EGEDES Landing, by Mr. RØNNING. RN. Dr. EMIL HADAĆ has helped me with Latin diagnoses.

To all who have helped me in the work I extend my sincere thanks.

Oslo, March 25th, 1948. EILIF DAHL.

INTRODUCTORY CHAPTER

Geographical Introduction.

The area concerned in this book comprises the three southernmost districts of Western Greenland, viz. the Godthaab, the Frederikshaab, and the Julianehaab Districts. The northernmost point of the area is at 65° 17′ N. lat.; the southernmost (Cape Farvel) at 59° 45′ N. lat. The westernmost point is at approx. 52° W. long.; the easternmost at approx. 43° W. long. (see the map).

The area is undoubtedly the one in Greenland which has the most favourable climate; and 5307 out of a total population of 14343 Greenlanders live within the area (1918 acc. to: Grønland i 200-året for HANS EGEDES Landing, Kjøbenhavn 1931, from which source most of the information in this chapter is taken). The Greenlanders live in small villages or groups of houses, having given up their former nomadic way of living. The largest of the villages are the district capitals Godthaab with 357 Greenlanders and 34 Danish inhabitants; Frederikshaab with 201 Greenlanders and 7 Danish inhabitants and Julianehaab with 390 Greenlanders and 34 Danish inhabitants. Nanortalik has 290 inhabitants. Ivigtut, in the southernmost part of the Frederikshaab District, is a village which has grown up around the cryolite mines. In summer approx. 110 European workers are employed there. Greenlanders are not allowed to enter Ivigtut without special permission; nor are the workers of Ivigtut admitted to the villages of the Greenlanders. The vast majority of the Greenlanders live in villages with less than 100 inhabitants.

The topography of the area is very like that of Western Norway, especially like Møre. There is a typical and well developed strand flat where most of the population live. The strand flat may be as wide as 60 km around Julianehaab (see WEGMANN in Medd. om Grønl. Bd. 113, 1938, Plate VII). Inside the strand flat a highland rises. The highland is cut by fjords which may attain considerable lengths. Tunugdliarfik in the Julianehaab District is the longest and 120 km from the innermost end, the Qingua, to the coast outside Julianehaab. The mountains increase in height towards the inland ice and may reach 2000 m in the

north, and 2300 m in the south. In some places like Nanortalik and at the head of the Arsuk fjord high mountains rise close to the very coast, the strand flat here being quite narrow. The inland ice reaches the bottoms of most of the larger fjords, and a calving glacier generally forms the innermost end. Floating ice is consequently seen on most of the fjords, even during the warmest part of the summer.

There is ample evidence that the inland ice in former periods, during the Ice Ages, had a larger extension than at present. Glacial striae and erratics are seen everywhere in the lowlands. It is, however, hardly probable that the ice covered the whole of the area. Many of the mountains have very markedly sharp peaks and ridges, socalled nunatac sculpture. Geologists agree (see Grønland i 200-året for HANS EGEDES Landing II, p. 426) that the whole of the Julianehaab District hardly had been inundated by ice during the last Ice Age. Some problems in this connection will be discussed in a later chapter (see p. 165).

The climate of an area as large and varied in structure as the three southern districts of Western Greenland must be quite variable. The East Greenland Polar Current which carries along ice from the Arctic Ocean and from the glaciers of East Greenland southwards, makes a bend around Cape Farvel towards the north on the western coast and brings ice and cold water in summer along the coast as far north as Godthaab. Outside Julianehaab the Polar Current is estimated to be 40—60 km wide. The southernmost district is the one most severely affected by the Polar Current. The current brings most of the ice to Western Greenland in the summer months, beginning in April outside the Julianehaab District. The ice forms a barrier outside Julianehaab during the summer months (June, July, and August) so that Julianehaab in average years is open to traffic by ships only in spring and autumn. The districts farther north are not so severely affected. Godthaab is usually open to traffic all summer except for years with extraordinarily bad ice conditions which occur approximately every 5 or 6 years. The current exercises a great influence on the climate, making the summer colder and more foggy in the coastal parts of the Julianehaab District than in the inner parts of the fjords and the districts farther north. Compare for instance the temperature of the warmest month (July) in Nanortalik and in Godthaab (Table 1). This temperature is higher in Godthaab than in Nanortalik although Godthaab is situated 4 degrees farther north and although the average temperature of the year is $-1.7°$ C. in Godthaab but $+0.5°$ C. in Nanortalik. Both are coastal stations.

Partly due to the Polar Current and partly due to other factors there is a considerable difference in the climate of the coastal parts of

Table 1. Temperatures of the months in some meteorological stations in South West Greenland

(after *Petersen:* Klima der Küsten von Grønland. Handbuch der Klimatologie Bd. II. Til K, Berlin 1935). °C.

	Jan.	Febr.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average of year
Qôrnoq 1876—1925	-10.8	-10.9	-8.0	-3.8	2.2	6.4	8.5	7.7	3.4	-1.1	-5.1	-8.8	-1.7
Godthaab 1876—1925	-9.8	-10.1	-7.5	-4.0	0.8	4.4	6.5	6.3	3.2	-0.8	-4.6	-7.9	-1.9
Fiskernæs 1877—1886	-10.5	-10.4	-7.5	-3.5	1.9	5.5	7.2	6.6	3.0	-1.6	-5.7	-8.8	-2.0
Ivigtut 1881—1925	-7.4	-7.1	-4.5	-0.5	4.5	8.0	9.9	8.6	5.0	1.1	-2.9	-5.9	0.8
Julianehaab 1881—1925 ..	-8.2	-7.7	-4.7	-0.6	3.9	6.2	7.4	7.4	4.8	1.0	-3.5	-6.5	0.0
Nanortalik 1884—1925 ...	-5.3	-5.2	-3.3	0.5	3.0	5.0	6.2	5.8	4.0	1.4	-1.6	-3.9	0.5

Table 2. Precipitation of the months in some meteorological stations in South West Greenland.

	Jan.	Febr.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total of year
Qôrnoq 1876—1925	24	18	22	25	23	24	40	49	47	41	31	21	369
Godthaab 1876—1925	36	43	43	31	43	46	55	78	83	63	49	37	596
Ivigtut 1880—1925	84	66	85	64	89	81	78	96	148	144	118	81	1134

the district and the inner parts of the fjords. The climate of the inner parts of the fjords is of a more continental type, there is less fog in summer, less precipitation, colder winters and warmer summers. Unfortunately I have been unable to find any meteorological data for Igaliko or any other station at the inner parts of the fjords of the Julianehaab District, which offers the most favourable localities for plant growth in Greenland. The difference between a fjord station and a coastal station may be illustrated by comparing the data of the stations Qôrnoq and Godthaab. Qôrnoq is a fjord station situated 52 km inland from Godthaab. It will be seen that the temperature of July is 2° C. higher in Qôrnoq than in Godthaab, while the annual precipitation is approx. 60 % of that in Godthaab. It is believed that the difference is still greater between stations like Julianehaab and Igaliko.

A feature of great importance to the flora and vegetation is the foehn winds which frequently occur in the fjords. The foehn winds come from the great inland ice. During the fall from the heights of the

icecap down to sea level, the air is considerably heated and the foehns are very violent and hot winds. They occur during all parts of the year and may often melt away all snow in a few days in midwinter.

The rocks of the district are exclusively of archean types, gneisses, granites, syenites, and also more or less metamorphic schists, like hornblende schists and mica schists. There is only one indubitable sediment, the Igaliko sandstone, a red sandstone of unknown, probably archean, age which occurs around the inner parts of the N. Sermilik, Tunugdliarfik, and Igaliko fjords. Within the same district a peculiar complex of nepheline syenites occurs, with many rare minerals. The gneisses of the Julianehaab District are cut by a system of abyssal rocks mainly consisting of diabases and essexites. The crystals are often large, and weather rapidly producing an excellent soil for calcicole plants.

The bird life, so important for the lichen flora in other Arctic countries, is not so important in South West Greenland. Bird cliffs are rare and become still rarer farther south on the coast. Fortunately the villages of the Greenlanders make a good substitute for the bird cliffs as localities for to nitrophilous lichen species.

As a general characteristic of the conditions for plant growth in Southern Greenland may be mentioned that only here birch "forests" occur. The conditions for plant growth should thus be compared with those of regions at, and above, the tree line in other countries.

It may be doubted whether the whole area concerned in this book should be termed Arctic. There are many southern features also in the lichen flora which make Southern Greenland different from all other parts of Greenland and other Arctic countries.

History of the Lichenological Exploration of South West Greenland.

Pre-Vahlian collectors.

During the years of early Danish exploration of Greenland, some of the explorers and colonizers also collected lichens. I have seen plants collected by WORMSKJOLD, HOLBOELL (in Greenland 1822—1856), and BOOK (who worked in Greenland 1812—14). The plants are nearly always insufficiently labelled without specified localities within Greenland. Thus it cannot be ascertained whether they really have been collected within the area concerned in this paper. As none of the plants collected by them are species otherwise rare, or of any peculiar distribution, the reference to finds by these collectors have been omitted in the plant lists.

Jens Lorenz M. Vahl. 1828—1831.

During the first three years of his long period of collection of lichens and vascular plants in Greenland, Jens Vahl stayed in the three southern districts of Greenland. Jens Vahl was a collector of lichens and a lichen systematist as well, thus his collections form the basis of our knowledge of the lichen flora of Greenland up to the present day. Unfortunately he was not able to work out and publish his Lichenographia Groenlandica. After his death he left a manuscript which is now in the library of the Botanical Museum in Copenhagen. Reference has been made to his notes by Deichmann Branth and Grønlund (1888), where also his localities have been published. Some of his more important finds were published already by Nylander: Ad Lichenographiam Groenlandiam qaedam addenda. Flora 1862 No. 6; and reference to many of his finds are also made in Th. Fries: Lichenes Arctoi 1860. His collections contain a great number of interesting finds, thus the first find of *Lobaria Halli* from Greenland is due to him, though not formerly recognized. He also found *Umbilicaria Pennsylvanica* in Greenland; he found a peculiar *Leptogium* not yet identified, and made scores of other interesting finds.

The first year (1828) Vahl spent within the Julianehaab District. The next year he went on an expedition to the East Coast and he also collected lichens within the southern part of the Julianehaab District. In 1830 he went from the Julianehaab to the Godthaab District, and made collections inter alia in the Ameralik Fiord where he discovered a very rich lichen flora. The whole of the summer 1831 Vahl travelled within the Godthaab District. According to the diary Vahl also made some collections within the Godthaab District in April 1832; but I have seen no lichen collected by him within the district in 1832. Later he went northwards, beyond the area dealt with in this book, where he stayed up to 1836.

H. J. Rink (1848—1868).

The famous explorer and administrator of Greenland, Heinrich Joachim Rink, also collected some lichens during his many years in Greenland. Many of his lichens are only labelled Greenland, others bear more precise localities, but very rarely dates.

Dr. Walker (1858).

Dr. Walker was a surgeon and a naturalist on the "Fox Expedition" which travelled along the West Coast of Greenland; he also visited localities west of Baffin Bay. Dr. Walker collected plants at Fiskenæsset, Frederikshaab, Godthaab, Disko, and Upernivik. The collections

of lichens are published by W. MITTEN: Lichens in Dr. J. D. HOOKER: An Account of the Plants collected by Dr. WALKER in Greenland and Arctic America during the Expedition of Sir FRANCIS McCLINTOCK R. N. in the Yacht "Fox." Journ. Linn. Soc. Vol. 5. Botany p. 87. 1860. Only very few localities of lichen species from our district are given, all of which belong to common species.

JOH. LUND 1866.

A few lichens collected by JOH. LUND at Julianehaab are to be found in the Copenhagen herbarium.

SCHIØDT 1868.

A few lichens are labelled Ivigtut leg. SCHIØDT.

TH. M. FRIES 1871.

In 1871 the great lichenologist THORE MAGNUS FRIES joined an expedition with two Swedish gunboats to Disko. On the journey the expedition also visited Godthaab, and Fries had the opportunity of making a few excursions in the neighbourhood of the colony. The collections were determined and the results published by Lynge in 1937.

JOHNSTRUP 1874.

In the summer 1874 Professor JOHNSTRUP collected some lichens at the Arsuk Storø in the Frederikshaab District. His collections are published by GRØNLUND in Vidensk. Medd. fra den naturhistoriske Forening i Kjøbenhavn 1877, p. 1. The lichens are not in the herbarium of the Botanical Museum in Copenhagen, so I have had no opportunity of checking the determinations. GRØNLUND sent the more problematic plants for revision to TH. M. FRIES in Uppsala, who confirmed the determinations. As none of the species of macrolichens recorded are rare within the district these records have been included in the lists of localities of the various species with the exception of *Stereocaulon denudatum*, *Cladonia uncialis*, and *Cetraria fahlunensis* which may have been confused with other lichen species.

A. KORNERUP 1876 and 1878.

In 1876 stud. polyt. A. KORNERUP collected a few lichens at Ivigtut. In 1878 he joined an expedition under Lt. J. A. D. JENSEN to the southern part of the Godthaab District. The Agdlumersat Fiord (Bjørnesund) was explored and some lichens were also collected on the famous J. A. D. Jensens Nunatakker.

Carl Petersen 1880.

During an expedition under G. F. Holm to the Julianehaab District 1880 cand. polyt. Carl Petersen collected a few lichens, mainly from the Igaliko Fjord.

Sylow 1881.

In the year 1881 G. F. Holm again undertook an expedition to Southern Greenland, and cand. polyt. P. L. P. Sylow joined the expedition as a botanist. The expedition worked mainly in the southernmost part of the Julianehaab District and also went through the Ikerasagssuaq to the East Coast.

Eberlin 1883—1885.

During the years 1883—1885 an expedition under G. F. Holm and V. Garde explored the East Coast from Cape Farvel northwards. P. Eberlin collected lichens during the expedition, many of them within the Julianehaab District. He found *Cladonia papillaria* which has not subsequently been found in Greenland.

The "Fylla" Expedition 1884.

In the year 1884 the ship "Fylla" sailed with an expedition to the northernmost part of the Godthaab District and northwards. On board were the famous Professor Warming and Th. Holm. They collected a few lichens within the district. Their collections are mostly labelled "Fylla-Expeditionen" and no individual collector is quoted. In a few cases either Holm or Warming is recorded as the collector, but in the list of localities I have also quoted these finds as collected by the Fylla Expedition.

Kolderup Rosenvinge 1888.

In the year 1888 the famous Danish botanist, L. Kolderup Rosenvinge, travelled through all the three districts of Southern Greenland. Besides making notes on the land vegetation, he collected vascular plants and marine algae and also spent time in collecting a considerable number of lichens.

Hartz 1889.

The collections of Kolderup Rosenvinge were followed by the collections of stud. mag. N. Hartz in 1889 who also travelled through all the districts and collected a large amount of lichens.

Mrs. Lundholm and Mrs. Lütken 1890.

A few lichens were collected by Mrs. Eleonora Lundholm and Mrs. Lütken at Frederiksdal 1890.

P. H. SØRENSEN.

Between 1890 and 1895 the Rev. P. H. SØRENSEN collected a few lichens within the district.

LINDHARD

collected a few lichens at Ivigtut 1899.

A. E. and M. P. PORSILD 1925.

The head of the Danish Arctic station of Disko, M. P. PORSILD, and his son made an expedition to Southern Greenland in a small motor boat. A few lichens were collected in the Frederikshaab and Julianehaab Districts.

The 1927-Expedition.

In the Copenhagen herbarium a number of lichens collected in the northern part of the Godthaab District are to be found. No collector is mentioned, only the date and year 1927 are given. I do not know who the collector is.

EUGENIUS 1929.

In 1929 the Eskimo kateket, EUGENIUS, collected some lichens at Neria in the Frederikshaab District, mainly major species.

The Danish-Norwegian Expedition 1936.

In 1937 an expedition financed by the RASK-ØRSTED Fond was sent to southern Greenland. Leader of the expedition was Magister JOHS. GRØNTVED, the present writer was a member with the special task of collecting lichens. The Danish hunter, POUL POULSEN, was an assistant on the expedition. The expedition had the opportunity of making extensive collections between Arsuk Fjord and the Agdluitsoq, at the coast as well as in the fiords. The collections are kept in the Oslo herbarium with one duplicate set in Copenhagen. The collections of lichens approximately amount to between 5 and 6000 lichens. The number of macrolichens collected during the expedition lies between 2 and 3000.

M. SKYTTE CHRISTIANSEN 1946.

In 1946 an expedition under leadership of Dr. T. BÖCHER made explorations and collections in Greenland. The expedition worked mainly in the district of S. Strømfjord in the Holsteinsborg District, but stayed also about three weeks in the Arsukfjord. The lichenologist of the expedition, M. SKYTTE CHRISTIANSEN, made collections, but the material has not yet been determined.

List of Localities.

Below a list is given of the localities within the three southern districts of Greenland where lichens have been collected according to literature or to specimens kept in the Copenhagen and Oslo herbaria.

It is very often difficult exactly to locate where the lichens have been collected. The pronunciation and orthography of the Eskimo language is very complicated, thus the names of localities have been misspelt in many labels. That most of the labels are written by hand does not make things easier. When the collectors of lichens participated in an expedition, a report of it was generally published afterwards in "Meddelelser om Grønland." By comparing the expedition report, the dates of collection, and the map, the place of collection may in most cases be located. An excerpt of VAHL's diary proved very useful for the determination of his localities. Much help is to be found in the list of localities, visited by botanists in Greenland, which is drawn up by HARTZ: Fortegnelse over Stednavne i Conspectus Florae Groenlandicae. Medd. om Grønl. Bd. III, h. 3. 1894, pp. 997—1016. Finally the grand old man of Greenland botany magister M. P. PORSILD, has kindly revised the lists of localities, corrected the pronunciation and helped through his profound knowledge of Greenland botany and the Eskimo language.

Some of the collection localities could all the same not be exactly ascertained. In the cases where such localities could be localized within a minor area, like a fjord, or a minor part of the coast, references to such finds have been included and the localities listed below. In a few cases where the localities could not be localized within the area, references to such finds have been omitted. Fortunately no finds of great importance belong to this category.

Abbreviations.

(V) = JENS LORENZ VAHL
(KORN.) = A. KORNERUP
(S) = P. L. P. SYLOW
(F) = Fylla-Expeditionen
(KR) = L. KOLDERUP ROSENVINGE
(H) = HARTZ
(E) = EBERLIN
(D) = EILIF DAHL

Godthaab District.	N. lat.	W. long.
Godthaabsfjorden: Qugssuk July 1830 (V)	64° 35′	51° 15′
Narssarssuaq Aug. 1831 (V)	64° 35′	50° 40′
Qôrnoq 9.7.1927	64° 32′	51° 5′
Amitsuarssuk 1927	64° 30′	50° 22′
Kapisigdlit July 1830 (V); 2.7.1927	64° 25′	50° 17′
Sadlen RINK	64° 17′	51° 28′
Baals Revier Aug. 1831 (V)	ca. 64° 10′	51° 40′

	N. lat.	W. long.
Godthaab RINK; WALKER 1858; 10.6.1871. TH. FRIES; 27.6.1884 (F); 18.6.1886 (KR)	64° 11′	51° 45′
Hjortetakken RINK	64° 8′	51° 35′
Kobbe Fjord RINK; 28—29.6.1884 (F)	64° 8′	51° 40′
Kook Øer 9.6.1871. TH. FRIES	64° 6′	51° 44′
Godthaabsøerne, June 1890 SØRENSEN	64° 6′	51° 44′
Nûgârsúngiaq, Aug. 1831 (V)	64° 6′	51° 26′
Ameralik. WORMSKJOLD; Aug. 1830 and July 1831 (V)	ca. 64°	50—51°
Ameralik: Igdlorsuit July 1830 (V)	64° 12′	48° 30′
Qarajaq ilua 24.5.1888 (KR)	63° 58′	51° 28′
Kavssissagdlit 27.6.1889 (H)	63° 55′	51° 50′
Simiútat 25—26.7.1889 (H)	63° 45′	51° 51′
Skinderhvalen (Merquitsoq) 20.5.1878 (KORN.)	63° 42′	51° 8′
Sermilik 1878 (KORN.)	ca. 63° 30′	
Sermilik: Qaersoq 23—25.5.1878 (KORN.)	63° 32′	51° 12′
Island outside Sermilik 1878 (KORN.); 26.5.1888 (KR)	63° 27′	51° 18′
Marraq 27.7.1888 (KR)	63° 25′	51° 12′
Ilivertalik 4.6.1878 (KORN.)	63° 12′	50° 35′
Kúgssuaq 1878 (KORN.), JENSEN	63° 12′	50° 32′
Naujat 1.7.1878 (KORN.) (on labels misspelt Manut)	63° 12′	50° 10′
Ulitsivik 5.7.1878 (KORN.)	63° 11′	50° 5′
South of Qáqatsiaq 13.6.1878 (KORN.) (plants labelled, Teltplads I, Bjørnesund)	63° 6′	49° 53′
Fiskenæsset, June 1830 (V); WALKER 1858; 1.7.1889 (H)	63° 4′	50° 40′
Kangârssuk, south of Fiskenæsset, 2.6.1888 (KR)	62° 58′	50° 35′
Bjørnesund (Agdlumersat) 1878 (KORN.)	ca. 63°	
Bjørnesund: Eqaluit, 16.5.1878 (KORN.)	62° 55′	50° 10′
Island outside Agdlumersat, 13.6.1888 (KR)	62° 53′	50° 30′
Head of Agdlumersat, 3.6.1888 (KR)	62° 47′	50° 20′
J. A. D. Jensens Nunatakker, 1878 (KORN.), JENSEN	62° 50′	48° 55′
Niaqornaq near Ravns Storø, 2.7.1889 (H)	62° 43′	50° 20′
Magdlerssorniarfiq, 1889 (H)	62° 40′	
Itivdleq near Ikátoq, 13.7.1878 (KORN.)	62° 37′	50° 10′
Tuluvartalik, 5.6.1888 (KR)	62° 30′	50° 20′
Frederikshaab District.		
Tiningnertôq, 30.6.1878 (KORN.)	62° 20′	49° 50′
Island between Avigait and Frederikshaab's Isblink, July 1927	ca. 62° 20′	50° 0′

	N. lat.	W. long.
Nutarmiut north of Frederikshaab, 10.6.1888 (KR)	62° 16′	49° 40′
Frederikshaab, June 1828 (V); WALKER 1858, 8.7.1889 (H); July 1927	62° 0′	49° 42′
Kúanersôq Qingua, 11—14.7.1889 (H)	ca. 62° 5′	49° 0′
Sangmissokfjord south of Frederikshaab, 1888 (KR)		
Narssalik, 14.8.1925 PORSILD	61° 38′	49° 23′
Neria, 1929 EUGENIUS	61° 33′	49° 10′
Neriap qingua, 28.7.1889 (H)	61° 33′	48° 55′
Head of Neria on the southern side, 20.7.1889 (H)	61° 33′	49° 10′
Smallesund, 16.6.1888 (KR)	61° 32′	49° 20′
Kangârssuk near Tindingen, 17.6.1888 (KR)	61° 25′	49° 0′
Sermiligârsuk, 8.8.1889 (H)	61° 23′	48° 50′
Arsuk Storø, 1874 JOHNSTRUP	61° 9′	48° 20′
Arsukfjorden: Bjørnedal, 16.9.1936 (D)	61° 19′	48° 11′
Kungnait on the eastern slope of the mountain and in the valley east of the mountain. 8—12.9.1936 (D)	61° 14′	48° 28′
Langenes, 24.6.1888 (KR)	61° 11′	
Ivigtut, 1868 SCHIØDT; Oct. 1876. (KORN.); 24.6.1888 (KR). 2.6.1899 LINDHARD, 7.9.1937 (D.)	61° 11′	48° 15′
Smallesund near Ivigtut, 15.6.1876 (KORN.)		
Qôrnoq Isblink, 3.7.1888 (KR)	61° 5′	47° 27′
Borgshavn near Sánerut, 3.7.1937 (D)	60° 58′	48° 16′
Julianehaab District.		
Josvaminen, 4.7.1937 (D)	60° 52′	48° 10′
Qagssimiut, 4.7.1937 (D)	60° 46′	47° 8′
N. Sermilik: Ukîvigssaqaq April 1930 (V) (in labels written Okivisekan, in one label Okivisekan in sinu Sermilik)	61° 0′	46° 10′
Isaromiut, 19.7.1937 (D)	61° 10′	45° 42′
Tasiussaq, 29.7.1937 (D)	61° 9′	45° 40′
Tunugdliarfik, Sept. 1828 (V.), SØRENSEN	ca. 61°	
Tunugdliarfik: Narssaq, 9.7.1937 (D)	60° 54′	46° 4′
Summit of Narssaqfjell, 650 m, 11.7.1937 (D)	60° 55′	46° 2′
Western side of Narssaqfjell, 12.7.1937 (D)	60° 55′	46° 3′
Qissungadalen, 10.7.1937 (D)	60° 57′	46° 6′
Approx. 3 km north-east of Narssaqfjell, 700 m, 16.7.1937 (D)	60° 56′	46° 0′
Ilimaussaq, up to 1200 m, 16.7.1937 (D)	61° 0′	45° 52′
Tunuarmiut, 16—17.7.1937 (D)	60° 58′	45° 48′

	N. lat.	W. long.
Nunasarnaq near Tunuarmiut, 20.7.1888 (KR)	60° 57′	
Sitdlisit, 18.7.1937 (D)	61° 4′	45° 35′
Qagssiarssuk, 26.7.1937 (D)	61° 9′	45° 33′
Kiagtût from the sea up to the inland ice, 28.7.1937 (D)	61° 11′	45° 27′
South of Kiagtut, 16.8.1925 PORSILD	61° 10′	45° 29′
Qordlortoq, 18.8.1888 (KR); 21.7.1937 (D)	61° 12′	45° 34′
Qíngua, 20.7.1937, and 22.7.37. (D)	61° 14′	45° 33′
Approx. 3 km west of Qíngua, 300 m, 23.7.37 (D)	61° 14′	45° 36′
Innermost part of Kangerdluarssuk, 12.8.1888 (KR)	60° 53′	45° 45′
Qaqortoq, July 1828 (V); 25.8.1937 (D)	60° 48′	45° 50′
Kangerdluarssuk: Eqalugarssuit, 26.7.1937 (D)	60° 47′	46° 9′
Uperniviarssuk, north-east of Julianehaab, July 1828, Sept. 1829 (V); 4.7.1937 (D)	60° 47′	45° 57′
Julianehaab. July 1828, May 1830 (V); 1877 JOH. LUND; 1890 SØRENSEN; 7.7. and 11—12.8.1937 (D)	60° 43′	46° 7′
Kirkefjellet, near Julianehaab, 1880 PETERSEN	60° 43′	46° 7′
Itivdliatsiarssuk, just east of Julianehaab, 23.8.1888 (KR)	60° 43′	46° 6′
Kobbermineøen, near Julianehaab, 8.8.1888 (KR)	60° 43′	45° 47′
Igalikofjord, Aug. 1828 (V)	ca. 60° 45′	
Igalikofjord: Eqaluit, June 1880 PETERSEN; 9—10.8. 1937 (D)	60° 46′	45° 33′
Sigssardlugtoq, June 1880. PETERSEN; 4.8.1937 (D)	60° 55′	45° 28′
Qagssiarssuq, Aug. 1828 (V); 25.7.1888 (KR)	60° 54′	45° 17′
Igdlerfigssalik Aug. 1828 (V); 2.8.1937 (D)	61° 4′	45° 22′
Igaliko, Aug. 1828 (V); 30.7.1888 (KR); SØRENSEN; 31.7.—3.8.1937 (D)	60° 58′	45° 25′
Upernivik, north-east of Sârdloq on a small island, 7.8.1937 (D)	60° 35′	46° 2′
Qaersoq, 6.5.1885 (E)	60° 33′	45° 56′
Agdluitsoq, Sept. 1828 (V)	ca. 60° 30′	
Agdluitsoq: Sydprøven, 6.5.1885 (E)	60° 27′	43° 45′
Davids Sund, Aug. 1828 (V)	?	?
Sermiligârssuk, Aug. 1828 (V)	?	?
Sletten, 1.11.1900 SØRENSEN; 14.—15.8.37 (D)	60° 36′	45° 22′
Approx. 3 km south of Sletten in talus slopes and on a low mountain 19.—20.8.1937 (D)	60° 35′	45° 22′
Approx. 4 km east of Sletten in a small valley, 17.8.1937 (D)	60° 36′	45° 18′

	N. lat.	W. long.
Qagdlumiut, 22.8.1937 (D)	60° 43′	45° 18′
Amitsuarssuq, Oct. 1828 (V)	60° 45′	45° 10′
Qordlortorssuaq from the sea through the birch forest up to the cascade 22.8.1937 (D)	60° 45′	45° 10′
Igdlorpait, 7.5.1885 (E)	60° 27′	45° 23′
Sermersôq, July 1828 (V); 1889 (H)	60° 12′	45° 15′
Sermilik: Itivdlerssuak, a low plain in the innermost part of the fjord, 22.9.1881 (S)	60° 35′	44° 45′
Innermost end of Sermilikfjord, Sept. 1881 (S)	60° 34′	44° 30′
Nanortalik, Febr.—March, 1928 (V); 6.3. and 8.4. 1885 (E)	60° 9′	45° 15′
Tasermiut, Aug. 1829 (V); 1884 (E); 1889 (H). a.	60° 10′	
Amitsuarssuk, Sept. 1829 (V)	60° 2′	44° 45′
Frederiksdal, Sept. 1829 (V)	60° 0′	44° 43′
Nunarssuaq 1890 Mrs. LUNDHOLM; 1890 Mrs. LÜTKEN	59° 58′	44° 32′
Ilua: Kangerdlek Qingua, 29.8.1881 (S)	60° 13′	44° 14′
Nûk, 4.8.1885 (E)	60° 12′	44° 13′
Ujaragssuit, July 1829 (V)	60° 12′	44° 11′
Mountain 4000′ high near Igdlorssuit, 15.8.1881 (S)	60° 14′	44° 2′
Innermost end of Iluafjord 22.8.1881 (S) Prob.	60° 18′	44° 17′
Sagdliaruseq, 1829 (V) (Sagdlevik)?	60° 6′	44° 12′
Sangmissoq, 6.5.1884 (E)	59° 59′	43° 55′
Ikerasagssuaq, (Prins Christians Sund) July 1829 (V) ca.	60° 7′	
Qeqertaq in Ikerasagssuaq, April 1829 (V)	60° 4′	43° 15′
Qapiarfik, 14.7.1881 (S)	59° 51′	43° 12′
Nunatsuk, 16.—23.7.1881 (S)	60° 4′	43° 5′
Kangerajuk, 28.7.—3.8.1881 (S)	60° 14′	43° 3′
Qeqertatsiaq, 4.—12.6.1885 (E)	60° 13′	43° 7′
Nanûseq, May 1829 (V); 11.9.1884 (E)	60° 28′	43° 10′

On Methods in Lichen Systematics.

In all systematic work it is necessary to arrive at a clear understanding of the principles according to which one wants to systematize. The points of view given here do not claim to be new.

It is hard to give a definition of the concept of species. The matter has been discussed for a long time. From a systematic point of view it may be defined as the basic unit of our system. Not all units found in nature can, however, reasonably be used as basic units. All modifications and forms which can be found and which through all transitional types are connected with other forms and modifications cannot

reasonably be used as basic units, as the system would then be interminable, and it will be difficult to class each specimen found in nature under a definite unit. By a species one must demand that a fully developed specimen presented, with fairly great certainty may be classified as belonging to one species.

It is an old rule that it is not wise to create a new species on the basis of one single character. This is a sound and reasonable rule, considering that one must use the utmost care regarding the species, which is to be the basic unit of the system. If a single specimen found in collections, often from very distant places, by one single character differs from those of a previously known species, the specimen may represent the extreme of a series connected with the known species through all the transitional forms. If however the specimen presented also exhibits another character beyond the range of variation of the species known, it is extremely improbable that these two extremes of different ranges of variation, should coincide in one specimen. It may therefore generally be justified to describe the specimen as a new species. The chance that the new species should be connected with the known species through all transitional forms will be small, and it may therefore be considered as a natural and certain unit.

Here is a difficulty: What is meant by: One character. In many, perhaps most, cases we cannot decide whether we are facing a single character or a complex of characters. In some cases, however, one may say we have found a single character. This is the case regarding two very important characters in lichen systematics, the chemical characters, and the presence or absence of soredia or isidia. We can decide whether the plant reacts through a certain test or not, and we can decide whether a plant bears soredia or isidia or not.

Of course the view can not be overlooked that single characters may be found so important and of such a radical significance to the plants that this single character may be sufficient to describe a new species. Thus to quote GYELNIK (Ann. Myc. Vol. XXXIII, nos. 5—6, 1935, p. 357): "Meiner Meinung nach ist jedoch dem Vorhandensein oder Fehlen von Isidien oder Soredien ferner den Unterschieden in der chem. Reaktionen ein spesifischer systematischer Wert beizumessen, und diese meine Meinung behalte ich bei, bis mir das Gegenteil eklatant bewiesen wird." Such an apriori attitude towards a problem I do not consider warranted. One cannot, indeed, brush aside the criticism of an opponent by demanding that he presents a general binding negative proof. The burden of proof in this case lies on GYELNIK.

Have we any means of deciding whether such an either-or-character has any systematical value in each single case. Three points shall here be mentioned: First: If individuals of one type differing from another

in one character have the same range of variation and varies in the same way under different ecological conditions as individuals of the other type, this is an indication that the character is of little systematic value. There is little chance of one species having exactly the same range of variation and reacting exactly in the same way towards different ecologic conditions as another species. Consequently if we repeatedly and under varying ecological circumstances find specimens of the same appearence, apart from the one different character, living together, this is an indication that the character is of little systematic value. Secondly: If specimens with the character in question are always found together with the normal type, and merely under certain ecological conditions, this is an indication that the character has been created by these outer circumstances. It can therefore be of little systematic value only. Thirdly: Characters being bound to a certain stage of development and missing in other stages cannot be used for distinguishing the different stages of development as different species.

With these views as a basis I shall discuss the problem of the systematic value of soredia and isidia, and the question of the systematic value of the chemical characters.

The former problem has been discussed for a long time. The characters about the soredia and isidia are unanimously considered as a rule to be of great value. If proofs are wanted one may refer to the paper of Du Rietz: Die Soredien und Isidien der Flechten. (Sv. Bot. Tidsskr. Bd. 18, H. 3, 1924, pp. 372—396). The proofs are so overwhelming that they have led to the conclusion that these characters should be specific characters in all cases. The question may then be put: Are there cases where we have reasons for believing that this is not so. In some cases I think we have such reasons.

1. *Cetraria Delisei.* I have found this species bearing soredia in two places in Spitsbergen and together with normal types; in one place together with fertile plants. At Røros in Eastern Norway I found it in the course of a fortnight in four different places, always together with normal fertile *C. Delisei.* In the summers 1942, 1946, and 1947 in Rondane in Central Norway I found soredious *C. Delisei* in perhaps a hundred places in depressions in the lichen heath, and always together with fertile normal *C. Delisei.* As *C. Delisei* is quite rare with soredia, and as apothecia in *C. Delisei* are not common, this seems to be more than a mere accident. As a rule the fertile and soredious plants are found together in depressions in the lichen heath in a certain type of vegetation dominated by *Cetraria Delisei*, *Loiseleurea procumbens*, *Deschampsia flexuosa*, *Empetrum nigrum*, *Dicranum fuscescens*, *Lophozea alpestris* and *Cladonia coccifera.* The specimens often in those places seem overfat, are easily broken, and have a sick appearance. It looks

to me as if the soredia have been created by certain ecologic conditions corresponding rather closely to those creating apothecia in the species. My opinion is that the soredia character in this case does not mean more than that the soredious type can be described as a forma. I have found no other difference than the presence of the soredia as a distinguishing character between the soredious and normal type.

I think we find quite a corresponding case as far as *C. nigricans* is concerned, which was found with soredia at one place in S. W. Greenland together with fertile plants.

2. *Alectoria sarmentosa.* This species Dr. HADAČ and I have found in about 10 places in Nordmarka near Oslo with soredia. In all cases we found fertile specimens as a rule on the same branch or on the same tree, and always very near each other. As *A. sarmentosa* with soredia is not very common in Nordmarka—nor are fertile specimens living everywhere—I consider also this as in *C. Delisei* to be more than a mere accident.

3. *Peltigera spuria.* The relations between this species and the socalled *P. erumpens* have long been unclear. They are said to be distinguished by *P. erumpens* being soredious and as a rule not fertile, *P. spuria* on the other hand always fertile and lacking soredia. GYELNIK described a new species *P. Hazlinskyi* as being fertile and having soredia. SCHOLANDER ,however, pointed out (Notes on *Peltigera erumpens* (TAYL.) VAIN s. l. Nyt Mag. Nat. Vid. Bd. LXXIII 1933, p. 37) that *P. Hazlinskyi* was nothing but fertile *P. erumpens.* In the same year MAGNUSSON (Gedanken über Flechtensystematik und ihre Methoden. Medd. f. Göteborgs Bot. Trädg. Bd. VIII 1933, p. 60) stated that specimens of *P. spuria*, if more carefully studied, were found to have soredia, and that soredious specimens and specimens lacking soredia repeatedly were found mixed in the samples. He therefore considered *P. Hazlinskyi* as a mere form of *P. spuria.*

I have personally seen the following development of one individual of a *Peltigera* close to my home near Oslo in Norway. The specimen was discovered in spring growing at an old place of fire close to a road. It was then partly a typical *P. erumpens*, partly it had commenced developing apothecia and approaching *P. Hazlinskyi.* Later in summer it became more and more typical *P. Hazlinskyi.* As the lobes expanded, the older parts of the thallus with the soredia died away, and the plants lost their soredia. This development continued during autumn, and next spring the plants were typical *P. spuria.* This example shows clearly that the three "species" only are three stages of development of one species. This is, however, a fact which has been known to Swedish botanists for a long time.

Consequently we learn that there are cases where soredia as a distinguishing character are of little systematic value only.

As regards the question of the systematic value of chemical characters, I shall take some examples from the genus *Cladonia*. That is, indeed, to some degree to anticipate the results.

The problem of chemical characters in lichen systematics has arrived at a new stage after the works of ASAHINA on microchemical determination of lichen acids. It is now possible to explain the reasons of the different reactions of different lichens to different reagents like KOH, $Ca(OCl)_2$, paraphenylendiamine and others. Thereby we are able to distinguish between the cases where the reactions are mere pseudo-reactions and the other ones where we find real differences The *Cladonia gracilis-ecmocyna*-group gives a good example of this. The lichen acid atranoric acid is present in *Cl. ecmocyna* and lacking in *Cl. gracilis*. Atranoric acid causes a yellow colouring with KOH and consequently *Cl. ecmocyna* gives a yellow reaction to KOH, but no such reaction in *Cl. gracilis*. Both species, however, contain fumar-protocetraric acid, an acid giving a characteristic reaction with paraphenylen diamine in alcohol (short Pd), as the acid with Pd gives an intensely red colour. Accordingly both *Cl. ecmocyna* and *Cl. gracilis* give the reaction Pd + red. The fumar-protocetraric acid causes a faint brown colour with KOH. If we test a light specimen of *Cl. gracilis* with KOH a brown spot will appear in the place where the KOH is placed on the thallus, and this fact has given rise to the belief that the lichen reacted with yellow colour to KOH. On dark specimens no reaction is visible. Consequently a series of specimens of *Cl. gracilis* has been classified as *Cl. ecmocyna*, and this has caused confusion in the conception of those species.

Examples showing that chemical reactions can be of value to lichen systematics are easily to be found. *Cl. alpicola* is distinguishable, both chemically and morphologically, from the closely related *Cl. acuminata*, and the same applies to *Cl. decorticata*. If examples are wanted we may refer to ZOPF (1907). I only want to point out that chemical characters are of importance also for distinguishing higher units than species. ZOPF was also aware of this. Thus the species of the *Cl. acuminata*-group and of the *Cl. cariosa*-group are no doubt closely related, and they also both contain lichen acids of the same group and differ from those in other *Cladonias*. In the same way there is little doubt that the species only containing squamatic acid, viz. *Cl. squamosa*, *crispata*, *Delessertii*, and *cenotea*, are closely related to each other.

But the chemical characters are not absolute. Two examples may here be quoted.

1. *Cladonia coccifera.* Two types have since long been distinguished in Europe, the *Cl. coccifera* v. *stemmatina* lacking soredia and the *Cl. coccifera* v. *pleurota* having granulose soredia on the cups. ZOPF found that in Europe the v. *stemmatina* contained barbatinic acid, while the v. *pleurota* on the other hand contained zeorine. There was a clear correlation between the chemical and the morphological characters, and consequently he described them as new species. Later ASAHINA has confirmed his results. In Europe the species must be characterized as good. Later ASAHINA examined Japanese specimens and found them all containing zeorine, even if there were forms which according to the morphology should be classified as v. *stemmatina.* If we consider Greenland the case grows still more complicated. Besides barbatinic acid and zeorine there is still another unidentified lichen acid present in these lichens, and also squamatic acid occurs. Zeorine may be found both in *stemmatina* and *pleurota* forms (after morphology). The unknown lichen acid is only found in v. *pleurota*, whereas the barbatinic acid is found in the v. *stemmatina.* The squamatic acid is only found once in a *pleurota* type. As then the zeorine and the unknown lichen acid may occur together in one podetium or alone, and when in some specimens none of the lichen acids mentioned have been found, the possibilities of combinations become numerous. I have not found any morphologic characters parallel to the chemical ones. In my opinion we have the peculiar situation that in one area (Europe) we have two good species, but the same systematic units in other districts (Japan, Greenland), cannot be considered more than varieties. The chemical characters are of value in Europe, but of a minor value in Japan and in Greenland.

2. *Cladonia chlorophaea.* Specimens of the *Cl. chlorophaea* may contain at least six different lichen acids. In the most carefully determined and best exsiccate we have, SANDSTEDE's: *Cladoniae exsiccata*, we find repeatedly that the collections consist of morphologically like, but chemically different, specimens. There are many variations, thus I can mention that in one case ASAHINA in Japan in one number in his specimen of the exsiccate found one lichen acid, whereas in Oslo in the same number in our specimen of the exsiccate plants were found containing two other different lichen acids, (see p. 107). After this I do not believe that the chemical characters in this case have any systematic value.

A general judgment of the systematic value of chemical distinguishing characters, and also of the characters of the soredia and isidia, must in my opinion be formed as follows:

Differences in the contents of lichen acids and differences regarding the soredia and isidia in many cases prove to be correlated with other systematical, ecological or phytogeographical characters. One may

therefore assume that these characters in most cases are genotypically determined and may be used in distinguishing systematic units. The problem must, however, be considered in each single case, and by examining the correlation of the character with other systematic distinguishing characters or the ecological and phytogeographical conditions, one must decide whether the character in each case may be considered of systematic value or not.

A few points concerning the higher system of lichens in families and orders should be mentioned. A higher system aims at giving a grouping of organisms into units after their degree of relationship. Any grouping which is to be called a natural system should also give a picture of the history of evolution of the organisms in question.

In many cryptogamic groups science has not advanced so far as to make the establishment of a natural system possible. This also partly applies to the lichens. But anyone dealing with the system of lichens should have this point in mind, that the goal is to make a grouping after natural relationship.

The creation of a natural system encounters special difficulties in the case of lichens. The lichen organism is a symbiosis organism; there are two different organisms with different histories of evolution, which together are given the lichen name.

In the part of the lichen world, where the gonidia are green algae, the whole higher system is based on the morphology of the fungus. It is characters with spores and the organisation of the apothecia which form the basis of the system. And in some cases this system approaches a natural system. There is hardly any doubt that the families with placodiomorphic spores (the families *Caloplacaceae*, *Teloschistaceae*, *Buelliaceae*, and *Physiciaceae*, see ZAHLBRÜCHNER 1926) are related; that the *Umbilicariaceae* consist of species which are related, etc.

In the part of the lichen world where the gonidia are bluegreen algae, the system, however, is often not a natural one. Here the whole present grouping is based on the character of the gonidia, even if the anatomy of the fungus suggests relationship to genera with green gonidia (e. g. *Pyrenopsis pulvinata* and *macrocarpa* seem to be related to *Lecanora*). In many cases the genera must be considered natural groupings but that does not apply to the families in many cases.

This is distinctly obvious in the case of the family of *Pyrenopsideae*. The system of the family of *Pyrenopsideae* is based on the investigations of FORSELL (Beiträge zur Kenntnis der Anatomie und Systematik der Gloelichenen 1885). This work was on its appearance a beautiful treatise on the difficult group, and is still of great value. It has provided an analytical key which secured a reliable determination of the species with *Gloeocapsa*, *Chroococcus*, and *Xanthocapsa* gonidia. The family was

divided into three subfamilies, the *Pyrenopsidei* (TH. FR.) FORSS. with violet, thinwalled *Gloeocapsa* gonidia, the subfamily *Phylliscei* NYL. with large thickwalled *Chroococcus* gonidia, and the subfam. *Omphalariei* (MASS.) FORSS. with olivaceous *Xanthocapsa* gonidia. Each of the subfamilies consisted of two or more genera. This system has later been adopted by ZAHLBRUCKNER 1926.

If we look up the genus *Gloeocapsa* in GEITLER's monograph on the *Cyanophycae* in RABENHORSTS Kryptogamenflora (Bd. XIV, Lieferung 1—6, 1932, p. 175) we read: "Schon lange nicht mehr gebräuchliche Synonyme sind *Bichaetia* . . . . *Protosphaeria*, *Xanthocapsa*." About *Chroococcus* we find: "*Gloeocapsa* unterscheidet sich von *Chroococcus* durch die abstehenden, blasigen, gegeneinander deutlich abgegrentzte Hüllen. Wie vielfach innerhalb der *Chroococcaceen* gibt es auch hier fliessende Übergänge. In manchen Fallen scheint es ungewiss, zu welcher Gattung eine bestimmte Art zu stellen ist. In dieser Bearbeitung sind unter *Gloeocapsa* nur typische Arten aufgenommen. Übergangsformen sind bei *Chroococcus* behandelt."

Distinctions which by the specialists on *Cyanophycae* are considered of minor systematic importance, form the basis of distinction between genera and subfamilies in lichen systematics.

In my opinion the whole system of cyanophilous lichens must be revised and broken up, and a new system based more on the morphology and anatomy of the fungus component should be created. This, however, is the object of a monograph by itself and outside the scope of the present work. Here the old lines are followed to secure a good key of determination, although the writer is aware that the system is not a natural one.

The Micro — Chemical Methods.

The microchemical methods of determining lichen acids have been introduced by ASAHINA in a series of papers: Mikrochemischer Nachweis der Flechtenstoffe I—IX. Previously if the contents of lichen acids in lichens were to be determined, one had to use comparatively large quantities of material, at least several grammes. The student of lichen systematics has as a rule no more than a small piece of the thallus, or a single podetium, for this purpose. By means of microchemical methods it is possible to identify the lichen acids present even in such small quantities of lichens. As the methods are little known only, I shall mention the most important of them used in the present study.

For extraction mostly acetone or benzene is used. Acetone dissolves most of the lichen acids, but if we want to separate the content of lichen acids it will often be useful to extract by means of benzene first and then by acetone, and examine each fraction separately. Ex-

traction is carried out mostly in two different ways. One may place a few pieces of the thallus in a heap on an object glass, add some drops of the dissolving agent, and evaporate cautiously by means of a small spirit lamp (the flame ought not to be wider than 3 mm) almost into a state of dryness. Then a few more drops are added, the pieces of thallus are removed, and the fluid evaporated till dryness. The residue on the object glass is used for further examinations. This method is very

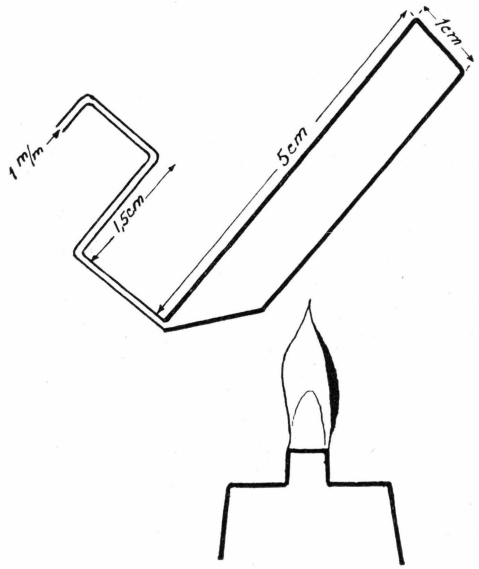


Fig. 1.

advantageous in connection with easily dissolvable substances as atranoric or usninic acid, and where no quantitative extraction is required.

If it is a question of heavily dissolvable substances or if a quantitative extraction is required, it is preferable to extract in an extraction tube as shown on fig. 1. Some pieces of the lichen in question are placed in the tube and so much of the dissolving fluid (usually acetone) is added that the pieces just are covered. Then the tube is cautiously heated by the spirit lamp. (Beware of bump boiling). The extraction fluid is evaporated on one or more object glasses by dripping the fluid out of the point of the tube onto the object glass which is heated by the spirit lamp. The residue is used for further examinations. Under my examinations I have found it advisable to use a shorter and thicker tube than the type used by ASAHINA. The botanist can easily make such tubes himself.

Then the residue it to be examined. It is often examined directly under the microscope with or without crossed nichols (a polarisation microscope is in any case almost indispensable for further examinations)

or reagents like solutions of KOH, $Ca(OCl)_2$ or paraphenylendiamine are admixed. Often the residue is recrystallized out of various solutions on the object glass. The most important of those solutions are:

Glycerine—alcohol—water (1:1:1) abb. G A W.
Glycerine—acetic acid (1:3) abb. G E.
Glycerine—water—pyridine (1:3:1) abb. G W Py.
Glycerine—alcohol—chinoline (2:2:1) abb. G A Q.
Glycerine—alcohol—aniline (2:2:1) abb. G A An.
Glycerine—alcohol—ortho-toluidine (2:2:1) abb. G A o-T.
Solution of soda or potash 10 %.

One or a few drops of the recrystallisation fluid are added to the residue, it is covered by a cover glass and cautiously heated by the spirit lamp. The time and intensity of heating differ much for different materials. On cooling crystals of different types appear either at once or after a while, perhaps a day or so. The crystals are studied under the microscope. When recrystallisation fluids containing basic components have been applied, salts of the lichen acids generally crystallize. A series of such crystals have been photographed (Plates III—VII).

ENUMERATION OF THE LICHENS

Dermatocarpaceae.

Dermatocarpon.

1. *Dermatocarpon miniatum* (L.) MANN. coll.

Julianehaab District: N. Sermilik: Ukivigssaqaq polyphyll. (V), Isaromiut sp. 15—19 × 6—7 μ ad typica (D), Tasiussaq sp. 15—16 × 6 μ polyphyll. (D).—Julianehaab: sp. 14—18 × 7—8 μ typica (D).—Tunugdliarfik: Western side of Narssaqfjell sp. 6—10 × 6—7 μ polyphyll. (D), Qagssiarssuk sp. 9—11 × 6—7 μ polyphyll. (D), Qordlortoq sp. 10—15 × 6—8 μ typica (D), Qíngua sp. 7—10 × 6—7 μ polyphyll. (D).—Agdluitsoq: Qagdlumiut sp. 13—15 × 6—8 μ polyphyll. (D).

The *Dermatocarpon miniatum*-group is a very problematic one in the Arctic regions and certainly comprises several species. *D. polyphyllum* (WULF.) DT et SARNTH. have been recorded from Arctic regions (see LYNGE 1937, p. 33). In the exsiccatas two different entities under the name of *D. polyphyllum* are to be found: Fl. Hung. 311 are large pulvinate specimens, the pulvinae more than 5 cm broad. The leaves are thin with sinuate and partly laciniate margins. Specimens of this type have been collected in Norway at Ringebu in Gudbrandsdalen. The other type is represented by Magn. 202 which occurs in small pulvinae (1—2 cm. in diameter) with thick leaves with rounded dissected lobes. Both types have globose or broadly elliptic spores. Which of the types is the original one, I cannot decide as I have not seen the type specimen.

The *D. polyphyllum* type from the Arctic regions is the type corresponding to Magn. 202. The Arctic plants are fairly small, the leaves generally no more than 0.5 cm long, and the spores are globose or broadly elliptic. Specimens closely corresponding to the type of Magnusson have been found in North East Greenland and other districts of the Arctics, and are also found among my plants from Greenland (e. g. from Qingua). But in my material plants occur which after their general appearance fit well with the MAGNUSSON type, but they have much longer spores

(e. g. from Qagssiarssuk). Similar types have been found in many places in the Arctics. Finally my collections from Greenland contain typical *D. miniatum*, partly of the *complicatum* type with large leaves and long narrow spores (e. g. from Julianehaab).

In Fennoscandia and in Middle Europe a whole series of small-leafed species of *Dermatocarpon* has been described as *D. deminuens* VAIN., *D. leptophyllodes* (NYL.) A. ZAHLBR., *D. Bachmanni* ANDERS and others. Some of my plants from Greenland may belong to one of the species described, but the field needs a monographic revision. Until this has appeared I dare not, in a material as scanty as that from Greenland, split up the *D. miniatum* complex in different units, what sooner or later probably will have to be done. I have therefore preferred to refer them all to *D. miniatum* sens. lat.

Dermatocarpon miniatum coll. has been collected only within the Julianehaab District and never farther north, which may be an accident. The ecology of the species is very variable, it occurs on sunny rocks or on irrigated rocks, a fact that also indicates different units. I have at the localities added the spore measures and the type of growth (polyphyllum-type with small leaves or typica with large leaves).

D. miniatum coll. is distinguished from *D. rivulorum* by a greyish colour, whereas *D. rivulorum* is brownish, by the smooth under side (*D. rivulorum* is plicated underneath), and by smaller spores. The *D. miniatum* coll. in Greenland is generally pruinose and has in some cases a tendency towards plication on the under side towards the margins.

2. *Dermatocarpon rivulorum* (ARN.) (DT) et SARNTH.

Julianehaab District: Tunugdliarfik: Narssaq sp. 17—25 × 7—8 μ (D), Ilímaussaq 1200 m sp. 16—20 × 7—8 μ (D), Qagssiarssuk sp. 15—22 × 6—7 μ (D).

Hitherto only found at Tunugdliarfik. The plants are all typical with plicated under side and large spores, 15—25 × 6—8 μ, living at or in water up to an altitude of 1200 m. Previously collected at the Eastern coast.

Dermatocarpon Lyngei SERVIT

Neue u. selt. Fl. aus. dem Fam. Verruc. und. Dermat. 1936, p. 266.
LYNGE, Lich. Isl. 1940, p. 11.
Dermatocarpon sphaerosporum LYNGE, Lich. N. E. Greenl. 1932, p. 17.

Julianehaab District: Tunugdliarfik: Approx. 3 km west of Qíngua 300 m (D).

Undoubtedly rare and scarce at the place of collection. The specimens have very lobated black-brown leaves and spores 8—9.5 × 5—8 μ in complete accordance with the type.

Dermatocarpon botularirum (NYL.) has been recorded from the Julianehaab District: Ilua: Ujaragasuit (V) (see DEICHMANN BRANTH and GRØNLUND, p. 509). The specimen in the Copenhagen herbarium has epruinose small leaves with dark faintly plicated under side, spores 16—20 × 6—8 μ. It seems to come fairly close to *D. meiophyllizum* VAIN. (see SANTESSON Lakustr. Fl. Medd. Lund. Limnol. Inst. Nr. 1, 1939, p. 6), but as the whole group is in need of revision I dare not state the specificity of the plant.

4. *Dermatocarpon rufescens* (ACH.) TH. FR. coll.

Godthaab District: Ameralik: Igdlorsuit (V).

Frederikshaab District: Arsukfjord: Kungnait elliptic spores (D), Borgshavn sp. 14—16 × 6—8 μ (D).

Julianehaab District: N. Sermilik: Ukivigssaqaq (V), Tasiussaq (D).—Tunugdliarfik: (V), Qissungadalen (D), Qordlortoq sp. 10—14 × 7—9 μ (D), Kiagtut sp. 19—23 × 9—11 μ (D), Qagssiarssuk sp. 15—20 × 7—9 μ (D).—Kangerdluarssuk: Eqalugarssuit sp. 16—19 × 7—9 μ (D).—Agdluitsoq: Sletten (D).

Dermatocarpon rufescens coll. is fairly frequent in South Greenland. In Arctic regions *D. rufescens* is difficult to distinguish from *D. hepaticum* (ACH.) TH. FR. and in one of the sheets in the Copenhagen herbarium LYNGE states that he believes that most of what has been called *D. rufescens* in Greenland belong to *D. hepaticum*. Some of my plants from Greenland, however, have distinctly ascending lobes (*D. hepaticum* has adnate lobes), and the spore measures are also too large for *D. hepaticum*. All the same I cannot deny that some of the plants may belong to *D. hepaticum*. I believe that most of the material at least is true *D. rufescens*.

5. *Dermatocarpon cinerum* (PERS.) TH. FR.

Frederikshaab District: Borgshavn (D).

Julianehaab District: Julianehaab (D).— Igalikofjord: Sigssardlugtoq (D).—Agdluitsoq: Ca. 3 km south of Sletten (D).—Sermilik: Itivdlerssuaq (S).

Scattered; few but typical specimens in each place. Some of the perithecia, especially young ones, are not black around the whole perithecium, only in the upper half. In the Copenhagen herbarium there is another plant from Scoresbysund leg. HARTZ.

7. *Dermatocarpon daedalum* (KREMPELH.) TH. FR.

Julianehaab District: N. Sermilik: Ukivigssaqaq (V).—Tunugdliarfik: Qordlortoq (D).

Probably not common, but easily overlooked. There is another plant in the Copenhagen herbarium from Upernivik leg. VAHL.

Pyrenidiaceae.

Coriscium.

1. *Coriscium viride* (ACH.) VAIN.

Frederikshaab District: Frederikshaab (H).—Arsukfjord: Ivigtut (D), Bjørnedalen (D).

Julianehaab District: Tunugdliarfik: Qissungadalen (D), Tunuarmiut (D).—Kangerdluarssuk: Eqalugarssuit (D), Uperniviarssuk (D), Julianehaab (D).—Agdluitsoq: Sletten (D), 4 km east of Sletten (D), Qagdlimiut (D), Qordlortorssuaq (D).

Fairly common on mosses and on earth in the southernmost part of the district up to Frederikshaab which is the northernmost locality in Greenland in which it has been collected.

DEICHMANN BRANTH (1888, p. 509) mentions *Normandina viridis* (ACH.) from Nanortalik and from Ameralik, but I have found no specimens in the Copenhagen herbarium.

Sphaerophoraceae.

Sphaerophorus.

1. *Sphaerophorus globosus* (HUDS.) VAIN.

Godthaab District: Simiútat (H)—Skinderhvalen (KORN.)—Island outside Sermilik (KORN.).

Frederikshaab District: Kuánersôq Qíngua (H),—Neria Qíngua (H).—Arsukfjord: Bjørnedalen (D), Ivigtut (D).

Julianehaab District: Qagssimiut (D).—Tunugdliarfik: Narssaq c. fr. (D), Narssaqfjell 650 m (D), Tunuarmiut typica and f. congesta c. fr. (D), Qíngua (D),—Uperniviarssuk typica and f. congesta (D), Julianehaab (V).—Agdluitsoq: Sletten typica c. fr. and congesta c. fr. (D).—Sermilik: Itidligatssiak (H), Nanortalik (E), Tasermiut (H).

In the Julianehaab District, *Sph. globosus* is certainly less common than *Sph. fragilis*, but in the Godthaab District and the northern part of the Frederikshaab District, we have more collections of *Sph. globosus* than of *fragilis*. *Sph. fragilis* is a more southern species than *Sph. globosus* and in still more northern districts (Spitsbergen, northern half of Greenland) *Sph. fragilis* is only rarely found.

Fertile plants of *Sph. globosus* and the f. *congesta* LAMY are not rare in the district.

2. *Sphaerophorus fragilis* (L) PERS.

Godthaab District: Kavsissagdlit, (H).

Frederikshaab District: Neria Qíngua (H).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D), Bjørnedalen (D),—Borgshavn near Sánerut (D).

Julianehaab District: Qagssimiut (D).—Kangerdluarssuk: Eqalugarssuit c. fr. (D), Julianehaab (D).—Tunugdliarfik: Narssaq (D), Western side of Narssaqfjell c. fr. (D), Narssaqfjell 650 m (D), Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk c. fr. (D), approx. 3 km west of Qíngua c. fr. (D).—Igalikofjord: Igaliko c. fr. (D).—Agdluitsoq: Approx. 3 km south of Sletten (D), approx. 4 km east of Sletten (D), Qordlortorssuaq (D).—Nanortalik (E).—Sangmissoq (E).—Qeqertaq (V).

Sph. fragilis is quite common within the district, growing on the vertical or sloping sides of large stones. It is often seen together with *Parmelia omphalodes* and *Sph. globosus* and seems to shy places in-influenced by the excrements of birds. Fertile plants are quite common.

Chrysothricaceae.

Crocynia.

1. *Crocynia neglecta* (NYL.) HUE

Julianehaab District: Tunugdliarfik: Qissungadalen (D), Tunuarmiut (D).—Igalikofjord: Sigssardlugtoq (D).—Agdluitsoq: 3 km south of Sletten (D), 4 km east of Sletten (D).

Fairly frequent within the Julianehaab District, but overlooked on account of its inconspicuousness.

Under the name of *Crocynia neglecta* (NYL.) HUE or *Lecidea neglecta* NYL. doubtlessly a number of different things are hiding. The "typical" *Crocynia neglecta* has a soft thallus almost dissolved in soredia giving the reaction Pd + intense flavescens — citrinus — auranthiacus and is found amongst mosses. Another type is frequently found in barren snowpatches among liverworths in Scandinavia and has a thallus with almost no soredia and which gives the reaction Pd —.

Crocynia arctica LYNGE has not been found within the three southern districts of Western Greenland, but there is a specimen in the Copenhagen herbarium from Sarfanguak in the Holsteinsborg district named *Amphiloma lanuginosum* collected by the "Fylla" Expedition.

Ephebeaceae.

Spilonematopsis E. DAHL gen. nov.

Thalli forma *Scytonema* determinata. Apothecia terminalia, pycnidia lateralia. Hymenium paraphysas multas continens. Asci multispori, sporae simplices, decolores.

Typus generis: *Spilonematopsis multispora.*

1. *Spilonematopsis multispora* E. DAHL sp. nov.

Thallus e filamentis nigris, pulvinos densos ad 5 mm in diam. latos, appressos, interdum confluentibus, formantibus compositus. Pulvini ca. 0.5 mm alti, habitu *Spilonema revertens* NORRL. et NYL. 585b revocantes.

Forma thalli *Scytonema* determinata; algae filamenta simplicia formant. Cellulae globosae, rarius paulum ad longitudinem compressae. Capsula crassa, tertiam partem diametri efficiens. Filum 15—22 μ crassum, ad 1 mm longum, ramis perpendicularibus paucis, ramulis perpaucis.

In filis algarum iuvenilibus, colore cotton blue addito, hinc inde tantum hyphae apparent; sed in veteris partibus hyphae numerosae occurrunt, cellulis ad triplo longioribus quam latis, ca. 1 μ crassis.

Apothecia globosa, nigra, 0.2—0.3 mm in diam., disco haud aperto, terminalia. Hymenium 50—70 μ altum, ascis et paraphysis tenuibus apice haud incrassatis, ca. 1 μ crassis instructum. Epithecium decolor. Asci digitati, 30—60 $\times$ 6—10 μ. Sporae ellipticae, subglobosae, decolores, unicellulares, 4—6 $\times$ 3—5 μ; ascus unus plus quam 8 sporas continet. Sporae difficile evadunt ex ascis. Hypothecium decolor. Asci J addito vinosi, paraphysae dilute tantum reagentes.

Pycnidae laterales, ca. 0.1 mm in diam., globosae. Pycnoconidia cylindrica duplo longiora quam lata, 2—3 μ longa. Conidiophori ramosi.

Locus class.: Julianehaab District: Tunugdliarfik: Western side of Narssaqfjell. leg. E. DAHL.

This genus obviously belongs to the *Ephebeaceae.* The present species by habitus much resembles *Spilomena revertens* (NYL.) VAIN as distributed in NORRL. et NYL. 585 b. Yet the algal host is somewhat different, the algae of *Spilonematopsis* having more rounded cells, not so compressed in the thread as in *Spilonema revertens.* The apothecia with slender paraphyses and numerous spores in the asci distinguishes *Spilonematopsis* from *Spilonema* the latter having 8-spored asci and thick paraphyses. Also the pycnidia of *Spilonematopsis* forming small globular shapes on the thread are different from those of *Spilonema* where the pycnidia are immersed in small verrucae.

The genus which seems to be most closely related to *Spilonematopsis* is *Zahlbrucknerella* HERRE (in Jour. Wash. Acad. Sci. Vol. II, No. 15, 1912, p. 384). But according to the description *Zahlbrucknerella* has lateral apothecia (the apothecia in the present genus being terminal), only few paraphyses (in the present genus numerous) and darkening spores (spores persistently uncoloured in *Spilonematopsis*). *Thermutis* differ by an entirely different type of algae and by having eight-spored asci.

Sterile *Spilonema*-like threads have been found in some places.

Ephebe

1. *Ephebe lanata* (L) VAIN.

Godthaab District: Godthaabsfjord: Narssarssuaq (V),—Island outside Sermilik (KR).

Frederikshaab District: Ivigtut (KR).

Julianehaab District: Tunugdliarfik: Tunuarmiut (D), Kiagtût (D),—Qaqortoq (V),—Julianehaab (D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: (V),—Sermiligârssuk (V),—Nanûseq (V).

Ephebe lanata seems to be fairly frequent all over the district. In all collections from Greenland the plant is found growing on earth, while in Scandinavia it is generally found on stone. I have seen no fertile specimens from Greenland.

Ephebeia.

1. *Ephebeia hispidula* (ACH.) NYL.

Julianehaab District: N. Sermilik: Tasiussaq c. ap. (D).—Tunugdliarfik: Narssaq c. ap. with many spores in the asci and uncoloured epithecium (D), Ilimaussaq 1200 m (D),—Uperniviarssuk c. ap. (D).—Igalikofjord: Eqaluit with *Placynthium pannariellum* (D).

To distinguish between *Ephebe lanata* and *Ephebeia hispidula* in sterile state is difficult. Fertile plants are easily distinguished the latter having paraphyses in the hymenium, the former lacking paraphyses. The asci are of a different form, the asci of *Ephebeia* being fingershaped, in *Ephebe* the asci are more rounded and thicker. The spores are only with difficulty freed from the asci, but if a good preparation is obtained, the twocelled spores of *Ephebe lanata* are seen, while the spores of *Ephebeia* are undivided. The number of spores in the asci of *Ephebeia* is eight, yet I believe I have seen higher numbers in specimens from Greenland.

By means of staining with cotton blue, the two species may be distinguished also in sterile state.

The tips of the branches of *Ephebe lanata* are more tapering towards the apices, while the apices of *Ephebeia hispidula* are coarser and the branchlets not much broader inwards than just behind the initial zone of division of the algal cells.

The surface of the branches is more even in *Ephebe* than in *Ephebeia*. The mucilage sheet is generally thicker behind the zone of cell division of the algal host, 5—10 μ in *Ephebe* against up to 5 μ in *Ephebeia*. Consequently some large cells of the algae, or group of large cells of the algae cause small verrucae on the surface of *Ephebeia* while no effect on the surface is seen in *Ephebe*.

The most important character lies in the position and type of the hyphae towards the apices. The hyphae imbedded in the mucilage sheet are more regular in *Ephebe* forming smooth threads of long and narrow cells, often more than five times longer than wide, lying free in the mucilage. In *Ephebeia* the web of hyphae is more irregular and at times difficult to detect, often being more appressed to the algal cells. The cells of the hyphae are not so regularly arranged in smooth threads, and hardly more than thrice as long as wide.

Ephebeia hispidula is probably fairly frequent in Southern Greenland occurring on stones near water. Material from Iceland: Arnessyssla: Almannagjá leg. LYNGE (see LYNGE, Lich. Isl. 1940, p. 13 as *Ephebe lanata*) belongs to the present species.

In my material I have not distinguished between *Ephebeia hispidula* and *Ephebeia trachytica* VAIN Adjum. 1881, p. 83, as I am not quite sure as regards that species. The same is the case with v. *Martindalei* CROMBIE. Some of my plants had a greenish colour of the epithecium which suggests this variety.

The genus *Ephebeia* is at the present time known from Scandinavia, Iceland, Scotland, and Greenland.

Coenogonium nigrum (HUDS.) ZAHLBR. has not been found within the area, but there is a plant from Sarfanguaq near Holsteinsborg collected by the Fylla Expedition in the Copenhagen herbarium.

Pyrenopsidaceae.

Pyrenopsis.

1. *Pyrenopsis macrocarpa* E. DAHL sp. nov.

Thallus areolatus; areolae usque ad 4 mm latae, 1 mm altae, et lobis mamillisve multis convexis compositae, margine paulum lobato-inciso. Thallus roseus-roseofuscus. Omnes areolae multis apotheciis instructae sunt, ad 1.5 mm latis, disco aperto, margine distincte crenulato vel mamillato. Discus planus, brunneus, lucidus.

Thallus 250—500(1000) μ crassus, facie superiore necnon inferiore ecorticatus, homoeomerus, omnino algis repletus, quae superne numerosiores sunt. Lineae algarum verticales vel apotheciorum marginem sequentes.

Gonidia e familia *Cyanophycearum*, irregularia, superficie rosea KOH addito violacea, 7.5—25 μ in diam., capsula gelatinosa haud crassa. Capsula gelatinosa cellulam unam vel paucas continens.

Gonidia eis *Pyrenopsis pulvinatae* similia.

Gonidia omnia dense hyphis ca. 2.5 μ crassis, ramulosis, brevicellulatis paraplectenchymatis modo circumtexta; textura KOH addito magis perspicua. Locis partis mediae nonnulis fila hyphacea occurunt.

Epithecium olivaceobrunneum, valde glutinosum, itaque apices paraphysarum superficiem haud attingunt. Hymenium 75—100 μ altum. Hypothecium sub hymenio distincte lentiforme, ad 50 μ crassum, sed hyphae e parte majore perpendiculares fines hymenii hypotheciique inconspicuas esse faciunt. Excipulum multis gonidiis repletum.

Paraphysae distinctae, moderate ramosae, facile liberae, laeves, apice leviter incrassatae, ca. 1 μ crassae. Cellulae paraphysarum multo longiores quam latae.

Asci octospori, 25—40 × 5—7 μ, conspicue paraphysarum breviores, Hymenii tertia pars superior ascis caret. Sporae haud coloratae, simplices, 9—13 × 4—7 μ, membranis tenuibus. Hymenium J + distincte coeruleum, demum luteo-vinoso-roseum. Pycnidia immersa, longe acuminata. Pycnoconidia parva, elliptica ad subglobosa, 2—3 μ longa.

Locus class.: Julianehaab District: Tunugdliarfik: Tunuarmiut, in saxo, 16.7.37 una cum *Phylliscum Demeangeoni*, *Polychidium muscicola* et al., leg. E. Dahl.

Pyrenopsis macrocarpa is a most characteristic species. It is probably related to *P. pulvinata*. They have the same type of gonidia and the same type of hymenium with a thick gelatinous layer above the apices of the paraphyses. *P. marcocarpa* has a red reddish-white colour and a crenulated margin of the apothecia recalling species of *Lecanora* e. g. *L. melanophthalma*. The plant gives an impression of a *Lecanora* where the ordinary green algae have been replaced by a *Gloeocapsa*. Is really *Pyrenopsis* sugben. *Euopsis* so remotely related to *Lecanora* as the present system indicates?

2. *Pyrenopsis pulvinata* (Schaer.) Hellb.

Julianehaab District: Tunugdliarfik: Tunuarmiut (D),—Nunarssuaq (Mrs. Lundholm).

Pyrenopsis pulvinata is probably much overlooked within the district and is probably more frequent than these few finds may indicate.

The gonidia of *P. pulvinata* are large, up to 20 μ in diameter and could thus easily be confused with the type of gonidia occurring in *Pyrenopsidium*. But they are of a more irregular form. This is most easily seen in the gonidia in the medulla or under the hymenium. These gonidia are globular and with a dominating gelatinous sheet in *Pyrenopsidium*, but more edged and with a narrower gelatinous sheet in *Pyrenopsis pulvinata*.

In the Copenhagen herbarium there is only one other plant from Greenland, viz. from Danmarks Ø on the Eastern Coast leg. HARTZ.

3. *Pyrenopsis rhodosticta* (TAYL.) MÜLL. ARG.

in Lich. Beitr. XXX Flora 1888. ZAHLBR. Cat. Lich. II, p. 775.

Julianehaab District: Tunugdliarfik: Qissungadalen with *Placynthium pannariellum* (D), Uperniviarssuk (D).

MÜLLER ARGOVIENSIS lumps together under *Pyrenopsis rhodosticta* also *Pyrenopsis subareolata* NYL., *P. sanguinea* ANZI, and *P. fuscatula* NYL. MÜLLER ARGOVIENSIS gives its spore measures to 8—11 × 5—6 μ and states that it has an uncoloured to brownish epithecium. *P. subareolata* NYL. has according to HUE, Addenda Nova p. 8, spores 11—15 × 7—9 μ and uncoloured epithecium. *P. sanguinea* has according to the description spores 11 × 6 μ and brownish epithecium. *P. fuscatula* has according to CROMBIE, Brit. Lich. p. 24, yellowish epithecium and spores 8—10 × 4.5—5 μ.

My material from Greenland is scarce, but very uniform. The Uperniviarssuk plants have spores 6—10 × 3—5 μ, the plant from Qissungadalen spores 7—10. × 3—4 μ The Greenland. *P. rhodosticta* has thus smaller spores than the specimen mentioned. Habitually the Greenland plants differ from European material, distributed under the names *P. rhodosticta*, *subareolata*, and *sanguinea*, by more solitary areoles not forming a subcontinuous areolated crust as the European plants do, but the European material is also variable in this respect. According to CROMBIE's description, *P. fuscatula* corresponds with other European plants in this respect. It may be that the Greenland material belongs to a separate species, but it should not be described as such until the whole group has been revised.

Pyrenopsis cfr. *sanguinea* ANZI has been recorded by DEGELIUS from Great Smoky Mountains (Arkiv før Botanik Bd. 30, No. 3, 1941). His plants have according to the description glabrous areolae and larger spores (10—12 × 6.5—7 μ).

4. *Pyrenopsis* (*Malmgrenia*) *myriospora* E. DAHL sp. nova.

Thallus areolatus, areolae ad 1 mm in diam., solitariae vel paucae accumulatae, substrato adnatae, 0.1—0.2 mm crassae, atrofuscae vel atrorubentes, madefactae paulum clariores. Areolae omnes multis apotheciis ornatae, nonnulae disco 1 mm in diam., atro, aperto.

Thallus facie superiore ac inferiore ecorticatus. Thallus omnis gonidiis repletus, gonidia superne numerosiora, lineas indistincte perpendiculares formantes.

Gonidia ad genus *Gloeocapsa* pertinent, in aggregata 25—40 μ concreta, rosea, KOH addito violacea. Cellulae simplices, globosae, 8—12 μ in diam., vel ad 2—4 in aggregatum gelatinosum concretae 12—20 μ in diam. Capsula gelatinosa conspicua, saepe sat crassa.

Thallus locis nonnulis aggregata globosa algarum viridium includit. Aggregata sunt ca. 50 μ in diam., cellulis irregulariter globosis, membranis tenuibus 5—10 μ in diam.

Hyphae thalli inconspicuae, colore "cotton blue" addito hyphae solitariae irregulares apparent. Ceterum spatium inter gonidiis gelatina granulosa repletum; centra granulorum addito "cotton blue" colorantur. Apothecia usque ad 250 μ in diam., disco plano. Supra apotheciis coloniae *Gloeocapsarum* precipue ad marginem crescunt. Epithecium incoloratum vel hymenium superne dilute fuscum. Hymenium 70—100 μ altum. Paraphysae paucae, tenues, ramulosae, cellis irregularibus, apice haud incrassatae. Hymenium maxima parte gelatine repletum.

Asci 35—45 $\times$ 15—25 μ superne dilatati, multispori. Sporae minutae, ellipticae, unicellulares, incoloratae 4—5 $\times$ 2 μ.

Sub hymenio stratum e hyphis parallelis cum superficie, 8—20 μ crassum, gonidiis compressis, situm est. Hymenium J addito primum olivaceo-aeruginosum, demum vinosum.

Loc. classicus: Julianehaab District: Kangerdluarssuk: Eqalugarssuit saxicola cum *Placynthium pannariellum* et aliis lichenes hydrophiliis. 1937 E. DAHL.

Pyrenopsis myriospora is undoubtedly closely related to *P. grumulifera* NYL. Lich. Scand. 1861, p. 26 and distributed in NORRL. et NYL. 103. They have the same gelatinous hymenium, the same thick-walled gonidia and the gelatinous hyphae of the thallus. Yet they are widely different. *Pyrenopsis grumulifera* has eight-spored asci (ex. NORRL. et NYL. 193 see also FORSSELL Gloeolich. p. 50) and much larger spores (8—10 $\times$ 4—5 μ), thicker and more numerous paraphyses (paraphyses approx. 2 μ thick stained with cotton blue) and a different thallus with uneven, almost corallinoid crowded areolae (whereas *P. multispora* has single, smooth or somewhat verrucose areolae).

P. grumulifera has been referred to a subgenus *Malmgrenia* TREV.

This has been raised to a separate genus by VAINIO (Lich. Ins. Kotiluoto. Ann. Univ. Turkuensis VII 1940, p. 18). This genus should be characterized by spore-numbers larger than eight and by the gelatinous hymenium. Yet *P. grumulifera* has only 8 spores. Other members of the genus is *P. Laatokkaënsis* VAIN. (loc. cit. p. 17) which according to the description has 12—16 spores in the asci and spore size 7—9 × 4.5—5 μ and a crustose thallus. The third member, which probably is the closest relative to *P. myriospora* is *P. pleiobola* NYL. (HUE, Addenda Nova 1886, p. 9, see also CROZALS Mont Blanc Revue Savoienne 1910 fasc. 3, p. 4). *P. pleiobola* has numerous globular spores in the asci 3—5 μ large and no paraphyses.

Pyrenopsidium.

1. *Pyrenopsidium granuliforme* (NYL.) FORSS.

FORSS. Gloeolich. p. 60. ZAHLBR. Cat. Lich. II, p. 782.
Exsicc.: NORRL. et NYL. 354.

Julianehaab District: Tunugdliarfik: Tunuarmiut (D).

Pyrenopsidium granuliforme was collected but once. It is readily recognized by the blackish effuse areolated thallus with minutely verrucose areolae containing large *Gloeocapsa* gonidia with a thick gelatinous sheet (see also under *Pyrenopsis pulvinata*). My plants are in complete accordance with NORRL. et NYL. 354.

P. granuliforme is previously recorded from Scandinavia and from the British Isles.

2. *Pyrenopsidium Iivaarense* (VAIN.) FORSS.

FORSS. Gloeolich, p. 61.
Pyrenopsis Iivaarensis VAIN. Adjum. p. 86.

Julianehaab District: Josvaminen (D).—Igalikofjord: Eqaluit (D).

Thallus thick, areolate. The areolae are rugged and verrucose, dark reddish brown to black, edged, up to 2 mm. in diam. The apothecia are brown, up to 0.7 mm in diameter with distinct margin, concave, smooth, many on each of the areoles.

There is no cortex, neither on the upper nor on the under side. The gonidia are dispersed through the whole thallus, but somewhat more crowded towards the upper side. No structure in the order of the gonidia is apparent.

The gonidia in the central part of the thallus are large, blue-green of colour, globose up to 20 μ in diam. with a gelatinous sheet up to 5 μ thick, with one or two cells within each sheet. Towards the upper side and along the margin of the apothecia the gonidia are of minor

size down to 5 μ in diameter with thinner gelatinous sheets, with a bright red colour turning violet with KOH. The gonidia probably belong to the same group as the gonidia of *Pyrenopsidium granuliforme* ex NORRL. et NYL. 354.

The gonidia are surrounded by a dense web of shortcelled, intricately branched hyphae. The thick hyphae (up to 7.5 μ) and the short cells (hardly longer than broad) give the impression of a plektenchymatous tissue.

The apothecia are lecanorine with gonidia in the excipulum. The epithecium is brownish red. The hymenium is 75—100 μ high. The paraphyses are distinct, branched, slender, approx. 1 μ thick and the apices are often distinctly incrassated up to 2.5 μ broad and easily separated. Under the hymenium a distinct hypothecium is seen up to 100 μ thick. Along the sides of the hymenium a layer without gonidia up to 15 μ thick consisting of hyphae parallel to the paraphyses is seen. This layer continues under the hypothecium where some gonidia are found exhibiting a pressed and deformed shape. The asci are 50—70 $\times$ 10—17 μ, broadest near the epithecium, with eight spores in each of the asci. The spores are colourless, simple 13—16 $\times$ 5—8 μ. The hymenium turns vinose red, the hypothecium blue, and afterwards vinose with J.

The above description is based on material from Eqaluit where it grows on stone together with *Lecanora granatina* SMRFT. The gonidia refer this species to *Pyrenopsidium* and the analytical key by FORSSELL Gloeolich. p. 60 readily brings you to *P. Iivaarense*. I have seen no plant from Finland, but VAINIO's description fits well with our plant.

At Josvaminen the species occurred on gravel. The apothecia were somewhat smaller, the disk not more than 0.2 mm. The spores were 11—15 $\times$ 5—7.5 μ and the paraphyses not so distinctly incrassate, but otherwise there is complete accordance between the two collections.

P. Iivaarense is previously recorded from Finland.

At Narssaq a sterile *Pyrenopsidium* was found in hydrophilous localities bearing a certain likeness to *P. Iivaarense*, but with a brighter red-brown colour and smaller verrucae. As no apothecia are found I am unable to identify the plant with certainty.

Phylliscum.

1. *Phylliscum Demeangoni* (WG.) NYL.

Julianehaab District: Tunugdliarfik: Tunuarmiut in hydrophilous station with *Placynthium pannariellum*, *Pyrenopsis macrocarpa* et aliis (D).—Agdluitsoq: Sletten (D).

Phylliscum Demeangoni is an addition to the lichen flora of Greenland.

Thallinocarpon E. DAHL gen. nov.

Thallus pulvinatus, suffruticosus, madefactus consistentia gelatinosa. Gonidia ad genus *Xanthocapsa* pertinent. Asci in strato gonidioso evolvunt. Paraphysae desunt. Asci multispori, sporae decolores, simplices.

Thallinocarpon pulvinatum DAHL sp. nov.

Plate I, Fig. 1.

Thallus pulvinatus, orbicularis, ca. 1 cm in diametro, niger, madefactus atro-olivaceofuscus, perspicuus, haud lucidus, consistentia resinosa. Thallus e lobis suffruticulosis dense compressis compositus, qui ad $^1/_2$ cm crassi sunt et superne dilatati, itaque lobi partis superioris horizontales sunt. Loborum horizontalium pars terminalis 0.5—1.5 mm lata et aequilonga, margine leviter sinuoso subincrassato, quam ob rem interdum patelliformis. Pagina superior similis est paginae inferioris.

Apothecia horizontalia, colore a thallo haud discrepantia, margine crasso. Apothecia iuvenilia difficile est a lobis regularibus discernere. Lobi 0.5(—1) mm crassi, omnino ecorticati, superficie olivaceofusci. Sub superficie stratum gonidiale situm est, 50—100 μ crassum; gonidia ibi hyphis perpendicularibus circumtexta. Cellulae hypharum breves, haud multo longiores quam latae. Stratum gonidiale a medulla parum distincte delimitatum. Medulla gonidiis paucis hyphisque horizontalibus instructa. Cellulae hypharum multo longiores quam latae, ca. 1 μ crassae. Medulla mucilagine in KOH liquescente repleta.

Gonidia solitaria vel in conglomeratis 10—20 μ in diam. Cellulae globosae vel subangulatae 4—10 μ in diam., flavovirides, membranis tenuibus, ad genus *Xanthocapsa* probabiliter pertinentes.

Stratum gonidiale J addito vinosum, medulla dilute flavo-vinosa.

Apothecia sequenti modo evolvunt: In lobo discus marginatus apparet. Margo conspicue sinuatus, sed anatomice haud est a lobo diversus. In disco stratum densum, gonidiis parvis (2—4 μ in diam.) se format; gonidia a ceteris parum diversa, sed creberrime solitaria, haud agglomerata, hyphis densis circumtexta. Hyphae haec ramosae sunt, cellulis brevibus, perpendiculares. In hoc strato 65—75 μ crasso asci oriuntur. Asci sacculiformes, superne longe acuminati, hinc inde digitiformes, ca. 35—50 μ longi. Hoc stadio sporae haud emittuntur.

Sub "hymenio," hypothecium decolor ad 50 μ altum hyphis ad superficiem parallelis se format, gonidiis paucis vel nullis. Sub hypothecio medulla ut in aliis typis occurrit.

Apothecio evolvente stratum hymeniale crassior fit, ad 120 μ. Stratum superficiale—"epithecium"—colorem fuscum ostendit. Hypothecium crassior est ad 65 μ. Asci maturant, formam conservantes, 75—100 × 8—16 μ. Paraphysas non vidi.

Sporae in ascis numerosae, unicellulares, decolores, 6—10 × 3—5 μ.

Hypothecium J coeruleum. Asci membranis mucilaginosis, J addito intense vineo-roseis. Asci strato hymeniali circumtexti.

Pycnidia immersa, globularia, 100—150 μ in diam., strato hyphoso ad superficiem pycnidorum parallelo, 10—20 μ crasso, a medulla indistincto circumdata. Pycnoconidia cylindrico-bacillariformia, triplo ad quadruplo longiora quam lata, 2—3 μ longa.

Locus class.: Julianehaab District: Agdluitsoq: Qagdlumiut, 22.8.37 leg. E. DAHL.

The lichen described above is the most peculiar I ever met with. It has the appearance of a small *Collema polycarpon* but the gonidia refer the lichen to the family *Pyrenopsidae*, and the hard gelatinous consistence of the thallus in wet state recalls *Thyrea radiata*. The most distinctive feature lies in the structure of the apothecia where the asci develop and ripen within a layer of gonidia and thalline hyphae. Accordingly it is difficult without a microscopical examination to distinguish young apothecia from the usual thalline lobes. The genus name *Thallinocarpon* alludes to this. The feature recalls the genus *Gonohymenia* STNR. (Zweiter Beitr. Flechtenfl. Algiers. Verh. zool. bot. Ges. Wien 1902, p. 485; see also ZAHLBR. in ENGLER u. PRANTL. Nat. Pflanzenfam. 1926, p. 157), which seems to be the nearest relative. The members of the genus *Gonohymenia* are distributed in the Mediterranean area, Mesopotamia and in Czechoslovakia. According to the description *Gonohymenia*, however, has a true hymenium with paraphyses, but a thalline layer is superposed on the young hymenium, through which the hymenium breaks out before the spores are free. In *Thallinocarpon* the asci develop within a gonidious thalline tissue and no paraphyses are found. At last the members of *Gonohymenia* are crustaceous lichens, while *Thallinocarpon pulvinatum* is pulvinate and sub-fruticulose.

Thyrea.

1. *Thyrea radiata* (SMTF.) ZAHLBR.

Plate I, Fig. 3.

ZAHLBR. in ENGLER-PRANTL. Nat. Pflanzenfam. Teil I, Abt. I, 1906, p. 162. ZAHLBR. Cat. Lich. III, p. 810.

Collema radiatum SMFT. Suppl. Fl. Lapp. 1826, p. 121.

Julianehaab District: Tunugdliarfik: Qordlortoq (D).

This very distinctive and highly interesting species is previously only recorded from Scandinavia and the British Isles.

Collemaceae.

Leciophysma.

1. *Leciophysma finmarckicum* TH. FR.

Julianehaab District: Igalikofjord: Eqaluit very scarce (D).

Leciophysma finmarckicum is very easily overlooked and is probably not so rare as this single find might indicate.

Sterile crusts were collected at Kiagtut and Qíngua which by Dr. DEGELIUS were suggested to belong to *Leciophysma.*

2. *Leciophysma occidentale* E. DAHL sp. nov.

Thallus papilloso-granuloso-corallinus, coralliis 0.1 mm crassis, ramosis. Crescit super muscos, ca. 1 cm crassus, est fuscocinereus—vel ater, madefactus cinero-olivaceus, gelatinosus. Apothecium disco atro, convexo, margine inconspicuo vel nullo, ad 0.3 mm latum.

Thallus homaeomerus, ecorticatus. Gonidia e genere *Nostoc* lineas moniliformes per totum thallum formantes; quorum cellulae 2—5 μ in diam. habent. Hyphae inconspicuae, ramosae, ad 2 μ crassae.

Apothecium lecideinum. Epithecium intenese fuscum ad fusco-olivaceum. Hymenium 50—75 μ altum. Hypothecium inconspicuum, dilute fuscum. Pagina inferior cortice paraplectenchymatico ad 70 μ crasso, e cellulis 5—10 μ in diam. composito, instructa est. Stratum marginale corticis colore aeruginoso ludit. Centrum apothecii hyphis inconspicuis valde ramosis irregularibus dense repletum est, gonidia ibi nulla.

Paraphysae simplices, conspicuae, facile liberae, ca. 2 μ crassae, cellulis basi valde longioribus quam latis, superne parum longiores quam latae. Apices incrassati, ad 4 μ lati. Asci apice dilatati, 40—60 $\times$ 12—20 μ, octospori. Sporae ellipticae, leviter acuminatae, 12—16 $\times$ 6—8 μ, decolores, simplices; nonnulae guttas oleaceas continent. Asci J addito vinosi, paraphysae flavescens.

Loc. class.: Julianehaab District: N. Sermilik: Tasiussaq in muscos 29.7.1937 (D).

The homeomerous thallus with Nostoc gonidia readily refers the specimen to *Collemaceae*, and the lecideine apothecia with simple spores and the thallus which in moist state is gelatinous, refers the specimen to *Leciophysma* (see ZAHLBR. in Nat. Pflanzenfam. 1926, p. 164). After the habitus the present plant resembles *Leciophysma finmarckium*, the widespread representative in the Arctics of the genus, but has smaller granules. Anatomically they differ with regard to the spores (in *L. finmarckicum* the spores are broadly elliptic-globose diam. 10.5—16 μ, in *L. occidentale* the spores are elliptic 12—16 $\times$ 6—8 μ), by the hymenium (in *L. finmarckicum* the hymenium is 100—130 μ high, in *occidentale*

only 50—75 μ) and by the colouring of the hymenium by J. (*L. finmarckicum* asci J + blue, the rest vinose, *L. occidentale* asci J + vinose, the rest faintly yellow).

Leciophysma furfurascens (NYL.) GYELN (in Rabenh. Krypt. Fl. IX, Abt. II, Teil 2, p. 270) seems to come quite close to the present species especially as regards the minutely granulose thallus. In *L. furfurascens*, however, the hymenium is higher (90—105 μ), the hymenium gives the reaction J + blue, and the epithecium is yellowish-brown (the epithecium in *L. occidentale* is brown-olivaceous brown) and the spores are larger (17—20 × 8—10 μ in *L. furfurascens* ex HUE Addenda Nova p. 424).

Collema.

The collections of *Collema* from Greenland have been revised by Dr. DEGELIUS of Uppsala who kindly has allowed me to publish the results of his revision. *Collemas* in Arctic countries are often very badly developed, and consequently a good number of my collections could not be determined with certainty.

1. *Collema ceraniscum* NYL.

Syn. *Collema arcticum* LYNGE.

Julianehaab District: Tunugdliarfik: Qagssiarsuk (D).

Collema ceraniscum can hardly be a common species in South West Greenland.

2. *Collema furvellum* RÄS.

Julianehaab District: N. Sermilik: Tasiussaq (D).—Tunugdliarfik: Western side of Narssaqfjell (D), Qissungadalen (D), Kiagtùt (D), Qordlortoq? (D), Qíngua, 3 km west of Qíngua (D),—Uperniviarssuk (D).— Igalikofjord: Eqaluit? (D).

The determinations of the specimen from localities with query mark were regarded as uncertain by Dr. DEGELIUS. Anyhow *Collema furvellum* is by far the most common *Collema* in the district.

Collema rupestre has been recorded several times from South West Greenland. But all the specimens thus determined, do not belong to *Collema rupestre* according to notes on the labels by Dr. DEGELIUS. Most of them belong to *C. furvellum.*

3. *Collema pulposum* (BERNH.) ACH.

Julianehaab District: Tunugdliarfik: (V), Sitdlisit (D).

Collema pulposum does not seem to be common in South West Greenland.

4. *Collema undulatum* LAUR.

Julianehaab District: Tunugdliarfik: (V), Kiagtut (D), Qordlortoq (D).

Lempholemma sp.

Julianehaab District: Tunugdliarfik: Qagssiarssuk (D), Qordlortoq (D),—Uperniviarssuk (D).—Igalikofjord: Eqaluit (D).

Specimens from the above localities were determined *Lempholemma* sp. by Dr. DEGELIUS.

Arctomia.

1. *Arctomia delicatula* TH. FR.

Julianehaab District: Julianehaab (D).

This inconspicuous species was found but once between mosses, but is probably not so rare as this single find might indicate. The spores are 6—9-septated and measures 35—60 × 5—7.5 μ.

A sterile lichen from Ivigtut has a close resemblance to this species.

Polychidium.

1. *Polychidium muscicola* (MASS.) ZAHLBR.

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D).

Julianehaab District: Tunugdliarfik: Western side of Narssaqfjell (D), Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D),—Uperniviarssuk (D),—Eqalugarssuit (D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D).

Polychidium musicola is quite common all over the district visited in 1937, growing on moss and on earth. It is a variable species, in hydrophilous localities the lobes become appressed to the substratum, flattened and loose the usual shiny brown colour while becoming more blackish.

SCHWENDNER (Algentypen der Flechtengonidien 1869) examined the anatomy and especially the type of gonidia of *Polychidium*. He found, though somewhat doubtful, that the gonidia belonged to the *Scytonema* type and believed to have seen the gonidia growing out to *Scytonema* threads sitting on the thallus. His material of *Polychidium* came from a locality where also *Sirosiphon* (or *Scytonema*) occurred abundantly and between the threads of *Polychidium*. Thus the observation was not safe, the *Scytonema* threads which appeared to have grown up from the gonidia of *Polychidium* might well be interpreted as a *Sirosiphon* growing on the thallus of *Polychidium*. SCHWENDNER expressively states that his observation needed confirmation. SCHWEND-

NER further found that *Polychidium* was very different from the members of *Leptogium* known to him by the plechtenchymatous tissue.

For these reasons *Polychidium* has been referred to *Epebeaceae*. In this family it occupies an isolated position on account of the highly organized thallus.

HUE (Lich. Anjou, p. 17 cited after HARM. Lich. France, p. 16) found that the gonidia belong to *Nostoc*. This is also in accordance with my observations. The gonidia of *Polychidium* in a good section or in a "quetsch" preparation are seen to form chains of thinwalled rounded cells exactly of the same type as gonidia found in the thallus of many members of the genus *Leptogium*. They are not as large and have not so edged a shape as the gonidia of the genera *Porocyphus* and *Placynthium* (see p. 49), which have gonidia of the *Scytonema* type. If the gonidia of *Polychidium* were *Scytonema* algae with potentiality to form threads outside the thallus, one would expect to find such threads also in localities where free-living *Sirosiphon* is not abundant, and this should be easily observed as *Sirosiphon* threads may be observed under a good lens. I have examined numbers of plants of *Polychidium* from various localities, but have been unable to detect such threads.

As to the anatomy of the thallus the section *Homidium* of *Leptogium* is characterized by a plechtenchymatous tissue of the thallus. In fact I can see no essential difference in the anatomy of the thallus of *Leptogium* (*Homidium*) *tenuissimum* (DICKS.) FR. (ex. NORRL. et NYL. 356), and of *Polychidium muscicola*, and also the anatomy of the apothecia is very much alike in the two species.

For these reasons the gonidia of *Polychidium* should so far be referred to *Nostoc* and the genus *Polychidium* to *Collemaceae* with a close relationship to *Leptogium*.

Leptogium.

1. *Leptogium lichenoides* (L) ZAHLBR.

Frederikshaab District: Arsukfjord: Kungnait *typica* (D),—Borgshavn (D).

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq v. *pulvinatum* (D).—Tunugdliarfik: (V), western side of Narssaqfjell v. *pulvinatum* (D), Tunuarmiut (D), Qagssiarssuk *typica* and v. *pulvinatum* (D), Kiagtut *typica* and v. *pulvinatum* (D), Qordlortoq v. *pulvinatum* c. ap. (D).—Kangerdluarssuk: Eqalugarssuit v. *pulvinatum* (D), Julianehaab (V).—Igalikofjord: Eqaluit v. *pulvinatum* (D), Igaliko *typica* (D).—Agdluitsoq: Sletten v. *pulvinatum* and *typica* (D), Qagdlumiut v. *pulvinatum* (D).—Tasermiut (H).—Fredriksdal (V).

Leptogium lichenoides is fairly common in southernmost Greenland and seems to prefer localities in the inner parts of the fjords. I am unable to find any clear line of distinction between the v. *pulvinatum* and the typical plant in the material from Greenland. The two types may occur typically, and such plants are referred to *typica* or v. *pulvinatum* after the locality. But a number of plants could not be referred to any of the types with certainty, most of them incline more towards typica than towards v. *pulvinatum*. After my experience I can not distinguish between two different species.

It is a typical southern character in the lichen flora of South-Western Greenland, that the typical *lichenoides* is almost as common as the *pulvinatum* type.

2. *Leptogium saturninum* (DICKS.) NYL.

Godthaab District: Ameralik (V).

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Qagssiarssuk (D), Kiagtut (D), Qordlortoq (D), 3 km west of Qíngua 300 m corticola (D).—Kangerdluarssuk: Eqalugarssuit (D).—Agdluitsoq: Qagdlumiut (D).

Leptogium saturninum has a typical continental distribution within the district. It is generally found growing on mosses and the specimens are well developed. In the Copenhagen herbarium there is a specimen from Sarfanguak near Holsteinsborg (Fylla-Expedition) and one from Scoresby Sound (V. Teltplads i Tågefjorden which probably is the same as Qíngua in Gaasefjorden) collected by HARTZ.

Heppiaceae.

Arctoheppia Lynge.

1. *Arctoheppia Scholanderi* LYNGE

Lich. Spitsb. and N. E. Land, 1938, p. 108.
Fernaldia Scholanderi LYNGE Lich. West Greenland, 1937, p. 24.

Julianehaab District: Tunugdliarfik: Qíngua (D).

I was very happy to find the member of LYNGE's new genus from Greenland. My specimens are somewhat large and better developed than the original type from Disko, and the crust is more effuse, but agrees otherwise completely with the type. There is nothing to be added to to LYNGE's description.

Placynthiacae E. DAHL fam. nov.

Gonidia scytonemiformia, sed habitus lichenis fungo determinatus est. Thallus laciniatus vel laciniato-complicatus vel areolatus, sed nunquam filiformis. Gonidiorum lineae laciniis parallellae vel perpendiculares. Thallus madefactus haud gelatinosus. Hyphae saepe lumine lato (ad 5 μ) sed membranis tenuibus, saepe dense paraplectenchymatis modo contextae. Sporae unicellulares vel raro polycellulares, membranis indistinctis.

Typus familiae est genus *Placynthium.*

During the description of the Greenland *Porocyphus* I became aware that these morphologically and anatomically were much like *Placynthium.* If a section taken through one of the areolae of *Porocyphus dispersus* is compared with one of the central areolae of *Placynthium asperellum* hardly any essential difference can be seen. Yet they are, according to ZAHLBRUCKNER's system, (ZAHLBRUCHNER 1926) placed in different families, *Porocyphus* in the *Ephebeaceae*, *Placynthium* in the *Pannariaceae.*

Relying upon a cultivation experiment by GEITLER (Archiv für Protistenkunde, Bd. 82, 1934 p. 62) who found that the gonidia of *Placynthium* belong to a *Rivulariaceae*, and taking ZAHLBRUCKNER's system after the text GYELNIK (RABENH. Krypt. Fl. Bd. IX, Abt. II, Teil 2) put *Placynthium* and some other related genera in the family *Lichinaceae.* According to ZAHLBRUCKNER the genus *Pterygium* belongs to *Lichinacea*, but *Pterygium* and *Placynthium* can hardly be placed within two different families.

The genus *Vestergrenopsis* was kept by GYELNIK in the *Pannariaceae.* Yet the anatomy of the lobes of *Vestergrenopsis isidiata* can hardly be distinguished from that of *Placynthium pannariellum.* Thus the closely related genera *Porocyphus*, *Placynthium*, *Pterygium*, and *Vestergrenopsis* have been placed within three different families.

There are important features in common between the four mentioned genera. The gonidia are orientated in chains with a distinct orientation either along the lacinia or transverse to the surface. The gonidia are large and irregularly globose and in irregular chains. Even if the gonidia are free (quetsch-preparation) they maintain their irregular shape and are not rosary-like as the typical *Nostoc.* I call this type of gonidia Scytonemeiform. Far too few experiments of cultivation have been made to ascertain if there are different blue green Scytonemeiform algae, but in the lichen I cannot distinguish them.

There are also other characteristics which are common for the said genera. They have leptodermatous hyphae with wide lumina giving the medulla and gonidial layer a paraplechtenchymatous structure. This is

a feature alien to the true *Ephebeaceae* where thin hyphae are running through the gelatinous sheath of the algae. These genera are also distinguished from the *Ephebeaceae* by the character that the organization of the fungus host determines the morphological character of the lichen, whereas in *Ephebeaceae* it is the gonidia which determine the morphologigal character.

If *Polychidium* is removed from the family *Ephebeaceae* and placed in the *Collemaceae* (see p. 46), and *Leptogidium*, *Pterygiopsis*, and *Porochyphus* are referred to the new family, *Placynthiaceae*, (see ZAHLBRUCKNER 1926, p. 152) the family *Ephebeaceae* would have a much more uniform character. The family *Ephebeaceae* would then comprise the genera *Thermutis*, *Zahlbrucknerella*, *Spilonematopsis* (see p. 34), *Spilonema*, *Ephebe*, and *Ephebeia*. *Lecanephebe* FREY (in Mitt. Naturforsch. Ges. Bern, 1929) and *Trichobacidia* also belong here as far as I can judge from the description. Whether *Ginzbergerella* ZAHLBR. (in Hedwigia 1931, p. 206) belongs here I dare not decide after the description.

The *Placynthiaceae* differ from the typical *Pannariaceae*, e. g. *Massalonghia*, *Parmeliella*, and *Pannaria* in the first place by the gonidia. The gonidia of *Pannariacae* are true *Nostoc* with no distinct orientation of the chains within the thallus. If the gonidia are set free in a quetsch preparation the typical rosary-like chains with smooth globose cells are seen. Very often in literature it is said that some species or other have gonidia of *Scytonema* type; but they are at any rate different from those of *Placynthiacae*. I call the type of gonidia found in *Pannaria* and other genera Nostociform. There is a distinct tendency towards forming laciniato-complicate areolae within *Placynthiaceae* which is alien to the true *Pannariacae*.

The gonidia of the true *Lichinaceae* are of the type which has been called *Calothrix*. The chains are tapering towards both ends and have often heterocysts. I would restrict the family *Lichinaceae* only to comprise genera with *Calothrix* gonidia.

The family *Lichinaceae* (see ZAHLBRUCKNER, 1926, p. 161) would then comprise the genera, *Calothrichopsis Steinera*, and *Lichina*. *Pterygium*, *Lichinodium*, *Lichinella*, and *Homopsella* are referred to *Placynthiaceae*.

The core of the family *Placynthiaceae* would be the genera *Pterygiopsis*, *Porocyphus*, *Pterydium Placynthium*, and *Vestergrenopsis*. *Placynthium* is the type of the family. Further this family would comprise (as far as I can judge from the description) *Leptogidium*, *Lichinodium*, *Lichinella*, *Homopsella*, and perhaps *Asirosiphon* (see GYELNIK in Rabh. Krypt. Fl. IX, Abt. II, Teil 2, p. 102).

The genus *Coccocarpia* has an external morphology which in some respects approaches the *Pannariaceae*, but according to the description

and excellent figures of BORNET (Rech. Gon. Lich. p. 28 and Pl. 11, figs. 1—6), it has a Scytonemeiform type of gonidia. I can only confirm his observations.

According to BORNET (l. c. p. 28) *Erioderma* has Scytonemeiform gonidia. I can confirm his observations. The gonidia are, however, rarely organized in chains, but are more irregularly distributed. They have a more edged shape than the gonidia of Nostociform type. With some luck and in a good microtome section, one may observe how some of the cells grow out into regular short *Scytonema* threads. However, the structure of the thallus differs considerably from that in other genera of *Placynthiaceae*, and as it also has a very different morphology it should most likely be placed in a family of its own. This family would have a similar position towards the *Placynthiaceae* as the *Peltigeraceae* towards the *Pannariaceae*.

The family *Pannariaceae* comprises in the new sense, *Hydrothyria*, *Lepidocollema*, *Lepidoleptogium*, *Massalonghia*, *Parmeliella*, *Pannaria*, *Hueella*, *Psorcma*, *Psoromaria*, and *Placynthiella* (GYEL. in RABENH. Krypt. Fl. IX, Teil II, Abt. 2, p. 164).

An analytical key to the families in question would run as follows.

A. Gonidia of *Calothrix*-type ..... *Lichinaceae*
B. Gonidia of *Scytonema*-type.
   1. The form of the lichen determined by the algal component. Hyphae thin..... *Ephebeaceae*
   2. The form of the lichen determined by the organization of the fungus. Hyphae generally leptodermatous, wide, giving the tissue a paraplechtenchymatous structure. Algal chains orientated along the lacinia or transverse to the surface ..... *Placynthiaceae*
C. Gonidia nostociform with no distinct orientation of the algal chains.
   1. With no medullar layer. Tissue generally paraplektenchymatous. Fulcrae exobasidial..... *Heppiaceae*
   2. With distinct medullar layer, only the cortex of a paraplechtenchymatous structure. Fulcrae endobasidial..... *Pannariaceae*

Porocyphus

1. *Porochyphus dispersus* E. DAHL sp. nov.

Thallus areolatus, areolae solitariae vel nonnulae agglomeratae, ad 2 mm in diam., asperae, sed haud corallino-verruculosae, nigrae. Areolae madefactae fere confluentes. Apothecia plurima in una areola occurrunt; apothecium juvenile unico puncto apertum, demum discus ad 0.2 mm in diam., distincte marginatus, niger apparet. Thallus complicatus, lobis accumulatis compositus. Areolae 150—300 μ crassae, lobi thalli

50—125 μ alti, teretes vel paulo compressae. Inter lobis saepe *Gloecapsae* vel al. species occurrunt.

Lobi ecortati, homeomeri, sed gonidiis superne numerosioribus, parte centrali paucis vel nullis. Gonidia saepe in lineas irregulares perpendiculares composita, ad *Scytonemam* verosimiliter pertinentes.

Gonidia fusca-olivaceo-fusca, catenulata vel irregulariter conglomerata. Cellulae subglobosae, eae in catenulis compressae, 3—10 μ in diam., membrana tenuis.

Hyphae inconspicuae nisi coloratae, valde gelatinosae. In praeparatis colore "cotton blue" coloratis gonidia hyphis dense obtexta videri possunt. Hyphae valde ramosae, cellulis parvo tantum longioribus quam latis, hic inde lumine ad 5 μ lato. In praeparatis dilute coloratis paraplechtenchymaticam texturam ostendunt.

Apothecia iuvenilia parum aperta, demum disco aperto 100—250 μ in diam., lecanorina, excipulo gonidiis repleto. Margo distinctus.

Epithecium intense aeruginosum ad olivaceo-aeruginosum. Hymenium 65—100 μ altum. Hymenium strato hyphaceo 5—12 μ cum alto superficie parallelo circumdatum. Accedit porro stratum gonidiosum, ubi gonidia catenulae superficie apothecii parallelas formant.

Sub hymenio hypothecium lenticuliforme ad 20 μ crassum situm est. Paraphysae simplices, tenues, parum laeves, cellulis 3—5plo longiores quam latiores, apice subincrassato. Asci superne dilatati, 40—55 $\times$ 10—15 μ, octospori. Sporae incoloratae, simplices, 9—10 $\times$ 6—7 μ.

Hymenium J addito haud coloratur.

Locus class.: Frederikshaab District: Kungnait pars orientalis una cum *Placynthium asperellum* et *pannariellum* ac *Caloplaca fraudans*, in saxo essexitico 8—11.9.1937, leg. E. DAHL.

The closest relative of *Porocyphus dispersus* seems to be *P. globulosus* (MASS.) COUDREC (apud CROZAL's Lich. Herault. Bull. Acad. Geogr. Bot. Vol. XVII 1909, p. 9; see also CROZAL's Collemaces de Toulon Ann. Soc. Hist. Nat. Toulon 1926, p. 15) which according to the description, however, seems to have more rimose thallus (paraissant areole à l'état sec, continu quandil est humide) and longer and narrower spores (10—17 $\times$ 4—5 μ). Also *P. cataractarum* KOERB. PARERGA, p. 440 seems to come close to *P. dispersus* but has also narrower spores (13—15 $\times$ 5—6.5 μ) and a rimose thallus. But both these species have the negative reaction of the hymenium with J. The rest of the species that may be considered, viz. *P. furfurellus* (NYL.) FORSS., *P. aerolatus* (FW.) FORSS., and *P. coccodes* (FW.) KOERB. gives the reaction hymenium J + intense vinosus, in *P. areolatus* first blue. All have also a more rimose thallus which in wet state is more or less contiguous. Further they have an uncoloured epithecium, while *P. dispersus* have a green epithecium. At least the spore measures are different. *P. furfurellus* (ex

HARM. Lich. Fr. p. 24) has spores 13—15 × 5—6 μ, *P. areolatus* has spores 14—24 × 8—12 μ, and *P. coccodes* (EX. KOERB. Lich. Sel. Germ. 30) has one-twocelled spores 11—15 × 6—8 μ. In *P. dispersus* the spores are 8—9 × 6—7 μ.

2. *Porocyphus groenlandicus* E. DAHL sp. nov.

Thallus ex areolis parvis, irregulariter papillariiformibus formatis, ad 1 mm crassis, nigris. Areolae solitariae vel agglomeratae. Margo paulum a substrato distans, subsinuatus. Apothecia plura in areola una, prominentia papillosa formantes. Discus punctiformis $^1/_{10}$ mm in diam. Thallus 125—275 μ crassus, compactus, omnino cortice carens. Gonidia viridi-fusca, in agglomeratis 25—40 μ in diam., vel in lineis parvis perpendicularibus hinc inde superficio penetrantes papillas minutas formantes, quam ob rem gonidia descripta ad genus *Scytonema* pertinere puto. Cellulae in catenulis compressae, angulatae, 5—10 μ in diam., capsula gelatinosa tenui circumdatae. Gonidia superne densiora, sed in thallo toto occurentia.

Hyphae thallinae gelatina circumdatae, inconspicuae nisi coloratae. Colore cotton blue addito, hyphae partis centralis irregulares, hyphae partis superioris perpendiculariter collocatae apparent. Cellulae hypharum breves sunt atque irregulares.

Apothecia globosa, 90—150 μ in diam., orbiculatoaperta, omnino gonidiis circumdata. Apothecium strato hyphaceo decolori, ubi hyphae 12—25 μ crassae apothecio parallelae sunt, obtectum est.

Hymenium 85—100 μ altum. Epithecium fuscum. Paraphysae superne concretae, tenues, ca. 1 μ tantum crassae, ramulosae, apice haud dilatatae. Cellulae paraphysarum plurimum triplo longiores quam latae.

Asci claviformes, superne dilatati, 50—75 × 15—20 μ, multispori (16 vel plus). Sporae simplices, decolores, membrana tenui, ellipticae vel late ellipticae 8—12 × 4—5 μ.

Asci J addito flavo-vinosi vel vinosi, paraphysae dilute flavescente.

Pycnidia globuliformia, ca. 50 μ in diam., immersae. Pycnoconidia ellipsoidea, duplo longiora quam lata, ca. 2 μ lata.

Locus class.: Julianehaab District: Kangerdluarssuk: Eqalugarssuit, una cum *Placynthium asperellum*. 26.8.1937 leg. E. DAHL.

Porocyphus groenlandicus has a superficial resemblance to *P. dispersus* in the solitary areoles. The areoles are, however, thinner, and do not consist of a web of interwoven lacinia like *P. dispersus* and other species of *Porocyphus* (see above). *P. groenlandicus* gives a negative reaction of the paraphyses by J, the asci, however, turn vinose red.

P. groenlandicus is the only *Porocyphus* known to me with more than eight spores in the asci.

Placynthium S. GRAY.

1. *Placynthium asperellum* (ACH.) TREV.

Frederikshaab District: Arsukfjord: Eastern side of Kungnait with *Caloplaca fraudans* and *Spilonema* (D).

Julianehaab District: Kangerdluarssuk: Eqalugarssuit fertile sp. 15—17 × 4—5 μ di- or tetrablastae with *Caloplaca fraudans* (D)—Uperniviarssuk (D)—Julianehaab with *Caloplaca fraudans* (D).—Tunugdliarfik: 3 km west of Qíngua with *Caloplaca fraudans* (D).—Igalikofjord: Igdlerfigssalik 7—800 m (D).

Placynthium asperellum does not seem rare in Southern Greenland. Peculiarly enough it has not been collected by previous collectors in Southern Greenland, and in the Copenhagen herbarium only very few plants from Greenland are to be found (from northernmost Greenland leg. WULFF, and from Scoresby Sound leg. HARTZ). It is very often associated with *Caloplaca fraudans* (see LYNGE, 1940, p. 115).

Three species of *Placynthium* have been recorded from the Atlantic Arctic region, viz. *Pl. asperellum* (ACH.) TREV., *Pl. pannariellum* (NYL.) MAGN., and *Pl. nigrum* (HUDS.) S. GRAY. These species may be distinguished by the following characters.

1 a. Where lobes develop over a free rock surface a green hypothallus is found.

2 a. Lobes effigurated (i. e. radially arranged towards the margins). Hypothallus with indistinct outer limit. The lobes are often flattened and somewhat broader towards the margins having a greyish or greenish colour. The apices of the marginal lobes only loosely attached to the substratum..... *Pl. pannariellum* (NYL.) MAGN.

2 b. Lobes never effigurated. The hypothallus is sharply delimited and exhibits a radial structure. The lobes are microphylline forming indistinct areolae or no areolae at all..... *Pl. nigrum* (HUDS.) GRAY.

1 b. No hypothallus visible. Lobes effigurated. The apices of the marginal lobes are closely adnated and of a shiny brownish ar blackish colour. Towards the centre the thallus breaks up in areolae consisting of densely interwoven lobes..... *Pl. asperellum* (ACH.) TREV

When apothecia are present, *Pl. asperellum* and *pannariellum* are easily distinguished by the anatomy of the apothecia the latter having a higher hymenium (80—100 μ against 60—70 μ) and less intensely coloured epithecium.

I have seen no typical specimen of *Pl. nigrum* from the Atlantic

Arctic region. LYNGE's specimens from Novaya Zemlya (see LYNGE, Nov. Zeml. 1928, p. 53) are not typical. According to notes on the labels in LYNGE's handwriting it appears that also LYNGE later doubted the determinations. They probably belong to *Pl. pannariellum.*

2. *Placynthium pannariellum* (NYL.) MAGN.

Frederikshaab District: Kungnait with *Pl. asperellum* (D).

Julianehaab District: Tunugdliarfik: Narssaq in hydrophilous localities with *Pyrenopsis* (D), Qissungadalen also f. *pterygoides* GYEL. with *Pyrenopsis* and *Spilonema* (D), Tunuarmiut with *Pyrenopsis* (D), Qagssiarssuk (D).—Igalikofjord: Eqaluit with *Ephebeia hispidula* (D).—Agdluitsoq: Sletten with *Pyrenopsis* (D).

Does not seem rare. Distinctly hydrophilous, almost invariably found together with species of *Pyrenopsis*, *Spilonema*, and other lichens with Cyanophyceous gonidia.

Formerly known from Greenland only from North-East Greenland. (See LYNGE, 1940, p. 22).

Vestergrenopsis.

1. *Vestergrenopsis isidiata* (DEGEL.) E. DAHL comb. nova.

Pannaria isidiata DEGELIUS in Bot. Not. 1943, p. 90.

Frederikshaab District: Kungnait (D).

Julianegaab District: Kangerdluarssuk: Eqalugarssuit (D).—Tunugdliarfik: Tunuarmiut (D).

Does not seem very frequent within the district.

GYELNIK (in Rabh. Krypt. Fl. IX, Abt. II, Teil 2, 1940, p. 265) created a new genus for the formerly known *Pannaria elaeina* (WBG.) NYL. Unfortunately he chose for this genus the very unhappy name *Vestergrenopsis* (which means that it resembles VESTERGREN, in honour of whom the new genus was named). DEGELIUS (loc. cit.) criticizes the view of GYELNIK and states that the *Pannaria elaeina* (WBG.) NYL. is a true *Pannaria.* It appears that his criticism of GYELNIK is correct as the characters quoted by GYELNIK are not sufficient to create a new genus. But unfortunately there are other characters of importance which make it necessary to give the former *Pannaria elaina* and *Pannaria isidiata* DEGEL. a separate genus name.

1. The gonidia are not of the same type as in *Pannaria*, but of the the same type as in the genus *Placynthium.* The gonidia are larger than the usual *Nostoc* gonidia of *Pannaria*, the chains are not so regularly linked, some of the cells of the chains are of irregular shape as if they were pressed together. If an entire lobe is placed under the microscope

and full light put on, the chains are seen to be orientated parallel to the long axis of the lobe (as in *Placynthium*).

2. The sporae are divided by septa, not simple as in *Pannaria*. The asci contain 16 spores (in *Vestergrenopsis elaeina* (WBG.) GYELN.).

Thus it appears that *Vestergrenopsis* must be more closely related to *Placynthium* than to *Pannaria*. Also the general appearance is quite similar to *Placynthium pannariellum* (NYL.) MAGN. Yet *Vestergrenopsis* cannot be referred to *Placynthium* on account of the lecanorine apothecia with distinct margins.

The two species *Vestergrenopsis isidtata* (DRGEL.) E. DAHL and *V. elaeina* (WBG.) GYELN. are distinguished by *V. elaeina* having apothecia and no isidia, while *V. isidiata* always have distinct isidia. The plants determined by LYNGE from the Disko district (LYNGE in Medd. om Grønl. Bd. 118, 1937, p. 26), belong to *V. isidiata*. So does LYNGE's plants from Iceland (LYNGE Lich. Isl. 1940, p. 17) except one from Suður-Múlasysla: Hallormstadahalsfjellet leg. LYNGE, which is *V. elaeina*. In the Faeroes only *V. elaeina* occurs judging from many plants in the Copenhagen herbarium.

As the anatomy of the thallus and apothecia of *V. elaeina* seem insufficiently known, a description is given below of the Iceland plant.

The upper surface of the thallus as seen in section is uncoloured or has an indistinct brownish-yellowish colour.

No distinct upper cortex is present (vide DEGELIUS l. c. p. 92).

The uppermost layer looks like a paraplechtenchymatic gonidia layer (see DEGELIUS l. c. p. 92). The cells of the hyphae are of irregular shape with thin walls, up to 7.5 μ in diameter. The gonidia are irregularly scattered in small colonies or in chains transverse to the surface. The gonidial cells are of an olive-brown to yellowish colour 5—10 μ large.

Under the upper gonidial layer a medulla 90—150 μ thick is found. This seems also to have a paraplechtenchymatic structure, but the hyphae are distinct and orientated parallel to the long axis of the lobes, the cells being 3—5 μ broad and 5—15 μ long. Some gonidial chains, irregularly longitudinally arranged are found, the gonidial cells being 5—12 μ broad and not as long as broad.

The under side is covered by an indistinct layer 15—25 μ thick consisting of densely interwoven, longitudinal hyphae.

The apothecia are up to 2 mm in diameter, first cupshaped, afterwards flattened, and at last the disk is convex with a brown or brownish-black colour. The margin is distinct and persistent.

The apothecia are of lecanorine type with gonidia in the excipulum. The excipulum is paraplechtenchymatous of the same structure as the upper paraplechtenchymatic gonidia layer of the thallus. The cells are,

however, larger, up to 12 μ in diameter. Towards the margins the hyphae are orientated radially parallel to the discus of the apothecium, and the gonidia form chains orientated along the direction of the hyphae.

A hypothecium of densely interwoven hyphae, 40—70 μ thick, thickest at the centre of the apothecium and tapering towards the sides is found below the hymenium.

The hymenium is 85—125 μ high. The epithecium has a brown colour and is up to 10 μ thick. The asci are clubshaped, broadest somewhat above the middle 37—50 $\times$ 7.5—10 μ each containing 16 spores. The spores are uncoloured, twocelled with a septum of a high refractive index, elliptic or slightly curved 8—10 $\times$ 4—6 μ. The paraphyses are septated in the upper part, the upper two or three cells brown and very incrassate up to 10 μ broad.

The hymenium is coloured deep blue by J.

Pannariaceae.

Massalonghia.

1. *Massalonghia carnosa* (Dicks.) Koerb.

Frederikshaab District: Arsukfjord: Kungnait (D)—Borgshavn (D). Julianehaab District: Qagssimiut (D).—Tunugdliarfik: Narssaq (D), approx. 3 km north-west of Narssaqfjell 700 m (D), Qissungadalen (D), western side of Narssaqfjell (D), Ilímaussaq 1200 m (D), Tunuarmiut (D), Qordlortoq (D), Qagssiarssuk (D), Qíngua (D)—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igaliko (D), Upernivik (D).—Agdluitsoq: Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).

Massalonghia carnosa is common and widespread all over the district visited in 1937 in warm, sunny places. Seems to be more common towards the bottom of the fjords. Peculiarly enough I have seen no collection of it by previous collectors in the district in the Copenhagen herbarium, but it has been collected on the eastern coast (see Dahl, Lynge, and Scholander 1937).

According to literature *Massalonghia carnosa* contains *Scytonema* gonidia. This seems to date from Bornet (Rech. Gon. Lich. p. 45) where he notes that he in *Pannaria muscorum* (Ach.) Del. (which is synonymous with *Massalonghia carnosa*) has found *Scytonema* associated with *Gloeocapsa*. On page 28 l. c. he mentions the lichens in which he has found *Scytonema*, but *Pannaria muscorum* is not amongst those.

I can see no difference between the gonidia of species of *Pannaria* (e. g. *pezizoides* and *Hookeri*) and of *Massalonghia*, but they differ from those found in *Placynthium nigrum* which Bornet refers to *Scytonema*.

I thus wonder whether the statement by BORNET that *Pannaria muscorum* contains *Scytonema* gonidia may be due to a misprint. If not more evidence is brought forward in favour of the existence of *Scytonema* gonidia in *Massalonghia* I think it better to refer the gonidia of *Massalonghia* to *Nostoc*. GYELNIK (IN Rabenh. Krypt. Fl. Bd. IX, Abt. II, Teil 2, p. 154) also states that the gonidia are of *Nostoc* type.

Parmeliella.

1. *Parmeliella lepidiota* (SMRFT.) VAIN.

Godthaab District: Ameralik (V).

Julianehaab District: Tunugdliarfik: (V), western side of Narssaqfjell (D), Tunuarmiut (D), Qordlortoq (D).—Kangerdluarssuk: Eqalugarssuit (D)—Qaqortoq (D).—Igalikofjord: Eqaluit (D)—Upernivik (D).—Agdluitsoq: Sletten (D), 4 km east of Sletten (D), Qagdlimiut (D).

Parmeliella lepidiota seems to be fairly common in the whole district, but is easily overlooked.

Parmeliella microphylla (SW.) MÜLL. ARG. has been recorded from Ameralik in DEICHMANN BRANTH, Grønl. Lich. Fl. p. 474. There is a specimen in the Copenhagen herbarium from Ameralik thus named, but in my opinion it is only a blackish specimen of *P. lepidiota*, suggesting the var. *tristis* (TH. FR.) VAIN.

2. *Parmeliella corallinoides* (HOFFM.) ZAHLBR.

Frederikshaab District: Arsukfjord: Kungnait (D).

Julianehaab District: N. Sermilik: Tasiussaq (D)—Tasermiut (E).

Does not seem common but is possibly overlooked and not as rare as these few finds may indicate.

3. *Parmeliella oblongata* LYNGE

Lich. West Greenl. 1937, p. 27.

Julianehaab District: Tunugdliarfik: Approx. 3 km west of Qíngua 300 m with *Polychidium muscicola* (D).

The specimen from Qíngua very much resembles a very minutely squamulose *P. lepidiota* v. *tristis*. It is still more minutely squamulose than any other specimen of *P. lepidiota* that I have seen, and was at first mistaken for a *P. corallinoides*. My plants differ from LYNGE's original of *P. oblongata* by not being so expanded over the substratum. This difference, however, may be only modificational as *P. lepidiota* also varies in this respect, the high Arctic plants being more expanded

than those from more favourable localities. Fortunately a few very young apothecia were found. They are black with a distinct margin as may be seen also in very young apothecia of the type. The anatomy of the apothecia is very different from that of *P. lepidiota*. The epithecium is aeruginose (brown in *P. lepidiota*), the hymenium is low 50—70 μ (against 100 μ in *P. lepidiota*), and the hypothecium is dark brown (faintly brown in *P. lepidiota*). In these characters my specimens agree with the type. Unfortunately no spores were found.

Pannaria.

1. *Pannaria Hookeri* (Borr.) Nyl.

Frederikshaab District: Arsukfjord: Kungnait (D).

Julianehaab District: Tasermiut (V).

Pannaria Hookeri is obviously rare in the area, as it seems to be also in other parts of Greenland. In the Copenhagen herbarium there is only one other plant from Greenland, viz. from Ikerasak 68° 1′ on the Eastern Coast collected by Kruuse.

2. *Pannaria pezizoides* (Web.) Lightf.

Frederikshaab District: Frederikshaab (KR).—Arsukfjord: Kungnait (D)—Qornoq (KR)—Borgshavn (D).

Julianehaab District: Qagssimiut (D).—Tunugdliarfik: (V), Narssaq (D), western side of Narssaqfjell (D), Tunuarmiut (D)—Julianehaab (D) (V).—Igalikofjord: Igaliko (D).—Agdluitsoq: 3 km south of Sletten (D)—Sermersoq (V)—Nanortalik (V).—Ilua: Nûk (E), Ikerasagssuaq (V)—Nanûseq (V).

Pannaria pezizoides is obviously common all over the southern part of the district. Peculiarly enough there is no plant from the Godthaab District. This does not necessarily mean that it does not occur there, as there are many plants from localities farther north from the Disko area in the Copenhagen herbarium. But it is remarkable that Vahl, who found it in many places in the Julianehaab District, has not collected it in the Godthaab District.

Psoroma.

1. *Psoroma hypnorum* (Vahl) S. Gray.

Godthaab District: Kook Øer (Th. Fries)—Marraq (KR).

Frederikshaab District: Frederikshaab (V, KR).—Arsukfjord: Ivigtut (D)—Qornoq Isblink (KR)—Borgshavn (D).

Julianehaab District: N. Sermilik: Isaromiut (D).—Tunugdliarfik: (V), Qissungadalen (D), Ilímaussaq 1200 m (D), Tunuarmiut (D), Qagssiarssuk (D)—Julianehaab (D)—Itivdliatsiarssuk (KR).—Igalikofjord: Eqaluit (D)—Upernivik (D)—Tasermiut (V, H)—Ikerasagssuaq (E)—Qapiarfik (E).

Psoroma hypnorum is common on mosses and sand in South West Greenland as it is everywhere in the Arctic.

Stictaceae.

Lobaria.

1. *Lobaria verrucosa* (HUDS.) HOFFM. = *Lobaria scrobiculata* (SCOP.) D. C.

Godthaab District: Ameralik (V).
Frederikshaab District: Frederikshaab (D).
Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), Tunuarmiut (D), Sitdlisit (D), Qagssiarssuk (D), Qordlortoq (D).—Igalikofjord: Eqaluit (D)—Upernivik north-east of Sardloq (D).—Agdluitsoq: Qagdlumiut (D).

Lobaria verrucosa is fairly frequent in the inner parts of the fjords, growing on stone and mosses often between old twigs. In the region between the inner part of Tunugdliarfik and Sermilik it was quite common.

Lobaria verrucosa is collected as far north as Sarfanguak near Holsteinsborg (Fylla-Expeditionen).

2. *Lobaria Halli* (TUCK.) ZAHLBR.

Cat. Lich. III, p. 321.
Sticta Halli TUCK in Proceed. Americ. Acad. Arts. and Scienc. Vol. XIII, 1877, p. 168, et Syn. North. Americ. Lich. Vol. I, 1882, p. 102. FINK: Lich. Fl. of the U.S.A. 1935, p. 181. *Stictina Halli* STZBGR. in Flora Vol. LXXXI, 1895, p. 126.

Godthaab District: Ameralik (V).
Julianehaab District: Tunugdliarfik: Qagssiarssuk (D).

Thallus up to 5 cm in diameter, expanded or the lobes somewhat ascending at the margins. The lobes are broad, entire and rounded. The upper side is ash-grey—dark-grey, densely tomentose, reticulately plicated with small round leadcoloured or dark-grey soralia dispersed on the whole upper side. The under side is bright to dark brown, densely tomentose without nerves but with small white naked spots.

The upper cortex 20—30 μ with rough upper side bearing one-celled hairs 5—10 μ thick and up to 40 μ long. The cortex consists of densely interwoven hyphae with almost no intercellular room. The lowermost part has a faintly yellowish colour.

The gonidia layer of varying thickness, 50—80 μ and very indistinctly delimited towards the medulla. Gonidia layer and medulla are together 80—150 μ thick, in some places with minor expansions. The gonidia in some places go down to under cortex. The hyphae are loosely interwoven, generally parallel to the surface and 3—5 μ thick.

The gonidia are blue-green, many together within one gelatinous sheet, often arranged in rays transverse to the surface. They are morphologically identical with the gonidia found in *Lobaria verrucosa* which are regarded as *Nostoc*.

Under cortex 15—25 μ thick, consisting of densely interwoven hyphae. The surface is covered with one-celled hairs or bundles of one-celled hairs, 5—10 μ thick and up to 100 μ long. In some places the hairs are lacking, the hyphae of the cortex are loosened up and disappear and the medulla comes out to the surface. The features remind of the anatomy of the papillae of *Nephroma resupinatum*, but do not form an expanded papilla; the surface remains plane.

By all authors *Lobaria verrucosa* and *L. Halli* are regarded as very closely related, and my plants have an anatomy very like that of *L. verrucosa*. Especially the gonidia and the white spots on the under side are characteristic. *Lobaria Halli* is described from Oregon. My plants fit well with the original description. Except that the original had apothecia, the description of TUCKERMAN in Syn. N. Americ. Lich. might well have been made after the Greenland plant. It runs: "Thallus . . . wide lobed, reticulatolacunose . . . at length more or less villous and beset now with leadcoloured soredia, ashy-glaucescent, beneath ribbed, pale villous with naked whitish spots. . . ."

After the species was detected in Greenland, AHLNER has found the *Lobaria Halli* in Jämtland in Sweden and also in Norway[1]). He has also had access to the type and has informed me that his Scandinavian plants, mine from Greenland, and the type, doubtlessly belong to the same species. It is an interesting case of the many species which are common for Scandinavia and Southern Greenland.

Lobaria Halli was collected already by VAHL, but was not previously recognized. At Qagssiarsuk it was found on mosses between twigs of *Juniperus* and *Betula glandulosa*.

---

[1]) See AHLNER in Acta Phytogeographica Suecica 22 1948 p. 60.

Peltigeraceae.

Solorina.

1. *Solorina crocea.* (L) ACH.

Godthaab District: Godthaabfjord: Baals Revier (V)—Godthaab (TH. FRIES, KR)—Kobbe Fjord (FYLLA-EXPED.)—Ameralik (V)—Sermilik (KORN.)—Marrak (KR)—Ilvertalik (KORN.).

Frederikshaab District: Neria Qíngua (H)—Arsuk Storø (KR).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D), Smallesund (KR)—Borgshavn (D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Isaromiut (D).—Tunugdliarfik: Narssaq (D), Narssaqfjell 650 m (D), western side of Narssaqfjell (D), Qissungadalen (D), Ilimaussaq (D), Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D)—Uperniviarssuk (V, D)—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igaliko (V, D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D)—Nanortalik (V)—Qapiarfik (S).

Solorina crocea is common in places where the snow melts away only late in the season in Southern Greenland as it seems to be in all parts of Greenland. In the Julianehaab District, however, it seems to become less frequent in the lowlands around the inner parts of the fjords.

2. *Solorina saccata* (L) ACH.

Julianehaab District: Tunugdliarfik: Sitdlisit (D), Qagssiarssuk (D), Kiagtût (D), Qordlortoq (D).

Solorina saccata is fairly rare in South Western Greenland, and was not previously collected in the district. Specimens determined *Solorina saccata* from the district in the Copenhagen herbarium all belong to other species. Altogether there is only one correctly determined plant from the whole Greenland from Gåselandet at Scoresby Sound leg. HARTZ in the Copenhagen herbarium.

3. *Solorina octospora* ARN.

Frederikshaab District: Arsukfjord: Kungnait (D).

Solorina octospora is doubtlessly very rare in Western Greenland and has not previously been collected from the area, but in many places on the eastern coast (see LYNGE and SCHOLANDER, 1932, p. 26).

Solorina octospora is a very characteristic species which besides the number of spores in the asci may be recognized by the brownish colour of its thallus. The specimen at Kungnait was recognized in the field.

4. *Solorina spongiosa* (Sm.) Anzi.

Julianehaab District: Tunugdliarfik: (V) Qagssiarssuk (D), Kiagtût (D), Qordlortoq (D).

Solorina spongiosa has much the same distribution in Southern Greenland as *S. saccata*, and was only scarce in each locality.

5. *Solorina bispora* Nyl.

Julianehaab District: Kangerdluarssuk: Eqalugarssuit (D).—Igalikofjord: Eqaluit (Petersen, D).—Agdluitsoq: Qagdlumiut (D).

Solorina bispora was found only in few places, and there is no specimen in the Copenhagen herbarium from the region. It has, however, been collected many times in northwestern Greenland judging from the many plants in the Copenhagen herbarium.

Nephroma.

1. *Nephroma arcticum* (L) Torss.

Godthaab District: Godthaabfjord: Amitsuarssuk (1927)—Godthaab (Rink, Th. Fries)—Kobbe Fj. (Fylla-Exp.)—Ameralik (V)—Simiútat (H).

Frederikshaab District: Frederikshaab (H).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (Korn., D)—Borgshavn (D).

Julianehaab District: Josvaminen (D)—Qagssimiut (D).—N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), Narssaqfjell 650 m (D), western side of Narssaqfjell 700 m (D), Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D) 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D)—Uperniviarssuk (D)—Julianehaab (Lund, D).—Igalikofjord: Eqaluit (Petersen, D), Igdlerfigssalik (D), Igaliko (D)—Upernivik northwest of Sârdloq (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D)—Tasermiut (V)—Frederiksdal (V)—Innermost end of Ilua (S), Ikerassagssuaq (V)—Qapiarfik (S).

Nephroma arcticum is common everywhere, and is frequently collected on account of its conspicuousness.

2. *Nephroma expallidum* NYL.

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Narssaq (D), 3 km north-east of Narssaqfjell (D), Tunuarmiut (D), Qagssiarssuk (D), Kiagtût (D), Qíngua (D), 3 km west of Qíngua c. ap. (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik (D), Igaliko (D).—Agdluitsoq: 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).

If *Nephroma arcticum* is a commonly collected lichen in Greenland *N. expallidum* is not. There is not a single plant in the Copenhagen herbarium. In Southern Greenland it has a typical continental distribution and is quite common in the inner parts of the fjords, but is never seen on the coast.

DEICHMAN BRANTH (Tillæg til Grønlands Lichenflora, Medd. om Grønl. 1892, p. 753) records *N. expallidum* from Tørvøen near Egedesminde leg. HARTZ. I have seen the plant which is of a peculiar type and seems rather to be a deformed *Cetraria glauca* than a *Nephroma expallidum.*

3. *Nephroma resupinatum* (L) ACH.

Frederikshaab District: Qornoq Isblink (KR).
Julianehaab District: Tunugdliarfik: Qagssiarssuk (D).

Nephroma resupinatum is doubtlelssy rare in Greenland.

4. *Nephroma laevigatum* ACH.

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D), Bjørnedalen (D).

Julianehaab District: N. Sermilik: Ukivigssaqaq (V).—Tunugdliarfik: Western side of Narssaqfjell (D), Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D), 3 km west of Qíngua (D)—Julianehaab (SØRENSEN)—Kobbermineøen near Julianehaab (KR).—Agdluitsoq: Sletten (D).

Nephroma laevigatum is fairly frequent between mosses, on trunks and twigs in the area visited 1937, especially in the inner parts of the fjords.

5. *Nephroma parile* ACH.

Godthaab District: Ameralik (V).
Frederikshaab District: Arsukfjord: Kungnait (D), Bjørnedalen (D)—Borgshavn (D).
Julianehaab District: N. Sermilik: Ukivigssaqaq (V), Tasiussaq (D),

Isaromiut (D).—Tunugdliarfik: (SØRENSEN, V) Narssaq (D), Western side of Narssaqfjell (D), Qissungadalen (D), Tunuarmiut (D), Nunasarnaq (KR), Qagssiarssuk (D), Kiagtut (D), Qordlortoq (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D).—Igalikofjord: Eqaluit (D), Igaliko (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D)—Tasermiut (E, H)—Frederiksdal (V).

Nephroma parile is found in the same type of localities as *N. laevigatum* and often together with it. It is more common and widespread and has a distribution of a distinctly continental character like most of the other species of *Nephroma* in South West Greenlnad.

Peltigera.

Peltigera aphthosa (L) WILLD.

Frederikshaab District: Nutarmiut (KR)—Neriaq Qíngua (H).—Arsukfjord: Ivigtut (KR, D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Qissungadalen (D), Tunuarmiut (D), Qíngua (D), Julianehaab (D).—Kangerdluarssuk: Eqalugarssuit (D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: Qagdlumiut (D), Qordlortorssuaq (D)—Tasermiut (V).—Ilua: Kangerdlek Qíngua (S).

Both *Peltigera aphthosa* and *P. leucophlebia* are more common than these localities might indicate. In the field these species were met with in many more places in 1937 than are recorded here, but I did not distinguish between them in the field. Only the localities from which specimens were collected are listed. In the Copenhagen herbarium there are many plants from localities farther north on the coast.

2. *Peltigera leucophlebia* (NYL.) GYELN.

Godthaab District: Bjørnesund (KORN.).

Frederikshaab District: Sangmissokfj. (KR).—Arsukfjord: Kungnait (D).

Julianehaab District: N. Sermilik: Tasiussaq (D), Isaromiut (D).—Tunugdliarfik: Narssaq (D), Western side of Narssaqfjell (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua 300 m (D)—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igaliko (D).—Agdluitsoq: Sletten (D).

Peltigera leucophlebia is a good species well distinguished from *P. aphthosa.* It may be recognized by a smoother thallus with more

rounded lobes, and the colour often turns more brownish in the sun. The ecology of the species is also different, *P. leucophlebia* preferring more shady moist places, often vertical rockwalls, growing on mosses, while *P. aphthosa* prefers more open places exposed to the sun. They are, however, often found together. Besides the well known characters of the nerves on the under side of the thallus and the cortex on the under side of the apothecia, there is in Southern Greenland a character of the cephalodia which may serve to distinguish them. If the cephalodia are found on well developed lobes, they are in *P. aphthosa* flattened and the more the larger the cephalodia. In *P. leucophlebia* the cephalodia are more rounded, globose to semiglobose when small. In the later stages of development the cephalodia become complicated globuliform, often looking like a model of the cerebrum. In Southern Greenland this character is constant, but that does not hold good for other parts of the world.

P. leucophlebia has also been collected in many localities farther north on the coast according to specimens kept in the Copenhagen herbarium.

3. *Peltigera venosa* (L) HOFFM.

Godthaab District: Godthaabfjord: Qugssuk (V)—Kangârsuk south of Fiskenesset (KR).

Frederikshaab District: Arsukfjord: Kungnait (D).

Julianehaab District: Tunugdliarfik: (V), Narssaq (D), Western side of Narssaqfjell (D), Tunuarmiut (D), Kiagtût (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua (D)—Julianehaab (V).—Igalikofjord: Igaliko (V).—Agdluitsoq: 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D).

P. venosa is widely distributed in the district, but is scarce in each locality. It is not to be expected that a typical calcophilous plant should be common in a district dominated by archean rock types as Southern Greenland. That it, however, has been found in so many localities is due to the dikes of basic rocktypes which occur fairly frequently and by weathering give a good soil to calcophilous plants. In such localities also species of the *Solorina saccata* group and *Papaver radicatum* are to be found.

4. *Peltigera canina* (L) WILLD.

Godthaab District: Tuluvartalik (KR).

Frederikshaab District: Frederikshaab (H).—Arsukfjord: Kungnait (D)—Borgshavn (D).

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Western side of Narssaqfjell (D), Qissunga-

dalen (D), Tunuarmiut (D)—Qíngua (D)—Uperniviarssuk (D), Julianehaab (D).—Igalikofjord: Eqaluit (D), Igaliko (D).—Agdluitsoq: Sletten (D), Qordlortorssuaq (D)—Nunarssuaq (LUNDHOLM)

Peltigera canina is quite common in the district. It is not always easy to distinguish *P. canina* from *P. rufescens* and in some cases I have not been certain about the determination. Yet I believe they are different species, as the specimens if they are well developed are easily distinguished, only stunted Arctic plants offer difficulties.

5. *Peltigera rufescens* (WEIS.) HUMB.

Godthaab District: Kobbe Fj. (Fylla Exp.).
Frederikshaab District: Arsukfjord: Kungnait (D), Borgshavn (D).
Julianehaab District: N. Sermilik: Isaromiut (D).—Tunugdliarfik: Narssaq (D), Western side of Narssaqfjell (D), Narssaqfjell 650 m (D), Ilímaussaq 1200 m (D), Qagssiarssuk (D), Kiagtût c. ap. (D), Qordlortoq (D), Qíngua c. ap. (D), 3 km west of Qíngua 300 m c. ap. (D)—Julianehaab (D).—Igalikofjord: Igaliko (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), Qagdlumiut c. ap. (D).

Peltigera rufescens seems within the Julianehaab District to have a wider distribution than *P. canina* and grows far up into the mountains (1200 m at Ilímaussaq). This may be explained by the fact that *Peltigera rufescens* is a more northern species than *P. canina*. Fertile plants are quite common and often densely tomentose (*P. Suomensis* GYELN.).

6. *Peltigera lepidophora* (NYL.) VAIN.

Julianehaab District: Tunugdliarfik: Qordlortoq (D), 3 km west of Qíngua (D).—Agdluitsoq: Qagdlumiut (D).

Peltigera lepidophora is rare and scarce within the district and has not previously been collected in Western Greenland.

7. *Peltigera spuria* (ACH.) D. C.

= *P. erumpens* (TAYL) VAIN.

Frederikshaab District: Arsukfjord: Kungnait (D).
Julianehaab District: N. Sermilik: Isaromiut v. *leptoderma* and *typica* (D), Tasiussaq (D)—Tunugdliarfik: Narssaq (D), Western side of Narssaqfjell (D), Tunuarmiut (D), Qagssiarssuk (D), Kiagtût (D), Qordlortoq (D), Qíngua (D)—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igaliko (D),—Agdluitsoq: Sletten (D), Qagdlumiut (D).

Peltigera spuria occurs quite frequently within the district visited 1937, but is scarce in each locality. There are no specimens collected by previous collectors in the Copenhagen herbarium, but this may be due to its paucity. There are some plants from localities farther north

on the coast. The variety *leptoderma* is rare and was found only in one locality. No fertile plants were detected.

About the relation between *P. spuria* and *P. erumpens* see p. 22.

8. *Peltigera scabrosa*. TH. FR.

Godthaab District: Godthaab (TH. FRIES)—Ameralik (V)—Marrak (KR). Frederikshaab District: Arsukfjord: Kungnait (D)—Borgshavn (D). Julianehaab District: Josvaminen (D)—Qagssimiut (D).—Tunugdliarfik: Narssaq (D), Qissungadalen c. ap. (D), Qagssiarssuk (D)—Uperniviarssuk (D)—Julianehaab (D).—Igalikofjord: Eqaluit c. ap. (D), Igdlerfigssalik 7—800 m (D).—Agdluitsoq: Sletten c. ap. (D), 4 km east of Sletten (D), Qagdlumiut (D).

Peltigera scabrosa seems to be quite common in the coastal part of the district visited 1937, but becomes more scarce towards the inner parts of the fjords. It is one of the few species with a distinctly oceanic distribution in Southern Greenland. Fertile plants were remarkably common.

At Qordlortorssuaq a peculiar *Peltigera* was found. It had an appearance of *P. scabrosa*, but the scabrous upper side so characteristic of *P. scabrosa* was found only in the tips of the youngest lobes. Instead the upper side was distincly tomentose towards the margins, a feature never seen in *P. scabrosa*. The specimens were fertile. Exactly the same type has previously been collected by LYNGE in Iceland: Sudur-ðingeyarsysla: Vaglaskogar. LYNGE's determination was *P.* (*scabrosa*) pr. *caninam*, and he had sent the specimen to Uppsala where AHLNER, DEGELIUS, and HASSELROTH with some doubt suggested that it was a new species. A third find of this peculiar type has been made by KOLDERUP ROSENVINGE who collected it at Ivigtut. It should at any rate have its own name, and I will call it:

P. scabrosa v. *occidentalis* E. DAHL var. nov.

Differt a typo lobis juvenilibus apice tantum scabriusculis marginibusque tomentosis.

Locus classicus: Qordlortorssuaq leg. E. DAHL.

9. *Peltigera malacea* (ACH.) FUNK.

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D). Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D). Tunugdliarfik: Western side of Narssaqfjell (D), Ilímaussaq 1200 m (D), Tunuarmiut (D), Qíngua c. ap. (D), 3 km west of Qíngua 300 m (D)—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igaliko (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).

Peltigera malacea is quite common in the district visited 1937, often in large specimens, even fertile, and it grows far up into the mountains. Peculiarly enough there is no collection of it from the district in the Copenhagen herbarium. It is probably common all over the district as there are some finds on the coast farther north in the Disko area.

10. *Peltigera polydactyloides* Nyl.

Godthaab District: Kobbe Fjord (Fylla-Exp.)—Marrak (KR).

Frederikshaab District: Frederikshaab (H).

Julianehaab District: Tunugdliarfik: Narssaq (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D)—Julianehaab (D)—Nanortalik (E).

Peltigera polydactyloides is no very common species within the district. It is very difficult to distinguish between *P. polydactyloides* and *P. polydactyla*, and I am not convinced that they are different species. *P. polydactyla* is distinguished from *P. polydactyloides* by having nerves on the under side (Thallus subtus venosus), while *P. polydactyloides* is without nerves (Thallus subtus malacaeformis, avenosus. Gyeln. in Revue Bryol. et Lichenol. Tome V. Fasc. 2—3). I have seen plants determined by Gyelnik as *P. polydactyloides*, but they have nerves in the central parts of the under side, only the nerves are not extending to the margins of the lobes as they do in typical *P. polydactyla*. But it is very difficult to find a limit as to how long the nerves may be admitted to reach if the specimen is to be called *P. polydactyloides*.

Some of the plants from South East Greenland (see Dahl, Lynge, and Scholander 1937, p. 17) determined as *P. polydactyla* are rather of a *P. polydactyloides* type. Some of the specimens from Southern Greenland are distinctly of a *polydactyloides* type, but I have seen no typical *polydactyla*. For this reason I have referred tham all to *P. polydactyloides*.

11. *Peltigera scutata* (Dicks.) Duby.

Julianehaab District: N. Sermilik: Tasiussaq (D), Isaromiut (D).—Tunugdliarfik: Western side of Narssaqfjell (D), Qagssiarssuk (D), Kiagtût (D), Qordlortoq (D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).

Peltigera scutata has a distinctly continental type of distribution in South Greenland, and is fairly common in the inner parts of the fjords. It prefers sunny places. Some of the specimens would probably have been called *P. subscutata* by Gyelnik. I am not convinced that it is a proper species. *P. scutata* is new to Greenland.

Cladoniaceae.

Baeomyces.

1. *Baeomyces roseus* PERS.

Julianehaab District: Tunugdliarfik: Qíngua (D).

Scarce and probably rare in Southwest Greenland. The plants are sterile, but in complete accordance with Icelandic and European materail.

Baeomyces roseus has previously been collected at Disko (see LYNGE, 1937, p. 99).

2. *Baeomyces rufus* (HUDS.) REBENT.

Julianehaab District: Tunugdliarfik: Tunuarmiut (D).—Igalikofjord: Eqaluit (D)—Upernivik (D).

Baeomyces rufus is an easily overlooked species, and is probably not so rare as these few finds would indicate. Most of the plants are fertile with typical podetia and apothecia. I have seen no mention of it before from Greenland.

Icmadophila.

1. *Icmadophila ericetorum* (L) ZAHLBR.

Godthaab District: Naujat (KORN.)

Julianehaab District: Agdluitsoq: Sletten (D), Approx. 4 km east of Sletten (D), Amitsuarssuk (V).

Fairly frequent around Sletten on *Sphagnum* peat. The specimens are beautifully developed.

Cladonia.[1])

Key of Determination of Southern Greenland Cladonia.

As for determination of atranoric acid	see	*Cladonia ecmocyna*	page	98
— barbatinic acid -	—	*Floerkeana* -		79
— psoromic acid -	—	*alpicola* -		95
— squamatic caid -	—	*squamosa* -		91
— usninic acid -	—	*alpestris* -		78

[1]) After the completion of the manuskript I have received two papers by YASIHUKO ASAHINA: Chemismus der *Cladonien* unter besonderer Berücksichtigung der japanischen Arten. Journ. of Japanese Botany. Vol XIX Nos. 3 and 8. 1943. His results conforms well with mine. The unknown lichen acid of *Cladonia decorticata* is according to him perlatolic acid. Besides usninic acid the species *Cl. cyanipes*, *carneola* and *bacilliformis* contain barbatinic acid. He reports of *Cl. pyxidata* types containing atranoric acid *(Cl. conistea* (DEL,) ASAHINA) and psoromic acid *(Cl. subconistea* ASAHINA).

A. With crustose primary thallus. Poderia small up to 0.5 mm papilliform. No squamules or soredia found present
Cl. papillaria (Ehrh.) Hoffm. p. 79

B. Primary thallus squamulose or lacking.

I. Plants without soredia or squamules, neither on the podetia nor at the base. Cortex always smooth. Podetia always branched. Contain usninic or atranoric acid.

1 a. Colour yellow. Contains usninic acid.

2 a. Plants intricately branched, generally with slender apices.

3 a. The apices of the branches directed to all sides. The colonies terminated above by rounded and thyrsoid cluster of branches
Cl. alpestris (L) Rab. p. 78

3 b. The apices of the branches more or less curved towards one side.

4 a. Pd + yellow turning red. The apices very slender ..... *Cl. sylvatica* (L) Hoffm. p. 77

4 b. Pd —. The apices generally somewhat thicker and more strongly curved than in the former species ..... *Cl. mitis* Sanst. p. 77

2 b. Podetia not so intricately branched. The apices often more blunt.

5 a. Podetia generally bearing cups. The axils generally closed. Contains barbatinic acid
Cl. amaurocraea (Flk.) Schaer. p. 84

5 b. Poderia without cups. The axils always widely open. Contains squamatic acid
Cl. uncialis (L) Web. p. 85

1 b. Colour grey. Contains atranoric acid
Cl. rangiferina (L) Web. p. 76

II. With squamules or soredia, or the podetia with areolated or verruculose cortex.

A. Apothecia red and (or) red or reddish pycnides.

1 a. Contains usninic acid. Colour yellow. Pd —.

2 a. Podetia slender with or without narrow cups, often squamulated .. *Cl. bellidiflora* (Ach.) Schaer. p. 83

2 b. Podetia bearing broad cups, rarely squamulated.

3 a. Podetia with farinose soredia, generally more than 2 cm high, cups and podetia often sliced
Cl. deformis (L) HOFFM. p. 82

3 b. Podetia with granular soredia or with areolated cortex. Cups entire
Cl. coccifera (L) WILLD. p. 80

1 b. Lacks usninic acid.

2 a. Colour yellow. Pd + red *Cl. digitata* (L) SCHAER p. 80

2 b. Colour grey. Pd —. Contains barbatinic acid
Cl. Floerkeana (FR.) SMFT. p. 69

B. Apothecia brown, or more seldom pale. Pycnides brown.

1 a. Podetia generally branched. Axils usually perforated and often dilatated. Cups open.

2 a. Contains squamatic acid. Pd —.

3 a. With sorediose widely open cups
Cl. cenotea (ACH.) SCHAER. p. 91

3 b. Lacks soredia.

4 a. Podetia with black spots at the base. Squamules generally lacking
Cl. Delessertii (NYL.) VAIN. p. 89

4 b. No black spots at the base of the podetia. Podetia generally with squamules.

5 a. Generally with more or less smooth cortex, cups dentated at the margins
Cl. crispata (ACH.) FLOT. p. 86

5 b. Cortex generally more or less disintegrating, often developing into squamules *Cl. squamosa* (SCOP) HOFFM. p. 90

2 b. Contains fumar-protecetraric acid. Pd + yellow turning pure red.

3 a. With large squamules at the base. Contains atranoric acid . . . *Cl. turgida* (EHRH.) HOFFM. p.

3 b. Without large squamules at the base, but with squamulated and towards the top sorediated podetia. Lacks atranoric acid
Cl. scabriuscula DEL. 86

1 b. Podetia unbranched, or if branched, with closed axils and cups.

2 a. Contains usninic acid.

3 a. Podetia bearing cups with coarse granular soredia Cups often prolificating from the margins, often Pd + . . *Cl. pyxidata chlorophaea* (Flk.) Spreng f. 104

3 b. Podetia with fine granular or farinose soredia. Pd —. Of yellowish colour.

4 a. With broad cups, rarely more than 2 cm wide with granular soredia.

5 a. Podetia and cups are transparent in wet conditions *Cl. carneola* Fr. p. 112

5 b. Podetia and cups not transparent in wet conditions *(Cl. coccifera* (L) Willd. p. 80)

4 b. Podetia with narrow cups, or cups lacking.

5 a. Podetia slender more than 2 cm with thin coating of farinose soredia *Cl. cyanipes* (Smrft.) Vain. p. 112

5 b. Podetia low, less than 2 cm with masses of farinose soredia *C. bacilliformis* (Nyl.) Vain. p. 113

2 b. Lacks usninic acid.

3 a. Pod and squamules Pd — or Pd + yellow often turning into orange, but never Pd + yellow turning into pure red. Lacks fumar-protocetraric acid.

4 a. With broad typical cups. Pd — *Cl. pyxidata chlorophaea* (Flk.) Spreng. f. p. 104

4 b. Cups lacking, medulla with more or less longitudinal hyphae, cortex areolated or more or less disintegrating so that the medulla can be seen between the areolae.

5 a. Contains atranoric acid.

6 a. Podetia acuminated, with granular soredia towards the top, apothecia rare *Cl. acuminata* (Ach.) Arn. p. 95

6 b. Podetia stout, not acuminated, often with apothecia, soredia lacking *Cl. cariosa* (Ach.) Spreng. p. 92

5 b. Lacks atranoric acid.

6 a. Pd +. Contains psoromic acid. *Cl. alpicola* (Flot.) Vain. p. 94

6 b. Pd —. Contains unknown lichen acid *Cl. decorticata* (Flk.) Spreng. p. 95

3 b. Contains fumar-protocetraric acid. Pd + yellow changing into pure red.

4 a. Contains atranoric acid.

5 a. With well developed primary squamules which are orientated more or less parallel to the substratum. Pod with cups bearing granular soredia
Cl. pyxidata Poclilum v. p. 104

5 b. Basal squamules not orientated parallel to the substratum or badly developed. Podetia without soredia.

6 a. Podetia with broad cups, prolificating from the center. Cortex smooth. Basal squamules well developed.

7 a. Basal squamules long, somewhat greyish on the under side. Podetia brown and cracked
Cl. subcervicornis (VAIN.) DR p. 102

7 b. Basal squamules broad, purely white on the under side. Podetia grey and entire
Cl. macrophyllodes NYL. p. 103

6 b. The cups are narrow compared with the length, cupbearing forms with badly developed basal squamules.

7 a. Podetia with black spots at the base, either with squamules or with cups prolificating from the center
Cl. lepidota NYL. p. 101

7 b. Podetia without black spots at the base. Podetia acuminated or with a very narrow cup at the top, generally without squamules
Cl. ecmocyna (ACH.) NYL. p. 97

4 b. Lacks atranoric acid.

5 a. Forms lacking soredia.

6 a. Podetia slender, cups lacking or narrow, podetia generally more than 3 cm.

7 a. Podetia blackspotted at the base, richly branched, generally with squamules

Cl. degenerans (Flk.) Spreng. p. 101

7 b. Podetia without black spots at the base, not, or slightly, branched, squamules rare.

Cl. gracilis v. chordalis (Flk.) Schaer. p. 96

6 b. Podetia stout with broad cups.

7 a. Podetia prolificating from the center. Cortex smooth.

Cl. cervicornis (Ach.) Fw. 102

7 b. Podetia prolificating from the margins. Cortex cracked.

8 a. Basal squamules erect, often badly developed.

Cl. pyxidata negelcta (Elk.) p. 104

8 b. Basal squamules well developed partly parallel to the substratum

Cl. pyxidata Pocillum (Ach.) p. 104

5 b. With farinose or coarsely sorediose cups.

6 a. Cups narrow, indistinct or lacking.

7 a. Corticated at the base, colour brownish or greyish.

Cl. cornuta (L.) Schaer p. 99

7 b. Without cortex at the base, colour greenish.

Cl. coniocraea Flk. p. 111

6 b. Cups broad, distinct.

7 a. Cups farinosely sorediated, soredia often being scratched away. *Cl. fimbriata* (L) Fr. p.

7 b. Cups coarsely sorediate.

8 a. Basal squamules distinct, horizontal.

Cl. pyxidata Pocillum v. *pachythallina* (Wallr.) Vain p. 104

8 b. Basal squamules badly developed or erect.
Cl. pyxiadata chlorophaea SPRENG. p. 104

Key of Determination of Arctic Cladonias Mainly Consisting of Basal Sqamules (Podetia Badly developed).

1 a. Pd — or yellow in some cases turning orange (but never pure red). Lacks fumar-protocetraric acid...*Cl. cariosa* (ACH.) SPRENG. p. 92

1 b. Pd + yellow afterwards turning distinctly red, especially in the tips of the squamules.

2 a. Contains atranoric acid.

3 a. The squamules are especially towards the margins orientated more or less parallel to the substratum
Cl. pyxidata Pocillum v. *pachythallina* (WALLR) VAIN. p. 104

3 b. The squamules are distinctly erect, also towards the margins

4 a. The squamules are thick, not transparent. If podetia are present they have cups.

5 a. Squamules long with a greyish colour on the under side, cups cracked, of brown colour
Cl. subcervicornis (VAIN.) D R p. 102

5 b. Squamules broad, purely white underneath. Pod. grey, rarely cracked *Cl. macrophyllodes* NYL. p. 103

4 b. The squamules transparent, pale. Pod. without cups.

5 a. Squamules large, delicate, often 5 mm long. Pod. with no black spots at the base
Cl. turgida (EHRH.) HOFFM. p. 91

5 b. Squamules small. Pod. with black spots at the base *Cl. lepidota* f. *hypophylla* (NYL.) VAIN. p. 101

2 b. No atranoric acid present.

3 a. Squamules thin though not transparent, broad. Pod. with smooth cortex..... *Cl. cervicornis* (ACH.) FW. p. 102

3 b. Squamules thicker, somewhat narrower in the lobes. Pod. with areolated or granulated cortex
Cl. pyxidata neglecta (Flk.) p. 104

1. *Cladonia rangiferina* (L) WEB.

Godthaab District: Godthaabfjord: Amitssuarssuk (1927), Qôrnok (1927), Kobbe Fjord (Fylla-Exp.)—Ameralik (V)—Karajaq Ilua (KR)—Kavssissagdlit (H).

Frederikshaab District: Frederikshaab (WALKER)—Neria (EUGENIUS)—Arsuk Storø (JOHNSTRUP).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D)—Borgshavn (D).

Julianehaab District: Josvaminen (D)—Qagssimiut (D).—N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Narssaqfjell 650 m (D), Western side of Narssaqfjell (D), Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D)—Uperniviarssuk (D)—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik (D), Igaliko (D), Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Frederiksdal (V).—Ikerasagssuaq (V).

Cladonia rangiferina is one of the most common lichens in the district, and was not missing in any of the places where more careful investigations were made in 1937.

Contains atranoric acid. All forms of *Cl. silvatica* contain usninic acid.

2. *Cladonia sylvatica* (L) HOFFM.

Frederikshaab District: Arsukfjord: Kungnait (D).

Julianehaab District: N. Sermilik: Isaromiut (D).—Kangerdluarssuk: Eqalugarssuit (D)—Uperniviarssuk (D)—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D).

Cladonia sylvatica is considerably rarer than its brother, *Cl. mitis*, but its frequency is a good indication that one no longer is in the real Arctic regions.

The only certain distinguishing feature between *Cl. silvatica* and *Cl. mitis* is the Pd-reaction. One may, however, also usually see a difference in the general appearance, as the branch tips of the *Cl. mitis* are thicker, coarser and more curved than those of *Cl. sylvatica*, but this is not always the case. Thus, plants from Eqalugarssuit and Uperniviarssuk had branch-tip forms of the *mitis* type, whereas the Pd-reaction was positive. On the other hand one plant from Qíngua showed negative Pd-reaction in spite of the branch-tips being of the *sylvatica* type.

The distinct difference in the distribution, however, strongly indicates that *Cl. sylvatica* and *Cl. mitis* are good species.

3. *Cladonia mitis* SANST.

Godthaab District: Godthaabfjord: Kapisigdlit (1927), Amitsuarssuk (1927)—Godthaab (RINK)—Kook Øer (TH. FRIES)—Ameralik (V)—Kavsissagdlit (H).

Frederikshaab District: Neria (EUGENIUS).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D), Smallesund (KORN.)—Borgshavn (D).

Julianehaab District: Josvaminen (D)—Qagssimiut (D).—N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Narssaqfjell 650 m (D), Western side of Narssaqfjell (D), Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D)—Uperniviarssuk(D)—Julianehaab(D).—Igalikofjord:Eqaluit (D), Igdlerfigssalik (D), Igaliko (D)—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D)—Tasermiut (H).

Like *Cl. rangiferina*, *Cl. mitis* was not missing in any of the localities investigated. It mostly occurs in far greater quantities than *Cl. rangiferina* and is undoubtedly the most important component in the lichen heath. It contains usninic acid, causing the yellow colour of the plant.

4. *Cladonia alpestris* (L) RABH.

Godthaab District: Godthaabfjord: Kapisigdlit (1927), Amitsuarssuk (1927)—Godthaab (RINK).

Frederikshaab District: Neria (EUGENIUS).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (SCHIØDT, D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Isaromiut (D), Tassiussaq (D).—Tunugdliarfik: Between Narssaq and Qissungadalen (D), Tunuarmiut (D), Qíngua (D), ca. 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D)-Uperniviarssuk (D)—Julianehaab (D).—Igalikofjord: Eqaluit (D)—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D)—Tasermiut (V)—Frederiksdal (V).

Cl. alpestris is very widespread in the district, but is nowhere found in large quantities, usually there are a few specimens in each place. Utilisation is therefore out of question. It occurs among stones on the talus slopes or in the lichen heath. The lichen heath consists of the three *Cladonia* species, *Cl. alpestris*, *rangiferina*, and *mitis*, sometimes also *Cl. gracilis* v. *chordalis* and *Cl. crispata*, further *Stereocaulon paschale* and also *Cetraria islandica* and *nivalis*. Sometimes in localities exposed to the wind, *Alectoria ochroleuca* is found. The lichen heath is most luxuriantly developed in the middle of the fjords (Tunuarmiut, Eqaluit); it is less well developed in the outer parts of the fjords, and badly in the inner parts of the fjords.

Cladonia alpestris has been collected as far north as Godhavn (leg. HOLBOELL).

Cladonia alpestris contains usninic acid. This may be identified in the following way: Usninic acid is soluble in acetone and benzene. Benzene, which otherwise dissolves few lichen acids is to be preferred as a solute. A few pieces of the lichen in question are placed on an object glass. A few drops of benzene is added and the lichen acid extracted as described on page 27. The lichen acids thus extracted are recrystallized in GE. As a result large yellow crystals of angular extinction under crossed nichols are obtained (Plate III, Fig. 1). Recrystallized of a 10 % sodiumcarbonate solution beautiful, colourless crystals are obtained (Plate III, Fig. 2). Recrystallized of G A An without too long heating, large colourless balks, plates or bundles of plates are obtained (Plate III, Fig. 3).

Besides usninic acid, several other lichen acids occur in *Cl. alpestris* (see EVANS, 1943 b).

5. *Cladonia papillaria* (EHRH.) HOFFM.

Julianehaab District: Qeqertatsiaq (E).

There are a few specimens of *Cl. papillaria* in the Copenhagen herbarium collected by EBERLIN, and no objection can be made against the determination. It must be very rare and was eagerly searched for in 1937, but without success.

6. *Cladonia Floerkana* (FR.) SMRFT.

Godthaab District: Kook Øer (TH. FRIES).

Frederikshaab District: Arsukfjord: Kungnait (ad v. *chlorodes*) (D).

Julianehaab District: Josvaminen (v. *caracata*, v. *intermedia*) (D).—N. Sermilik: Tasiussaq (v. *intermedia*) (D), Julianehaab (v. *intermedia*) (D).—Igalikofjord: Eqaluit (v. *intermedia*) (D).—Agdluitsoq: Sletten (v. *intermedia*) (D).

Cl. Floerkana is quite common in the coastal part of the district visited in 1937 and was never found far inland along the fjords. It only grows on highly humified soil in the heath or on stones. Its variety, *intermedia*, is most widespread in the district, v. *carcata* and v. *chlorodes* are rare.

Cl. Floerkana contains barbatinic acid. If some podetias of *Cl. Floerkana* are extracted by acetone on the object-glass, the acetone evaporated and the residue recrystallized of GE short prisms or cubes develop, with high relief on account of a high index of refraction, and

with high double refraction, only small crystals showing interference colours (Plate III, Fig. 4). Supernormal interference colours are often seen in the same way as squamatic acid. Barbatinic, and squamatic acid are chemically very closely related.

7. *Cladonia digitata* (L) SCHAER.

Julianehaab District: Tunugdliarfik: Narssaq (D).—Lichtenaufjord: Qordlortorssuaq (D).

Undoubtedly a rare species not previously collected in Greenland. Easily distinguished from *Cl. deformis* by the reaction Pd + intensely red (Thamnolic acid). The plants from Qordlortorssuaq are well developed, but the plants from Narssaq have deformed podetias and consist mainly of soredious squamules.

8. *Cladonia coccifera* (L) WILLD.

v. *stemmatina* ACH.

Godthaab District: Godthaabsfjord: Amitsuarssuk (1927), Qôrnoq (1927),—Kook Øer (TH. FRIES).

Frederikshaab District: Neria (EUGENIUS).—Arsukfjord: Bjørnedalen Z (D), Kungnait Z (D), Ivigtut (SCIØDT),—Borgshavn B (D).

Julianehaab District: Tunugdliarfik: Qíngua ÷ (D), 3 km west of Qíngua 300 m Z (D).—Julianehaab: ÷ (D).—Agdluitsoq: Qagdlumiut ÷ (D), Qordlortorssuaq Z (D).

v. *pleurota* (FLK.) VAIN.

Godthaab District: Godthaab (KR),—Ameralik (V),—Simiútat (H).

Frederikshaab District: Arsukfjord: Bjørnedalen ÷ (D), Kungnait Z (D), Ivigtut Z (D),—Borgshavn Z, Z + u (D).

Julianehaab District: N. Sermilik: Isaromiut Z (D).—Tunugdliarfik: (V), Narssaq S (D), Ilímaussaq 1200 m (D), Tunuarmiut Z (D), Qagsiarssuk Z + u (D), Qíngua ÷ (D), 3 km west of Qíngua 300 m (D),—Uperniviarssuk v. Kangerdluarssuk Z + u (D),—Julianehaab Z (D).—Igalikofjord: Igaliko Z (D), Eqaluit Z + u (D).—Agdluitsoq: (V), Sletten Z (D), 4 km east of Sletten Z + u (D).

Cladonia coccifera is widespread in the district, and is frequently found especially on soil of a rather firm consistency for instance on knolls in bogs, but also on gravel and on earth in rockfalls.

Different from other parts of the Arctic (the rest of Greenland, Iceland, Spitsbergen, Novaya Zemlia) the *Cl. coccifera* v. *pleurota* is much more common in South West Greenland than *Cl. coccifera* v. *stemmatina*.

This is a distinctly southern feature, for instance in Middle Europe the *Cl. coccifera* v. *pleurota* is still more dominant than in Greenland.

The varieties are here distinguished after their morphological characters. ZOPF examined material from Europe chemically and found that the *stemmatina* forms contained barbatinic acid, and no zeorine. The *pleurota* forms, on the other hand contained zeorine and no barbatinic acid. As these characters were correlated with the morphological characters ZOPF determined *Cl. coccifera* v. *pleurota* as species by itself, *Cl. pleurota*, different from the *Cl. coccifera* v. *stemmatina* which was called *Cl. coccifera* proper. As far as Europe is concerned his results were confirmed by ASAHINA (1939 I). ASAHINA then examined (1939 II) the Japanese forms of *Cl. coccifera* and *pleurota* and found that they all contained zeorine and lacked barbatinic acid, in spite of the fact that he also had forms which according to morphology hardly could be distinguished from European *Cl. coccifera* v. *stemmatina*. ASAHINA chose to classify all Japanese forms under the species *Cl. pleurota* because of their contents of lichen acid, alleging that chemistry is more important for the classification of species of lichens than the morphological characters in question.

I have examined extracts from almost all my samples of *Cl. coccifera* s. l. in the following way: One podetium was extracted in the extraction tube with cold benzene, and the benzene evaporated on the object glass. In all cases yellow crystals of usninic acid were obtained. The zeorine, if present, is found together with the usninic acid. The zeorine is identified in the following way: The usninic acid-zeorine mixture is heated cautiously under a cover glass with G.A.An. until practically all usninic acid is dissolved. After a day and sometimes even a longer period, the zeorine crystallizes in pyramids or often compound and lengthened hexagon pyramids and prisms showing extinction along the axis of the pyramid. The double refraction is low and the crystals colourless. Together with the zeorine crystals, colourless plates or bundles of plates of an aniline salt of the usninic acid or a decomposition product of usninic acid occur (Plate IV, Fig .1). In the cases where I found zeorine in the lichen, a Z is added after the locality.

The podetia were then cautiously washed in cold benzene until all usninic acid and zeorine were removed. The podetia were then extracted with acetone in the extraction tube, and the acetone evaporated on the object glass and the residue re-crystallized in GE. Then different things might occur. In one case I got the characteristic square crystals of barbatinic acid (indicated by a B after the locality), in another case the characteristic grits of squamatic acid crystallized, showing a high double refraction and often super-normal interference colours (green is very frequent)—(indicated by an S after the locality). The contents of squa-

matic acid may indicate certain forms of *Cl. deformis* but confusion with this species is here out of the question. The *Cl. coccifera* v. *pleurota* concerned has no trace of mealy soredias, and is rather more related to *Cl. coccifera* v. *stemmatina* than to *Cl. deformis*. In some cases I got needles or bundles of needles which sometimes resemble certain forms of psoromic acid crystals. (Plate IV, Fig. 2). They were, however, much smaller and often curved. As the *coccifera* forms are P —, psoromic acid is out of the question. I have not been able to identify this acid with certainty with any acid described by ASAHINA in his papers on Cocciferae, but it may be didymic acid, which I on account of lack of material have been unable to confirm. In the cases where I have found these crystals, an u is added after the locality.

With some samples I did not succeed in finding any lichen acid besides the usninic acid. They are marked with a— ÷ after the locality.

Considering these micro-chemical results, one arrives at the following conclusion: In the different *Cl. coccifera* forms there are several different combinations of lichen acids. To some degree they are correlated with the morphologic characters, (the combination Z + u only in *pleurota*, B only in *stemmatina*) but otherwise the correlations are very uncertain. This probably indicates that the production of lichen acid in the *Cl. coccifera* forms is not stabilized, and thus of little value as a systematic character. Thus the chemical distinction between the *Cl. coccifera* v. *stemmatina* and the v. *pleurota* fails. It will therefore probably be most correct not to consider them as different species, but as varieties of the same species.

About the difference between *Cl. carneola* and *Cl. coccifera* see p. 112.

9. *Cladonia deformis* (L) HOFFM.

Godthaab District: Godthaab (TH. FRIES),—Kobbe Fjord (Fylla-Exp.),—Simiûtat (H).—Agdlumersat: Eqaluit (KORN.), At the mouth of the fjord (KR).

Frederikshaab District: Neria (EUGENIUS).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (SCHIØDT, D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Tasiussaq (D).—Tunugdliarfik: (V), Narssaqfjell (D), Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D),—Uperniviarssuk (D),—Julianehaab (D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten 325—375 m (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D),—Tasermiut (V),—Frederiksdal (V).

Cl. deformis is very common in the whole district. This is once more a southern feature. It lives on knolls in bogs and among shrubs, but also on good soil in rockfalls and below rocks, preferably not too exposed.

Cl. deformis contains usnininc acid. Some forms from Qordlortorssuaq were remarkably green, but they contain usninic acid in small quantities and must consequently be considered as yellow from a chemical point of view. (The yellow colour of many *Cladonias* is due to usninic acid—see also *Cl. mitis*).

ASAHINA (1939) has divided *Cl. deformis* into two species, after their content of lichen acids, the *Cl. crenulata* containing zeorine and *Cl. gonecha* containing squamatic acid. I have examined almost all my specimens of *Cl. deformis* for squamatic acid and zeorine. The zeorine is found by the procedure described under *Cl. coccifera*, the squamatic acid by first extracting the usninic acid and zeorine with hot benzene, and afterwards extracting the squamatic acid with acetone and evaporating the acetone on object glass and recrystallize out of G.E. I then got crystals as mentioned under *Cl. squamosa* (see p. 91). All my plants proved to contain squamatic acid, none of them zeorine. Thus they belong chemically to the *gonecha* type. As the only certain distinctive character between the *Cl. gonecha* (ACH.) ASAHINA and *Cl. crenulata* FLK. em. ASAHINA is the chemical, I consider it doubtful whether they are to be regarded as independent species. *Cl. deformis* is easily distinguished from all forms of *coccifera* by the mealy soredia of the podetia.

10. *Cladonia bellidiflora* (ACH.) SCHAER.

Godthaab District: Godthaabsfjord: Qôrnoq (1927),—Godthaab (RINK, KR),—Kook Øer (TH. FRIES),—Qarajaq Ilua (KR),—Head of Agdlumersat (KR).

Frederikshaab District: Neria (EUGENIUS).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (SCHIØDT, D), Smallesund (KORN.),—Borgshavn (D).

Julianehaab District: Josvaminen (D),—Qagssimiut (D).—N. Sermilik: Tassiussaq (D).—Tunugdliarfik: Narssaq (D), Narssaqfjell 650 m (D), Western side of Narssaqfjell (D), 3 km northeast of Narssaqfjell 700 m (D), Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D),—Uperniviarssuk (D),—Julianehaab (Lund, D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik (D), Igaliko (D), Upernivik (D).—Agdluitsoq: Sletten (D), 3 km east of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D),—Nanortalik (V),—Ujaragsuit (V),—Qeqertatssiak (E).

Cladonia bellidiflora is very common, only in the most continental districts it does not seem to be so common. It is generally found in rockfalls together with *Cl. amaurocraea* and other species of *Cladonia*. It prefers a little shadow, and often grows in the deep holes between the rocks in the rockfalls. Besides it is often found among *Salix* shrubs in moist places.

Cl. bellidiflora is a rather variable species. The main form (*coccocephala*) is most common, whereas the f. *subuliformis* and f. *polycephala* are not so frequent. The f. *Hookeri* does not seem to be common (Tunuarmiut).

Cladonia bellidiflora contains usninic acid and bellidiflorin.

11. *Cladonia amaurocraea* (FLK.) SCHAER.

Godthaab District: Ameralik (V),—Kavssissagdlit (H).

Frederikshaab District: Arsukfjord: Kungnait (D),—Borgshavn (D).

Julianehaab District: Josvaminen f. *oxyceras* (D),—Qagssimiut (D).—N. Sermilik: Isaromiut c. ap. (D), Tasiussaq (D).—Tunugdliarfik: Ilímaussaq 1200 m (D), Qagssiarssuk (D), Qíngua (D), 3 km west of Qíngua 300 m f. *oxyceras* et f. *celotea* (D),—Uperniviarssuk (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 1000 m. f. *oxyceras* (D), Igaliko f. *fasciculata* (D),—Upernivik (D).—Agdluitsoq: 3 km south of Sletten f. *oxyceras* et f. *celotea* (D), 4 km east of Sletten (D), Qordlortorssuaq f. *crassipeda* (D).

Cl. amaurocraea is quite common in the whole district. It is often found in rockfalls and on rocks, often together with *Cl. bellidiflora* and others. It is a quite variable species. Where nothing is remarked the plant may more or less clearly be classified among the f. *celotea*, that is considered the typical form. Otherwise the forms (f. *oxyderas* and f. *crassipeda*) without cups are rather common.

Cl. amaurocraea contains usninic and barbatinic acid. (ASAHINA). *Cl. amaurocraea* and *Cl. uncialis* are rather hard to distinguish after their morphological characters in Arctic material. In Europe this is usually simple. The best distinguishing characters are: *Cl. amaurocraea* has cups, *Cl. uncialis* never has cups. *Cl. uncialis* has open and bristling branch angles, a feature very rare in *Cl. amaurocraea*. The *Cl. amaurocraea* is usually more slender than *Cl. uncialis* and is often, at least in Europe, of a brighter colour. There are also chemical differences. *Cl. uncialis* contains squamatic acid, the *Cl. amaurocraea* contains barbatinic acid. These acids are found in the following way: Some podetia are put into the extraction tube, and left for 5 minutes with as little benzene as possible. The benzene containing the usninic acid is rejected and the

rest of the usninic acid extracted with some new benzene. Then all lichen acid is extracted with hot acetone and the acetone evaporated on the object glass. Usninic acid which possibly may be left is washed away by means of cold benzene and the residue is recrystallized by GE. If there is barbatinic acid present, barbatinic acid crystals as described under *Cl. Floerkeana* are obtained. If there is still some usninic acid left, broad, thin plates or squares will appear, which in contradistinction from usninic acid have an inclined extinction, often with transition forms to the typical barbatinic acid crystals. If squamatic acid is present, typical squamatic acid crystals will appear as described under *Cl. squaamosa.*

This method has one defect: If there is little barbatinic acid, the barbatinic acid can be dissolved together with the usninic acid. But I have not succeeded in finding any better method. Pyridine salt, in other cases used for ascertaining the presence of barbatinic acid, cannot be used, as usninic acid, squamatic acid and barbatinic acid all give almost identical crystals with G.W.Py.

The chemical characters are, however, of very good service as regards Arctic forms. In the Arctic the tips of the podetias often freeze so that cups cannot develop, and *oxyceras* and *crassipeda* forms are also rather common. But it is hopeless to distinguish them on the basis of their general appearance only without any chemical determination keys. There are typical specimens of *uncialis*, but typical forms of *Cl. amaurocraea* are neither known from Spitsbergen nor from North East Greenland. Therefore all plants from these districts have been classified under *Cl. uncialis.* I have succeeded in finding barbatinic acid in specimens which as regards general appearance are related to *Cl. amaurocraea*, and which therefore ought to be classified under the *Cl. amaurocraea* from both places. Nevertheless the *Cl. uncialis* is probably more common than *Cl. amaurocraea*, but the latter exists in some places. Several plants which have been tested contained neither barbatinic acid nor squamatic acid, while some of an *uncialis* character contained squamatic acid. It appears that the production of squamatic acid and barbatinic acid in this case shows a very good correlation with the morphological characters. I have never found any contradiction between chemistry and morphology in this case.

12. *Cladonia uncialis* (L) Web.

Godthaab District: Godthaab (Rink),—Kobbe Fjord (Fylla-Exp.),—Ameralik (V),—Kugssuaq (Korn.),—Tuluvartalik (KR).

Frederikshaab District: Frederikshaab cum. *Cl. rangiferina* (V).—Arsukfjord: Kungnait (D), Ivigtut (Schiødt, D), Smallesund (Korn.), —Borgshavn (D).

Julianehaab District: Josvaminen (D).—N. Sermilik: Tasiussaq (D).—Tunugdliarfik: 3 km northeast of Narssaqfjell 700 m (D), South of Kiagtút (PORSILD), Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D),—Uperniviarssuk (D),—Upernivik (D).—Agdluitsoq: Qagdlumiut (D),—Nanortalik (V).

Cl. uncialis is a very common species in the district, certainly it is more common than indicated by these localities, and probably even more common than the *Cl. amaurocraea*. Because of the uncertainty in distinguishing it from *Cl. amaurocraea*, I dare not trust my diary notes in the field which indicate that it was found in almost every place visited in 1937. It is mostly found in rockfalls or on rather damp soil.

Cl. uncialis contains usninic acid and squamatic acid. *Cl. uncialis* has usually a brighter colour in the Arctic than its relatives in more southern districts. As regards how to distinguish it from the *Cl. amaurocraea*, see that species.

13. *Cladonia scabriuscula* DEL.

Frederikshaab District: Arsukfjord: Kungnait (D).

Julianehaab District: Igalikofjord: Eqaluit (D), Igaliko c. ap. (D).—Agdluitsoq: Sletten (D).

Far from common in the district. It lives in rockfalls, often some distance down between the stones. At Igaliko it was found among *Salix* shrubs. The plants were always typical and well developed.

Cl. scabriuscula contains fumar-protocetraric acid. (Pd+rub.).

14. *Cladonia crispata* (ACH.) FLOT.

v. *infundibulifera* (SCHAER.) VAIN.

Frederikshaab District: Arsukfjord: Bjørnedalen (D).

Julianehaab District: Tunugdliarfik: 3 km northeast of Narssaqfjell 300 m (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D),—Uperniviarssuk (D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: Sletten (D).

v. *virgata* (ACH.) VAIN.

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).

Julianehaab District: Josvaminen (D).—N. Sermilik: Tassiussaq (D).—Tunugdliarfik: 3 km northeast of Narssaqfjell 700 m (D), Tunuarmiut (D), Qíngua (D), 3 km west of Qíngua 300 m (D),—Uperniviarssuk (D).—Igalikofjord: Igaliko (D),—Upernivik (D).—Agd-

luitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).

v. *dilacerata* (Schaer.) Malbr.

Godthaab District: Qarajaq Ilua (KR).

Frederikshaab District: Arsukfjord: Bjørnedalen f. *elegans* (D), Kungnait (D), Ivigtut f. *elegans* and f. *rigidula* (D).

Julianehaab District: Josvaminen f. *elegans* (D),—Qagssimiut f. *elegans* (D).—N. Sermilik: Isaromiut f. *rigidula* (D), Tassiussaq f. *rigidula* (D).—Tunugdliarfik: Western side of Narssaqfjell f. *elegans* and *f. rigidula* (D), Narssaqfjell f. *elegans* (D), Tunuarmiut *typica* and *f. rigidula* (D), Qagssiarssuk f. *elegans* (D), Qíngua (D), 3 km west of Qíngua 300 m f. *rigidula* (D).—Kangerdluarssuk: Eqalugarssuit (D),—Julianehaab (D).—Igalikofjord: Eqaluit *typica* and f. *rigidula* (D),—Upernivik f. *elegans* (D).—Agdluitsoq: Sletten *typica* and *rigidula* (D), 3 km south of Sletten f. *rigidula* (D), 4 km east of Sletten (D), Qagdlumiut (?) (D), Qordlortorssuaq *typica*, f. *elegans*, and f. *rigidula* (D),—Tasermiut (V).

v. *gracilescens* (Rabh.) Vain.

Julianehaab District: Qagssimiut (D).

Cl. crispata is very common and widespread in many different forms in South West Greenland. The most common variety is probably the v. *dilacerata* among which the forms *elegans* and *rigidula* are rather frequent, whereas the typical form is more scarce. Almost quite as common is the v. *virgata*, in accordance with the fact that Greenland is an arctic-subarctic district. Squamulose forms (f. *Kairamoi*) are common. The variety being the most common in Norway the v. *infundibulifera* has a more limited distribution and lives mostly, though not without exceptions, in more continental districts. The v. *gracilescens* has only been found in one place, and the v. *cetrarioides* has not been found at all. Where there are no remarks in connection with the locality it is the typical form which has been found.

It is remarkable that the squamulose forms of v. *dilacerata* are so widespread. As far as I know (South East Greenland possibly excepted) there is no other district where such forms are so frequent. As these forms often bear very close resemblance to forms of the *Cl. squamosa* v. *levicorticata*, and as this variety of the *Cl. squamosa* is very common in Greenland, it is very difficult to distinguish the forms of the *Cl. crispata* from those of the *Cl. squamosa.*

This was the most difficult problem I came across while examining my material from South West Greenland. The forms overlap in various

ways, and it is not possible to set up any single character by which they can be distinguished. The words of VAINIO are the only consolation: "Dans les Cladoniens les plus souvent c'est plutôt l'ensemble des caractères que les propriétés spéciales que caracterise les espèces. Chacun des caractères spéciaux peut varier, mais ensembles, réunis d'une facon caractéristique, ils constituent la note spécifique l'espèce de ses congénères."

In their typical form they are easily distinguished. *Cl. crispata* has usually a smooth bark and toothed, prolificating cups, whereas *Cl. squamosa* has no cups and has squamules which seem to develop in the following way: The cortex is chapped and the lower parts of the squares thus developed, start growing. In this way they turn into squamules of a certain type, which I will name "micro-squamules." There will always be pieces without cortex between the micro-squamules and they will also mostly be smaller than the ordinary type of squamules characteristic of *Cl. crispata.* Between the ordinary squamules the cortex is here usually intact. These two types of squamules are not always easy to distinguish, especially in older stages of development.

Cl. squamosa has mostly wider open branch angles than *Cl. crispata. Cl. crispata* is also in most cases more transparent than *Cl. squamosa.* There is ,however, hardly one of the characters mentioned, from which there is no exception. Whether one form is to be considered as belonging to the one species or to the other depends on the fact whether it is possible in a large material to find transitions in direction of the one species or the other. This has been possible in some cases in the material from South West Greenland. The best way to distinguish the two complexes of forms which belong to *Cl. squamosa* and *Cl. crispata* is probably to make a determination key to the formae of the two species which cause difficulties at the determination.

A. With toothed, prolificating cups.
   a. Small podetias, less than 2 cm high with broad cups, microsquamulated
      Cl. squamosa v. *levicorticata* f. *pseudocrispata* SANST.
   b. Podetias of other types..... *Cl. crispata* v.

B. Without toothed cups.
   a. With no pieces of cortex left between the squamules (A relatively large material should be examined)..... *Cl. squamosa* v.
   b. With pieces of cortex left between the squamules.
      I. Cortex smooth, without microsquamules..... *Cl. crispata* v.

II. Cortex chappy with microsquamules.

1. Pod. with microsquamules or an areolated chappy cortex, no ordinary squamules
Cl. squamosa v. *levicorticata* SANST.

2. Pod. with microsquamules and ordinary squamules.

' Pod. slender, richly branched, mostly more than 3—4 cm with large squamules, younger parts with smooth cortex, in older parts cortex is often lacking
Cl. crispata v. *dilacerata* f. *elegans* (DEL.)

'' Pod. shorter, often more rigid and coarse, mostly with few branches.

+ Pod. tapering towards the tip, the branch-tips stiffly erected, often split
Cl. crispata v. *dilacerata* f. *rigidula* ARN.

++ The tops of the podetias broader and the branches often divergent.....*Cl. squamosa* v. *levicorticata* SANST.....

Cl. crispata contains squamatic acid, just like *Cl. squamosa*, so that we get no help from chemistry. How to identify squamatic acid, see *Cl. squamosa*. How to distinguish *Cl. crispata* from *Cl. Delessertii*, see the latter (p. 90)

Cladonia Novae-Angliae MERRILL. A plant by this name was distributed by MACOUN: Canadian Lichens No. 148 from Gaspé. I cannot see that it has been published elsewhere in any other way. The specimen in the Oslo herbarium is undoubtedly a form of *Cl. crispata* being closely related to the v. *dilacerata* or the v. *virgata*.

15. *Cladonia Delessertii* (NYL.) VAIN.

Frederikshaab District: Arsukfjord: Kungnait *typica* et *atypica* (D). Julianehaab District: Qagssimiut *typica* (D).—N. Sermilik: Tassiussaq *typica* (D).—Kangerdluarssuk: Eqalugarssuit *typica* (D),—Upernivik *typica* (D).—Agdluitsoq: 3 km south of Sletten 325—375 m *atypica* (D), 4 km east of Sletten *atypica* (D).

Cl. Delessertii is quite common in the outer fjord districts. Farther inland it is more rare or missing.

Among my material there are two types of *Cl. Delessertii*. One of them, which is considered typical, corresponds very closely to the Sanst. Clad. Exsicc. 737 and has stout podetias, smooth cortex, and short branches protruding nearly at right angles from the trunk branches, and the branch angles are wide open. The other type is considered as

atypical and has been called f. *tenuior* or f. *trichotera*. It has a more delicate frame, mostly antenniform tips, the cortex often areolated of the same type as is seen in *Cl. squamosa* developing into squamules, short branches are rare and phyllocladia are often seen at the basis. There are often several trunk branches protruding around one opening in the podetia, a phenomenon never seen in the typical form, and the openings in the branch angles are mostly narrower than in the typical form. These two forms have different distribution. From the Arctic (except from West Greenland) there are in the Oslo herbarium only specimens of the a-typical form. In South West Greenland the typical is more common than the a-typical one. In Scandinavia the typical is far more frequent than the a-typical.

There are also plants which probably must be considered as transitions between both forms.

Cl. Delessertii contains squamatic acid. It may be distinguished from forms of *Cl. crispata*, by never bearing cups and in the character that the cracks between the pieces of cortex at the basis are coloured black. The latter character also distinguishes *Cl. Delessertii* from forms of *Cl. squamosa.*

16. *Cladonia squamosa* (SCOP.) HOFFM.

v. *phyllocoma* f. *muricella* (DEL.) VAIN.

Frederikshaab District: Arsukfjord: Bjørnedalen (D).

Julianehaab District: N. Sermilik: Tasiussaq (D).—Tunugdliarfik: Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D),—Uperniviarssuk (D). Agdluitsoq: 4 km east of Sletten (D), Qordlortorssuaq (D).

v. *levicorticata* SANST.

Frederikshaab District: Arsukfjord: Bjørnedalen f. *turfacea* (D), Kungnait f. *pseudocrispata* and f. *turfacea* (D), Ivigtut f. *turfacea* and ad. f. *polychonia* (D).

Julianehaab District: Qagssimiut f. (D).—N. Sermilik: Tasiussaq f. *turfacea* (D).—Tunugdliarfik: Tunuarmiut f. *turfacea* (D), Qíngua f. *turfacea* (D), Uperniviarssuk f. *turfacea* (D),—Julianehaab f. *pseudocrispata* and f. *turfacea* (D).—Igalikofjord: Eqaluit f. *turfacea* (D),—Upernivik f. *turfacea* and f. *subtrachynella* (D).—Agdluitsoq: Sletten f. *turfacea* (D), 3 km south of Sletten f. *turfacea* (D), 4 km east of Sletten f. *turfacea* (D), Qagdlumiut f. *turfacea* (D), Qordlortorssuaq f. *turfacea* (D),—Nanortalik (E).

It is remarkable that only corticate froms of *Cl. squamosa* are known from South West Greenland. The froms dominating are the v.

phyllocoma f. *muricella* and v. *leviorticata* f. *turfacea*. The latter is by far the most common and is found all over the district visited in 1937. The former seems to prefer more continental districts. *Cl. squamosa* is found as far north as Disko: Eqalunguit: Itivnerit (Porsild) (Hb. Copenh.) and is probably also to be found in the districts between Disko and Arsukfjord.

The fact that both forms found are of the corticate type makes it very difficult to distinguish them from *Cl. crispata*. Regarding this problem see *Cl. crispata*.

Cl. squamosa contains squamatic acid. This may be extracted by means of acetone, but not by benzene. The residue when the acetone is evaporated, gives when recrystallized of GE small crystals under the microscope looking like rice grains. They are usually not more than a few μ in length, but show vivid, often super-normal (green) interference colours under crossed nichols, (Plate IV, Fig. 4). If the residue is recrystallized of G.W.Py the result is the pyridine salt crystallizing in small plates or parallelograms, very like those appearing when barbatinic acid is tested in the same way.

If squamatic acid is repeatedly heated with GAAn till bubbles appear under the object glass, red, characteristic crystals appear (Plate IV, Fig. 3) after abt. 24 hours. The same kind of crystals appear when barbatinic acid is treated in the same way. This must probably be an aniline compound of a decomposition product of these acids, which chemically are closely related.

17. *Cladonia cenotea* (Ach.) Schaer.

Godthaab District: Ameralik (V).

Julianehaab District: Agdluitsoq: Qordlortorssuaq (D).

Cladonia cenotea is one of the rarest *Cladonia* species in Southern Greenland. At Qordlortorssuaq the species was found abundantly on old trunks in the birch forest.

In the Copenhagen herbarium there is one specimen collected by Porsild at Disko: Engelskmandens Havn.

Cl. cenotea contains squamatic acid.

18. *Cladonia turgida* (Ehrh.) Hoffm.

Frederikshaab District: Arsukfjord: Bjørnedalen (D) Kungnait (D).

Julianehaab District: Tunugdliarfik: Ca. 3 km north-east of Narssaqfjell 600 m (D), Qagssiarssuk (D),—Uperniviarssuk (D).—Agdluitsoq: Qagdlumiut (D).

Not very common, and scarce in each place where it was found. But the plants are well developed. In most places the podetias are well developed while the basal phyllocladia are few or lacking. *Cl. turgida* contains atranoric acid and fumar-protocetraric acid. When the podetias are well developed and the basal phyllocladia not, the plant may bear some resemblance to *Cl. uncialis* from which it, however, is distinguished by more irregularly caved podetia, and by the content of lichen acids. If the basal phyllocladia are well developed, it may be confused with *Cl. macrophyllodes*. It has, however, thinner phyllocladia than *Cl. macrophyllodes*.

19. *Cladonia cariosa* (ACH.) SPRENG.

Frederikshaab District: Arsukfjord: Kungnait (D).

Julianehaab District: N. Sermilik: Isaromiut contains metylether salazinic acid (D).—Tunugdliarfik: Oordlortoq contains psoromic acid (D), Qagssiarssuk contains unknown lichen acid (D), Qíngua (a—b)+, also typical (D), 3 km west of Qíngua (D).—Igalikofjord: Sigssardlugtoq (D).—Agdluitsoq: 3 km south of Sletten, contains metylether salazinic acid (D), Qagdlumiut contains metylether salazinic acid; specimens containing unknown lichen acid are also to be found (D).

Cl. cariosa is quite widespread in the area visited in 1937, especially in districts with a continental climate. The specimens are often typically developed, with podetia.

If European material is examined the *Cl. cariosa* group causes the systematist few difficulties. All species of the *Cl. cariosa* group give the reaction Pd+yellow and afterwards orange-yellow → orange-red; in *Cl. cariosa*, however, the reaction may be very weak or completely missing. The reaction Pd+rubescens, which is so frequently met with in *Cladonia* and which is due to fumar-protocetraric acid, is never seen. It is also characteristic of the group that pycnidia develop on the phyllocladia.

Cl. subcariosa contains norsticnic acid. It therefore gives the reaction K+rub, and if a piece of thallus is placed under the cover glass on an object-glass with KOH, red crystal needles of norsticnitic potassium will appear under the microscope. *Cl. cariosa* and *Cl. symphycarpea* both contain atranoric acid. They are easily distinguished. *Cl. cariosa* has smaller squamules, with no tendency of horizontal spreading, whereas *Cl. symphycarpea* has larger squamules, which especially towards the edge are distinctly more or less horizontal. In the middle of the pads the squamules are often pressed up, probably for lack of space, so that they stand more or less vertical. In *Cl. symphycarpea* the squamules are

mostly well developed and somewhat stout, scarcely branched podetias are poorly developed. In *Cl. cariosa* the podetia are well developed, very areolated, and often split up in more branches, whereas the squamules are poorly developed.

Cl. symphycarpea lives in mild districts on rocks of lime among moss, *Cl. cariosa* occurs mostly on somewhat acid soil, often on sand. There are also chemical differences. *Cl. symphycarpea* gives an immediate reaction P + citrine, afterwards the colour turns more orange. *Cl. cariosa* gives the reaction Pd — or Pd + slowly, with a faint, yellow colour, and afterwards, in rare cases, more orange. If squamules or podetias of *Cl. symphycarpea* and *Cl. cariosa* are extracted with benzene to remove the atranoric acid, and then with acetone and the acetone has evaporated on the object-glass, *Cl. cariosa* gives a residue which is hardly visible, gives no light under crossed nichols (indicated by (a—b-), *Cl. symphycarpea* gives a white residue (a— b +) which lights up under crossed nichols, and which recrystallized from GE gives trichitic spheres or very thin needles. When present in some quantities, red needles and bundles of needles appear, or thin prisms appear with KOH, exactly corresponding with the description of ASAHINA (1934) of the potash salt of norstictinic acid and methylether salazinic acid. This is in accordance with the previous suppositions of ASAHINA. This substance is missing, or is in any case only present in very small quantities in *Cl. cariosa*, whereas it occurs in large quantities in *Cl. symphycarpea*. The distinct reaction of *Cl. symphycarpea* with Pd is caused by the methylether-salazinic acid.

Turning to collections from Arctic regions we find the matter more complicated. I have not succeeded in finding any specimen corresponding to *Cl. symphycarpea* as far as general appearance is concerned and containing methylether salazinic acid. It would have been surprising if the *Cl. symphycarpea* with its southern distribution and xerotherm ecology, at least according to Scandinavian standards, should have been present in the Arctic. Nor has the *Cl. subcariosa* been found. All Arctic plants classified under *Cl. cariosa* and examined by me, contain atranoric acid.

In the Oslo herbarium there are a few plants which give a red colour with Pd and therefore must be supposed to contain fumar-protocetraric acid. In my opinion these plants cannot be classified as belonging to the *cariosa* group. They are probably poorly developed specimens of *Cl. subcervicornis*, *macrophyllodes* or *Cl. neglecta Pocillum* v. *pachythallina*. At such a stage of development it is often hopeless to decide the species definitely.

The remaining part of the material gave the reaction Pd — or +, either with a light yellow colour or with a deep yellow colour afterwards

turning orange. The plants proved to be a— b— in all cases where the squamules were Pd— or turning slowly yellow. In this category were included all plants having well developed podetia. This fact is a proof that the plants were genuine *Cl. cariosa*. I consider it doubtless that there is a large material of genuine *Cl. cariosa* from the Arctic, and that *Cl. cariosa* is widespread.

The plants reacting Pd+ yellow afterwards turning orange, also were a— b+. In some cases I could establish that the residue consisted of a metylether salaqinic acid. The plants in question were not *Cl. symphycarpea*, as none of the specimens had the coarse horizontal squamules characteristic of the latter. The residue from some plants to my surprise proved to be psoromic acid (as for determination of psoromic acid see p. 95).

In some cases from South Western Greenland I had plants bearing some resemblance to *Cl. symphycarpea* as far as general appearance is concerned. They were a— b+ and reacted P+ yellow-orange, but they contained neither *a*-methyleter salazinic nor psoromic acid. Towards the edge of the residue after the extraction with acetone small needles will crystallize. If the residue is recrystallized of GE the residue will melt, and on cooling thin needles appear in the melted residue. What kind of acid this is, I cannot tell definitely.

Thus it proves that Arctic *Cl. cariosa* consists of chemically different units. I have not succeeded in finding any certain morphologic difference between them. A certain difference may, however, perhaps be found: The genuine *Cl. cariosa* forms have more often podetias and the squamules are rarely horizontal. The forms giving a— b+ have mostly slightly horizontal squamules especially towards the edge. Podetias are rare and when they are found, they are poorly developed. The podetias are also slightly different. Often the medulla of the podetia with their characteristic longitudinal structure is not so clearly visible as with the genuine *cariosa* forms, but they are more of the *Cl. symphycarpea* type. The character is, however, not constant, and I do not venture upon classifying the Arctic *Cl. cariosa* forms in different species on the basis of such a small material only and such unprecise characters. Perhaps a thorough anatomical examination will give some results.

The *Cl. cariosa* group is easily distinguished from resembling species by the fact that it contains atranoric acid, and by the reaction Pd— or yellow to orange (never Pd+red).

20. *Cladonia alpicola* (FLOT.) VAIN.

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Ivigtut (D). Julianehaab District: Tunugdliarfik: Narssaq (D), Tunuarmiut (D), Qagssiarssuk (D), 3 km west of Qíngua (D),—Julianehaab (D).—

Igalikofjord: Eqaluit (D), Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten 325—375 m (D), 4 km east of Sletten (D), Qagdlumiut (D).

Cladonia alpicola is quite common in Southern Greenland in rock-falls, often well developed with apothecia.

Cl. alpicola is the only Arctic *Cladonia* containing psoromic acid. Psoromic acid is readily recognized in the following way: It gives the reaction Pd + yellow-orange (not red as the fumar-protocetraric acid). By extraction with acetone, by evaporation of the acetone on the object glass, and by recrystallization of the residue of GE, large dentritic crystals of psoromic acid are obtained (Plate V, Fig. 1).

21. *Cladonia decorticata* (Flk.) Spreng.

Frederikshaab District: Arsukfjord: Kungnait (D).

Certainly rare, and only present in small quantities at the only place where it was found. The specimens are typical. This is the only known locality in the Arctic, if South West Greenland is to be considered as being an Arctic district. It has been recorded from Iceland (Lynge 1940, p. 30) but the specimens belong to *Cl. acuminata* v. *Norrlini*. Lynge also agreed with this determination.

If a podetium of *Cl. decorticata* is extracted with acetone in the extraction tube, the acetone evaporated on the object glass, the residue will melt. In the melting small needles or bundles of needles crystallize after a couple of days. What kind of lichen acid this is, I do not know.

Cl. decorticata is distinguished from *Cl. alpicola* and *acuminata* by the distinct squamules on the podetias, being more like those of *Cl. squamosa*. There are also chemical distinguishing characters. *Cl. decorticata* contains an unknown lichen acid, whereas *Cl. alpicola* contains psoromic acid and the *acuminata* forms contain atranoric acid and a derivative of salazinic acid. *Cl. decorticata* may also be mistaken for a *Cl. squamosa*, but is distinguished from the latter by exhibiting a coarse and distinct medulla. It has no, or only a few, branches, the branch angles are closed, and the squamules are thick. There are also chemical differences, *Cl. squamosa* containing squamatic acid, which is lacking in *Cl. decorticata*.

22. *Cladonia acuminata* v. *Norrlini* (Vain.) E. Dahl comb. nov.

Julianehaab District: N. Sermilik: Isaromiut (D).—Tunugdliarfik: Tunuarmiut (D), Sitdlisit (D), Qordlortoq (D), Qíngua (D),—Julianehaab (D).—Agdluitsoq: Sletten (D), c. 4 km east of Sletten (D), Qagdlumiut (D).

Cl. acuminata v. *Norrlini* is considerably rarer than *Cl. alpicola*, and there were only few specimens in each place. It seems to have a somewhat continental distribution, the plants from Julianehaab being poorly developed.

All plants from South West Greenland gave the reactions K+ yellow, Pd+ yellow-orange. *Cl. acuminata* contains atranoric acid causing the yellow colour with KOH. If a squamule of a genuine *Cl. acuminata* is placed under a cover glass together with a solution of 5% KOH + 10% K_2CO_3, red crystal needles disengage from the tips of the squamules. According to ASAHINA this is due to norstictinic or *a* metylether salazinic acid. The closely related *Cl. Norrlini* VAIN. contains atranoric acid and a substance which to judge by its reactions might be *b*-metylether salazinic acid. It often gives only a faint yellow colour with Pd.

Cl. Norrlini bears a very close resemblance to *Cl. acuminata*. As to general appearance I can see no difference at all. It seems as if the production of norstictinic acid in *Cl. acuminata*, especially in the basal squamules, is connected with the parts of the plants which are in the process of growing. It is therefore an obvious conclusion that the production of norstictinic acid may be influenced by ecologic conditions. The consequence should then be that in this case not too much importance should be attached to chemical differences. The most rational thing to do is probably to consider *Cl. Norrlini* to be nothing more than a variety of *Cl. acuminata*.

The *Cl. alpicola-acuminata* group is apparently closely related to the *Cl. cariosa* group. They all have the extraordinary structure of the podetias, the hyphae of the medulla which appear between the squamules, being longitudinally arranged, a phenomenon which is not common in *Cladonia*. Besides, the *Cl. cariosa* group and the *Cl. acuminata* group contains related lichen acids.

The *Cl. acuminata* is easily distinguished from *Cl. alpicola* by the lighter colour and by the chemistry. The latter contains psoromic acid, the former, however, contains atranoric acid an a derivative of salazinic acid. The *Cl. acuminata* forms are also more finely grained towards the tip than *Cl. alpicola.*

23. *Cladonia gracilis* v. *chordalis* (FLK.) SCHAER.

Godthaab District: Ameralik (V),—Qarajaq Ilua (KR),—Kavsissagdlit (H),—Kugssuaq (KORN.).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait *typica* et f. *aspera* (D), Ivigtut *typica* et f. *aspera* (SCHIØDT, D),—Borgshavn (D).

Julianehaab District: Josvaminen (D),—Qagssimiut (D).—N. Sermilik:

Isaromiut (D), Tassiussaq (D).—Tunugdliarfik: Narssaqfjell 650 m (D), Western side of Narssaqfjell (D), 3 km northeast of Narssaqfjell 700 m (D), Qissungadalen (D), Ilímaussaq 1200 m (D), Tunuarmiut *typica* et ad v. *elongata* (D), Qagssiarssuk, *typica* et f. *aspera* (D), Qíngua *typica* et f. *aspera* (D), 3 km west of Qíngua 300 m (D)—Uperniviarssuk *typica* et ad v. *elongata* (D)—Julianehaab *typica* et f. *aspera* (D).—Igalikofjord: Eqaluit *typica* et f. *aspera* (Petersen, D), Sigssardlugtoq (D), Igdlerfigssalik (D), Igaliko (D)—Upernivik *typica* et f. *aspera* (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq *typica* et f. *aspera* (D)—Tasermiut (V).

Cl. gracilis v. *chordalis* is widespread and very common in the district in rackfalls and lichen heaths. Some forms, e. g. from Uperniviarssuk, are fairly like *Cl. elongata*. *Cl. gracilis* v. *chordalis* reaches high altitudes.

24. *Cladonia ecmocyna* (Ach.) Nyl.

Godthaab District: Godthaab (Rink, KR)—Kobbe Fjord (Fylla-Exp.)—Kook Øer (Th. Fries)—Kavssissagdlit (H)—Bjørnesund (Korn.)—Malerssorniarfik (H).

Frederikshaab District: Tiningnertôk (Korn.)—Frederikshaab (1927)—Neria (Eugenius).—Arsukfjord: Kungnait (D), Ivigtut (D).

Julianehaab District: Josvaminen (D)—Qagssimiut (D).—N. Sermilik: Isaromiut (D).—Tunugdliarfik: Narssaqfjell (D), 3 km northeast of Narssaqfjell 700 m (D), Ilímaussaq 1200 m (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D)—Julianehaab (Lund, D)—Uperniviarssuk (D).—Igalikofjord: Eqaluit (D), Igaliko (D)—Upernivik (D).—Agdluitsoq: 4 km east of Sletten (D), Qagdlumiut (D)—Frederiksdal (V)—Ikerasagssuaq (V).

Cl. ecmocyna is widespread and common within the district. It prefers snowfields and bogs.

In South West Greenland it is a distinct species, well distinguished from all *gracilis* forms. Besides containing atranoric acid what no *gracilis* does, it is different from the most closely related forms of *gracilis* by having coarse podetia and a smoother cortex. The atranoric acid gives the reaction K + yellow. This has for some time been the only reaction by which *Cl. gracilis* v. *elongata* has been distinguished from *Cl. ecmocyna*. But it has caused some confusion.

Both forms contain fumar-protocetraric acid. (P + red). The fumar-protocetraric acid after a while is dissolved with a brownish colour in

KOH, and against a background of a light-coloured thallus, one may easily get the impression of a K+reaction. In this way forms of *Cl. gracilis* and *Cl. ecmocyna* have been confused.

The atranoric acid present may be identified in the following way: A few pieces of thallus are placed on an object glass and a few drops of benzene are added. This is then heated cautiously by a spirit lamp till the benzene evaporates. Another drop of benzene is added, the pieces of thallus are removed, and the benzene again evaporated. Afterwards a residue of characteristic atranoric acid crystals remain. They have a white colour, and are easily recognized under the microscope. (Plate V, Fig. 2). If atranoric acid crystallizes by evaporation of an acetone solution, branched crystals appear towards the edges. (Plate V, Fig. 3). By recrystallization of GE under coverglass characteristic crystals appear (Plate V, Fig. 4). The only lichen acid which as far as I know is present in *Cladonias* and which may be confused with atranoric acid is usninic acid. If a piece of a thallus containing usninic acid is tested in the same way, usninic acid crystals appear which bear some resemblance to atranoric acid crystals, but have a yellow colour. Recrystallized of GE the crystal forms are rather different (Plate III, Fig. 1).

To show that the chemical and morphological characters are strongly correlated in the *Cl. gracilis-ecmocyna*-group, I proceeded in the following way: After having obtained some understanding of the characteristics of *Cl. ecmocyna* through morphological and chemical studies in the herbarium, I divided my material from Greenland into three groups:

1) Plants which after their general appearance I considered as certain *Cl. gracilis* (49 samples).
2) Plants which after their general appearance I could not determine with certainty. (27 samples).
3) Plants which after their general appearance I considered as certain *ecmocyna* (24 samples).

They were then all put to chemical tests. Of group 1) all proved to be without atranoric acid. Of group 2) all except one proved to be without atranoric acid. Of group 3) all except two proved to contain atranoric acid. Afterwards it was easy to see that the one of group 2) had to be classified under *Cl. ecmocyna* and the two under group 3) under *Cl. gracilis*

At Ivigtut a peculiar form of the *Cl. ecmocyna* was found. Its thallus had irregular cavities and the general appearance was more like *Cl. crispata* v. *dilacerata*. It had irregular prolificating cups and was richly fertile. It undoubtedly deserved a name of its own.

Cl. ecmocyna f. *foveata* E. DAHL, f. nov.

A typo differt ramis principalibus robustis, irregulariter foveatis saepe pocillos proliferos gerentibus. Copiose fructificans.

Locus classicus: Arsukfjord: Ivigtut leg. E. DAHL.

Such are conditions in South West Greenland, and to judge by the herbaria in Oslo and Copenhagen, in the whole of Greenland. All plants in the Oslo herbarium classified under *Cl. elongata* proved to contain atranoric acid, except four. They were found in South West Greenland at Mortensberg, (TORNØE), and at Heimen (BJØRLYKKE), in West Greenland at Sukkertoppen (BERGGREN) and at Kornak (PORSILD). In other places of the world the whole thing is more complicated. In Central Europe there are forms called *Cl. gracilis* v. *elongata* or *Cl. elongata.*

Such plants have a general appearance quite like that of *Cl. ecmocyna*, but it contains no atranoric acid. Typical specimens of the *Cl. elongata* (such as those distributed through the Sanst. Clad. Exsicc.) I have never seen in Greenland, where only more or less fair forms of the *Cl. gracilis* v. *chordalis* and *Cl. ecmocyna* seem to occur. Some forms of *Cl. gracilis* v. *chordalis* are rather like *Cl. elongata*, but as I have seen no quite typical specimens, I should think they are forms of the *Cl. gracilis* v. *chordalis.* Otherwise *Cl. elongata* has a wide distribution. I have seen specimens from Central Europe, Scandinavia, USA, Alaska, and Kamtchatka. I have seen specimens of *Cl. ecmocyna* from Central Europe, Scandinavia, America, Spitsbergen, Novaje Zemlja, Kamtchatka, and Patagonia. As I have not seen enough of *Cl. elongata* in nature, I cannot have any definite opinion as to whether it is a distinct species differing from *Cl. gracilis* v. *chordalis.* I feel convinced, however, that *Cl. ecmocyna* is a good species. This is indicated by its contents of atranoric acid, its geographical distribution, and its ecology different from that of *Cl. gracilis* v. *chordalis.*

25. *Cladonia cornuta* (L) SCHAER. *typica.*

Frederikshaab District: Arsukfjord: Ivigtut (D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Tassiussaq (D).—Tunugdliarfik: Tunuarmiut (D), Sitdlisit (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D)—Julianehaab (D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qordlortorssuaq (D).

Cl. cornuta is rather common in Southern Greenland, especially in the central parts of the fjord district. It is somewhat rarer in the coastal districts. It mostly lives in rockfalls, but is also found in *Salix* shrubs.

A *Cladonia*, the classification of which has cost much trouble, is rather common in the district. It may be classified somewhere between *Cl. cornuta* and *Cl. cornutoradiata*, but is probably most related to *Cl. cornuta*. At any rate, it deserves a name of its own as a variety:

Cl. cornuta typica	*Cl. cornuta* v. *groenlandica* E. DAHL v. nov (Plate II, Fig. 1)[1]
Squamae primariae deciduae	Squamae primariae plerumque perseverantes
Podetia creberrime esquamosa (f. *phyllotheca* basi tantum squamosa)	Podetia creberrime ad basin versus squamosa
Podetia sensum acuminata vel pocillo unico attenuato haud prolifero ornata	Podetia modo simplicia, sensim acuminata vel pocillo terminata, modo ramosa, ramis pocillo terminatis. Pocilla saepe ampla et prolifera, ramis secundariis pocillo terminantibus.
Rami podetiorum raro pocillis instructi	
Sorediae pulverulentae e corticis partitionibus dissolutis, vel in fissuris corticis oriuntur	Sorediae e corticis partitionibus dissolutis vel in fissuris corticis, ubi sorales nascunt, oriuntur
	Sorediae praecipue basales, granulatae
Cortex creberrime cinereofuscus	Cortex creberrime fuscus

Locus classicus: Julianehaab District: Agdluitsoq: Sletten leg. E. DAHL.

Cl. cornuta v. *groenlandica* was found in the following localities. Julianehaab District: Qagssimiut (D).—N. Sermilik: Tassiussaq (D).—Tunugdliarfik: Tunuarmiut (D), Qagssiarssuk (D).—Kangerdluarssuk: Eqalugarssuit (D)—Uperniviarssuk (D)—Julianehaab (D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten 325—375 m (D).

Cl. cornuta v. *groenlandica* is quite widespread in the district and has nearly the same distribution as the typical variety. There was a rich material from various localities. It makes its own complex of forms, well separated from that of the *Cl. cornuta*. The plants of *Cl. cornuta* collected in North East Greenland must probably be classified under v. *groenlandica*. The only European specimen in the Oslo herbarium I have seen which must be classified under v. *groenlandica* is one from Finland: Tavastia australis Leg. LANG, called *Cl. cornuta* f. confirm.

[1]) Possibly identical with *Cl. cornuta f. subdilatata* ASAHINA in Journ. Jap. Bot. Vol. XIX No. 8 p. 229. 1943 (Nov. 1949).

WAINIO. I have also seen *groenlandica*-forms in Rondane in Central Norway occurring in bogs.

Cl. cornuta v. *groenlandica* is very like certain forms of the *Cl. fimbriata* group, especially the *Cl. cornutoradiata*. It differs, however, from the latter by always having a fully developed cortex at the basis. Besides, *Cl. cornutoradiata* has always a more greyish colour.

All *Cl. cornuta* forms contain fumar-protocetraric acid.

26. *Cladonia degenerans* (FLK.) SPRENG.

Frederikshaab District: Arsukfjord: Kungnait f. *cladomorpha* et *dilacerata* (D).

Julianehaab District: *N. Sermilik*: Tassiussaq f. *cladomorpha* et f. *phyllophora* (D), Isaromiut f. *euphorea* et f. *cladomorpha* (D)—Tunugdliarfik: 3 km northeast of Narssaqfjell f. *phyllophora* (D), Narssaqfjell 650—750 m. (D), Ilimaussaq 1200 m (D), Qordlortoq f. *euphorea* (D), Qíngua f. *cladomorpha* et *dilacerata* (D), 3 km west of Qíngua 300 m. f. *euphorea* et *cladomorpha* (D)—Kangerdluarssuk: Eqalarssuit f. *phyllophora* (D)—Uperniviarssuk f. *dilacerata* (D)—Julianehaab f. *cladomorpha* (D)—Igalikofjord: Eqaluit (PETERSEN, D), Sigssardlugtoq f. *euphora* (D), Igaliko (D).—Agdluitsoq: Sletten f. *cladomorpha* et f. *phyllophora* (D), 3 km. south of Sletten f. *cladomorpha* (D), Qagdlumiut f. *cladomorpha* et f. *dilacerata* (D).

Cl. degenerans is quite common in rockfalls. It seems to be able to stand a stronger exposure to the sun and be more resistant to drought than other *Cladonias*.

The most common form is the f. *cladomorpha*. The f. *euphorea* seems to have a more continental distribution. Besides, the f. *phyllophora* and f. *dilacerata* are also found, but more scattered.

Although it has a distribution of a marked southern character, it reaches very high altitudes (1200 m). It is found as far north as Upernivik in Western Greenland (leg. WULFF).

Contains fumar-protocetraric acid.

27. *Cladonia lepidota* NYL.

Frederikshaab District: Island between Avigait and Frederikshaabs Isblink v. *stricta* (1927).—Arsukfjord: Kungnait v. *stricta* (D), Ivigtut v. *stricta* f. *hypophylla* (D)—Borgshavn (D).

Julianehaab District: Josvaminen v. *stricta* (D)—Qagssimiut v. *stricta* (D).—Tunugdliarfik: Narssaqfjell 650 m v. *stricta* (D), Western side of Narssaqfjell v. *stricta* (D), Qissungadalen v. *gracilescens* (D),

Tunuarmiut v. *stricta* et v. *gracilescens* (D), Qíngua v. *gracilescens* (D), 3 km west of Qíngua 300 m v. *stricta* (D)—Julianehaab v. *stricta* (D).—Igalikofjord: Eqaluit v. *gracilescens* (D).—Agdluitsoq: 3 km south of Sletten v. *stricta* (D), Qagdlumiut v. *stricta* (D), Qordlortorssuaq v. *gracilescens* (D)—Tasermiut v. *stricta* (H)—Qapiarfik v. *stricta* (S).

About as common as *Cl. degenerans*. This is a feature indicating that the south western part of Greenland is no Arctic district, where the *Cl. lepidota* otherwise is decidedly the most widespread. It is found in rockfalls and on moors. *Cl. lepidota* v. *gracilescens* is mostly found in rockfalls, whereas the v. *stricta* prefers the moors. Of the two varieties the v. *gracilescens* is obviously of a more continental distribution. The v. *stricta* is more common along the coast.

Besides fumar-protocetraric acid the *Cl. lepidota* also contains atranoric acid, a character distinguishing it from all forms of *Cl. degenerans* and *cervicornis*.

28. *Cladonia cervicornis* (ACH.) FW.

Godthaab District: Ameralik (V).

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D).

Julianehaab District: Josvaminen (D).—Tunugdliarfik: (V), Narssaq (D), Western side of Narssaqfjell (D), Qissungadalen (D), Tunuarmiut (D), Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D)—Uperniviarssuk (D)—Julianehaab (D).—Igalikofjord: Eqaluit (D), Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten 325—375 m (D), 4 km east of Sletten (D).

Cl. cervicornis is a frequent species in the whole district. It lives in varying localities, ranging from moors and more or less peaty soil to grassland.

Cl. cervicornis is easily distinguishable from *Cl. subcervicornis*, *macrophyllodes* and *cariosa* by lacking atranoric acid. Regarding distinction from *Cl. pyxidata*, see p. 109.

29. *Cladonia subcervicornis* D R.

Frederikshaab District: Borgshavn (D).

Julianehaab District: Josvaminen (D)—Qagssimiut (D).—N. Sermilik: Tassiussaq (D) (?).—Tunugdliarfik: Narssaqfjell 650 m (D), Qagssiarssuk f. *turgescens* (D), Qíngua f. *contraria* (D), 3 km west of Qíngua 300 m f. *turgescens* (D)—Julianehaab (D).

Cl. subcervicornis is most common in the coastal districts. It lives on peat on rocks. Seems to be able to stand intense exposure to the sun.

Cl. subcervicornis is easily distinguishable from the *Cl. cervicornis* by containing atranoric acid. Regarding distinction from *Cl. macrophyllodes* see p. 103.

In my opinion we have no certain specimens of the *Cl. subcervicornis* from Spitsbergen and Novaja Zemlja. The plants in the Oslo herbarium are partly undoubtedly *Cl. cervicornis* (lacking atranoric acid) and partly they seem to be more related to *Cl. macrophyllodes*. The *Cl. subcervicornis* from Disko (LYNGE 1937, p. 105) belongs to *Cl. cervicornis* (lacking atranoric acid).

30. *Cladonia macrophyllodes* NYL.

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D).

Julianehaab District: Qagssimiut (D).—Tunugdliarfik: (V), Narssaqfjell 650 m (D), Western side of Narssaqfjell (D), 3 km northeast of Narssaqfjell 700 m (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 700—800 m (D), Igaliko (D).—Agdluitsoq: Sletten (D), Qagdlumiut (D).

Cl. macrophyllodes is quite common in Southern Greenland. It thrives well up in the mountains and is frequently found in snow beds and is not much variable.

Cl. macrophyllodes is easily distinguishable from *Cl. cervicornis* by containing atranoric acid. The morphological characters correspond well with the chemical ones. *Cl. cervicornis* has squamules rarely longer than 4 mm, whereas *macrophyllodes* has considerably larger squamules, up to 1 cm. An undeveloped *Cl. cariosa* may be very like a young *Cl. macrophyllodes* (it also contains atranoric acid), but the reaction to Pd is very different, being Pd+yellow to orange. The *macrophyllodes* on the other hand has the reaction Pd+yellow to deep red (fumarprotocetraric acid).

Cl. macrophyllodes is the species most difficult to distinguish from *Cl. subcervicornis* and its determination may be very difficult. *Cl. subcervicornis* also contains atranoric acid, but is different from *Cl. macrophyllodes* by having a more greyish green colour (*macrophyllodes* is mostly light green), and the under side of the squamules has a greyish tinge, especially at the basis. (The under side of the squamules of *Cl. macrophyllodes* is always white as chalk). The squamules of *Cl. subcervicornis* are lengthened and dichotomically branched, while those of *Cl. macrophyllodes* mostly are broad and irregularly lobated. If podetia are present, they may be distinguished by *Cl. macrophyllodes* having light grey only

rarely cracked podetia whereas *Cl. subcervicornis* has brownish, cracked podetia.

A young and undeveloped *Cl. lepidota* f. *hypophylla* may be very like a *Cl. macrophyllodes*. But fortunately there are usually small podetias on the former, so that they consequently are rather easily distinguished.

Cl. macrophyllodes has been found as far north as Disko (Engelskmandens Havn leg. PORSILD in Hb. Copenh.).

31. *Cladonia pyxidata* (L) FR. subsp. *neglecta* FLK.

Godthaab District: Kook Øer (TH. FRIES)—Ameralik (V).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D).

Julianehaab District: Josvaminen (D)—Qagssimiut (D).—N. Sermilik: Ukivigssaqaq (V).—Tunugdliarfik: (V), Narssaq (D), Qissungadalen (D), Ilímaussaq 1200 m (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D)—Uperniviarssuk (D)—Julianehaab (V, D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik (D)—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).

subsp. *Pocillum* (ACH.)

Frederikshaab District: Borgshavn v. *pachythallina* (D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Isaromiut v. *pachythallina* (D), Tassiussaq (D).—Tunugdliarfik: Tunuarmiut (D), Sitdlisit v. *pachythallina* contains atranoric acid, (D), Qagsiars-Qíngua v. *pachythallina* (D)—Julianehaab v. *pachythallina* (D).

subsp. *chlorophaea* (FLK.) SPRENG.

Godthaab District: Godthaabsfjord: Qornoq (1927)—Amitsuarssuk (1927)—Sermilik (KORN.).

Frederikshaab District: Arsukfjord: Bjørnedalen, usninic acid and another acid; B+;! (D), Kungnait Pd— novochlorphaeic acid;! (D), Ivigtut (D)—Borgshavn (D).

Julianehaab District: Josvaminen Pd— merochlorophaeic acid (D)—Qagssimiut (D).—N. Sermilik: Ukivigsaqaq (V), Isaromiut (D), Tasiussaq f. *prolifera* Pd— novochlorophaeic acid and usninic acid;! (D).—Tunugdliarfik: Narssaq (D), Qissungadalen Pd— merochlorophaeic acid (D), Ilímaussaq 1200 m (D), Tunuarmiut B+ Pd—;! (D), Sitdlisit (D), Qagssiarssuk (D), Qordlortoq B+ (D), Qíngua Pd— novochlorophaeic acid; B+;! (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D)—Upernivi-

arssuk grayaninic acid (D)—Julianehaab Pd—; Pd— merochlorophaeic acid; f. *prolifera*! (D).—Igalikofjord: Eqaluit Pd— merochlorophaeic acid; B+;! (D), Sigssardlugtoq Pd— grayaninic acid (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten B+; novochlorophaeic acid 325—375 m (D), Qordlortorssuaq (D).

Cl. pyxidata is widespread in South West Greenland. Its sub-species *chlorophaea* and *neglecta* are almost equally common and reach high altitudes. The sub-species *Pocillum* (including the v. *pachythallina*) is rarer, in contradistinction to other Arctic districts.

In the monograph of SANDSTEDE (1931) and also in that of VAINO (Monographia Cladoniarum), the *Cl. pyxidata* subsp. *neglecta* and subsp. *chlorophaea* are described as independent species. This is partly based upon their morphological characters, *chlorophaea* has granuliform soredia, whereas *neglecta* is without soredia, partly upon chemical characters. ZOPF had found an acid in the *chlorophaea*, the chlorophaeic acid, which he did not find in *neglecta*.

The normal *pyxidata* all contain fumar-protocetraric acid becoming apparent through the reaction Pd+ rub and through an acrid taste. MERRILL found species which did not contain this acid, and grouped them in a special variety, v. *Grayi*. This group has later been raised to a species, *Cl. Grayi*, (see SANST. 1931), although it has not been possible to find any other distinguishing characters but chemical ones to tell it from the *Cl. pyxidata chlorophaea*.

Recently, (1939 and 1940) ASAHINA has examined the *Cl. chlorophaea* micro-chemically. He found the content of fumar-protocetraric acid always to be very scanty and the quantity to be varying. He therefore considers the fumar-protocetraric acid as an accessoric substance and does attach much systematic importance to cases where fumar-protocetraric acid are missing. On the other hand he found that abt. 60 % of the specimens of *Cl. chlorophaea* contained other acids. He called them cryptochlorophaeic acid, merochlorophaeic acid and grayninic acid, as he was not able to identify any of them with the chlorophaeic acid of ZOPF. They were easily found by microscopical tests, and if present, they were found in large quantities. He could thus not consider them as being accessoric ingredients. He consequently grouped *Cl. chlorophaea* in three species, *Cl. cryptochlorophaea* containing cryptochlorophaeic acid, *Cl. merochlorophaea* containing merochlorophaeic acid, and *Cl. Grayi* containing grayaninic acid, besides the genuine *Cl. chlorophaea* which only contained fumar-protocetraric acid. Under these groups he then set up varieties, characterized by lack of fumar-protocetraric acid.

I have revised and checked the results of ASAHINA and arrived at the following results:

We have in the *Cl. chlorophaea* group at least 4 different and easily distinguishable lichen acids besides the fumar-protocetraric acid.

1) The acid, which certainly is the cryptochlorophaeic acid of ASAHINA. It is typical in the Sanst. Cl. exsicc. 237. If it is extracted with benzene in an extraction tube and acetone evaporated on the object-glass, the result is a jelly, which afterwards dries. I have seen no other acid of such a nature. The residue exhibits a fine bluish-white crystal net under the microscope with crossed nichols. It reacts KC+ immediately red, the colour subsequently disappearing. By recrystallization of GAW (through cautious heating until almost all the residue is dissolved) the result is at first curved and then fine straight needles. (Plate VI, Fig. 1). Of GE I have seldom succeeded in obtaining good crystals, but according to ASAHINA the result is a melt which sends out fine trichitic needles so that the whole thing at last looks like a hedge-hog.

2) The acid certainly being the merochlorophaeic acid of ASAHINA. Typical in the Sanst. Cl. exsicc 1874. Soluble in benzene. Recrystallized of GE the result is bundles of plates with slanting edges. (Plate VI, Fig. 2). Of GAW the result is long plates often with somewhat dentated edges showing angles of extinction up to 45°. A residue after extraction by benzene reacts KC+red and is then discoloured.

3) An acid probably being the grayaninic acid of ASAHINA. Typical in the Sanst. Cl. exsicc. 958 and 1468. The residue after extraction with benzene reacts KC+red, but hesitatingly and little by little. ASAHINA gives the reaction KC—, but he makes the reaction in an alcoholic solution, and then probably the hypochlorite affects the alcohol before lichen acid. Recrystallization of GAW gives thin needles of a bluish colour under crossed nichols. (Plate VI, Fig. 3). Of GE the result is bundles of rods of a characteristic appearance. (Plate VI, Fig. 4).

4) A new acid which I provisionally will call novochlorophaeic acid. Present in Sanst. Cl. exsicc. 238 and 975 in the Oslo herbarium. If dissolved in benzene and the benzene is evaporated on the object-glass, the acid melts. It will then take a day or two before the melt crystallizes, mostly as fine needles. The reaction is KC—. If recrystallized of GAW the acid melts. The melt begins to crystallize comparatively soon, and forms intransparent crystal aggregates. Beside the melt and from the edge short polygon crystals crystallize, having a high double refraction (Plate VII, Fig. 1). At first they are small, but are gradually growing. If the GAW solution is heated to boiling, the crystals melt. The melting point of the acid can therefore not be much above 100°. GE gives, if the quantity of substance is sufficient, the same kind of crystals as GAW, only somewhat larger. As the melting point is so low, it is possible that this acid is the same as the fimbriatic acid of ZOPF. It had, however,

none of the crystals forms alleged to be characteristic of the fimbriatic acid. The alcoholic solution is coloured violet by $Fe\,Cl_3$, whereas the fimbriatic acid should remain colourless. The novochlorophaeic acid is consequently not identical with the fimbriatic acid.

All these acids were found in specimens of Sanst. Cl. exsicc. ASAHINA examined samples of all these specimens, but I have often found reactions of some of the specimens disagreeing with the results of ASAHINA. I have tested several of the exsiccate numbers which also had been tested by ASAHINA. Sometimes I arrived at the same results, sometimes the results were different.

According to ASAHINA the Sanst. Cl. exsicc. 235 contains grayaninic acid. In the Oslo herbarium the specimen consists of two lumps very like each other as to morphological characters. The specimens of one of the lumps contained merochlorophaeic acid, those of the other contained cryptochlorophaeic acid.

According to ASAHINA the Sanst. Cl. exsicc. 238 contains merochlorophaeic acid. In the Oslo herbarium the said number of the exsiccate consists of a collection of specimens being quite alike as to morphological characters but some of them containing merochlorophaeic acid, others novochlorophaeic acid. There is also a specimen which besides crystals of merochlorophaeic acid of GE also gives brown cushions of needles which disappear little by little. To judge from appearances the specimens may belong to the same clone.

Sanst. Cl. exsicc. 338 is stated by ASAHINA to contain grayaninic acid. The Oslo specimen consists of a mixture of specimens containing grayaninic acid and specimens containing merochlorophaeic acid.

Sanst. Cl. exsicc. 975 is said to contain grayaninic acid. The specimens in Oslo contain novochlorophaeic acid.

Sanst. Cl. exsicc. 1387 is said to contain grayaninic acid. The specimens in the Oslo herbarium contain merochlorophaeic acid.

I have not revised all specimens of *Cl. chlorophaea* or *Cl. pyxidata chlorophaea* in Sanst. Cl. exsicc. *Cl. chlorophaea* was once set up as a species of its own, distinguished from *Cl. pyxidata* on account of its characteristic soredia or granules of the cups and because of its contents of chlorophaeic acid. The last character is not constant in the first place because there is a large number of *Cl. chlorophaea* containing no kind of chlorophaeic acid at all, and secondly because the chlorophaeic acid is not only one kind of acid. Consequently the position of *Cl. chlorophaea* as a separate species becomes questionable. As transitional forms between *Cl. chlorophaea* and *Cl. neglecta* are rare I prefer to maintain them as sub-species. One must admit that there is also a certain chemical difference as acids of the chlorophaeic acid group only are found in species of the *Cl. chlorophaea.*

On the other hand, the distinction of different species within the *Cl. chlorophaea* group cannot be maintained. As far as I can see there is no difference as to morphological characters between *Cl. cryptochlorophaea*, *Cl. merochlorophaea*, *Cl. Grayi*, and *Cl. chlorophaea*, and they are found in complete mixture in one number of an exsiccate. Unfortunately we have at present no means of defining several acids together in one plant. That several acids may exist together in one podetium is proved by the case in Sanst. Cl. exsicc. 238. I also found several cases in my own material from Greenland.

In my opinion there is no weighty reason for supposing that the chemical difference in this case should be of any systematic importance. The single argument should be that great importance in other cases may justly be attached to chemical differences. But it seems to me unjustifiable to conclude that this should be the fact concerning the *Cl. chlorophaea* group. I am more inclined to consider this as a clear example of a case where chemical differences are of minor importance for lichen systematics.

To my great surprise there was also usninic acid present in some specimens of *Cl. *chlorophaea* from Greenland, besides the 4 acids mentioned. One would think that the specimens containing usninic acid could not belong to the *Cl. chlorophaea*, but the morphological characters of the plant left no doubt. In some cases I found that there were still other lichen acids which could be extracted with benzene, but I could not define the substances definitely, among other reasons also for want of sufficient material. In some cases it may have been hitherto unknown lichen acids. In some cases (for instance from Bjørnedalen and Qíngua) I got as a residue a melt which recrystallized of GAQ gave lumps of oil out of which after a while fine, silky crystals developed. I do not know any lichen acid behaving like this, but any further feature characterization I was not able to find.

After the localities in the list of localities of *Cl. pyxidata* the characteristics of the specimens are indicated. The plants being Pd + and not containing any substance soluble in benzene are given without any remarks. In cases of substances soluble by benzene, but where I could not find out what kind of acid was present, the letter B + is given. In those cases where I, beside Pd— specimens or specimens containing substances dissolvable in benzene, also found some without any such characteristic, I have used the sign "!".

Approximately 40 % of the specimens contained substances soluble in benzene. The *Cl. Pocillum* seems to me so characteristic that I think it ought to be ranking quite as high as *Cl. *neglecta* or *Cl. *chlorophaea*. I have classified the v. *pachythallina* under *Cl. *Pocillum* as it is often

very difficult in the Arctic to distinguish from the v. *pachythallina* with certainty.

A few specimens of the v. *pachythallina* proved to contain atranoric acid. This is also the fact regarding specimens from other parts of the Arctic, but the quantity is always very insignificant and varying so that I for the present am inclined not to attach much importance to this fact. But, the specimens containing atranoric acid are mostly among the whitest ones in the collection.

Cl. pyxidata **chlorophaea* may be mistaken for *Cl. fimbriata*. The latter has, however, mealy soredia, not found in *Cl. pyxidata* **chlorophaea*.

The *Cl. pyxidata* **neglecta* may be confused with the *Cl. cervicornis*. The latter has, however, a smoother cortex (not so areolated as that of the former) flatter cups and central prolification, not found in *Cl. pyxidata* **neglecta*.

Regarding the distinguishing of *Cl. pyxidata* forms from *Cl. cariosa* see p. 94.

32. *Cladonia fimbriata* (L) Fr.

(= *Cladonia fimbriata* v. *simplex* (Weiss) Fw. + v. *prolifera* (Retz) Mass. Wain. Mon. Clad. II = *Cladonia fimbriata* (L) Fr. + *Cl. major* (Hag.) Zopf Sanst. 1931).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D)—Borgshavn (D).

Julianehaab District: Tunugdliarfik: (V), Western side of Narssaqfjell (D), Qíngua (D)—Julianehaab (V).—Igalikofjord: Eqaluit (D), Igaliko (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D).

Scattered, but not rare in the whole district. Most of the specimens may be classified under the f. *minor* Hag.

Zopf (1907) examined the *Cl. fimbriata* forms chemically. He arrived at the following results, regarding their contents of lichen acids:

	Fumarprocetraric acid	Atranoric acid	Fimbriatic acid	Nemoxynic acid
Cl. fimbriata f. *minor*	+	..	+	..
- — v. *prolifera*	+	..	+	..
- — f. *major*	+	+	+	..
- — v. *cornutoradiata*	+	..	..	..
- — f. *coniocraea*	+	+	..	..
- — f. *nemoxyna*	..	..	..	+
- — f. *ochrochlora*	+	..	..	..

(ex Sanst. 1931)

On the basis of these results and on morphologic research, ZOPF and SANDSTEDE distinguished the following 6 species:

Cl. fimbriata (L) FR.
- *major* (HAG.) ZOPF.
- *cornutoradiata* COEM.
- *coniocraea* (FLK.) VAIN.
- *ochrochlora* FLK.
- *nemoxyna* (ACH.) COEM.

By the test with parapenylendiamine, *Cl. nemoxyna* is at once distinguishable from the others. It reacts Pd + yellow, whereas the others give the reaction Pd + red (fumar-protocetraric acid). An extract with acetone evaporated on object glass and recrystallized of GE gives characteristic lumps of crystals where the single crystals exhibit an inclined angle of extinction and often curved edges. (Plate VII, Fig. 2).

The acute angle of the edges is approx. 45°. The crystals have a high double refraction, are optically two axed, the angle between the axis is large. They consist of nemoxynic acid which according to ASAHINA is identical with homosekika acid.

The homosekika acid gives no reaction with paraphenylenediamine. There must consequently be another lichen acid, different from fumar-protocetraric acid, which causes the yellow colour with Pd. I cannot tell what acid this may be, but it appears as spheres of thin radial needles when recrystallized of GE (see figure). *Cl. nemoxyna* is thus characterized from the other species of the *fimbriata* group by morphological characters and by containing two lichen acids different from those in the other species of the group. *Cl. nemoxyna* must thus be regarded as a distinct species.

This cannot be said of the other ones. All authors agree that each and all species are K—, or—in rare cases—K + a faint yellow or discoloured. This does not agree with the theory that some of them contain atranoric acid, as the reaction then should be K + yellow. I have in a series of cases tried to find atranoric acid in the way described under *Cl. ecmocyna*, but the results have always been negative. The atranoric acid probably originates from some kind of impurity in the material of ZOPF. The discolouring by KOH is probably caused by the fumar-protocetraric acid.

The same is the fact regarding the fimbriatic acid. This acid is, according to the description of ZOPF, easily soluble in hot benzene. I have tried with a great number of *Cladonias* of the *fimbriata simplex* type whether it was possible to extract any lichen acid with hot benzene, but I have never succeeded. The fimbriatic acid may also originate from some kind of impurity in ZOPF's material. I have no certain opinion

as to nature of the admixtures they may perhaps have been *Cl. pyxidata* **chlorophaea*. But thereby the chemical basis of the first 5 species set up by ZOPF and SANDSTEDE is overthrown. Several of them can no longer be maintained as distinct species, in my opinion the *Cl. coniocraea* and the *Cl. ochrochlora* are longer distinguishable as species, nor are the *Cl. major* and the *Cl. fimbriata*.

On the basis of morphological, phytogeographical, and chemical characters the following 4 species of the *fimbriata* group in Northern Europe can be distinguished:

Cl. fimbriata (L) FR.
Cl. coniocraea FL = *Cl. coniocraea* FL. + *Cl. ochrochlora* FL. ex SANST.
Cl. cornutoradiata COEM.
Cl. nemoxyna (ACH.) COEM.

In the Arctic we have also geographical differences in the distribution between these species, showing that they form independent units of distribution.

The *Cl. nemoxyna* is never found in the Arctic. *Cl. coniocraea* is only known from the mildest part of South West Greenland and from Iceland. *Cl. fimbriata* and *Cl. cornutoradiata* are rather widespread in the Arctic, but there are certain differences in the distribution, the *Cl. cornutoradiata*, for instance, has not been found in South West Greenland, whereas the *Cl. fimbriata* is rather frequent. On Spitsbergen *Cl. fimbriata* has a much more limited distribution than *Cl. cornutoradiata*.

By extraction of specimens of *Cl. fimbriata* with acetone in the extraction tube, evaporation of the acetone on the object glass and recrystallization of the residue under the cover glass with GAQ under heating until almost all the substance was dissolved, characteristic crystals were obtained. The crystals appeared partly as spheroid aggregates which under crossed nichols showed a black cross, by parallel nichols the colour was olive brown; partly the crystals developed in bundles of plates also of an olive brown colour (Plate VII, Fig. 3). The crystals most probably are the chinoline salt of fumar-protocetraric acid. The same crystals were also obtained by the same procedure with *Cl. gracilis* v. *chordalis* and with *Cl. furcata*. With the pure fumar-protocetraric acid distributed through Sanst. Clad. exsicc. 1580, only spheroid aggregates were obtained.

33. *Cladonia coniocraea* FL.

(= *Cl. fimbriata* (L) FR. v. *apolepta* (ACH.) WAIN. WAIN. Mon. Clad. II = *Cl. coniocraea* FL. + *Cl. ochrochlora* FL. ex. SANST. 1931).

Julianehaab District: Agdluitsoq: Qordlortorssuaq (D).

Cl. coniocraea was only found once in the most favourable locality in the whole of Southern Greenland, and has not earlier been found in Greenland. The plants lived on old stumps of birch and were well developed.

Cl. coniocraea is distinguishable from the *Cl. fimbriata* s. str. forms by the more slender podetias either being pointed, or with narrow cups in the top. The top is mostly of a yellowish green colour. *Cl. fimbriata* s. str. has stouter podetias with broad cups in the top and are mostly of a pure grey or greyish white colour.

It is distinguished from *Cl. cornutoradiata* by yellowish-green colour, and by the latter having branched or prolifying cups at the end of the podetias, a phenomenon never seen in *Cl. corniocraea.*

34. *Cladonia carneola* FR.

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).

Julianehaab District: Josvaminen (D)—Qagssimiut (D).—Tunugdliarfik: Tunuarmiut (D), Qíngua (D).—Agdluitsoq: Sletten (D), 4 km east of Sletten (D), Qordlortorssuaq (D).

Cladonia carneola is widespread in Southern Greenland, but is easily overlooked on account of confusion with *Cl. coccifera* v. *pleurota.* It is possibly more common than these localities would indicate. It has been found as far north as Jakobshavn (leg. P. H. SØRENSEN in Hb. Copenhagen).

Cl. carneola is distinguished from *Cl. coccifera* v. *pleurota* by the brown colour of the apothecia. If apothecia are lacking, *Cl. carneola* may be recognized by the podetia being less stout than those of *Cl. coccifera* v. *pleurota*, and in wet state somewhat transparent. Besides, if apothecia are lacking, pycnides may be seen under a good binocular lens, and the pycnides are red in *Cl. coccifera*, but brown in *Cl. carneola.*

Cl. carneola contains usninic acid. I have been unable to find any other lichen acid in it.

35. *Cladonia cyanipes* (SMRFT.) VAIN.

Godthaab District: Godthaabsfjord: Amitsuarssuk (1927).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).

Julianehaab District: N. Sermilik: Tasiussaq (D).—Tunugdliarfik: 3 km northeast of Narssaqfjell (D), Tunuarmiut (D), Sitdlisit (D), Qagssiarssuk (D), Qíngua (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D)—Uperniviarssuk (D).—Igalikofjord: Eqaluit (D)—Upernivik (D).—Agdluitsoq: Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).

Cl. cyanipes is widely distributed in Southern Greenland, but generally only few specimens are found in each place.

Cl. cyanipes contains usninic acid.

36. *Cladonia bacilliformis* (Nyl.) Vain.

Julianehaab District: Tunugdliarfik: Qíngua (D).

Cl. bacilliformis is undoubtedly rare in the district. The plants are very typical and well developed and lived on decaying trunks. *Cl. bacilliformis* is distinguishable from all types of the *Cl. fimbriata* group which it often resembles by the reaction Pd— and by containing usninic acid. Thereby it gets a characteristic yellow colour missing in the *Cl. fimbriata* forms. It may also remind of *Cl. cyanipes*, from which it is distinguishable by having shorter and more clumsy podetias and a richer growth of soredia.

Stereocaulon.

1. *Stereocaulon botryosum* Ach. em. Frey.

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut c. ap. (D)—Borgshavn (D).

Julianehaab District: Qagssimiut (D).—Tunugdliarfik: Narssaqfjell 650 m (D), Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), 3 km west of Qíngua c. ap. (D).—Kangerdluarssuk: Eqalugarssuit (D)—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 1000 m (D).—Agdluitsoq: Sletten c.ap. (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qordlortorssuaq (D).

Stereocaulon botryosum is common on rocks in rockfalls or on gravel in places exposed to the wind. It is peculiarly enough often difficult to distinguish it from the *St. rivulorum*, especially if it is poorly developed. The sorediate forms (f. *dissolutum*) which are quite common, are of course not difficult to tell from *St. rivulorum*, but the esorediose forms are the difficult ones. The most important characters distinguishing *St. botryosum* from *St. rivulorum* are the following:

St. botryosum	*St. rivulorum*
With a characteristic furcated type of branching.	Irregularly branched.
The phyllocladia are always free from the branches even at the apices.	The phyllocladia, especially towards the apices appressed and parallel to the branches.
Branches only faintly tomentose, toment missing towards the base.	The branches are densely tomentose, also towards the base.

Apothecia are not rarely found in *St. botryosum* in South West Greenland. Fertile plants are easily distinguished from *St. rivulorum.*

2. *Stereocaulon denudatum* FLK.

Godthaab District: Ameralik (V)—Simiutat (H)—Ilivertalik (KORN.)—Itvidlek near Ikatok (KORN.).

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D), Borgshavn (D).

Julianehaab District: Qagssimiut (D).—Tunugdliarfik: (V), Narssaqfjell 650 m (D), 3 km northeast of Narssaqfjell 700 m (D), Qissungadalen (D), Qagssiarssuk (D).—Kangerdluarssuk: Eqalugarssuit (D), Julianehaab f. *pulvinatum* (D).—Igalikofjord: Igdlerfigssalik 1000 m (D), Igaliko f. *pulvinatum* (V, D)—Upernivik (D).—Agdluitsoq: Sletten (D), 4 km east of Sletten f. *pulvinatum* (D), Qagdlumiut (D)—Ikerasagssuak (V).

Stereocaulon denudatum seems to be common especially in the coastal districts. It is found in various forms, *pulvinatum*-forms are quite common. Regarding the distinguishing from *St. arcticum* see the latter.

3. *Stereocaulon arcticum* LYNGE.

Godthaab District: Simiutat (H)—Marrak (KR)—Jensens Nunatakker (KORN.)—Malerssorniarfik (H).

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (KORN., D)—Borgshavn (D).

Julianehaab District: Qagssimiut (D).—Tunugdliarfik: Narssaq (D), Narssaqfjell 650 m (D), Western side of Narssaqfjell 700 m (D), Qissungadalen (D), Ilímaussaq 1200 m (D), Tunuarmiut (D)—Julianehaab (D).—Igalikofjord: Igdlerfigssalik 1000 m (D).—Agdluitsoq: 4 km east of Sletten (D).

Stereocaulon arcticum is common, although not so common as *St. denudatum*, in the district. It was particularly common at higher elevations.

St. arcticum is not easy to distinguish from *St. denudatum.* I have studied cephalodia of all my plants, about 60 specimens, under the microscope. It is relatively easy to decide whether *Stigonema* or *Nostoc* are present in the cephalodia. A piece of a cephalodium is placed for some minutes in a solution of KOH on an object glass. The cephalodium is then "quetsched" out over glass by means of a piece of cork and then examined under the microscope. Rosary-like algae colonies indicate *Nostoc*, the colonies of *Stigonema* are more clotted. The cephalodia may

also often be distinguished by their general appearance. The *Stigonema* cephalodia are darker and more finely divided than the *Nostoc*-cephalodia, which are more rounded and undivided and have a bluish green colour. One may often find free *Stigonema* threads on *St. denudatum* plants.

Each plant has usually only one kind of cephalodia. In one plant from Julianehaab in a quite uniform pulvina I found, however, both *Nostoc* and *Stigonema* cephalodia. Because of its morphological characters it was classified under *St. arcticum*.

The characters of the cephalodia are to some extent parallel to other characters, even if none of them are quite constant. The differences between *St. arcticum* and *St. denudatum* are set up as follows: The most important characters are mentioned first.

St. arcticum	*St. denudatum*
The algae of the cephalodia *Nostoc*.	The algae of the cephalodia *Stigonema*.
Always more or less pulvinate forms.	Not always pulvinate forms.
Cephalodia scattered over the whole of the upper part of the podetia.	In some forms the cephalodia are placed only under the phyllocladia of the upper part of the podetia.
The podetia generally dies away at the basis. The pulvinae are therefore always only loosely attached to the substratum.	The podetia does not die away at the basis. The pulvinate forms are therefore firmly attached to the substratum.
The phyllocladia generally granulose.	The phyllocladia often in later stages of development squamuliform.

Since *Stereocaulon arcticum* besides these characters also has a distribution of its own, I regard it as a distinct species.

4. *Stereocaulon paschale* (L) Hoffm.

Godthaab District: Godthaabsfjord: Amitssuarssuk (1927), Qôrnoq (1927).—Ameralik (V).—Qarajaq Ilua (KR).—Qugssuk (Korn., Jensen).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).

Julianehaab District: Qagssimiut (D).—Tunugdliarfik: Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), South of Kiagtút (Por-

SILD), Qíngua (D), 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D).—Uperniviarssuk (D).—Igalikofjord: Eqaluit (D), Igaliko (KR, D).—Upernivik (D).—Agdluitsoq: (V), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Tasermiut (V).—Frederiksdal (V).

Stereocaulon paschale is common in the district, and is often an important component part of the lichen heath. It is considered difficult to distinguish from *St. alpinum*. It has, however, quite another type of cephalodia. The *St. paschale* has dark, finely divided cephalodia which are very distinct, and is found on the upper part of the podetia, which broadens to a shape like a pine. *St. alpinum* has small, bluish-green *Nostoc*-cephalodia. The podetias are of distinctly dorsiventral structure, and have not the shape of a pine. *St. paschale* has more finely divided phyllocladia than *St. alpinum*, with a form more like a cluster of grapes.

None of the specimens classified under *St. paschale* from Iceland seen by me is, in my opinion, correctly determined. They all probably belong to *St. alpinum*. At any rate they lack the typical paschale cephalodia, and the podetias are of a distinctly dorsiventral structure. LYNGE also mentions them with considerable reservation. *St. paschale* should be excluded from the lists of the flora of Iceland till more typical specimens are found. *St. paschale* is also found in the Angmagssalik District according to a specimen in the Copenhagen herbarium (Tasiusaq sept. 1892 leg. BAY.).

5. *Stereocaulon alpinum* LAUR.

Godthaab District: Godthaabsøerne (SØRENSEN).—Ameralik (V).

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D).—Borgshavn (D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), Western side of Narssaqfjell (D), Qissungadalen (D), Ilímaussaq 1200 m (D), Kiagtút (D), Qordlortoq (D), Qíngua (D).—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 4—500 m (V, D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qordlortorssuaq (D).—Ikerasagssuaq (V).—Qeqertatsiak (E).

Stereocaulon alpinum is probably the most common species of *Stereocaulon* in South West Greenland.

6. *Stereocaulon rivulorum* H. MAGN.

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D).
Julianehaab District: Uperniviarssuk (D).—Julianehaab (D).—Igalikofjord: Eqaluit (?) (D), Igdlerfigssalik 7—800 m (D), Igaliko (D).—Agdluitsoq: Qagdlumiut (D).

Stereocaulon rivulorum is not common in South Greenland. It has, on the whole, a more northerly distribution, both in East and in West Greenland.

At Igdlerfigssalik, near Tasiussaq and at Qagdlumiut a peculiar *Stereocaulon* was found which at least deserves its own variety name.

Stereocaulon rivulorum v. *groenlandicum* E. DAHL v. nov.

Plate II, Fig. 2.

Maior ac robustior typo, ad 5 cm alta podetiis arcte erectis longis, ramis principalibus usque ad 2 mm crassis. Planta minus tomentosa, ramis secundariis distincte dorsiventralibus, phyllocladiis paucis.

Locus classicus: Julianehaab District: Igalikofjord: Igdlerfigssalik 7—800 m leg. E. DAHL, 2.8.1937.

Exactly the same type is represented in the Copenhagen herbarium by plants from Godhavn (leg. VAHL), from Disko (leg. VAHL) and from Igaliko (leg. VAHL).

As to general appearance the new variety is very unlike *St. rivulorum*. The stiff, upright, straight podetias are more like a vigorous *St. glareosum* or a stiff *St. denudatum* than a *St. rivulorum*. At Igdlerfigssalik the variety lived together with *St. rivulorum* and could easily be distinguished from the latter. It has, however, the typical apothecia type of *St. rivulorum*. Probably it ought to be described as a separate species, but when I hesitate to do so, the reason is that I found specimens of *St. rivulorum* transitional to the v. *groenlandica*. When the material is so limited as the present, it is wiser to postpone its description as a species till more material is available.

7. *Stereocaulon glareosum* MAGN.

Frederikshaab District: Arsukfjord: Kungnait on gravel near a pond (D).

Stereocaulon glareosum has not previously been collected in Greenland. The specimens were small and the podetias were not well developed. Nevertheless it had the typical papilliform phyllocladia both at basis and on the podetias. The podetias are also typical, coarse and hardly branched. The cephalodia contain *Nostoc* gonidia.

8. *Stereocaulon tomentosum* FR.

Julianehaab District: Igalikofjord: Eqaluit (D).

Stereocaulon tomentosum has not previously with certainty been found in Greenland. The specimens are very typical, and richly fertile.

St. tomentosum is recorded from several places in Iceland by LYNGE (1940 p. 36). His plants in the Oslo herbarium are all densely tomentose and on account of this character they have been referred to *St. tomentosum*. There are, however, several indications that the plants are not conspecific with *St. tomentosum*. None of them, not even vigorous and well developed specimens, have any trace of apothecia, which are so common in *St. tomentosum*. They have also all the light greyish red colour so characteristic of *St. alpinum*, not the dark-grey colour with the dark-grey toment usually (but not always) seen in the *St. tomentosum*. The primary branches are not so thick and have not so many small phyllocladia as generally found in *St. tomentosum*. In my opinion they all belong to a tomentose form of *St. alpinum*. I have similar forms in my material from Greenland, and no indications of transitional forms between them and my plants from Eqaluit could be found. *St. tomentosum* ought preliminarily to be left out of the flora of Iceland.

9. *Stereocaulon coralloides* FR.

Julianehaab District: Agdluitsoq: 3 km south of Sletten in rockfalls (D).

Stereocaulon coralloides has not previously been found in Greenland. The plants are typical with distinct K+reaction of the medulla.

Umbilicariaceae.

Umbilicaria.

1. *Umbilicaria Pennsylvanica* (ACH.) HOFFM.

Godthaab District: Ameralik (V) in rupibus dejectis ad latera alinum sinus Ameralik Groenlandiae occidentalis circit. 300 ped. supra mare (FRIES Lich. Arctoi, p. 168).

Umbilicaria Pennsylvanica is an American representative in the lichen flora of South West Greenland, one of the very few. It must be very rare, and although eagerly searched for, I did not succeed in finding it in 1937.

2. *Umbilicaria Lyngei* SCHOL.

Julianehaab District: Tunugdliarfik: Kiagtût, not far from the glacier (D).

Umbilicaria Lyngei is a northern species and obviously rare in South West Greenland. The specimens are sterile, but fairly typical, growing on rocks without any influence from excrements of birds.

3. *Umbilicaria rigida* (DR) FREY.

Godthaab District: Jensens Nunatakker (KORN.).

Frederikshaab District: Kangerdluarssuk (V).—Frederikshaab (V).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).

Julianehaab District: Tunugdliarfik: Narssaqfjell 650 m (D), Qissungadalen (D), Ilímaussaq 1200 m (D), Tunuarmiut (D), Kiagtût (D).—Igalikofjord: Igdlerfigssalik 5—600 m and 1000 m (V, D).—Agdluitsoq: 3 km south of Sletten (D), 4 km east of Sletten (D), Qordlortorssuaq (D).—N. Sermilik: Itvidlerssuaq (S), Innermost end of Sermilikfjord 1800′ (S).—Ilua: Mountain 4000′ near Igdlorsuit (S).—Ujaragsarssuk (V).

Umbilicaria rigida is not at all rare in the district, and is mostly found in the area above the *Salix* region. It was found on the highest peaks, as high up as we came. It seems as if it avoids places with snow-cover in winter. It always lived in places much exposed to the wind, on Narssaqfjell only on the highest 50 metres, below it was totally lacking. In the lowland it was only found on protruding rocks. *U. rigida* has been found as far north as Disko (see LYNGE 1937, p. 109).

4. *Umbilicaria decussata* (VILL.) FREY.

Julianehaab District: Agdluitsoq: Sletten (D).

Umbilicaria decussata is rare in South West Greenland. At Sletten magnificient specimens were found near to the village on a steep rock wall together with *Caloplaca elegans*, *Umbilicaria vellea*, *Alectoria lanestris*, and *A. vexillifera*.

5. *Umbilicaria virginis* SCHAERER.

Julianehaab District: Tunugdliarfik: Ilímaussaq 1200 m (D).

Umbilicaria virginis is probably a more frequent species in the mountain regions than indicated by this single locality. In the lowland it is at any rate very rare. This agrees with the fact that it is a marked northerly and alpine species. The specimens are fertile and very typical.

6. *Umbilicaria torrefacta* (LIGH.) SCHRAD.

Godthaab District: Godthaab (TH. FRIES).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).—Borgshavn (D).

Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Ukivigssaqaq (V), Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), Western side of Narssaqfjell (D), 3 km north-east of Narssaqfjell 700 m (D), Qissungadalen (D), Ilímaussaq 1200 m (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Uperniviarssuk (D).—Kangerdluarssuk: Eqalugarssuit (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 1000 m (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Nanortalik (E).

It is hard to find a more common plant than the *Umbilicaria torrefacta*. It was found in every locality visited by me.

7. *Umbilicaria hyperborea* (ACH.) HOFFM.

Godthaab District: Godthaab (TH. FRIES).—Kobbe Fjord (Fylla-Exp.).—Ameralik (V).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).—Borgshavn (D).

Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Ukivigssaqaq (V), Isaromiut (D).—Tunugdliarfik: (V), Narssaq (D), Western side of Narssaqfjell (D), Narssaqfjell 650 m (D), Qissungadalen (D), Ilímaussaq 1200 m (D), Tunuarmiut f. *prolificans* and typical (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D).—Uperniviarssuk (D).—Julianehaab (D).—Kirkefjellet (PETERSEN).—Igalikofjord: Eqaluit (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Nanortalik (E).

Umbilicaria hyperborea is one of the most common lichens in the district and is hardly missing on any rock of some size. It very often occurs together with *Umbilicaria torrefacta*. It is somewhat variable and the marginal parts of the thallus are often perforated. F. *prolificans* OLIV. is a formae converging towards *U. polyphylla* from which it is distinguished by a lighter underside and by lacking the rounded lobes of *U. polyphylla*.

8. *Umbilicaria arctica* (ACH.) NYL.

Godthaab District: Godthaab (TH. FRIES).—Kobbe Fjord (Fylla-Exp.).—Kook Øer (TH. FRIES).—Ameralik (V).—Simiútat (H).—Naujat (KORN.).—Tuluvartalik (KR).

Frederikshaab District: Arsuk Storø (JOHNSTRUP).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut v. *subarctica* and *typica* (D), Smallesund (KORN.).—Borgshavn (D).

Julianehaab District: Josvaminen v. *subarctica* and *typica* (D).—Qagssimiut v. *subarctica* and *typica* (D).—N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq v. *subarctica* (D), Western side of Narssaqfjell (D), Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua (D).—Qaqortoq (V).—Uperniviarssuk (V, D).—Julianehaab (D).—Kirkefjellet (PETERSEN).—Igalikofjord: Eqaluit (D), Sigssardlugtoq (PETERSEN), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Nanortalik (E).—Sangmissoq (E).—Qeqertatsiak (E).

Umbilicaria arctica is as common as *U. hyperborea* and was only missing in two of the places visited in 1937, but being more conspicuous it has been collected more often by previous collectors. It is clearly coprophilous and is always found on bird stones.

The v. *subarctica* (NYL.) SAVIZ was also found in some places. It is very characteristic and is clearly different from the typical one by having a darker underside and thinner thallus. I have no transitional forms neither to *arctica* nor to *hyperborea* in my collection.

9. *Umbilicaria proboscidea* (L) SCHRADER.

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).—Borgshavn (D).

Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), Western side of Narssaqfjell (D), Narssaqfjell 650 m (D), Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), Kiagtût (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D).—Uperniviarssuk (D).—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 1000 m (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D).

Umbilicaria proboscidea is quite as common in the district as *Umbilicaria cylindrica* and other species. There are peculiarly few finds by previous collectors. It lives on fair-sized rocks or on the boulders on the mountains or on summits in the lichen heath exposed to heavy wind. On such peaks there is often a small open area, where the snow blows away, with a flora of its own. Here we find *U. proboscidea*, *U. rigida*,

Alectoria ochroleuca, *A. lanea*, *Cetraria hepatizon*, *Haematomma ventosum*, *Parmelia alpicola*, *P. austerodes*, and black crustaceous lichens forming a lichen society by itself.

10. *Umbilicaria fuliginosa* (HAVAAS) ZAHLBR.

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Ivigtut (D).

Julianehaab District: Agdluitsoq: 3 km south of Sletten in large quantities (D), Qagdlumiut (D).

Umbilicaria fuliginosa is no common plant in the district. It lives on isolated rocks or in rockfalls, preferably not too exposed to wind or sun. At Sletten it was found in enormous quantities in a rockfall. My plants all reacted C+. Two varieties have been distinguished, *U. fuliginosa* v. *Wenckii* and v. *typica* (see LYNGE and SCHOLANDER 1932, p. 65). V. *Wenckii* is said to give the reaction C—, the v. *typica* C+. I have tested specimens called v. *Wenckii* in the following way: A small piece of thallus was extracted with acetone in an extraction tube, the acetone was then evaporated on the object glass and the residue tested with Losanthine (a better substitute for chloric lime). It then reacted C+red. According to this there are reasons for believing that the difference in the C-reaction is due to differences in the quantity of the C positive substance (probably gyrophoric acid) in the various plants. There is consequently no difference in quality between the 2 varieties, and too much importance must therefore not be attached to the chemical differences.

11. *Umbilicaria polyphylla* (L) HOFFM.

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Isaromiut (D).—Tunugdliarfik: Narssaq (D), Qagssiarssuk (D), Kiagtût (D), Qíngua (D), 3 km west of Qíngua (D).—Igalikofjord: Eqaluit (D), Igaliko (D).—Agdluitsoq: Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).

Umbilicaria polyphylla has a marked continental distribution in South West Greenland. In the outer coastal district it is undoubtedly rare, but in the inner fjord districts it is rather common. It lives on rocks exposed to sun, often together with *Umbilicaria cinerorufescens*.

12. *Umbilicaria deusta* (L) BAUMG.

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D).—Borgshavn (D).

Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Narssaq (D),

Western side of Narssaqfjell (D), Qissungadalen (D), Ilímaussaq 1200 m (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D).—Uperniviarssuk (D).—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igaliko (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).

Umbilicaria deusta is exceedingly common, and was only lacking in two places visited in 1937. It lives on stones in rockfalls or on wet often irrigated rocky walls. There are peculiarly few finds by previous collectors; only one single specimens from Greenland is found in the Copenhagen herbarium from Holsteinsborg (leg. VAHL).

13. *Umbilicaria cylindrica* (L) DEL.

Godthaab District: Godthaab (TH. FRIES, KR).—Kook Øer (TH. FRIES).—Marrak (KR).

Frederikshaab District: Arsuk Storø v. *Delisei* (JOHNSTRUP).—Arsukfjord: Bjørnedalen v. *fimbriata* (D), Kungnait v. *Delisei* and v. *fimbriata* (D), Ivigtut (D).—Borgshavn v. *Delisei* and v. *fimbriata* (D).

Julianehaab District: Josvaminen (D).—Qagssimiut v. *fimbriata* (D).—N. Sermilik: Ukivigssaqaq (V), Isaromiut (D), Tasiussaq v. *Delisei* (D).—Tunugdliarfik: (V), Narssaq v. *Delisei* (D), Western side of Narssaqfjell (D), Narssaqfjell 650 m (D), 3 km northeast of Narssaqfjell 700 m v. *fimbriata* (D), Ilímaussaq 1200 m v. *Delisei* (D), Qíngua v. *Delisei* and v. *fimbriata* (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D).—Uperniviarssuk v. *fimbriata* (D).—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 1000 m (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Davids Sund (V), Sletten (D), 3 km south of Sletten v. *Delisei* (D), 4 km east of Sletten (D), Qagdlumiut (D), Amitsuarssuq (V), Qordlortorssuaq v. *Delisei* (D).—Nanortalik (V).—Nunarssuaq (LÜTKEN).—Sangmissoq (E).—Qeqertatsiak (E).

Umbilicaria cylindrica is as common in the district as *Umbilicaria hyperborea* and *torrefacta*, and is often found together with these plants. It is somewhat variable. Of the material collected some of the specimens had to be classified under the v. *Delisei* NYL. and a few of them under v. *fimbriata* NYL. The greater number of the plants were, however, transitional forms between the 2 varieties. They are hardly of much importance.

14. *Umbilicaria vellea* (L) em. FREY.

Godthaab District: Ameralik (V).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut ad cinereorufescens (D).—Borgshavn (D).

Julianehaab District: N. Sermilik: Ukivigssaqaq (V), Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), Narssaqfjell (D), Western side of Narssaqfjell (D), Ilímaussaq 1100 m (D), Tunuarmiut (D), Kiagtût (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D) Upperniviarssuk (V, D).—Julianehaab (D).—Igalikofjord: Eqaluit ad *cinereorufescens* and typical (D), Igaliko (D).—Agdluitsoq: Sydprøven (E), Sletten ad *cinereorufescens* and typical (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D).

Umbilicaria vellea is very common in the district. It lives preferably on vertical rocks, often in great quantities and large specimens together with *U. hyperborea* and *cylindrica*. It varies somewhat as to the hairiness on the under side, and is often hard to distinguish from *U. cinereorufscens*. Large, purely grey specimens were found at Sletten, with almost no rhizinae at the margins, but with some towards the centre, and with flatter and thinner thallus than usually seen. It differed somewhat from the ordinary typical *U. vellea*.

15. *Umbilicaria cinereorufescens* (SCHAER.) FREY.

In Hedwigia LXXI 1931, p. 109.
RABENH. Krypt. Fl. Bd. IX, Abt. IV/1, Lief. 1.

Frederikshaab District: Borgshavn (D).

Julianehaab District: Tunugdliarfik: Qissungadalen (D), Qíngua (D), 3 km west of Qíngua (D).—Igalikofjord: Igaliko (D).— Agdluitsoq: Qordlortorssuaq (D).

Umbilicaria cinereorufescens is not at all rare in the district. It lives preferably on rocks and rocky walls, much exposed to the sun, mostly in the inner fjord districts. It is not always so easy to distinguish from *U. vellea*, especially if the specimens are small and poorly developed. The best distinguishing character is that *U. cinereorufescens* has no rhizinae on the under side as found in *U. vellea* although small specimens of *U. vellea* also may have poorly developed rhizinae. Small plants of *U. vellea* may also often show indications towards a polyphyllous thallus and have the same dark greyish red colour as *U. cinereorufescens*. One has often the feeling that one is guided only by the presence or absence of rhizinae on the under side when *U. vellea* is to be distinguished from *U. cinereorufescens*, all other characters being left out of the question. There are many cases when I have not been able to state definitely whether the specimen belonged to *U. vellea* or to *U. cinereorufescens*. I have placed them under *vellae* and added: ad *cinereorufescens*. But the plants from the localities quoted above are quite typical.

U. cinereorufescens has not previously been recorded from Greenland or in any American area, as far as I know. But there is a specimen in the Copenhagen herbarium from Holsteinsborg leg. VAHL.

16. *Umbilicaria mammulata* (ACH.) TUCKERM.

Proc. Americ. Acad. Arts and Scienc. vol. I, 1848, p. 261.
Gyrophora mammulata ACH. Syn. Meth. Lich. 1814, p. 67
non. *Gyrophora mammulata* FREY. Hedwigia LXXX 1929 = *Umbilicaria cinereorufescens.* (SCHAER) FREY. Hedwigia LXXI 1931, p. 109. nec.
Umbilicaria caroliniana TUCK. Proceed. Americ. Acad. Arts and Science, Vol. XII, 1877.

Julianehaab District: Tunugdliarfik: Kiagtût near the glacier (D).

Umbilicaria mammulata is undoubtedly a very rare plant in the district, and has only been found in this single place. The genuine *U. mammulata* is known only from America (Habitat in America Septentrionalis in rupibus. Ach Syn. Meth. Lich. p. 67).

I have neither seen the original specimen of ACHARIUS, nor have I seen any photograph of it, and can therefore not state with absolute certainty that this is the species of ACHARIUS. The descriptions, however, fit very well with my plant. My plant is undoubtedly closely related to *U. cinereorufescens.* The genuine *U. mammulata* is also very like *U. cinereorufescens*, as also appears from the fact that a careful examination was necessary to ascertain that *U. cinereorufescens* was not identical with the ACHARIAN *Gyrophora mammulata. U. mammulata* (ACH.) TUCKERM. is distinguished from *U. cinereorufescens* (see FREY in Hedwigia, 1931) by the characters: 1) "thallo *laevigato* pallide olivaceo demum fusco-nigricante" Ach. Syn. 1814. My plants have quite a smooth surface distinguishing them from *U. cinereorufescens*, which has a rugged scabrous surface. (Compare TUCKERMAN's description 1848: "Thallus membranaceous, smooth . . ."). 2) On the under side very black, papillose-granulate and fibrillose . . ." TUCKERMAN 1848. My plants have both club-formed hair and genuine rhizinae on the under side, distinguishing them from *U. cinereorufescens.*

The ACHARIAN *Gyrophora mammulata* cannot be classed together with the TUCKERMANIAN *Umbilicaria caroliniana* as TUCKERMAN did later upon the suggestion of NYLANDER. *U. caroliniana* is quite smooth on the under side, whereas the original description of *U. mammulata* distinctly says: "Subtus aterrimo scabro fibrillosoque."

As there is no complete description of *U. mammulata* as far as I know, I will descibe my plants from Greenland:

Thallus monophyllous or polyphyllous up to 2 cm in diam., always folded towards the centre. The margins are torn or chappy, and the peripheral parts are easily broken off so that the edges mostly consist of fracture edges.

The colour is dark brown—brownish-black, not glossy. The upper side has a quite smooth surface, not chappy or scabrous.

The under side is quite black, with numerous rhizinae and papillae. Towards the centre there are traces of radial balks.

The upper cortex (the part above the gonidial layer) is 15—25 μ of a faintly paraplechtenchymatous structure (I here use the terminology of FREY in Rabenh. Krypt. Fl. Bd. IX, Aby. IV/1, Lieferung 1). The upper half consists of brown, rounded cells forming a coherent surface. Below this is the gonidial layer being unevenly bounded both upwards and downwards abt. 40—80 μ thick. Downwards it proceeds to the subgonidial stratum. The gonidial stratum + the subgonidial stratum are together 80—100 μ thick. The whole stratum, especially in the lower part, is strongly incrustated with lichen acids, reacting C+ (Probably gyrophoric acid). The hyphae are 5—7 μ thick. In the whole stratum there is no trace of paraplechtenchym, but the cells of the hyphae are short. Under the sugbonidial stratum there is a stratum of densely interwoven hyphae with small intercellular rooms. The layer is 40—70 μ towards the edge and 100—130 μ in the centre, varying much in thickness. The lowermost stratum consists of brown, rounded cells and is about 10—20 μ thick.

The anatomy of *U. mammulata* is in full agreement with that of *U. cinereorufescens* except that the thallus is somewhat thinner and that the cortex is smooth. The anatomy differs from that of *U. polyrrhiza* by having thinner hyphae in the medulla and from *U. vellea* by completely lacking the paraplechtenchymatous structure in the gonidial layer. As to general appearance it differs from *U. vellea* by a smaller thallus, a darker colour, a smoother surface, the fracture edges, and by a poylphyllous and thinner thallus. It is different from *U. polyrrhiza* by its unglossy surface and fracture edges. It has a smoother surface than *U. cinereorufescens* and is different by having fracture edges and rhizinae on the under side. The species is a characteristic one.

17. *Umbilicaria hirsuta* ACH. em. FREY.

Julianehaab District: N. Sermilik: Isaromiut (D).—Tunugdliarfik: Narssaq (D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D).

Umbilicaria hirsuta is no rare plant in continental districts round the inner parts of the fjords. It prefers the vertical sides of rocks and rocky walls.

Umbilicaria hirsuta has not previously with certainty been found in Greenland. There is no specimen in the Copenhagen herbarium.

Parmeliaceae.

Parmeliopsis.

1. *Parmeliopsis ambigua* (Wulf.) Nyl.

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Langenes (KR), Ivigtut (D).

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua (D).—Igalikofjord: Eqaluit (D), Igaliko c. ap. (Sørensen, KR, D).—Agdluitsoq: Sletten (Sørensen), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Tasermiut (V, E).

Parmeliopsis ambigua is widely distributed throughout the fjords of Southernmost Greenland on twigs of birch and *Betula glandulosa*, and most common in continental districts. It has not been collected farther north on the west coast than Arsukfjord, but has been found in the Scoresby Sound District (Røde Ø leg. Hartz) in East Greenland.

2. *Parmeliopsis hyperopta* (Ach.) Vain.

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Langenes (KR).

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Tunuarmiut (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua (D).—Igalikofjord: Igaliko (D).—Agdluitsoq: Qagdlumiut (D), Qordlortorssuaq c. ap. (D), Tasermiut (V, E, H).

Parmeliopsis hyperopta has a very typical continental type of distribution within Southernmost Greenland, and grows often together with *P. ambigua*.

Parmelia.

1. *Parmelia austerodes* Nyl.

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Western side of Narssaqfjell (D), Qagssiarssuk (D), Kiagtût (D).—Igalikofjord: Eqaluit (D), Igaliko (D).

Parmelia austerodes has a distinctly continental type of distribution in South West Greenland. It is found on twigs of *Betula* and *Juniperus*, but also together with *P. physodes* in areas eroded by the wind (see under *Umbilicaria proboscidea*).

P. austerodes has been found as far north as Disko (see Lynge 1937, p. 160). In the Copenhagen herbarium there is one specimen from Sydøstbugten on the Eastern coast south of Scoresby Sound (leg. Hartz).

I have examined micro-chemically a series of *Hypogymnias*, viz.

P. physodes (L) ACH., *tubulosa* (HAG.) BITT, *Bitteriana* ZAHLBR. (= *farinacea* BITT), *obscurata* BITT (= *Bitteri* LYNGE), *austerodes* NYL., *subobscura* VAIN., and *vittata* (ACH.) NYL. *Parmelia physodes* gives the reaction: Medulla and sor. Pd+ orange red. If the remaining species are tested with Pd directly on the thallus, a light yellowish colouring is often seen in the gonidial stratum and in the soredia, but the reaction can sometimes be almost invisible. If, however, the lichen is extracted with acetone, the acetone evaporated on object glass, and the reaction made on the residue almost all the remaining species give the reaction Pd+yellow—olive yellow. This reaction may be caused by atranoric acid as found by Mrs. HILDUR KROG.

All the *Hypogymnias* examined contain physodic acid. This is identified in the following way: If a piece of thallus is extracted with acetone in the extraction tube, the acetone evaporated on object glass, and the residue recrystallized of GE, the physodic acid crystallizes as curved fine needles. Often atranoric acid crystallizes besides in coarse prisms (Plate VII, Fig. 4).

Of the species examined, *P. physodes*, *tubulosa*, *Bitteriana*, *obscurata* and *austerodes* contain atranoric acid, whereas *subobscura* is lacking. *Parmelia vittata* contains small quantities of atranoric acid (H. KROG). It has been rather unclear whether *P. subobscura* VAIN is a good species well distinguished from *P. austerodes*. Besides the morphologic characters there is also a chemical one, being a good indication that it is a good species. I have examined a series of specimens of *P. subobscura* form Novaja Zemlja, Spitsbergen, Greenland, and Arctic America, but they never contained any traceable quantity of atranoric acid. All specimens of *P. austerodes* contained atranoric acid.

Some of my specimens had no soredia, but they all contained atranoric acid and as to general appearance they were also more like *P. austerodes*.

2. *Parmelia physodes* (L) ACH.

Godthaab District: Ameralik (V).

Julianehaab District: Tunugdliarfik: Tunuarmiut (D), Qagssiarssuk (D), 3 km west of Qíngua (D).—Nanortalik (E) (probably Tasermiut).

Parmelia physodes is rather rare and has only been found in the most continental districts. It is distinguishable from all other *Hypogymnias* (s. str.) which I have examined by the medulla giving the reaction Pd+orange red.

3. *Parmelia encausta* (SM.) NYL.

Julianehaab District: Tunugdliarfik: Qissungadalen (D), Tunuarmiut (D).—Igalikofjord: Igaliko (D).

P. encausta is certainly very rare in the district. It has not previously been found in Greenland.

It is not always so easy to distinguish *P. encausta* from *P. intestiniformis*. The best distinguishing feature is that *P. encausta* gives the reaction med. Pd + while *P. intestiniformis* is Pd—. The specimen from Tunuarmiut was morphologically somewhat more in the direction of *P. intestiniformis* and as the Pd-reaction was rather indistinct, the determination is not certain.

4. *Parmelia intestiniformis* (Vill.) Ach.

Frederikshaab District: Arsukfjord: Kungnait (D).—Borgshavn (D).

Julianehaab District: Qagssimiut c. ap. (D).—N. Sermilik: Ukivigssaqaq (V).—Tunugdliarfik: (V), Narssaq (D), Narssaqfjell 650 m (D), Tunuarmiut (D), Qíngua (D), 3 km west of Qíngua (D).—Igalikofjord: Eqaluit (Petersen).—Igaliko c. ap. (D).—Agdluitsoq: Sletten (D), Qagdlumiut (D), Amitsuarssuq (V).—Nanortalik (V, E).

Parmelia intestiniformis is quite common on rocks and is certainly more common than indicated by these localities. According to my diary from 1937 it was found in a considerable number of places, but I dare not use records because of possible confusion with *P. encausta*. It is frequently found on the vertical side of big erratic rocks.

5. *Parmelia alpicola* Th. Fr.

Godthaab District: Fiskenesset f. *aperta* (V).

Frederikshaab District: Arsuk Storø (Johnstrup).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).—Borgshavn (D).

Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Western side of Narssaqfjell (D), Qissungadalen (D), Tunuarmiut (D), Qíngua (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D).—Qaqortoq (D).—Uperniviarssuk (D).—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 1000 m (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), Qordlortorssuaq (D).—Nanortalik (E).

Parmelia alpicola is a very common species in the whole district. Nevertheless it is comparatively less common in the continental fjord districts.

6. *Parmelia stygia* (L) Ach.

Frederikshaab District: Arsukfjord: Kungnait (D).

Julianehaab District: N. Sermilik: Tasiussaq (D).—Tunugdliarfik:

Tunuarmiut (D), Qagssiarssuk (D), Qaqortoq (D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: Sletten (D).—Nanortalik (V, E).

Parmelia stygia occurs scattered, but is not rare in the district. All my specimens gave the reaction med. Pd+ flav.-rub.; with some specimens, however, the reaction was weak. All previously examined specimens from Greenland react Pd— and are classified under the northern v. *septentrionalis* LYNGE which is also remarkable by the radial growth of the lobes.

My specimens belong to the typical southern form, with which they also agree in the morphological character.

7. *Parmelia olivacea* (L) NYL.

Godthaab District: Godthaabsfjord: Qugssuk (V).

Julianehaab District: Tunugdliarfik: (V), Kiagtût (D).—Agdluitsoq: Qordlortorssuaq (D).—Tasermiut leg?

Parmelia olivacea is undoubtedly rare in South West Greenland, but being a conspicuous species it has been collected relatively often. It is found on the stems and twigs of birches, a substratum to which it is very closely bound. It was scanty in the places where it was found in 1937.

8. *Parmelia panniformis* (NYL.) VAIN.

Frederikshaab District: Arsukfjord: Ivigtut (D).

Julianehaab District: N. Sermilik: Tasiussaq c. ap. (D).—Tunugdliarfik: Qíngua (D).—Agdluitsoq: Sletten (D), Qordlortorssuaq (D).

Parmelia panniformis has a most distinct continental distribution in South West Greenland and has not earlier been reported from Greenland. It lives under overhanging rocks, so that it is rarely exposed to direct rainfall, but often to direct sunshine.

9. *Parmelia infumata* NYL.

Frederikshaab District: Arsukfjord: Kungnait (D).—Borgshavn (D).

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Qordlortoq (D), Qíngua (D).—Agdluitsoq: 3 km south of Sletten (D), Qagdlumiut (D).

Parmelia infumata occurs in many places in the district, but only in small numbers in each place. It is a strongly coprophilous species often found on protruding columns of the easily disintegrating abyssal rocks in the district.

10. *Parmelia isidiotyla* Nyl.

Julianehaab District: N. Sermilik: Isaromiut (D).—Tunugdliarfik: Narssaq (D), Qissungadalen (D), Qordlortoq (D), Qíngua (D).—Qaqortoq (D).—Igalikofjord: Sigssardlugtoq (D).

Parmelia isidiotyla has a marked continental distribution in South West Greenland. It lives in localities similar to those of *P. disjuncta.* Only the specimens from Narssaq and Sigssardlugtoq reacted KC—, all others gave a positive reaction with KC.

11. *Parmelia sorediata* (Ach.) Th. Fr.

Frederikshaab District: Borgshavn (D).

Julianehaab District: Josvaminen (D).—N. Sermilik: Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Qissungadalen (D), Qíngua (D).—Uperniviarssuk (D).—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igaliko (D).—Agdluitsoq: Ca. 3 km south of Sletten (D), Qagdlumiut (D).

Parmelia sorediata is not rare in the district, contrary to all other parts of Greenland. It is, however, not as common as *P. disjuncta.* It always lives on rocks exposed to intense sunshine.

P. soredia has been found at Disko: Eqalunguit, Itivnerit leg. Porsild according to specimen in the Copenhagen herbarium.

12. *Parmelia disjuncta* Erichs.
(= *P. granulosa* Lynge)

Frederikshaab District: Borgshavn (D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Tunuarmiut c. ap. (D), Qordlortoq c. ap. (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D).—Qaqortoq (V, D).—Igalikofjord: Sigssardlugtoq (D), Igaliko c. ap. (D).—Upernivik (D).—Agdluitsoq: Sletten c. ap. (D), 3 km south of Sletten (D), Qagdlumiut (D).

Parmelia disjuncta is quite common in the district. It is remarkably often fertile, and was found with apothecia in 4 places. It lives in the same type of localities as *P. sorediata*, and often together with the latter.

P. disjuncta may sometimes be hard to distinguish from *P. isidiotyla.* The former has, however, smaller soredia (seldom 1—2 mm) and more black and narrower lobes.

Parmelia prolixa is reported from the East Coast (Dahl, Lynge, and Scholander 1937, p. 57). The specimens differ considerably from

what is usually seen of *P. prolixa*; they are darker and have narrower lobes than usual. Through renewed revision I succeeded in finding soredia on 2 of the specimens. They must consequently be classified under *P. disjuncta*. The third specimen (from Kangerdlugsuak: Spekkpynten) had no soredia. It differs, however, so much from *P. prolixa*, and its general appearance is so like that of *P. disjuncta*, that I think it should be classified under the latter in spite of the fact that soredias are lacking. Consequently *P. prolixa* ought to be left out of the flora of Greenland.

13. *Parmelia conspersa* (EHRH.) ACH.

Godthaab District: Ameralik (V).

Frederikshaab District: Borgshavn (D).

Julianehaab District: N. Sermilik: Ukivigssaqaq (V), Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Western side of Narssaqfjell (D), Tunuarmiut c. ap. (D), Qagssiarssuk (D), Qordlortoq (D), 3 km west of Qíngua (D).—Julianehaab (V).—Igalikofjord: Igaliko (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), Qagdlumiut (D).

Parmelia conspersa has a distinct continental type of distribution in the district. It lives on rocks exposed to intense sunshine, the specimens beautifully developed. It was found in one place with apothecia.

14. *Parmelia centrifuga* (L) ACH.

Godthaab District: Godthaabsfjord: Qugssuk (V).—Kapisigdlit (V), Kobbe Fjord (Fylla-Exp.).—Ameralik (WORMSKJ.).—Ulitsivik (KORN.).—Bjørnesund: Eqaluit (KORN.).

Frederikshaab District: Arsuk Storø (JOHNSTRUP).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (SCHIØDT, D), Smallesund (KORN.).—Borgshavn (D).

Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Ukivigssaqaq (V), Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), western side of Narssaqfjell (D), Qissundagalen (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (corticola) (D), 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D).—Uperniviarssuk (D).—Julianehaab (V).—Igalikofjord: Eqaluit (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Nanortalik (V, E).—Tasermiut (V).—Ujaragsarssuk (V).

Parmelia centrifuga is very common in the whole district. At Qíngua it was found on cortex. Otherwise it is generally found on rocks or rocky walls over mosses.

The closely related *P. separata* TH. FR. was searched for in vain. *P. groenlandica* LYNGE is in my opinion only a *P. centrifuga*, destroyed by the Arctic climatic conditions. Professor LYNGE also agreed on this point. But still there is some difference between the Scandinavian type of *P. centrifuga* and the Greenland one. The latter often grows over mosses, rarely seen in Scandinavia and has not as pronounced a circular growth as the Scandinavian type.

15. *Parmelia incurva* (PERS.) FR.

Frederikshaab District: Arsukfjord: Bjørnedalen (D).

Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Tasiussaq (D).—Tunugdliarfik: (V), Narssaqfjell 650 m (D), Western side of Narssaqfjell (D), Qissungadalen (D), Ilímaussaq 625 m (D), Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Uperniviarssuk (D).—Julianehaab (V) (D).—Igalikofjord: Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Nanortalik (V, E).

Parmelia incurva is common in the southern part of the district on wind exposed rocks. It has been collected as far north as Disko.

16. *Parmelia saxatilis* (L) ACH.

Godthaab District: Sermilik: Kasuk (KORN.).

Frederikshaab District: Arsuk Storø (JOHNSTRUP).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).—Qornoq Isblink (KR).—Borgshavn (D).

Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Ukivigssaqaq (V), Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), Narssaqfjell 650 m (D), Western side of Narssaqfjell (D), Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), Kiagtut (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D).—Qaqortoq (V, D).—Uperniviarssuk f. *pruinosa* (D).—Julianehaab (V, D).—Igalikofjord: Eqaluit (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).— Nanortalik (E).—Tasermiut (H).—Sangmissoq (E).—Nunatsuk (S).—Kangerajuk (S).

Parmelia saxatilis is exceedingly common in the district. It was found in every locality visited in 1937. Specimens of *P. saxatilis* may be very like *P. omphalodes*, and if there were forms of the latter with isidia, it would be almost hopeless to distinguish it from forms of *P. saxatilis*.

Giant specimens were found on graves not more than 30 years old, near Sletten. Consequently it need not more than 30 years to attain its full development in South Greenland.

P. saxatilis was often found with apothecia. Red spots, probably due to the effect of urine, were rather frequent.

17. *Parmelia sulcata* TAYL.

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D).

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq(D).—Tunugdliarfik: (V), Western side of Narssaqfjell (D), Tunuarmiut (D), Qagssiarssuk (D), Kiagtut (D), Qordlortoq (D), Qíngua (D), ca. 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D).—Uperniviarssuk (V) (D).—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (*typica* and f. *convoluta* HILLM.) (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Nanortalik (E).

Parmelia sulcata is widespread in the southern part of the district, where it is rarer in the coastal districts. It was found on cortex and rocks. It is distinctly coprophilous and is often found on the top of bird rocks.

18. *Parmelia omphalodes* (L) ACH.

Godthaab District: Tuluvartalik (KR).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).

Julianehaab District: N. Sermilik: Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Qagssiarssuk (D), Qordlortoq (KR, D), Qíngua c. ap. (D).—Kangerdluarssuk: Eqalugarssuit (D).—Julianehaab (LUND).—Igalikofjord: Igaliko (D).—Agdluitsoq: 4 km east of Sletten (D), Qordlortorssuaq (D).—Nanortalik (E), Ikerasagssuaq (V).

Parmelia omphalodes is common in the whole district, but not as common as *P. saxatilis*. The specimens often live on rocks together with *Sphaerophorus* species forming a characteristic community. Most of the specimens have narrow lobes (v. *panniformis*).

19. *Parmelia dubia* (Wulf.) Schaer.

Julianehaab District: Tunugdliarfik: Qordlortoq scarce (D).

Parmelia dubia is certainly one of the rarest lichens in Greenland and has never been recorded from Greenland before. It has a relatively southern type of distribution and was found in a locality situated in the warmest part of Greenland.

Cetraria.

1. *Cetraria islandica* (L) Ach.

Godthaab District: Godthaabsfjord: Sadlen (Rink).—Godthaab (Rink).—Hjortetakken 3000' (Rink).—Ameralik (V).—Qarajaq Ilua (KR).— Kavsissagdlit (H).—Fiskenesset (H).—Head of Bjørnesund (KR).—Malerssorniarfik (H).

Frederikshaab District: Frederikshaab (V).—Sangmissoqfjord south of Frederikshaab (KR).—Neria (Eugenius).—Arsuk Storø (Johnstrup).—Arsukfjord: Kungnait (D), Ivigtut (Korn., D), Smallesund (Korn., KR).

Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Isaromiut (D).—Tunugdliarfik: Narssaq (D), Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), Kiagtût (D), South of Kiagtût (Porsild), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Uperniviarssuk (V, D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: (V), Amitsuarssuk (V), Qordlortorssuaq (D).—Nanortalik (V).—Kangerdluluk (V).

Cetraria islandica is one of the dominating species in the lichen heath and was often found with apothecia. In 1937 it was recorded in the diary in many more localities than stated above, but I dare not quote localities when no specimen was collected for fear of confusing it with *C. crispa*.

2. *Cetraria crispa* (Ach.) Nyl.

Julianehaab District: N. Sermilik: Tasiussaq (D).—Tunugdliarfik: 3 km northeast of Narssaqfjell c. ap. (D), Ilímaussaq 1200 m (D), Qíngua c. ap. (D).—Julianehaab (E).—Igalikofjord: Igdlerfigssalik 4—500 m (D).—Nanortalik (V).

Cetraria crispa is certainly a rarer species within South West Greenland than *C. islandica*, and seems to prefer more alpine localities. There are many specimens in the Copenhagen herbarium from the west coast north of Godthaab and the total lack of localities within the Frederikshaab and the Godthaab Districts is believed to be due only to insufficient investigation.

Cetraria crispa is distinguished from *C. islandica* by the pseudocyphellae only situated along the margin of the thallus and by the reaction: Med. Pd—. These seem to be very good and constant characters.

3. *Cetraria Delisei* (BOR.) TH. FR.

Godthaab District: Godthaabsfjord: Narssarssuaq (V).—Godthaab (RINK).—Ameralik (V).—Qarajaq Ilua (KR).—Island outside Sermilik (KORN., KR).—Head of Bjørnesund (KR).—Jensens Nunatakker (KORN., Jensen).—Malerssorniarfik (H).

Frederikshaab District: Narssalik (PORSILD).—Neria (EUGENIUS).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (LINDHARD) (D).—Borgshavn (D).

Julianehaab District: Josvaminen (D), Qagssimiut (D).—N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Narssaqfjell 650 m (D), Western side of Narssaqfjell (D), Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Innermost end (KR), Eqalugarssuit (D).—Uperniviarssuk (D).—Julianehaab (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D), Qeqertaq (V).

Cetraria Delesei is a very common species, and was found in all localities visited in 1937, often with apothecia and pycnidia. I never saw soredia. Regarding the systematic value of the soredia, see p. 21.

4. *Cetraria sepincola* (EHRH.) ACH.

Frederikshaab District: Neria Qíngua (H).—Sermiligârsuk (H).—Arsukfjord: Bjørnedalen (D), Kungnait (D).—Ivigtut (D).—Borgshavn (D).

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D), Ukivigssaqaq (V).—Tunugdliarfik: (V), Tunuarmiut (D),Qordlortoq (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Julianehaab (SØRENSEN).—Igalikofjord: Eqaluit (D), Igaliko (KR, D).—Agdluitsoq: 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D).—Sermersôq (H).—Tasermiut (V, H, E).

Cetraria sepincola has a distinctly continental type of distribution and is fairly common in the inner parts of the fjords. It lives almost exclusively on *Betula glandulosa*, *Betula odorata*, and *Salices*, often together with *Parmeliopsis* species.

5. *Cetraria chlorophylla* (Humb.) Vain.

Julianehaab District: Tunugdliarfik: Tunuarmiut on stone with *Parmelia omphalodes* and *Spaerophorus fragilis* (D).—Agdluitsoq: Sletten (D).

Cetraria chlorophylla is undoubtedly rare in the district; it lives on rocks.

6. *Cetraria glauca* (L) Ach.

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D).
Julianehaab District: N. Sermilik: Isaromiut (D).—Tunugdliarfik: Tunuarmiut (D), Qagssiarssuk (D).—Kangerdluarssuk: Eqalugarssuit (D).—Uperniviarssuk (D).—Agdluitsoq: Sletten (D).

Cetraria glauca is apparently not rare in South Greenland, and it is surprising that it has not previously been recorded with certainty from Greenland before. It either lives on steep rocky walls or on windy peaks, an indication that it cannot sustain a snow cover in winter. By Deichmann Branth and Grønlund 1892, p. 754, *Nephroma expallidum* is recorded from Tørveøen near Egedesminde leg. Hartz. The specimen in the Copenhagen herbarium is, however, no *Nephroma*, but a *Cetraria*. Another part of apparently the same collection lies in the Copenhagen herbarium under the name of *Cetraria glauca*, but Lynge doubts that the determination is correct.

7. *Cetraria nivalis* (L) Ach.

Godthaab District: Godthaabsfjord: Kapisigdlit (1927), Amitsuarssuk (1927), Qornoq (1927).—Kavssissagdlit (H).—Kugssuak (Jensen).
Frederikshaab District: Frederikshaab (H, Walker).—Neria (Eugenius).—Arsuk Storø (Johnstrup).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D), Smallesund (Korn.).—Borgshavn (D).
Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), Narssaqfjell 650 m (D), 3 km northeast of Narssaqfjell 700 m (D), Western side of Narssaqfjell (D), Tunuarmiut (D), Qagssiarssuk (D), South of Kiagtwt (Porsild), Qíngua (D), 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D).—Uperniviarssuk (V, D).—Julianehaab (D).—Kirkefjellet (Petersen).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 1000 m (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Amitsuarssuk (V).

Cetraria nivalis is very common and occurs in great quantities in the lichen heath over the whole district.

8. *Cetraria cucullata* (BELL.) ACH.

Godthaab District: Godthaabsfjord: Amitsuarssuk (1927.—Ameralik (V).

Frederikshaab District: Neria (EUGENIUS).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).—Borgshavn (D).

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), Tunuarmiut (D), Qagssiarssuk (D), Kiagtût (D), South of Kiagtût (PORSILD), Qíngua (D).—Uperniviarssuk (V, D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik (D), Igaliko (D).—Agdluitsoq: 3 km south of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Amitsuarssuk (V).

Cetraria cucullata is widespread in the district. It is not as common as *C. nivalis*, and does not form any mass vegetation.

9. *Cetraria pinastri* (Scop.) S. GRAY.

Julianehaab District: Tunugdliarfik: (V), Qíngua (D), 3 km west of Qíngua 150 m (D).—Igalikofjord: Igaliko (KR).

Cetraria pinastri is rare and has only been found on birch trees around the inner part of the Tunugdliarfik.

10. *Cetraria fahlunensis* (L) VAIN.

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).

Julianehaab District: Qagssimiut (D).—Tunugdliarfik: Narssaq (D), Narssaqfjell 650 m (D), Tunuarmiut (D).—Igalikofjord: Eqaluit (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Qeqertaq (V).

Cetraria fahlunensis is a good species, easily distinguishable from *C. hepatizon* by its general appearance. The under side is lighter and the specimens are more pulvinate than those of *C. hepatizon*, which are more appressed. A reliable character is the shape of the pycnidia, and in more dubious cases I have based my determinations on this character. To make sure, all specimens were examined under the microscope.

Cetraria fahlunensis is also ecologically different from *C. hepatizon*, because it preferably grows on rocks exposed to sunshine and mostly in lower elevations.

11. *Cetraria hepatizon* (Ach.) Vain.

Godthaab District: Kobbe Fjord (Fylla-Exp., Rink).

Frederikshaab District: Kangârssuk near Tindingen (KR).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).—Borgshavn (D).

Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Ukivigssaqaq (V).—Tunugdliarfik: (V), Narssaq (D), 3 km northeast of Narssaqfjell (D), Qissungadalen (D), Ilímaussaq (D), Tunuarmiut (D), Qordlortoq (D), Qíngua (D).—Uperniviarssuk (D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 1000 m (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Nanortalik (E).—Tasermiut (H).—Qeqertaq (V).

Cetraria hepatizon is common all over the district. It is a hardy species, reaching high altitudes. In the lowlands it often lives in windy places together with *Umbilicaria proboscidea* (see p. 121).

12. *Cetraria nigricans* Nyl.

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Isaromiut c. ap. (D).—Tunugdliarfik: (V), Narssaqfjell 650 m (D), 3 km northeast of Narssaqfjell c. ap. (D), Ilímaussaq 1050 m (D), Tunuarmiut c. ap. (D), Qagssiarssuk (D), Qíngua (D).—Igalikofjord: Igdlerfigssalik c. ap. 500—1000 m (V, D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdluimut (D).

Cetraria nigricans is fairly common in South West Greenland especially at higher elevations (above 400 m). It was found in enormous quantities especially on the table land from Ilímaussaq to Narssaqfjell. It was found in several places with apothecia. In one place soredious specimens were found together with fertile specimens. It deserves its own name as a form.

Cetraria nigricans f. *sorediata* E. Dahl f. nov.

Soraliis albis usque ad 1 mm latis a typo discrepat.

Locus classicus: Julianehaab District: Tunugdliarfik: 3 km NE Narssaqfjell 14.8.1937, leg. E. Dahl.

According to specimens in the Copenhagen herbarium, *C. nigricans* is found as far north as Upernivik, Ritenbenk, and Holsteinsborg.

Dactylina.

1. *Dactylina arctica* (HOOK) NYL.

Godthaab District: Godthaabsfjord: Baals Revier (V).—Ameralik (V).

Dactylina arctica is a northern species within South West Greenland, and was searched for in vain in 1937. It is one of the few species which is not common for South West Greenland and Scandinavia.

Cornicularia.

1. *Cornicularia divergens* ACH.

Godthaab District: Godthaab (TH. FRIES).—Ameralik (V).—Qarajaq Ilua (KR).—Niakornaq (H).

Frederikshaab District: Arsukfjord: Ivigtut (D).

Julianehaab District: Tunugdliarfik: Ilímaussaq 1200 m (D).—Uperniviarssuk (D).—Itivdliatsiarssuk (H).—Igalikofjord: Qagssiarssuk (V).—Upernivik (D).—Agdluitsoq: 3 km south of Sletten (D), 4 km east of Sletten (D), Qordlortorssuaq (D).

Cornicularia divergens is widespread in South Greenland, but not plentiful in each locality. It can easily be mistaken for *Alectoria subdivergens* E. DAHL (see p. 146).

2. *Cornicularia aculeata* (SCHREB.) ACH.

Godthaab District: Godthaab (RINK) (KR).—Simiutat (H).—Malerssorniarfik (H).—Tuluvartalik (KR).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).—Borgshavn (D).

Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Narssaqfjell 650 m (D), Western side of Narssaqfjell (D), Qissungadalen (D), Ilímaussaq 1200 m (D), Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D).—Uperniviarssuk (D) —Julianehaab (D).—Itivdliatsiarssuk (H).—Igalikofjord: Eqaluit v. *campestris* (D), Igdlerfigssalik ad v. *campestris* 1000 m (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qordlortorssuaq (D).

Cornicularia aculeata is a common species in rockfalls and in the lichen heath, and was only lacking in a few of the localities in the inner parts of the fjords visited in 1937.

C. aculeata in South West Greenland is a complex of several different types. The characters are, however, so varying that it is difficult to

distinguish any higher units, till new distinguishing features have been found. Most of the plants are typical v. *muricata* Ach., but the variations of plants in some places, for instance from Igdlerfigssalik, Qordlortorssuaq, Julianehaab and especially Eqaluit show transitions to v. *campestris*. A very distinctive form was found at Tunuarmiut which had much finer branches, the tips were much thinner and the branching more dense than in any other plant I have seen. It seems to deserve a name of its own.

Cornicularia aculeata v. *muricata* f. *tenuis* E. Dahl f. nov.

Tenuior atque densius ramificata quam v. *muricata* typica: rami spatio 1 mm ab apice ad 0.15 mm crassi (in v. *muricata* typica 0.3—0.4 mm).

Locus classicus: Julianehaab District: Tunugdliarfik: Tunuarmiut 10.7.1937 leg. E. Dahl.

Fertile specimens were found at Tunuarmiut.

Usneaceae.

Alectoria.

Key to the species of *Alectoria* in Greenland and to some related species.

1 a. Colour of the thallus, yellow. Contains usninic acid.
2 a. Main branches terete, smooth..... *A. ochroleuca*
2 b. Main branches compressed, flattened or foveated
A. vexillifera

1 b. Colour of the thallus, grey or greyish red, especially towards the base..... *A. nigricans*.

1 c. Colour of the thallus grey—brown—black.
3 a. Thallus elongated, pendulous, flaccid.
4 a. Divaricato-fibrillose..... (*A. subasiatica*)....
4 b. Not divaricato-fibrillose
5 a. With soredia, colour olivaceous, Pd—
A. chalybeiformis
5 b. Soredia lacking, colour brownish black, Pd +
A. lanestris
3 b. Thallus erect, divaricato-fibrillose (see 3 c).
6 a. Apices coarse, rigid, not antenniform.

7 a. Medulla Pd+ immediately red, branches terete *A. lanea*

7 b. Medulla Pd—, branches often longitudinally foveated.

8 a. Medulla C—. The hyphae of the cortex longitudinally orientated ..... *A. subdivergens*

8 b. Medulla C+. The hyphae of the cortex irregularly orientated ..... *Cornicularia divergens*

6 b. Apices antenniform. Main branches always terete. Medulla Pd— or Pd+ yellow afterwards often turning red.

9 a. With soredia. K— ..... *A. simplicior*.

9 b. Soredia lacking (in Greenland).

10 a. Darker towards the base, brown towards the apices. K+ yellow ..... *A. altaica*

10 b. Main branches dark to the tip, fibrillae shiny olivaceous grey ..... *A. tenuis*

3 c. Thallus decumbent, black, short, on stones (or earth).

11 a. Branches terete, apices not compressed and adnated *A. pubescens*

11 b. Branches towards the apices compressed and adnate, intricately branched ..... *A. minuscula*

1. *Alectoria chalybeiformis* (L) RØHL.

Godthaab District: Ameralik (V).—Island outside Sermilik (KR).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).

Julianehaab District: N. Sermilik: Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Western side of Narssaqfjell (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D).—Kangerdluarssuk: Eqalugarssuit (D).—Julianehaab (D).—Itivdliatsiarssuk (H).—Igalikofjord: Eqaluit (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).

Alectoria chalybeiformis is quite common in the district. It occurs on rocky walls, on rocks or on the top of windy hills together with other species as *A. vexilifera* and *A. ochroleuca*. In rainy weather with strong wind the tips and the thalli are bent in the direction of the wind, so that thalli generally are orientated in the direction of the wind prevailing. In the outer districts they are generally orientated in the direction SW—NE, in the inner districts mostly in the direction E—W. (Effect of foehn, which is often accompanied by rain).

2. *Alectoria lanestris* (Ach.) Gyelnik.

In Fedde Repert. XXXVIII, p. 227.

Julianehaab District: Agdluitsoq: Sletten, on a rocky wall (D).

The *Alectoria jubata* complex is very difficult from a systematic point of view. One may probably distinguish between 2 types in Scandinavia. The first corresponds to the *A. chalybeiformis* in Greenland. It lives on birch trees near the tree line and on the ground in great quantities. It has a greyish-black shiny colour and is rather coarse. The KOH reaction is greyish or olivecoloured. The other type lives on fir and spruce trees and is more delicate, of a brown colour, and gives no grey colour with KOH.

The *Alectoria lanestris* from Greenland reacted Pd + red and had no soredia. It was much more tender and brown than ordinary *A. chalybeiformis* which besides gives no Pd reaction. The 2 species are clearly distinguishable on Greenland. I have called my plant *A. lanestris* as it corresponds with the description of that plant, but I will not here express any opinion as to whether this is a good species distinguished from the genuine *A. jubata* and closely related forms.

3. *Alectoria lanea* (Ehrh.) Vain.

in Medd. Soc. Faun. et Flor. Fenn. v. XIV, 1886, p. 21.

Lichen laneus. Ehrh. Plant. Crypt. 1788.

= *Alectoria nitidula* (Th. Fr.) Vain. Adjum. Lich. Lapp. I, 1881, p. 116.

Godthaab District: Godthaabsfjord: Amitsuarssuk (1927).—Ameralik (V).—Qarajaq Ilua (KR).—Malersorniarfik (H).

Frederikshaab District: Arsukfjord: Kungnait (D), Ivigtut (D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Isaromiut (D).—Tunugdliarfik: (V), Narssaqfjell 650 m (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Uperniviarssuk (D).—Igalikofjord: (V), Eqaluit (Petersen, D), Qagssiarssuk (V).—Agdluitsoq: Sletten (D), ca. 3 km south of Sletten (D), ca. 4 km east of Sletten (D), Qordlortorssuaq (D).

Alectoria lanea is quite common in South West Greenland. It is very characteristic with its shiny brown colour, the intense red Pd reaction in the medulla and the branched short fibrillae. In my opinion it is a very distinct species different from *A. bicolor*. It has its own characteristic general appearance and a special distribution.

Alectoria bicolor and *A. lanea* both react red: Pd + immediately red. They must probably contain an unknown lichen acid, as no known lichen acid reacts like this, as far as I know.

In the Copenhagen herbarium there is a specimen from Iceland.

S.W. Iceland: Saxahol. 19.7.1897 leg. HELGI JONSSON. As far as I know *A. lanea* has never previously been recorded from Iceland. In Greenland it has been found as far north as Tassiusaq north of Upernivik ca. 73° 20′ N. lat. leg. WULFF.

4. *Alectoria simplicior* LYNGE.

Julianehaab District: Uperniviarssuk northeast of Julianehaab (D).—Upernivik north-east of Sardloq (D).—Agdluitsoq: Qordlortorssuaq (D).

Alectoria simplicior is hardly common in South West Greenland. I am indebted to my friend Dr. AHLNER for the determination. *A. simplicior* occurs only on earth or between mosses, I have never seen a specimen on birch trees, the usual substratum in Scandinavia. As far as I know this species has never been recorded west of the Atlantic ocean.

5. *Alectoria tenuis* E. DAHL sp. nov.

Thallus filiformis, ramos longos necnon ramulos divaricatos gerens, erectus ad 5 cm longus, pulvinatus. Rami principales nigri ad atrofusci a basi ad apicem usque concolores, ramuli plerumque fusci vel olivaceofusci, praecipue ramuli basales, colorem *Alectoriae bicoloris* aemulantes. Rami principales tenues, ad 0.4 mm in diam.; apices ramulorum saepe curvati itaque thallus crispus.

Cortex ramorum principalium ad apicem fere obscurus, 40—50 μ crassus, e hyphis longis densis contextus, a medulla bene distinctus. Corticis pars exterior ca. 5 μ crassa valde obscurior est quam pars centralis. Medulla e hyphis sparsis 2.5—5 μ crassis irregulariter agglomeratis consistens. Apices ramorum gonidiis viridibus rotundis, 10—20 μ in diam. repleti.

Cortex et medulla Pd—, K—, C—, Kc—.

Locus classicus: Julianehaab District: Igalikofjord: Eqaluit, in terra ad rivulum una cum *Parmelia saxatilis* et *Sphaerophorus*, copiose. 19.8.37 leg. E. DAHL.

Alectoria tenuis was only found in one single place, and is undoubtedly very rare in South West Greenland. It belongs to the section *Divaricatae* D. R. It is closely related to *A. altaica* but may be distinguished on the following characters.

A. tenuis	*A. altaica*
Main branches thinner (diam. o.4 mm) blackish brown to the very tip. Fibrillae near the basis are light olivaceous grey much lighter than the main branch.	Main branches coarser, towards the tip of a more light brown colour. The colour of the fibrillae near the base not different from that of the main branch.

Branch tips curved or curled.	Branch tips curved or straight, but not curled.
The cortex of the main branches with a dark colour throughout.	Only the superficial stratum of the cortex of the main branches dark-coloured.
Thallus K—.	Thallus K+.

Dr. AHLNER has had my *A. tenuis* for revision. He has informed me that he has found the same type in Scandinavia and recognized it as a new species, but it is not yet published. In Scandinavia this species has been confused with *A. bicolor* with which it has the light grey colour of the basal fibrillae in common. It is, however, much finer, the branches are much thinner. I have seen it on rocky walls at Krokkleiven near Oslo.

6. *Alectoria altaica* (GYELN.) RÄS.

In. Ann. Zool.-Bot. Fenn. Vanamo. Bd. 12, no. 1, 1939, p. 34. *Bryopogon altaicus* GYELN. in Tisia II, 1937.

Alectoria spinulosa AHLNER in Ann. Bot. Soc. Zool.-Bot. Renn. Vanamo Bd. 9, no. 1, 1937, nomen nudum.

Julianehaab District: Kangerdluarssuk: Eqalugarssuit (D).—Agdluitsoq: ca. 3. km south of Sletten (D), Qordlortorssuaq (D).

I am indebted to Dr. AHLNER for the correct determination of this species in Greenland. I was misled by the fact that no Greenland plant had soredia which is said to be characteristic of *A. altaica*, but in alpine localities soredia may be scarce or lacking, also in Scandinavia. *A. altaica* is new to Greenland.

7. *Alectoria subdivergens* E. DAHL sp. nov.

Plate II, Figs. 3—4.

Thallus filiformis, copiose divergenti-ramosus, ramis subaequis, plus minusve pulvinatus, erectus vel ad muscos prostratus, ad 10 cm longus, fuscus vel atrofuscus, creberrime haud nitidus vel raro lucidus. Rami principales ad 1—2 mm crassi, irregulares, foveolis longiusculis, sine foramine, pseudocyphellis destitutus. *Cornicullariam divergentem* revocat. Cortex e hyphis longis densis contextus, in ramis principalibus 70—100 μ crassus a medulla bene distinctus. Pars exterior 10 μ crassa, fusca. Medulla e hyphis sparsis 5—7 μ crassis contexta, gonidiis viridibus rotundis, 10—16 μ in diam. repletis.

Apothecia lateralia fusca haud lucida, emarginata, discis convexis ad 3 mm in diam.

Hymenium 45—65 μ crassum, pars superior 5—10 μ crassa, fusca. Hypothecium 30—50 μ crassum, e hyphis cum superficie parallelis consistens. Sub hypothecio stratum e hyphis irregulariter contextis situm

est, quod sub apothecio ad corticem transit. Hoc stratum una cum hypothecio 60—80 μ crassum a medulla bene distinctum est. Medulla e hyphis 5—8 μ crassis gonidiis viridibus, 10—20 μ in diam. instructis haud densis contexta est.

Cortex sub apothecio e hyphis densis contextus, 40—100 μ crassus, superne strato fusco 10 μ crasso crystallis numerosis repleto instructus. Hypothecium et hyphae corticales conglutinatae esse videntur; in KOH positae dispergunt et ramificationes numerosas ostendunt.

Asci apice dilatati, 10—15 × 35—50 μ, octospori. Sporae globosae vel subelipticae, 6—8 μ, incoloratae, unicellulares. Paraphyses tenues pauciramosae, partitae, apice leviter incrassatae. Medulla C—, Pd—.

Locus classicus: Julianehaab District: Qagssimiut inter muscos. 4.7.1937 leg. E. DAHL.

Alectoria subdivergens has been found in the following localities in Greenland.

Greenland (HOLBOELL).

Frederikshaab District: Arsukfjord: leg.?, Ivigtut (SCHIØDT).

Julianehaab District: Qagssimiut c. ap. (D).—Igalikofjord: Eqaluit (D).—Agdluitsoq: Qagdlumiut (D).

A. subdivergens is probably not rare in South West Greenland, but is easily mistaken for *Cornicularia divergens*. It is, however, different from this by the negative C-reaction of the medulla, by lacking pseudocyphellae, by a less shiny colour and more foveated branches, and, at last, by the hyphae of the cortex being longitudinally arranged.

The new species seem to be most closely related to *Alectoria divergescens* NYL. Fret. Beher. (1887) p. 76 see DU. RIETZ in Arkiv f. Bot. Bd. 20 no. 11, p. 20. It has been collected in China, but I have seen no specimen. It is reported to grow on trees, and the spores are different (spores 10—11 × 4.5 μ) whereas *A. subdivergens* has globose spores 6—8 μ in diameter).

I have revised the Scandinavian material of *Cornicularia divergens* in the Oslo herbarium to see whether it might occur in Scandinavia, but with no success. In a collection from Labrador, however, collected by TANNER, I found one specimen from Hebron.

8. *Alectoria nigricans* (ACH.) NYL.

Godthaab District: Godthaabsfjord: Qôrnoq (1927).—Kook Øer (TH. FRIES).—Kavssissagdlit (H).

Frederikshaab District: Neria Qíngua (H).—Arsuk Storø (JOHNSTRUP).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (KORN.) (SCHIØDT, D).—Borgshavn (D).

Julianehaab District: N. Sermilik: Ukivigssaqaq (V), Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Narssaqfjell (D), 3 km north-east of Narssaqfjell 700 m c. ap. (D), Ilímaussaq 1200 m (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Uperniviarssuk (D).—Kangerdluarssuk: Eqalugarssuit (D).—Itivdliatsiarssuk (H).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 100 m (V, D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—S. Sermilik: Innermost end of Sermilik 1880′ (S).—Nanortalik (E).

Alectoria nigricans is very common in the whole district. It lives preferably in rockfalls or near the edge of the lichen heath, towards spots where the compact lichen heath is destroyed by wind. It reaches high altitudes. In one locality it was found with apothecia.

At Qordlortorssuaq *A. nigricans* was found in a sorediated form. It deserves a name by itself.

Alectoria nigricans f. *sorediata* E. Dahl f. nov.

A typo soraliis punctiformibus magnis lateralibus numerosis discrepans.

Locus classicus: Julianehaab District: Agdluitsoq: Qordlortorssuaq 22.8.1937 leg. E. Dahl.

9. *Alectoria ochroleuca* (Ehrh.) Nyl.

Godthaab District: Godthaabsfjord: Amitsuarssuk (1927), Qôrnoq (1927).—Godthaab (Th. Fries).—Ameralik (V).—Qarajaq Ilua (KR)—Fiskenæsset (H).—Kangârssuk south of Fiskenæsset (KR).—Jensens Nunatakker (Korn.).

Frederikshaab District: Neria (Eugenius).—Arsukfjord: Arsuk Storø (Johnstrup), Bjørnedalen (D), East of Kungnait (D), Ivigtut (Korn., D), Smallesund (Korn.).—Borgshavn (D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), Narssaqfjell 650 m (D), Western side of Narssaqfjell (D), Ilímaussaq 1200 m (D), Tunuarmiut (D), Qagssiarssuk (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Uperniviarssuk (D).—Julianehaab (D).—Igalikofjord: Eqaluit (Petersen, D), Igdlerfigssalik 1000 m (D), Igaliko (D).—Upernivik (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D),

Qagdlumiut (D), Qordlortorssuaq (D).—Nanortalik (V).—Tasermiut (H).—Iluafjord: Kangerdlek Qíngua (S).

Alectoria ochroleuca is very common in the whole district. It often lives in windy places. All plants collected reacted Pd— nor was any of them like the f. *septentrionalis* LYNGE.

10. *Alectoria vexillifera* (NYL.) STZBRGR.

In. Ann. d. K.K. Naturhist. Hofmus. Wien 1892, p. 1222.
Alectoria ochroleuca subsp. *A. vexillifera* NYL. apud. KIHLM. in Medd. soc. Faun. et Flor. Fenn. Bd. 18. 1891, p. 48. = *A. cincinnata* (FR.) LYNGE in. Stud. Lich. Flor. Norway 1921, p. 217.

Godthaab District: Godthaabsfjord: Baals revier (V).—Godthaab (TH. FRIES).—Malerssorniarfik (H).
Frederikshaab District: Arsuk Storø (JOHNSTRUP).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (SCHIØDT, D).
Julianehaab District: Qagssimiut (D).—Tunugdliarfik: Tunuarmiut (D).—Julianehaab (V).—Igalikofjord: Eqaluit (PETERSEN, D), Qagssiarssuk (V).—Agdluitsoq: Sletten (D).—Nanortalik (V).

Alectoria vexillifera is not very common in the district. It lives on vertical rocky walls or in bleak, windy places.

I do not think there is any difference of species between the *A. vexillifera* and the *A. cincinnata* (FR.) LYNGE. As the first name is the oldest, the specimens must be called *A. vexillifera* (NYL.) STZBRGR.

In the flora list of LYNGE (1938, p. 111) *A. thrausta* is recorded from South Greenland after a record in my diary. Unfortunately the plant was misidentified, and belongs to *A. vexillifera.*

11. *Alectoria pubescens* (L) HOWE jr.

(= *Parmelia pubescens* (L.) VAIN. vidi DEGELIUS in Nyt. Mag. f. Nat. Vid. Bd. 78 1938, p. 285).

Godthaab District: Jensens Nunatakker (KORN.).
Frederikshaab District: Frederikshaab (V).—Arsuk Storø (JOHNSTRUP).—Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D), Smallesund (KR).—Borgshavn (D).
Julianehaab District: Josvaminen (D).—Qagssimiut (D).—N. Sermilik: Ukivigssaqaq (V), Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Narssaqfjell 650 m (D), West side of Narssaqfjell (D), Qissungadalen (D), Ilímaussaq 1200 m (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D).—Upperniviarssuk (D).—Julianehaab (D).—Igalikofjord: Eqaluit (PETERSEN, D), Igaliko (V) (D).—Upernivik (D).—Agdluitsoq: Sletten (D),

3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut Qordlortorssuaq (D).—Nanortalik (E).—Qeqertatsiak (E).

Alectoria pubescens is as common in the whole district as a lichen can be, from the sea and up to the peaks of the highest mountains. It lives preferably on big rocks or on windy gravel. The scarcity of localities from the Godthaab District can hardly mean that it is rare, but that it has not been collected in the district.

12. *Alectoria minuscula* Nul.

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).—Borgshavn (D).

Julianehaab District: N. Sermilik: Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Ilímaussaq 1200 m (D), Kiagtût (D).—Kangerdluarssuk: Eqalugarssuit (D).—Qaqartoq (D).—Igalikofjord: Igdlerfigssalik 1000 m (D), Igaliko c. ap. (D).—Nanortalik (E).

Alectoria minuscula is common in the district visited in 1937, however not as common as *A. pubescens*. It lives preferably in higher elevations and was found at the highest places visited.

The lack of localities in the Godthaab and the northern parts of the Frederikshaab Districts must be due to insufficient investigations.

Teloschistaceae.

Xanthoria.

1. *Xanthoria candelaria* (L) Arn.

Godthaab District: Sermilik: Qaersoq (Korn.).—Island outside Sermilik (KR, Korn.).

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).—Borgshavn (D).

Julianehaab District: Qagssimiut (D).—N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: Narssaq (D), Western side of Narssaqfjell (D), Qíssungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D).—Uperniviarssuk (D).—Julianehaab (D).—Igalikofjord: Eqaluit (Petersen, D), Igaliko (V, D).—Agdluitsoq: Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Nanortalik (E).—Tasermiut (H).

Xanthoria candelaria is very common in South West Greenland, it lives in abundant quantities on birds' resting places and near Eskimo residences which are the substitutes for the bird cliffs in South Greenland

for nitrophile lichen vegetation, often fertile. It is the type of the nitrophile lichen in the district.

Physciaceae.

Physcia.

1. *Physcia aipolia* (EHRH.) HAMPE.

Julianehaab District: Qaqortoq in muro ecclesiae (V) det. LYNGE.

The specimen in the Copenhagen herbarium is not quite typical of *Ph. aipolia* as seen in Scandinavia. It has some resemblance to *Ph. melops*, but is not typical of that either.

2. *Physcia melops* DUF.

Godthaab District: Ameralik (V).

Frederikshaab District: Borgshavn (D).

Julianehaab District: N. Sermilik: Isaromiut (D).—Tunugdliarfik: (V).—Western side of Narssaqfjell (D), Qagssiarssuk (D), Kiagtût (D), Qíngua (D).

Physcia melops is not rare in the inner parts of Tunugdliarfik. Some plants were quite typical, others had somewhat broader lobes than usually seen. It was found in places exposed to the sun on rocks and among moss, not nitrophilous.

Physcia melops was first mentioned by LYNGE and SCHOLANDER (1932, p. 98) from South West Greenland. On the same page also *Ph. aipolia* is recorded from South West Greenland. In my opinion one of the plants called *Ph. aipolia*, viz. that from Tunugdliarfik leg. VAHL, belongs to *Ph. melops*.

3. *Physcia stellaris* (L) NYL. em. HARM.

Julianehaab District: Tunugdliarfik: Western side of Narssaqfjell (D).—Kangerdluarssuk: Eqalugarssuit (D).—Qaqortoq (V, D).—Igalikofjord: Igaliko (D).

Physcia stellaris is new to the flora of Greenland. It is not common and lives on rocks always together with *Caloplaca elegans*. It bears some resemblance to *Physcia melops*, but is easily distinguished by its pruniose apothecia and by the negative reaction of the medulla with KOH.

Physcia stellaris has been stated by DEICHMAN BRANTH and GRØNLUND (1888, p. 472) to be quite common all over Greenland, but according to LYNGE and SCHOLANDER (1932, p. 98) this is due to incorrect determinations.

4. *Physcia caesia* (Hoffm.) Hampe.

Frederikshaab District: Arsukfjord: Kungnait (D).—Borgshavn (D).
Julianehaab District: N. Sermilik: Tasiussaq (D).—Tunugdliarfik: Western side of Narssaqfjell (D), Qissungadalen (D), Tunuarmiut (D), Sitdlisit (D), Qagssiarssuk c. ap. (D), Kiagtût (D), Qordlortoq (D), Qíngua (D).—Kangerdlugarssuk: Eqalugarssuit (D).—Qaqortoq c. ap. (D).—Julianehaab (V, D).—Igalikofjord: Igaliko c. ap. (D).—Agdluitsoq: Sletten (D), Qagdlumiut (D).—Nanortalik (E).

Physcia caesia is one of the most common Physcias in South Greenland. It is a nitrophilous species, but not as much as *Ph. dubia.*

5. *Physcia Wainioi* Räs.

Julianehaab District: Julianehaab on wooden roofs with *Ph. caesia* (D).

Physcia Wainioi has probably recently immigrated with the wood which has come from Denmark for wooden roofs. A similar case is the occurrence of *Usnea hirta* in Iceland (see Lynge 1940, p. 48).

6. *Physcia subobscura* Nyl.

Frederikshaab District: Arsukfjord: Kungnait (D).
Julianehaab District: Tunugdliarfik: Sitdlisit (D), Qagssiarssuk (D), Qordlortoq (D).—Qaqortoq (D).—Igalikofjord: Igdlerfigssalik (D).

Physcia subobscura is not very common in the district. It lives exclusively on rocks, very often together with *Ph. caesia.*

7. *Physcia dubia* (Hoffm.) Lettau em. Lynge.

Frederikshaab District: Borgshavn on stone and earth (D).
Julianehaab District: Qagssimiut (D).—Tunugdliarfik: Narssaq c. ap. (D), Qagssiarssuk (D), Kiagtût (D), Qordlortoq on stone and earth c. ap. (D).—Qaqortoq (D).—Julianehaab (D).—Igalikofjord: Qagssiarssuk (KR), Igaliko c. ap. (D).—Agdluitsoq: Sletten (D), 3 km south of Sletten (D), Qagdlumiut (D), Qordlortorssuaq (D).—Nanortalik (E).

Physcia dubia is common on birds' resting places and in other localities rich in nitrogen, for instance in the villages of the Greenlanders.

8. *Physcia intermedia* Vain.

Godthaab District: Ameralik (V).
Frederikshaab District: Borgshavn (D).

Julianehaab District: Tunugdliarfik: Narssaq (D), Qissungadalen (D), Tunuarmiut (D), Qagssiarssuk (D), Qordlortoq (D), Qíngua (D).—Julianehaab (D).—Igalikofjord: Igaliko (D).—Agdluitsoq: Sletten (D).

Physcia intermedia is fairly common in the district on rocks. It is not as distinctly nitrophilous as other species of *Physcia*, but is nevertheless often found together with *Ph. caesia*.

Some of the plants belong to the *Wahlenbergii* type.

To distinguish *Ph. teretiuscula* and *intermedia* in Arctic material is difficult. Some of the plants collected by LYNGE on Iceland and called *teretiuscula* I should prefer to call *intermedia*. They give also a distinctly negative reaction of the medulla with KOH. Some plants, however, give the reaction medulla K+ yellow, and also after their general appearance I prefer to class them under *teretiuscula*. None of the specimens from Greenland can be confused with *teretiuscula*.

9. *Physcia tenella* BITTER.

Julianehaab District: Ilua: Sagdliaruseq (V) det LYNGE.

Physcia tenella must be rare in South Greenland and was not found during the expedition in 1937.

10. *Physcia lithothodes* NYL.

Godthaab District: Godthaabsfjord: Qugssuk (V).

Frederikshaab District: Arsukfjord: Kungnait (D).—Borgshavn (D).

Julianehaab District: N. Sermilik: Isaromiut (D), Tasiussaq (D).—Tunugdliarfik: (V), Narssaq (D), Western side of Narssaqfjell (D), (D), Qissungadalen (D), Qagssiarssuk (D), Qordlortoq (D), 3 km west of Qíngua (D).—Uperniviarssuk (D).—Julianehaab (V, D).—Agdluitsoq: Qagdlumiut (D).—Tasermiut (V, H).

Physcia lithothodes is quite common in and near brooks on rocks and among moss.

The peculiar *Physcia* referred to by LYNGE and SCHOLANDER (1932, p. 98) determined by LÅNG to *Physcia Aquila*, in my opinion belongs to *Ph. lithothodes*.

11. *Physcia sciastra* (ACH.) D. R.

Julianehaab District: N. Sermilik: Isaromiut (D).—Tunugdliarfik: Qagssiarssuk (D), Qordlortoq (D), 3 km west of Qíngua (D).—Kangerdluarssuk: Eqalugarssuit (D).—Igalikofjord: Eqaluit (D), Igaliko (D).—Agdluitsoq: 4 km east of Sletten (D).

Physcia sciastra has a distinctly continental distribution in the district. In the rich locality for *Physcia* on the church ruin near Qaqortoq (where *Ph. grisea*, *orbicularis*, *caesia* c. ap., *stellaris*, *subobscura* and *melops* occur) a peculiar form of *Ph. sciastra* was found. It was more microphylline than usual and had some resemblance to *Ph. subobscura* except for the rhizinae. The isidia were coarse and large and were mostly developed along the margins of the lobes.

12. *Physcia orbicularis* (Neck.) D. R.

Julianehaab District: Qaqortoq (D).—Agdluitsoq: 3 km south of Sletten (D).

Physcia orbicularis is rare and scarce in South Greenland, at Qaqortoq it lived on mosses, at Sletten on rocks. It has not previously been recorded from Greenland.

13. *Physcia muscigena* (Ach.) Nyl.

Godthaab District: Ameralik (V).

Julianehaab District: N. Sermilik: Isaromiut c. ap. (D), Tasiussaq (D).—Tunugdliarfik: (V), Qagssiarssuk c. ap. (D), Kiagtût (D), Qordlortoq c. ap. (D), ca. 3 km west of Qíngua 300 m (D).—Kangerdluarssuk: Eqalugarssuit (D).—Qaqortoq (V, D).—Julianehaab (V, D).—Upernivik (D), Agdluitsoq: Sletten (D), 3 km south of Sletten (D), Qagdlumiut (D).—Frederiksdal (V).

Physcia muscigena is common on moss. I got the impression that it was basiphile or caliphile. It was not rare with apothecia.

14. *Physcia grisea* (Lam.) Zahlbr.

Julianehaab District: Tunugdliarfik: Qagssiarssuk (D).—Kangerdluarssuk: Eqalugarssuit (D).—Qaqortoq (V, D).—Agdluitsoq: Qagdlumiut (D).

Physcia grisea is not common in the district. It lives among moss and on rocks, preferably on vertical, somewhat shady, rock walls.

15. *Physcia nigricans* (Flk.) Stizenb. em. D. R. v. *groenlandica* E. Dahl v. nov.

A *Physcia nigricanti* typica discrepat: statura multo maiore ac robustiore, pulvines ad 1 cm in diam. formante, lobis margine rhizinis obscuris longis ornatis. Sorediae facie inferiore loborum apice oriuntur, ut in v. *sciastrella*, raro in apice loborum, ut in alliis formis *Physciae nigricantis*.

Locus classicus: Julianehaab District: Agdluitsoq: in decliviis et locis praeruptibus procul vicum, una cum *Caloplaca elegans*, *Xanthoria candelaria* et cum alliis lichenibus nitrophilis. Leg. E. DAHL.

I was much in doubt whether I should describe my plants as a new species. The smallest plants showed, however, transition characters to typical *Ph. nigricans* and especially to *Ph. parvula* as distributed in Räs. Lich. Fenn. 148. The plants of RÄSÄNEN have a few marginal rhizinae, but have not the typical form of the soredia of *groenlandica*. When more material is available, it will perhaps be possible to describe the v. *groenlandica* as a species of its own. But on the basis of the scarce material available to day, I do not consider it warrantable. My plants are probably more closely related to *Ph. nigricans* than to *Ph. labrata* MERESCHOVSKY. *Physcia nigricans* has not previously been found in Greenland.

Lichenes Imperfecti.

Thamnolia.

1. *Thamnolia vermicularis* SCHAER.

Frederikshaab District: Arsukfjord: Bjørnedalen (D), Kungnait (D), Ivigtut (D).

Julianehaab District: Tunugdliarfik: Narssaq (D), Narssaqfjell 650 m (D), 3 km northeast of Narssaqfjell 700 m (D), Western side of Narssaqfjell (D), Ilímaussaq 1200 m plentiful (D), Tunuarmiut (D), Qagssiarssuk (D), Kiagtût (D), Qordlortoq (D), Qíngua (D), 3 km west of Qíngua (D).—Uperniviarssuk (V, D).—Igalikofjord: Eqaluit (D), Igdlerfigssalik 1000 m (D), Igaliko (D).—Agdluitsaq: Sletten (D), 3 km south of Sletten (D), 4 km east of Sletten (D), Qagdlumiut (D).

Thamnolia vermicularis is found in many places, but it is scarce in each place, especially in the lowland. In higher elevations, in the *Juncus trifidus* zone, it is more common. All my plants reacted K + light yellow and consequently do not contain thamnolic acid. Thus, they must be classified under the chemical species *Thamnolia subvermicularis* ASAHINA in Journ. Jap. Bot. XIII, No. 5, 1937.

It may be doubted whether *Th. subvermicularis* is a distinct species as it has no known morphological character distinguishing it from *Th. vermicularis*. But it is an indication that it has an independent distribution that only one of the types is present in such big collections as those from South Greenland.

CONCLUDING REMARKS

Within South West Greenland altogether 198 species of macrolichens have been recorded with certainty, the term macrolichen used in the sense employed in this book.

The following new systematic units are described:

One new family

Placynthiaceae

Two new genera,

Spilonematopsis
Thallinocarpon

The following new species,

Spilonematopsis multispora
Pyrenopsis macrocarpa
— *myriospora*
Thallinocarpon pulvinatum
Leciophysma occidentale
Porocyphus dispersus
— *groenlandicus*
Alectoria subdivergens
— *tenuis*

The following new units of lower ranks,

Peltigera scabrosa v. *occidentalis*
Cladonia cornuta v. *groenlandica*
Stereocaulon rivulorum v. *groenlandicum*
Cetraria nigricans f. *soralifera*
Alectoria nigricans f. *sorediata*
Physcia nigricans v. *groenlandica*

The following species have not previously been recorded west of the Atlantic Ocean.

Ephebeia hispidula (Ach.) Nyl.
Pyrenopsidium granuliforme (Nyl.) Forss.
— *Iivaarense* (Vain) Forss.

Thyrea radiata (SMFT.) ZAHLBR.
Umbilicaria cinereorufescens (SCHAER) FREY.
Alectoria simplicior (VAIN) LYNGE

The following species are new to Greenland,

Pyrenopsis rhodosticta (TAYL.) MÜLL. ARG.
Phylliscum Demeangoni (WG.) NYL.
Lobaria Halli (TUCK) ZAHLBR.
Peltigera scutata (DICKS) DUBY.
Cladonia digitata (L) SCHAER.
— *decorticata* (FLK.) SPRENG.
— *coniocraea* FLK.
Stereocaulon glareosum MAGN.
— *tomentosum* FR.
— *coralloides* FR.
Umbilicaria hirsuta ACH. em. FREY.
— *mammulata* (ACH.) TUCK.
Parmelia encausta (SM.) NYL.
— *panniformis* (NYL.) VAIN.
— *dubia* (WULF.) SCHAER.
Cetraria glauca (L) ACH.
Alectoria lanestris (ACH.) GYELN.
— *altaica* (GYELN.) RÄS.
Physcia stellaris (L) NYL. em. HARM.
— *orbicularis* (NECK.) D. R.
— *Wainioi* RÄS.
— *nigricans* (FLK.) STIZENB.

The collections of macrolichens from South West Greenland are so extensive that a phytogeographical comparison between the South West Greenland lichen flora and the lichen flora of other regions like Scandinavia or the Alps must be warranted.

Our knowledge of the macrolichen flora of South West Greenland is, however, not sufficient to allow us to sort out different types of distribution within South West Greenland, except for continental and oceanic types of distribution. Among the vascular plants, *Nardus stricta* has a distinctly southern type of distribution, *Alnus viridis* on the other hand a northern type of distribution. Similar types of distribution among the lichens can hardly be stated, until more material is available.

The following species have distinctly a continental type of distribution:

Lobaria verrucosa (HUDS.) HOFFM.
Nephroma expallidum NYL.

Umbilicaria polyphylla (L) HOFFM.
Parmeliopsis hyperopta (ACH.) VAIN.
Parmelia isidiotyla NYL.
— *panniformis* (NYL.) VAIN.
Cetraria sepincola (EHRH.) ACH.

The following species are of a less distinctly continental type of distribution:

Collema furvellum RÄS.
Nephroma laevigatum ACH.
— *parile* ACH.
Cladonia cariosa (ACH.) SPRENG.
Umbilicaria cinereorufescens (SCHAER.) FREY.
Parmeliopsis ambigua (WULF.) NYL.
Parmelia physodes (L) ACH.
— *conspersa* (EHRH.) ACH.
Physcia melops DUF.
— *sciastra* (ACH.) D. R.

Some additional species show a tendency towards continentality in their distribution.

The corresponding oceanic type of distribution is represented by only few species, viz.

Cladonia Floerkeana (FR.) SMFT.
Peltigera scabrosa TH. FR.

Some alpine or high-Arctic species are not found in the inner parts of the fjords, but cannot be said to be of an oceanic type of distribution.

South West Greenland has a number of species of lichens which are not found in other parts of Greenland. As examples may be chosen,

Leptogium lichenoides (L) ZAHLBR. typica
Lobaria verrucosa (HUDS.) HOFFM.
Nephroma species
Peltigera scutata (DICKS.) DUBY.
Cladonia sylvatica (L) HOFFM.
— *coniocraea* FLK.
Stereocaulon paschale (L) HOFFM.
— *tomentosum* FR.
— *coralloides* FR.
Umbilicaria polyphylla (L) HOFFM.
— *hirsuta* (SW.) ACH.
Parmeliopsis hyperopta (ACH.) VAIN.

Parmelia conspersa (EHRH.) ACH.
— *isidiotyla* NYL.
— *panniformis* (NYL.) VAIN.
Cetraria fahlunensis (L) ACH.(?)
— *glauca* (L) ACH.
— *sepincola* (EHRH.) ACH.
Physcia stellaris (L) NYL. em. HARM.
— *grisea* (LAM.) ZAHLBR.
— *orbicularis* (NECK.) D. R.

All these species are of a more southern type of distribution, obviously dependent on warm summers. Many of them have previously been mentioned among the species of a continental type of distribution. Because of the long list of southern species characteristic of the region it may be doubted whether the region belongs to the real Arctic countries.

It is believed that the list of macrolichen species from South West Greenland gives a fairly correct picture of the composition of the macrolichen flora. Doubtlessly many species occur within the region which have not yet been found. But it is probable that these species belong to the same flora elements as those already found. This is the assumption on which the following discussion is based. Future investigations will prove or disprove the assumption.

In the phytogeographical comparison the genera of a crustaceous type of lichen are omitted, our knowledge of the distribution of these species is too incomplete. Therefore, members of the genera *Spilonematopsis*, *Pyrenopsis*, *Pyrenopsidium*, *Leciophysma*, *Arctomia*, *Arctoheppia*, and *Porocyphus* are not included in our phytogeographical comparison, only the rest, altogether 185 species of macrolichens.

The first difficulty which encounters us in our phytogeographical comparison is that the lichen flora of North America is so incompletely known. A few not too extensive collections from Ellesmere land, from Baffin Land and from Labrador form the whole basis of our knowledge of the lichen flora of these regions. No trained lichenologist has made collections in the Canadian Eastern Arctic or Labrador, and knowing how incomplete the collections of nonolichenologists generally are, we must admit we know very little.

Our knowledge of the lichen flora of regions more remote from Greenland, like the alpine districts of the Eastern United States or from the Rocky Mountains and Cordilleras, is also very incomplete. But still we know that America has a lichen flora of its own, with many characteristic species.

The first thing which strikes the lichenologist in South Greenland is the remarkable correspondence between the lichen flora of South

West Greenland and the alpine lichen flora of Scandinavia. The following species have not been found in Scandinavia, but are met with in South West Greenland:

Dermatocarpon Lyngei SERVIT.
Thallinocarpon pulvinatum E. DAHL.
Parmeliella oblongata LYNGE.
Umbilicaria Pennsylvanica (ACH.) HOFFM.
— *mammulata* (ACH.) TUCK.
Alectoria subdivergens E. DAHL.
Dactylina arctica (HOOK.) NYL.

Of these *Thallinocarpon pulvinatum* and *Parmeliella oblongata* have never been found outside Greenland but are perhaps American species. *Dermatocarpon Lyngei* has been found in Iceland and in North East Greenland. It belongs to a group of *Dermatocarpon* which is very insufficiently known. *Dactylina arctica* is a high Arctic species which in Greenland grows as far south as the northernmost part of our area. On the Eurasian side of the Atlantic Ocean it is found in Novaya Zemlya and Siberia (see LYNGE 1933) but never in Scandinavia. There remain three species, *Umbilicaria Pennsylvanica*, *U. mammulata*, and *Alectoria subdivergens*, which probably are American representatives in the macrolichen flora of South West Greenland.

We may thus state that the true American element in the macrolichen flora of South West Greenland is almost entirely lacking, probably 3, possibly 7, out of a flora of 185 species.

I shall concentrate upon a comparison between the macrolichen flora of South West Greenland and the alpine elements in the lichen floras of Scandinavia and the Middle European mountains. By alpine element I mean lichens with a considerable distribtution in alpine areas above the tree line or in subalpine areas, and to which the plains of Germany, the Netherlands and Belgium apparently have formed obstacles for their migration. I have chosen these regions because their lcihen floras are fairly well explored although new species still turn up.

First we can state that there is no species common for South West Greenland and the Alps, which is not found in Scandinavia.

There is ,however, a considerable element, altogether 22 species, which is found in South West Greenland and in Scandinavia, but not in the Middle European mountains viz.

Ephebia hispidula (ACH.) NYL.
Thyrea radiata (SMFT.) ZAHLBR.
Collema ceraniscum NYL.
Placynthium asperellum (ACH.) NYL.

Vestergrenopsis isidiata (DEGEL.) E. DAHL.
Lobaria Halli (TUCK.) ZAHLBR.
Cladonia Delessertii (NYL.) VAIN.
— *subcervicornis* (VAIN.) D. R.
Stereocaulon arcticum LYNGE(?).
— *rivulorum* MAGN.
Umbilicaria arctica (ACH.) NYL.
— *rigida* (D. R.) FREY.
— *Lyngei* SCHOL.
— *fuliginosa* (HAV.) FREY.
Parmelia intestiniformis (VILL.) ACH.(?).
Cetraria nigricans (RETZ.) NYL.
Alectoria lanea (EHRH.) VAIN.
— *altaica* (GYELN.) RÄS.
— *tenuis* E. DAHL.
Physcia intermedia VAIN.
— *subobscura* NYL.

Of these species *Cladonia subcervicornis* has perhaps no marked alpine distribution in Scandinavia. It is found in the British Isles, and as far south as Northern France. *Stereocaulon arcticum* and *Parmelia intestiniformis* have perhaps not been recognized in Middle Europe. *Physcia subobscura* occurs also along seashores as far south as Rügen and Schleswig in Northern Germany.

There are not so many alpine lichen species common for the Scandinavian mountains and the Middle European mountains, altogether 15 species, viz.

Dermatocarpon Arnoldianum DEGEL.
Ephebe lapponica NYL.
Lobaria linita (ACH.) RABENH.
Baeomyces placophyllus ACH.
Stereocaulon tyroliense LETTAU.
— *grande* (MAGN.) DEGEL.
— *incrustatum* FLK.
Umbilicaria crustulosa (ACH.) FREY.
— *Nylanderiana* (ZAHLBR.) MAGN.
— *subglabra* HARM.
— *leiocarpa* (D. R.) FREY.
Parmelia obscurata BITTER.
Cetraria juniperina (L) ACH.
Ramalina capitata (ACH.) NYL.
Physcia constipata (NYL.) NORRL. et NYL.

Of the latter *Ephebe lapponica* is an almost unknown species, and is perhaps only a variety of *E. pubescens*. *Baeomyces placophyllus* has been found in Iceland and North East Greenland, and may perhaps turn up in South West Greenland. *Stereocaulon incrustatum* has been found in the lowlands in Pomerania and has thus an open migration route between the Alps and Scandinavia. *Parmelia obscurata* has hardly much possibility of living in Greenland to-day. The birches in Greenland are almost devoid of lichen vegetation, even species like *Alectoria chalybeiformis*, *Alectoria simplicior* and *Parmelia physodes*, occurring on stones and between mosses, were never found on the birches. *Physcia constipata* has been found in North East Greenland and may turn up in South West Greenland.

14 species of an Alpine type of distribution are at present known from Scandinavia which are neither found in the Middle European mountains nor in South West Greenland, viz.

Tholurna dissimilis NORM.
Vestergrenopsis elaeina (Wg.) GYELN.
Parmeliella arctophila (TH. FR.) MALME.
Collema alpinum TH. FR.
Baeomyces caprinus (TH. FR.) MAGN.
Stereocaulon farinaceum MAGN.
— *capitellatum* MAGN.
Pilophoron robustum TH. FR.
Umbilicaria Herrei FREY.
— *aprina* NYL.
Parmelia fraudans NYL.
Cornicularia normoerica (GUNN.) D. R.

Of these *Vestergrenopsis elaeina* has been found in Iceland and the Faeroes. *Parmeliella arctophila* has by TH. FRIES been recorded from Greenland (see LYNGE, 1937, p. 27), but I have seen no plant from our district. *Tholurna dissimilis* has no possibility of living in Greenland as it occurs on twigs of spruce. *Parmelia fraudans* has been found in Labrador (see LYNGE, 1941), and may perhaps turn up in South West Greenland.[1])

11 species of Alpine type of distribution are found in the mountains of Middle Europe, but neither in Scandinavia nor in South West Greenland, viz.

Ephebe solida BORN.
Placynthium subradiatum (NYL.) ARN.
— *coerulescens* (HARM.) GYELN.

[1]) *P. fraudans* and *Stereocaulon* farinaceum have now been found in West Greenland by SKYTTE CHRISTIANSEN. (Aug. 1949).

Baeomyces speciosus LETTAU.
Cladonia sublacunosa VAIN.
— *japonica* VAIN.
Umbilicaria Ruebeliana (D. R. et FREY.) FREY.
— *cinerascens* (ARN.) FREY.
— *microphylla* MASS.
— *reticulata* CARESTIA.

Of these species *Ephebe solida* has been found in the Great Smoky Mountains in Eastern America by DEGELIUS.

From the above enumerations it will be evident that a closer relationship exists between the lichen floras of South West Greenland and Scandinavia than between the Alpine lichen floras of Scandinavia and the Middle European mountains. South West Greenland and Scandinavia have more species in common than Scandinavia and the Middle European mountains. There are no species common for the Middle European mountains and South West Greenland, which are not found in Scandinavia. These are facts which require an explanation.

It can hardly be assumed that this correspondence can be caused by postglacial migrations between Greenland and Scandinavia. If the lichens had migrated between Greenland and Scandinavia, why have they not migrated between Scandinavia and the Alps, where at least a connection over land exists. Nobody, as far as I know, assumes the existence of a postglacial land connection over the Northern Atlantic. And although a better possibility of postglacial migration between Scandinavia and the Alps exists, than between Scandinavia and Greenland, there is a closer connection between the lichen floras of South West Greenland and of Scandinavia than between the Scandinavian and the Middle European Alpine lichen floras.

There is hardly reason to believe that lichens should be better adapted for rapid dispersal at a long distance than other groups of plants. Already the existence of bicentric types of lichen distribution in Scandinavia e. g. *Pilophoron robustum* or the existence of the peculiar North Coast element in the lichen flora of Svalbard (LYNGE 1938) is an additional reason against such an opinion.

The amphiatlantic relationship might be caused by habitat factors. If the living conditions of the lichens were more similar in Greenland and Scandinavia than in Scandinavia and the Alps, the feature might be explained.

This might again depend on two different factors, either on the substratum on which the lichens grow, or on the climate in which the lichens live.

Many lichens are dependent upon a suitable substratum. As to lichens living on rocks, mainly two types can be recognized. The one

Table 3.

Table of comparison of meteorological data from some stations in Greenland, Norway and the Alps. (The data from Norwegian stations are taken from Nedbøriaktagelser i Norge. Oslo 1927 and B. J. BIRKELAND: Mittel und Extreme der Lufttemperatur. Geofysiske Publikasjoner Vol. XIV No. 1 1935. The data from Sulden and Hinterkirch are from H. v. FISCHER: Klimatographie von Tirol und Vorarlberg. Klimatographie der Oesterreich Wien 1909. The data of Pilatus and Schneekoppe are taken from ALT: Klimakunde von Mittel und Südeuropa. Handbuch der Klimatologie. Bd. III. Teil M. Berlin 1932). Temperatures in °C. Precipitation in mm. Total precipitation during the year and the mean temperature of the year in the last column.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Godthaab Greenland	−9.8	−10.1	−7.5	−3.5	1.9	5.5	7.2	6.6	3.0	−1.6	−5.7	−8.8	−2.0
	36	43	43	31	43	46	55	78	83	63	49	37	596
Ivigtut Greenland	−7.4	−7.1	−4.5	−0.5	4.5	8.0	9.9	8.6	5.0	1.1	−2.9	−5.9	0.8
	88	66	85	64	89	81	78	96	148	154	118	81	1134
Julianehaab Greenland ...	−8.7	−7.7	−4.7	−0.6	3.9	6.2	7.4	7.4	4.8	1.0	−3.5	−6.5	0.0
Pilatus Switzerland													
2068 m	−6.2	−5.7	−5.5	−2.0	1.7	5.3	8.1	7.9	6.3	1.3	−2.3	−5.4	0.3
	65	89	114	157	148	182	176	156	139	75	40	22	1393
Schneekoppe. Bavaria													
1618 m	−7.3	−7.6	−5.7	−1.9	3.4	6.5	8.3	7.8	5.2	1.0	−3.3	−6.3	0.8
	74	68	72	77	101	138	158	118	120	93	82	83	1202
Sulden Tyrol 1840 m.....	−7.1	−5.9	−3.7	0.8	4.9	8.4	10.4	9.7	6.7	2.1	−3.4	−6.4	1.4
													913
Hinterkirch Tyrol 1875 m.	−7.7	−6.6	−4.3	0.5	5.0	8.7	11.0	10.4	7.8	2.8	−2.9	−7.4	1.4
													635
Kongens Grube Norway													
865 m	−9.1	−9.1	−7.4	−2.8	1.9	7.5	9.8	8.4	5.0	−0.5	−5.4	−8.7	−0.9
	37	27	25	21	33	55	70	74	52	42	32	26	494
Haugastøl Norway 996 m.	−8.5	−8.4	−7.1	−2.4	2.7	7.6	10.0	9.0	5.5	0.5	−4.5	−8.1	−0.3
	63	47	56	31	46	48	77	89	69	69	64	71	730
Finse Norway 1224 m....	−8.6	−8.8	−7.8	−3.9	0.6	5.3	7.8	7.0	3.8	−1.0	−5.4	−8.6	−1.6
	84	66	70	36	49	51	70	102	89	97	83	90	887
Alta Norway 7 m.....	−8.0	−8.5	−6.1	−1.3	3.5	9.0	12.2	11.2	6.9	0.7	−6.4	−7.7	0.6
	22	20	15	13	16	27	47	43	35	27	27	16	308

prefers hard rocks, with no, or only a small amount of lime. The other type prefers limestone. Hardly any of the lichens enumerated during the comparison of the floras belong to the latter type. The lichens of the hard rocks seem to be fairly indifferent to different types of hard rocks. Thus a suitable substratum for such types of lichens is doubtlessly present within all the three areas.

Other alpine lichen types live on gravel, between mosses or in bogs. The most important factor seems to be the acidity of the soil, which to a large extent governs the type of vegetation. But the same type of soil development, both podsolation and brown earth profiles, both acid, or neutral, or subneutral bogs exist in all the three areas, perhaps neutral or subneutral soil types are less frequent in South West Greenland than in the other areas.

If the edaphic factors fail to give the explanation we may turn to the climatic factors. I have in Table 3 given data of some stations in the Alps, from Norway and from Greenland. The temperature decreases about 0.6° C. per 100 m altitude. It will thus appear from Table 3 that almost the same climate types are met with in South West Greenland, in the Scandinavian mountains, and in the Middle European mountains. I have chosen the station Finse in Norway because many of the lichens common for South West Greenland and Scandinavia occur in the neighbourhood like *Cladonia Delessertii*, *Stereocaulon rivulorum*, *Umbilicaria arctica*, *rigida*, and *fuliginosa*.

It will hardly be possible to convince a lichenologist with experience in Scandinavia and the Arctics, that lichens like *Cladonia Delessertii*, *Umbilicaria arctica*, *rigida*, *fuliginosa*, *Physcia intermedia* and others could not find living space today in the Central European mountains. Consequently an explanation of the problem by means of present day habitat factors seems very improbable.

If the explanation by means of habitat similarity was the right one, one should except that the same features also were expressed in the flora of vascular plants. This is not so. The flora of vascular plants of South West Greenland has a strong American element. If we want to insist upon that explanation, we must assume that quite different edaphic and climatic factors govern the distribution of vascular plants than the lichens today. This does not seem very probable to me.

If neither habitat factors, nor recent migration factors can explain the South West Greenland—Scandinavian correspondence of lichen flora, there must be some historical cause of the fact. It is most improbable that the similarity is due to postglacial migrations. This leads us to the conclusion that the resemblance between the South West Greenland macrolichen flora and the Scandinavian one must be older than the last Ice Age. The same must apply to the lichen floras. We are thus forced to assume that the macrolichen flora of South West Greenland, or at least the major part of it, has survived the last glaciation in South West Greenland or in some area not too far distant from it.

The hypothesis that unglaciated areas existed in different parts of Greenland during the last glaciation is by no means new. It dates back already to the time of WARMING and has been put forward several times

by many authors regarding different parts of Greenland (see GELTING: Studies on the vascular plants of East Greenland between Franz Josephs Fjord and Dove Bay. Medd. om Grønl. Bd. 101, No. 2, 1934). I will here recall what already previously has been pointed out (see p. 8) that there is geologic evidence that the district was partly uncovered by the inland ice during the last glaciation. How extensive the areas were, is at present unknown.

I have (DAHL 1946) attempted an explanation of the South West Greenland—Scandinavian correspondence of lichen floras on the following basis:

1. The lichen floras of South West Greenland and of Scandinavia date from a period when the correspondence in the whole flora between Europe and East America was closer than today.

2. The conditions, under which the lichens in Scandinavia and South West Greenland had to live during the last Ice Age, were almost the same in the two districts, but different from those in other areas like Novaya Zemlja or the Alps.

As to the second point the unglaciated areas of South West Greenland and in Western Scandinavia during the last Ice Age were caused by the relief conditions of the country. In these areas high mountains are found close to the deep ocean. An area of such relief can hardly be totally covered by the ice sheet because of the plasticity of the ice. The margin of the ice sheet cannot extend farther than to the border of the deep ocean. There the ice breaks up into pieces and floats away. The ice is plastic, thus the surface of large inland ice areas cannot have any gradient of the surface. Experience from areas where such conditions exist today shows us that inland ice coming out into the open seas undisturbed by mountains, have a gradient of the surface of approx. 1:200 over some tens of kilometres. It is thus hardly probable that areas like South West Greenland and Western Scandinavia can be totally covered by ice if the meteorological conditions were not quite different from those found anywhere on the earth today.

This type of unglaciated areas has been called the coastal mountain type. Unglaciated areas of this type may have an atlantic type of climate with much precipitation. The living-conditions of the plants were largely dependent upon the altitude of the firn line, which in South West Greenland and in Scandinavia hardly descended to the sea level during the last Ice Age.

The unglaciated areas during the last Ice Age in Northernmost Scandinavia, in Siberia, in Northern Svalbard, in Peary Land and in Arctic Canada were caused by lack of precipitation. The North Atlantic Ocean was covered by ice, and an ocean covered by ice acts, meteorolo-

gically speaking, like a continent. Thus the precipitation in these areas probably was smaller than today, so small that the insulation was sufficient to melt away the snow falling during the year. This is quite another type of unglaciated area which is called the tundra type. These refuges must have had a continental type of climate.

The mountains of Middle Europe were situated at the southern edge of the area of the last glaciation. The unglaciated areas were caused simply because they were situated along the southern climatic border of the glaciation.

It is thus probable that the conditions during the last Ice Age were similar in South West Greenland and in Western Scandinavia during the last Ice Age, but different from these existing in e. g. Novaya Zemlya or the Alps. (About further particulars see DAHL 1946.) One should thus expect that the same ecologic types of lichens could survive in the two areas, that the selection would cause a similarity of lichen floras of these two areas, provided that the interglacial lichen floras of the two countries were mainly the same.

The first point, that the interglacial floras of Europe and Eastern America were more similar than they are today, is substantiated by the fact that plants now extinct in Europe but occurring in North America have been found in interglacial layers in Europe. An example is the Cyperaceae *Dulichium spathaceum*. Another fact is the existence of a strong western Arctic element in the flora of Alpine vascular plants in Scandinavia. This element is explained by the theory that they have survived the last Ice Age in Scandinavia. But if it should be called an explanation of their distribution that they are survivors from the last interglacial period, it must be on the assumption that the flora during the last interglacial period in Europe had a more American character than it has today.

As to the problem of the survival of a lichen flora during the last Ice Age, or the Ice Ages before, one fact is of importance. There are more species of Alpine lichens in Scandinavia which have not been found in the Middle European mountains than vice versa, according to the above enumerations 35 species characteristic of the Scandinavian mountains against 11 of the Middle European mountains. According to the old theory, the whole flora was exterminated in Scandinavia during the last Ice Age. The present flora should accordingly have immigrated from South or East. Unfortunately not much is known of the Alpine lichen flora of the Ural. But it is hardly probable that the major part of the Scandinavian Alpine lichen flora has been recruited from Central Europe as the representatives of the old theory were inclined to believe, considering that there is a richer element of Alpine lichens in Scandinavia than in the Alps.

To explain why the interglacial floras of Europe and Eastern North America were more similar than the present ones is a difficult task.

Mainly two hypothesis have been advanced. One is the WEGENER hypothesis of continental drift, which assumes that the continent of North America and Europe in former times had a position closer to each other than today, and that the European and American continent afterwards drifted apart. The second is the hypothesis of land bridges between Europe and North America. It has been assumed that the bridge between Scotland, Iceland, and Greenland and (or) the bridge between Svalbard and North East Greenland were elevated over the sea level sometime during the Quaternary period.

These theories are opposed by HULTÉN (1937). He maintains that no migration of importance has taken place over the Atlantic Ocean. The amphiatlantic type of distribution is explained on the line that the species in question migrated from the Bering area to Europe and Eastern North America, but had afterwards become extinct in Eastern Asia and Western North America.

The view-points of HULTÉN has met with critizism e. g. from NANNFELDT (1941, p. 39). He points out that not only the same species, but even the same microspecies of genera like *Poa* have an amphiatlantic distribution. It is hardly probable that the same microspecies would develop independently on both sides of the Atlantic Ocean, that the microspecies in question are of a polyphyletic origin. It is also hardly probable that one microspecies of *Poa* could migrate in both directions from the Bering Strait to Europe and Eastern North America without undergoing considerable changes, considering the rapid rate of evolution in many species of *Poa.*

The facts pointed out in this paper strongly support the view of an amphiatlantic migration. Unfortunately very little is known of the lichen flora of the Bering region, but it is very difficult to understand how a correspondence as close as that between the South West Greenland and the Scandinavian Alpine lichen flora could develop through a migration over the Bering region.

The problem could be attacked by phytogeographic methods, by mapping the distribution of the species and comparing the distribution of different species. This is the method employed by HULTÉN. But the different types of distribution may be explained in different ways as the above shows us. If no other methods are employed, the result will easily become a statement of different opinions about the distribution of plants rather than a real argumentation. To avoid this other points of view should be taken into account.

The viewpoints of HULTÉN could be supported in two different ways. The hypothesis would be verified if it were possible to find fossil

remains of species of a present day amphiatlantic distribution in the Bering Strait area. If such finds could be made, it would make the case more probable also for species not found in fossil state. Secondly, if it is possible by means of our knowledge of the ecology of the species in question and by our knowledge of past and present climate and geography to give an indication why the species in question died out in the Bering Strait area but not on both sides of the Atlantic Ocean, the hypothesis would receive considerable support.

On the other hand, the assumption of transatlantic connections meets with difficulties. Those who defend hypotheses of that kind, must in some way make the existence of migration routes over the Atlantic Ocean probable by geologic evidence. In the search for such evidence, one may have considerable guidance in the phytogeographical facts. Perhaps new methods with deep sea borings may give results.

The purpose of these concluding remarks has been to state some phytogeographical facts which must be taken into consideration if somebody attempts to make an outline of the paleogeography of the North Atlantic region.

REFERENCES

(Literature on lichen chemistry and the most important literature on phytogeography and lichen systematics are only included. Otherwise references are found in the text).

ASAHINA, YASUHIKO 1934: Zur Systematik der Flechtenstoffe. Acta Phytochimica. Vol. VIII, Nr. 1. Tokyo.

— 1936—38: Microchemischer Nachweis der Flechtenstoffe I—IX. Journal of Japanese Botany. Vol. XII—XIV. Tokyo.

— 1939: Über den Chemismus der Flechten der *Cocciferæ* (*Cladonia* subg. *Cenomyce*). Journal of Japanese Botany, Vol. XV, No. 10—11. Tokyo.

— 1941: Chemismus der *Cladonien* unter besonderer Berücksichtigung der japanischen Arten. Journal of Japanese Botany, Vol. XVI, No. 12 and Vol. XVII, No. 8. Tokyo.

BRANTH, J. DEICHMANN og GRØNLUND, CHR. 1888: Grønlands Lichen-Flora. Medd. om Grønl. Vol. III, pp. 449—513.

— 1892: Tillæg til Grønlands Lichen-Flora. Medd. om Grønl. Vol. VII, pp. 753—762.

DAHL, E., 1946: On different types of unglaciated areas during the Ice Ages and their significance to phytogeography. The New Phytologist Vol. 45, No. 2. Cambridge. pp. 225—242.

— 1947: Litt om forholdene under og etter den sisste istid i Norge. Naturen. Nos. 7—8, pp. 232—252. Bergen.

— LYNGE, B. and SCHOLANDER, P. F. 1937: Lichens from Southeast Greenland. Skr. om Svalb. og Ishavet. No. 70. Oslo.

EVANS, ALEXANDER W. 1943a: ASAHINA's Microchemical Studies on the *Cladoniae*. Bull Torrey Bot. Club. Vol. 70, No. 2, pp. 139—151.

— 1943b: Microchemical Studies on the Genus *Cladonia* Subgenus *Cladina*. Rhodera Vol. 45, pp. 417—438.

FORSELL. K. J. B. 1885: Beiträge zur Kenntnis der Anatomie und Systematik der *Gloeolichenen*. K. Ges. der Wissensch. zu Uppsala.

HULTÉN, ERIC 1937: Outline of the History of Arctic and Boreal Biota during the Quaternary Period. Stockholm.

LYNGE, B. 1928: Lichens from Novaya Zemlya. Report of the Scientific Results of the Norwegian Expedition to Novaya Zemlya 1921, No. 43. Oslo.

— 1933: On *Duforea* and *Dactylina*. Three Arctic Lichens. Skr. om Svalb. og Ishavet. No. 59. Oslo.

— 1935: Lichens collected during the Danish fifth Thule Expedidion through Arctic Canada. Report of the fifth Thule Expedition 1921—24, Vol. II, No. 3. Copenhagen.

— 1937: Lichens from West Greenland collected chiefly by TH. M. FRIES. Medd. om Grønl. Bd. 118, No. 8. Copenhagen.

LYNGE, B. 1938: Lichens from the West and North Coast of Spitsbergen and the North East Land. I. Macrolichens. Skr. utg. av Det Norske Vid. Akad. i Oslo. I Mat. Nat. Klasse, No. 6.

— 1939: A Contribution to the Lichen Flora of Canadian Arctic. Collected by Father ARTHÉME DUTILLY o. m. e. naturalist of the Arctic Mission.

— 1940: Lichens from Iceland. I. Macrolichens. Skr. utg. av Det Norske Vid. Akad. i Oslo. I Mat. Nat. Klasse, No. 7.

— and SCHOLANDER, P. F. 1932: Lichens from North East Greenland collected on the Norwegian Scientific Expedition in 1929 and 1930. I. Macrolichens. Skr. om Svalbard og Ishavet. No. 41. Oslo.

NANNFELDT, J. A. 1940: On the polymorphy of *Poa arctica* R. BR. with special reference to its Scandinavian forms. Symbolae Botanicae Upsaliensis. Vol. IV, No. 4. Uppsala.

NOLAN, J. T. 1944: Lichen Substances in THORPES Dictionary of Applied Chemistry Vol. VII, p. 281—307. London.

SANDSTEDE, HEINRICH 1931: Die Gattung *Cladonia*. Rabenhorst Krypt. Fl. Bd. IX, Abt. IV, 2 Hälfte. Leipzig.

ZAHLBRUCKNER, A. 1926: Flechten. B. Spezieller Teil. Die natürlichen Pflanzenfamilien von ENGLER und PRANTL. Zweite Aufgabe. Bd. 8. Leipzig.

ZOPF, W. 1907: Die Flechtenstoffe in chemischer, botanischer, pharmakologischer und technischer Beziehung. Jena.

INDEX

Alectoria, *141*
altaica (Gyeln) Räs., *145*, 156, 160
chalybeiformis (L.) Röhl, 141, *142*, 166
cincinnata (Fr.) Lynge, 148
divergescens Nyl., 146
lanea (Ehrh.) Vain, 122, 142, *143*, 160
lanestris (Ach.) Gyeln., 119, 141, *142*, 156
minuscula Nyl., 142, *143*
nigricans (Ach.) Nyl., 141, *146*
f. sorediata E. Dahl., 147, 155
nitidula (Th. Fr.) Vain., 143
ochroleuca (Ehrh.) Nyl., 78, 122, 141, 142, *147*
f. septentrionalis Lynge 148
pubescens (L.) Howe jr., 142, *148*
sarmentosa Ach., 22
simplicior Lynge, 142, *144*, 155, 161
spinulosa Ahlner, 145
subdivergens E. Dahl,, 142, *145*, 155, 159. Plate II fig. 3 and 4.
subasiatica D. R., 141
tenuis E. Dahl, 142, *144*, 155, 160
thrausta Ach., 148
vexillifera (Nyl) Stzbrgr., 141, 142, *148*
Amphiloma lanuginosum (Ach.) Nyl, 33
Arctoheppia, *48*
Scholanderi Lynge, *48*
Arctomia, *46*
delicatula Th. Fr., *46*

Baeomyces, 70
caprinus (Th. Fr.) Magn, 161
placophyllus Ach., 160
roseus Pers., *70*
rufus (Huds.) Rebent., *70*
speciosus Lettau, 162

Calothricopsis, 50
Calothrix, 50

Caloplaca fraudans (Th. Fr.) Oliv., 52, 54
elegans (Link) Th. Fr., 119, 150
Cetraria, *135*
chlorophylla (Humb.) Vain., *137*
crispa (Ach.) Nyl., *135*
cucullata (Bell.) Ach., *138*
Delisei (Bor.) Th. Fr., 21, *136*
fahlunensis (L.) Vain., 12, *138*, 158
glauca (L.) Ach., 64, *137*, 156, 158
hepatizon (Ach.) Vain, *139*
islandica (L.) Ach., 78, *135*
juniperina (L.) Ach., 160
nigricans Nyl., 22, *139*, 160
f. sorediata E. Dahl., 139, 155
nivalis (L.) Ach., 78, *137*
pinastri (Scop.) S. Gray, *138*
sepincola (Ehrh) Ach., *136*, 157, 158
Cladoniaceae, *70*
Cladonia, *70*
acuminata (Ach.) Arn., 23, 73, *95*
v. Norrlini (Vain.) E. Dahl., *95*
amaurocreaea (Flk.) Schaer., 71, *84*
f. oxyceras, 84
f. celotea, 84
f. fasciculata, 84
f. crassipeda, 84
alpestris (L.) Rab., 71, *78*
alpicola (Flot.), Vain, 23, 73, *94*, 95
bacilliformis (Nyl) Vain., 73, *113*
bellidiflora (Ach.) Schaer., 71, *83*
f. cococephala, 84
f. Hookeri, 84
f. polycephala, 84
f. subuliformis, 84
cariosa (Ach.) Spreng., 73, 76, *92*, 109
carneola Fr., 73, *112*
cenotea (Ach.) Schaer., 23, 72, *91*
cervicornis (Ach.) Fw., 75, 76, *102*
coccifera (L.) Willd., 24, 72, 73, *80*

v. pleurota (Flk.) Vain, 24, *80*, 112
v. stemmatina Ach., 24, *80*
coniocraea Flk., 75, 110, *111*, 156, 157
cornuta (L.) Schaer, 75, *99*
v. groenlandica E. Dahl, 100
cornutoradiata Coem, 110, 111
crenulata (Ach.) Asahina, 83
crispata (Ach.) Flot., 23, 72, 78, *86*
v. dilacerata (Schaer.) Malbr., *87*
f. elegans (Del), 87, 89
f. rigidula Arn., 87, 89
v. gracilescens (Rabenh.) Vain, *87*
v. infundibulifera (Schaer.) Vain, *86*
v. virgata (Ach.) Vain., *86*
f. Kairamoi Vain., 87
cryptochlorophaea Asahina, 105
cyanipes (L.) Willd., 73, *112*
decorticata (Flk.) Spreng., 23, 73, *95*, 156
deformis (L.) Hoffm., 72, *82*
degenerans (Flk.) Spreng., 75, *101*
f. cladomorpha (Ach.) Vain, 101
f. dilacerata Schaer., 101
f. euphorea (Ach.) Flk., 101
f. phyllophora (Ehrh.) Fw., 101
Delessertii (Nyl.) Vain., 23, 72, *89*, 160, 164
f. tenuior, 90
f. trichothera, 90
digitata (L.) Schaer., 72, *80*, 156
ecmocyna (Ach.) Nyl., 23, 74, *97*
f. foveata E. Dahl., 99
elongata (Jacq.) Hoffm., 97, 99
fimbriata (L.) Fr., 75, *109*
v. apolepta (Ach.) Vain., 111
v. cornutoradiata Coem., 109
v. coniocraea (Flk.), 109
v. nemoxyna (Ach.) Coem., 109
v. ochrochlora (Flk.) Vain, 109
v. prolifera (Retz) Mass., 109
v. simplex (Weiss.) Fw., 109
Floerkeana (Fr.) Smft., 72, *79*, 157
v. chlorodes (Flk.) Vain, 79
v. carcata (Ach.) Nyl., 79
v. intermedia Hepp., 79
Grayi (Merr.) Sanst., 105
gracilis (L.) Willd v. chordalis (Flk.) Schaer., 23, 75, 7 *96* '8
f. aspera Flk., 96
v. elongata, 97
gonecha Flk. em. Asahina, 83
japonica Vain., 162
lepidota Nyl., 74, *101*
v. stricta (Nyl) DR, 101
v. gracilescens (Flk) D. R., 101
f. hypophylla (Nyl.) Vain, 76, 101, 104
macrophyllodes Nyl., 74, 76, 93, *103*
major (Hag.) Zopf, 109
mitis Sanst., 71, *77*, 78
merochlorophaea Asahina, 105
nemoxyna (Ach.) Coem, 110
Novae-Angliae Merrill, 89
ochrochlora Flk., 110
papillaria (Ehrh.) Hoffm., 71, *79*
pyxidata (L.) Fr. subsp. chlorophaea (Flk.) Spreng, 24, 73, 76, *104*
subsp. neglecta (Ekk.), 75, 76, *104*
subsp. Pocillum (Ach.), 74, 75, *104*
v. pachythallina (Wallr.) Vain., 75, 76, 93, 104
rangiferina (L.) Web., 71, *76*, 78
scabriuscula Del., 72, *86*
squamosa (Scop.) Hoffm., 23, *90*, 95
v. levicorticata Sanst., 87, 89, *90*
f. polyconia Flk., 90
f. pseudocrispata Sanst., 88
f. subtrachynella Vain., 90
f. turfacea (Arn.) Vain, 90
v. phyllocoma Rabenh. f. muricella (Del.) Vain., *90*
subcariosa Nyl., 92
subcervicornis (Vain.) D. R., 74, 76, 93, *102*, 160
f. contraria Magn., 102
f. turgescens Magn., 102
sublacunosa Vain., 162
sylvatica (L.) Hoffm., 71, *77*, 157
symphycarpea (Flk.) Arn., 92
turgida (Ehrh.) Hoffm., 72, 76, *91*
uncialis (L.) Web., 12, 71, 84, *85*
Coccocarpia, 50
Coenogonium nigrum (Huds.) Zahlbr., 36
Collemaceae, *44*, 50
Collema, *45*
alpinum Th. Fr., 161
arcticum Lynge, 45
ceraniscum Nyl., *45*, 159
furvellum Räs., *45*, 157
pulposum (Bernh.) Ach., *45*

rupestre (Sw.) Rabh., 45
undulatum Laur., *46*
Coriscium, *32*
viride (Ach.) Vain., *32*
Cornicularia, *140*
aculeata (Schreb.) Ach., *140*
v. campestris Schaer., 141
v. muricata Ach., 141
f. tenuis E. Dahl, 141
divergens Ach., *140*, 142
normoerica (Gunn.) D. R., 161
Crocynia, *33*
arctica Lynge, 33
neglecta (Nyl.) Hue, *33*

Dactylina, *140*
arctica (Hook.) Nyl., *140*, 159
Dermatocarpaceae, *29*
Dermatocarpon, *29*
Arnoldianum Degel., 160
Bachmanni Anders, 30
botulinarum Nyl., 31
cinereum (Pers.) Th. Fr., *31*
daedalum (Krempelh.) Th. Fr., *31*
deminuens Vain., 30
hepaticum (Ach.) Th. Fr., 31
leptophyllodes (Nyl.) Zahlbr., 30
Lyngei Servit, *30*, 159
meiophyllizum Vain., 31
miniatum (L.) Mann., *29*
v. complicatum (Lightf.) Th. Fr., 30
polyphyllum (Wulf.) D. T. et Sarnth., 29
rivulorum (Arn.) D. T. et Sarnth., *30*
rufescens (Ach.) Th. Fr., *31*

Ephebeaceae, *34*, 49, 50
Ephebe, *35*, 50
lanata (L.) Vain., *35*
lappnicao Nyl., 160
solida Born., 161
Ephebeia, *35*, 50
hispidula (Ach.) Nyl., *35*, 55, 155, 159
v. Martindalei Cromb., 36
trachytica Vain., 36
Erioderma, 51

Fernaldia Scholanderi Lynge, 48
Ginzbergerella, 50
Gonohymenia, 43
Gyrophora mammulata Ach., 125

Haematomma ventosum (L.) Mass., 122
Heppiaceae, *48*
Homopsella, 50
Hydrothyria, 51

Icmadophila, *70*
ericetorum (L.) Zahlbr., *70*

Lecanephebe, 50
Lecanora granatina Smrft., 41
melanophthalma Ram., 37
Leciophysma, *44*
finmarckicum Th. Fr., *44*
furfurascens (Nyl.) Gyeln., 45
occidentale E. Dahl., *44*, 155
Lecidea neglecta Nyl., 33
Lempholemma, 46
Lepidocollema, 51
Lepidoleptogium, 50
Leptogidium, 50
Leptogium, *47*
lichenoides (L.) Zahlbr., *47*
v. pulvinatum (Hoffm.) Zahlbr., 48
saturninum (Dicks.) Nyl., *48*
tenuissimum (Dicks.) Fr., 47
Lichina, 50
Lichinaceae, 49, 50
Lichinella, 50
Lichinodium, 50
Lobaria, *60*
Halli (Tuck.) Zahlbr., 11, *60*, 155, 160
linita (Ach.) Rabenh., 160
scrobiculata (Scop.) D. C., 60
verrucosa (Huds.) Hoffm., *60*, 157, 156

Massalonghia, 50, 51, *57*
carnosa (Dicks.) Koerb., *57*

Nephroma, *63*
arcticum (L.) Torss., *63*, 64
expallidum Nyl., *64*, 137, 156
laevigatum Ach., *64*, 157
parile Ach., *64*
resupinatum (L.) Ach., *64*
Normandinia viridis (Ach.), 32
Nostoc, 49, 50
Pannariaceae, 50, *57*
Pannaria, 50, 51, *59*
elaeina (Wg.) Nyl., 55

Hookeri (Borr.) Nyl., *59*
isidiata Degel., 55
muscorum (Ach.) Del., 57
pezizoides (Web.) Llghtf., *59*
Parmeliaceae, *127*
Parmelia, *127*
alpicola Th. Fr., 122, *129*
f. aperta Lynge etc., 129
austerodes Nyl., 122, *127*
Bitteriana Zahlbr., 128
centrifuga (L.) Ach., *132*
conspersa (Ehrh.) Ach., *132*, 157, 158
disjuncta Erichs., *131*
dubia (Wulf.) Schaer., *135*, 156
encausta (Sm.) Nyl., *128*, 156
incurva (Pers.) Fr., *133*
infumata Nyl., *130*
intestiniformis (Vill.) Ach., *129*, 160
isidiotyla Nyl., *131*, 157, 158
fraudans Nyl., 161
granulosa Lynge, 131
groenlandica Lynge, 133
obscurata Bitter, 128, 160
olivacea (L.) Nyl., *130*
omphalodes (L.) Ach., 33, *134*, 137
panniformis (Nyl.) Vain., *130*, 156, 157 158
physodes (L.) Ach., 127, *128*, 157, 161
prolixa (Ach.), 131
pubescens (L.) Vain., 148
saxatilis (L.) Ach., *133*, 144
f. pruinosa, 133
separata Th. Fr., 133
sorediata (Ach.) Th. Fr., *131*
stygia (L.) Ach., *129*
v. septentrionalis Lynge, 130
subobscura Vain., 128
sulcata Tayl., *134*
f. convoluta Hillm., 134
tubulosa (Hag.) Bitter, 128
vittata (Ach.) Nyl., 128
Parmeliella, 50, 51, *58*
arctophila Th. Fr., 161
corallinoides (Hoffm.) Zahlbr., *58*
lepidiota (Smft.) Vain., *58*
v. tristis Th. Fr., 58
microphylla (Sw.) Müll. Arg., 58
oblongata Lynge, *58*, 159
Parmeliopsis, *127*
ambigua (Wulf.) Nyl., *127*, 157
hyperopta (Ach.) Vain., *127*, 157
Peltigeraceae, 51, *62*
Peltigera, *65*
aphthosa (L.) Willd., *65*
canina (L.) Willd., *66*
erumpens (Tayl.) Vain., 22, 67
Hazlinskyi Gyeln., 22
lepidophora (Nyl.) Vain., *67*
leucoplehbia (Nyl.) Gyeln., *65*
malacea (Ach.) Funck., *68*
polydactyla (Neck.) Hoffm., 69
polydactyloides Nyl., *69*
rufescens (Weis.) Humb., *67*
scabrosa Th. Fr., *68*, 157
v. occidentalis E. Dahl., 68, 155
scutata (Dicks.) Duby., *69*, 156, 157
spuria (Ach.) D. C., 22, *67*
v. leptoderma (Nyl.), 67
subscutata Gyeln., 70
Suomensis Gyeln., 67
venosa (L.) Hoffm., *66*
Physciaceae, *150*
Physcia, *150*
aipolia (Ehrh.) Hampe, *150*
caesia (Hoffm.) Hampe, *151*, 153
constipata (Nyl.) Norrl. et Nyl., 160
dubia (Hoffm.) Lettau em. Lynge, *151*
grisea (Lam.) Zahlbr., *153*, 158
intermedia Vain., *151*, 160, 164
labrata Mereschowsky, 154
lithothodes Nyl., *152*
melops Duf., *150*, 153, 157
muscigena (Ach.) Nyl., *153*
nigricans (Flk.) Stzbrgr. em D. R.
v. groenlandica E. Dahl, *153*, 155, 156
orbicularis (Neck.) D. R., *153*, 156 158
sciastra (Ach.) D. R., *152*, 157
stellaris (L.) Nyl. em. Harm., *150*, 153. 156, 158
subobscura Nyl., *151*, 160
tenella Bitter, *152*
teretiuscula (Ach.) Lynge, 152
Wainioi Räs., *151*, 156
Pilophoron robustum Th. Fr., 161
Phylliscum, *41*
Demeangeoni (Wg.) Nyl., 37, *41*, 156
Placynthiaceae, *49*, 155

Placynthiella, 51
Placynthium, 49, *54*
asperellum (Ach.) Trevis., 49, 52, 53, *54*, 159
coerulescens (Harm.) Gyeln., 161
nigrum (Huds.) Gray., 54
pannariellum (Nyl.) Magn., 35, 38, 39, 41, 49, 52, 54, *55*, 56
f. pterygoides Gyeln., 55
subradiatum (Nyl.) Arn., 161
Polychidium, *46*, 50
muscicola (Mass.) Zahlbr., 37, *46*, 58
Porocyphus, 49, 50, *51*
areolatus (Fw.) Forss., 52
cataractarum Koerb., 52
coccodes (Fw.) Koerb., 52
dispersus E. Dahl., *51*, 155
furfurellus (Nyl.) Forss., 52
globulosus (Mass.) Coudrec., 52
groenlandicus E. Dahl., *53*, 155
Psoroma, 51, *59*
hypnorum (Vahl) S. Gray., *59*
Psoromaria, 51
Pterygiopsis, 50
Pterygium, 49, 50
Pyrenopsidium, *40*
granuliforme (Nyl.) Forss., *40*, 155
Iivaarense (Vain.) Forss., *40*, 155
Pyrenopsidaceae, *36*
Pyrenopsis, *36*
Pyrenopsis (*Malmgrenia*), *39*
fuscatula Nyl., 38
grumulifera Nyl., 39
Laatokaensis Vain., 40
macrocarpa E. Dahl., 25, *36*, 155. Plate 1 fig. 2.
myriospora E. Dahl., *39*, 155
pulvinata (Schaer.) Hellb., 25, *37*, 40
rhodosticta (Tayl.) Müll. Arg., *38*, 156
sanguinea Anzi, 38
subareolata Nyl., 38

Ramalina capitata (Ach.) Nyl., 160
Rivulariaceae, 49

Scytonema, 46, 50
Sirosiphon, 46
Solorina, *62*
bispora Nyl., *63*
crocea (L.) Ach., *62*
octospora Arn., *62*
saccata (L.) Ach., *62*
spongiosa (Sm.) Anzi, *63*
Sphaerophoraceae, *32*
Sphaerophorus, *32*
fragilis (L.) Perss., 32, *33*, 137
globosus (Huds.) Vain., *32*
f. congesta Lamy., 32
Spilonema, 50
revertens (Nyl.) Vain., 34
Spilonematopsis, *34*, 50, 155
multispora E. Dahl., *34*, 155
Steinera, 50
Sterepcaulon, *113*
alpinum Laur., *116*
arcticum Lynge, *114*, 160
botryosum Ach. em. Frey, *113*
f. dissolutum (Magn.), 113
capitellatum Magn., 161
coralloides Fr., 118
denudatum Flk., 12, *114*, 115
f. pulvinatum (Schaer.), 114
farinaceum Magn., 161
glareosum Magn., *117*, 155
grande (Magn.) Degel., 160
incrustatum Flk,. 160
paschale (L.) Hoffm., 78, *115*, 157
rivulorum Magn., 113, *117*, 160, 164
v. groenlandicum E. Dahl., 117, 155. Plate 2 fig. 2
tyroliense Lettau, 160
tomentosum Fr., *118*
Stictaceae, *60*
Sticta Halli Tuck., 60

Teloschistaceae, *149*
Thallinocarpon, *43*
pulvinatum E. Dahl., *42*, 155, 159. Plate 1 fig. 1
Thamnolia, *154*
subvermicularis Asahina, 154
vermicularis Ach., *154*
Thermutis, 50
Tholurna dissimilis Norm., 161
Thyrea, *43*
radiata (Smft.) Zahlbr., *43*. Plate 1 fig. 3
Trichobacidia, 50

Umbilicariaceae, *118*
Umbilicaria, *118*

aprina Frey, 161
arctica (Ach.) Nyl., *120*, 160, 164
v. subarctica (Nyl.) Savicz., 120
caroliniana Tuck., 125
cinerascens (Arn.) Frey., 162
cinereorufescens (Schaer.) Frey., 122, *124*, 125, 155.
crustulosa (Ach.) Frey., 160
cylindrica (L.) Del., *123*
v. Delisei Nyl., 123
v. fimbriata Nyl., 123
decussata (Vill.) Frey, *119*
deusta (L.) Baumg., *122*
fuliginosa (Hav.) Zahlbr., *122*, 160
v. Wenckii (Müll. Arg.), 122
Herrei Frey., 161
hirsuta Ach. em. Frey., *126*, 156, 157
hyperborea (Ach.) Hoffm., *120*, 121, 123, 124
f. prolificans Oliv., 120
leiocarpa (D. R.) Frey., 160
Lyngei Schol., *118*, 160
mammulata (Ach.) Tuck., *125*, 156, 159
microphylla Mass., 162
Nylanderiana (Zahlbr.) Magn., 160
Pennsylvanica (Ach.) Hoffm., 11, *118*, 159
polyphylla (L.) Hoffm., *122*, 157
proboscidea (L.) Schrad., *121*, 127
reticulata Carestia, 162
rigida (D. R.) Frey., *119*, 121, 160
Ruebeliana (D. R. et Frey) Frey., 162
subglabra Harm., 160
torrefacta (Lightf.) Schrad., *119*, 123
vellea (L.) em. Frey., 119, *123*
virginis Schaer., *119*
Usnea hirta (L.) Hoffm., 151

Vestergrenopsis, 49, *55*
elaeina (Wg.) Gyeln., 56, 161
isidiata (Degel.) E. Dahl., 49, *55*, 160

Xanthoria, 149
candelaria (L.) Arn., *149*

Zahlbrucknerella, 50

Færdig fra trykkeriet den 4. februar 1950.

PLATES

Plate 1.

Fig. 1. *Thallinocarpon pulvinatum* E. DAHL. Julianehaab District: Agdluitsoq: Qagdlumiut 22.2. 1937. E. DAHL.

Fig. 2. *Pyrenopsis macrocarpa* E. DAHL. Julianehaab District: Tunugdliarfik: Tunuarmiut. 16.7. E. DAHL with *Crocynia neglecta.*

Fig. 3. *Thyrea radiata* (SMFT.) ZAHLBR. Julianehaab District: Tunugdliarfik: Qordlortoq. 21.7.1937 E. DAHL.

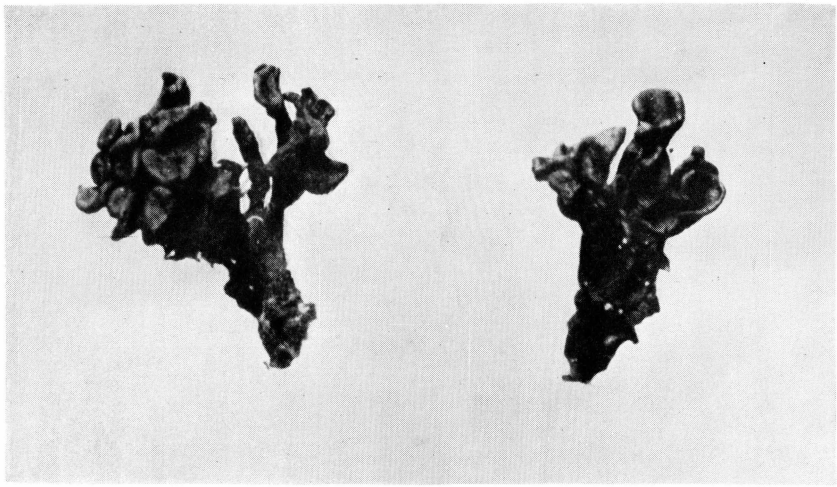


Fig. 1.

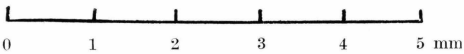
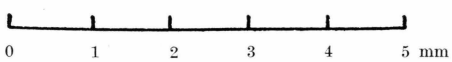


Fig. 2.



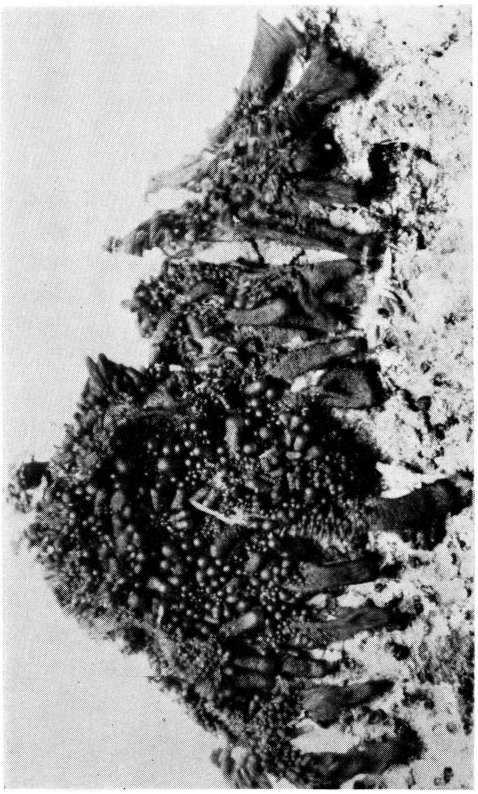


Fig. 3.

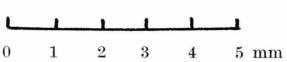


Plate 2.

Fig. 1. *Cladonia cornuta* v. *groenlandica* E. Dahl. Julianehaab District: Agdluitsoq: Sletten. 14.8.1937 E. Dahl.

Fig. 2. *Stereocaulon rivulorum* v. *groenlandicum* E. Dahl. Julianehaab District: Igalikefj.: Igdlerfigssalik 7—800 m. 2.8.1937. E. Dahl.

Fig. 3. *Alectoria subdivergens* E. Dahl. Julianehaab District: Agdluitsoq: Qagdlumiut. 22.8.1937 E. Dahl.

Fig. 4. *Alectoria subdivergens*. E. Dahl. Julianehaab District: Qagssimiut 4.7.1937 E. Dahl.

Fig. 1.

5 mm

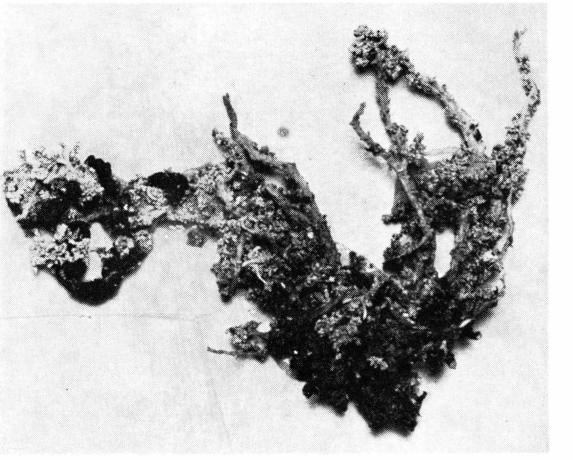


Fig. 2.

5 mm

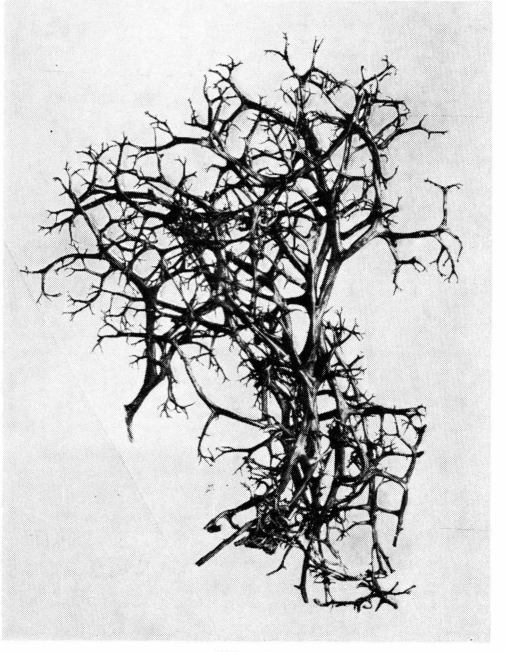


Fig. 3.

5 mm

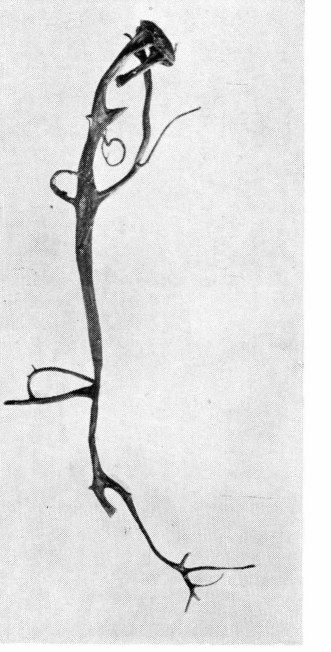


Fig. 4.

5 mm

Plate 3.

Fig. 1. Usninic acid recrystallized of G. E. × nichols. 35×.
Fig. 2. Sodium salt of usninic acid. × nichols. 75×.
Fig. 3. Crystals obtained by recrystallization of usninic acid of G. A. An. 35×.
Fig. 4. Barbatinic acid from *Cladonia Floerkeana* recrystallized of G. E. 75×.

Fig. 1.

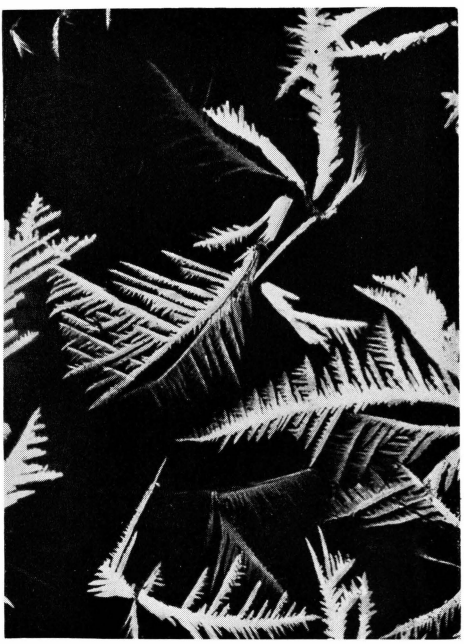


Fig. 2.

Fig. 3.

Fig. 4.

Plate 4.

Fig. 1. Extract of *Cladonia coccifera* containing zeorine recrystallized of G. A. An. Double pyramids: Zeorine. 120×.

Fig. 2. Crystals of unknown lichen acid obtained by extraction of *Cladonia coccifera* v. *pleurota* from Greenland first with benzene, afterwards with acetone. The residue of the extract with acetone is recrystallized of G. E. × nichols. 75×.

Fig. 3. Crystals obtained by heating of squamatic acid with G. A. An. × nichols. 75×.

Fig. 4. Squamatic acid recrystallized of G. E. 270×.

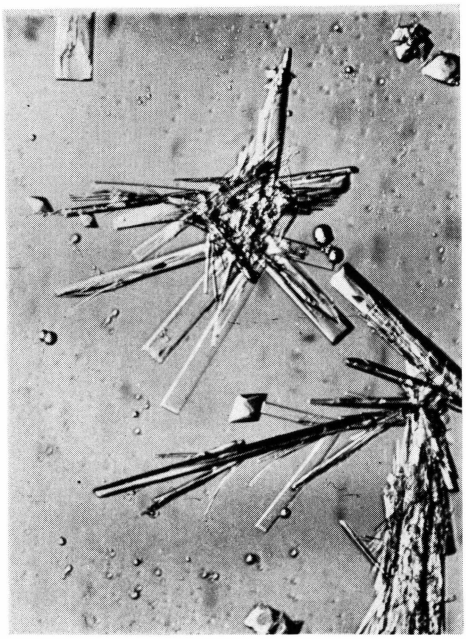


Fig. 1.

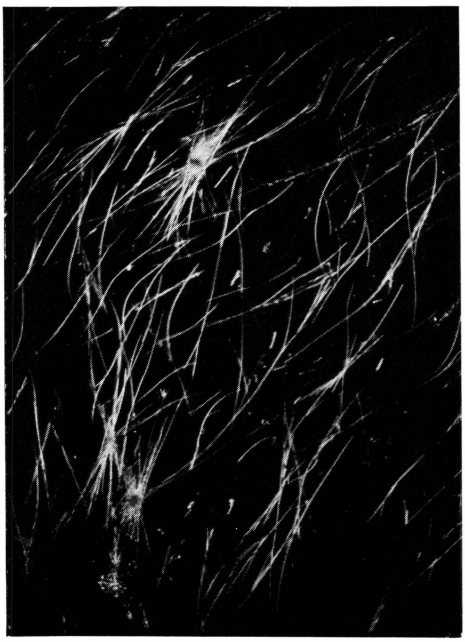


Fig. 2.

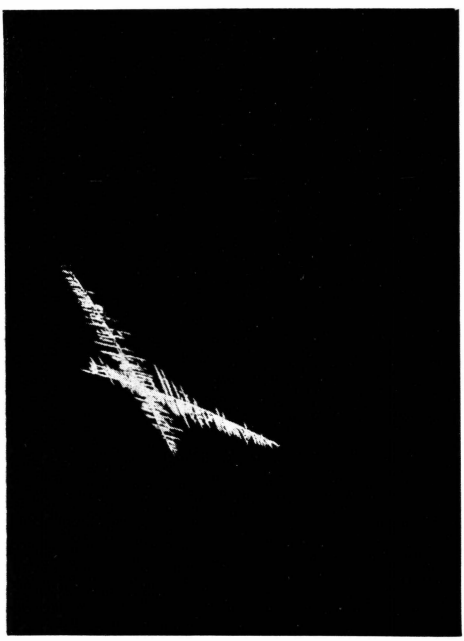


Fig. 3.

Fig. 4.

Plate 5.

Fig. 1. Psoromic acid recrystallized of G. E. × nichols. 40×.

Fig. 2. Residue after evaporation of solution of atranoric acid in benzene on the object glass. 40×

Fig. 3. Residue after evaporation of solution of atranoric acid in acetone. × nichols. 75×.

Fig. 4. Atranoric acid recrystallized of G. E. 120×.

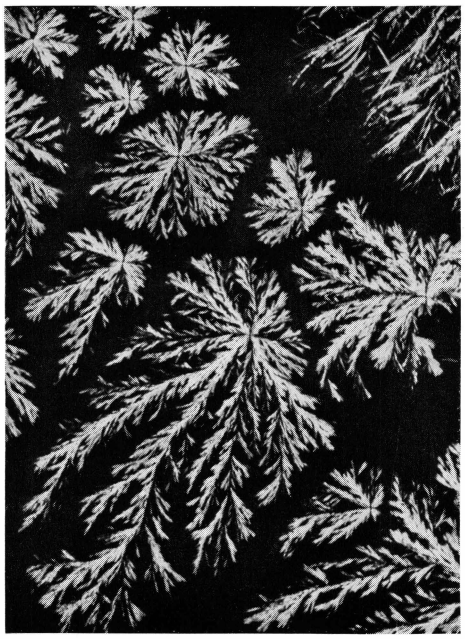


Fig. 1.

Fig. 2.

Fig. 3.

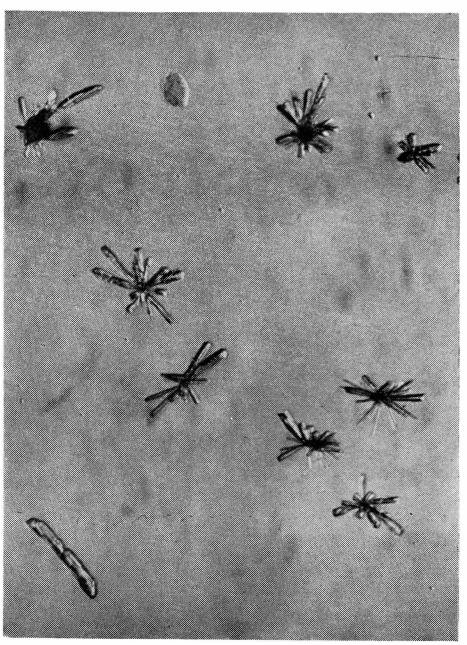


Fig. 4.

Plate 6.

Fig. 1. Cryptochlorophaeic acid from Sanst. Clad. Exsicc. 237 recrystallized of G. A. W. Dunkelfeld. 75×.

Fig. 2. Merochlorophaeic acid from Sanst. Clad. exsicc. 1847 recrystallized of G. E. 75×

Fig. 3. Grayaninic acid from Sanst. Clad. exsicc. 958 recrystallized of G. A. W. × nichols. 75×.

Fig. 4. Grayaninic acid from Sanst. Clad. exsicc. 468 recrystallized of G. E. 75×.

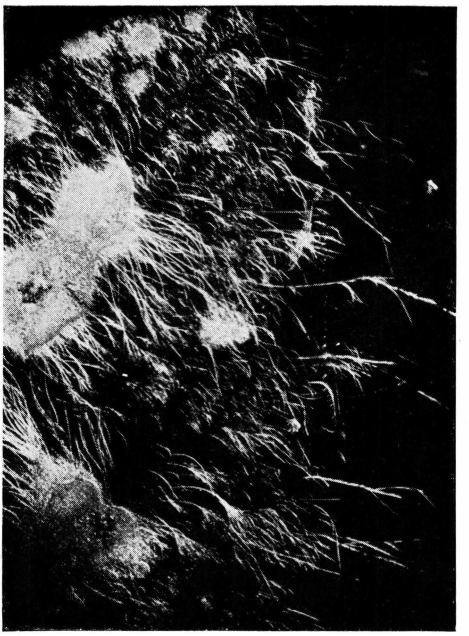


Fig. 1.

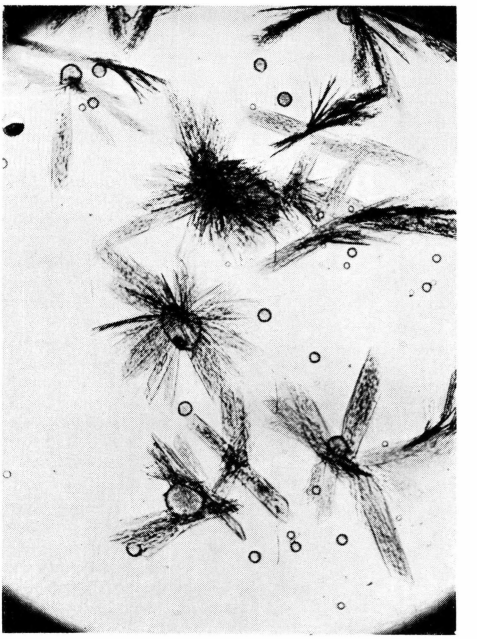


Fig. 2.

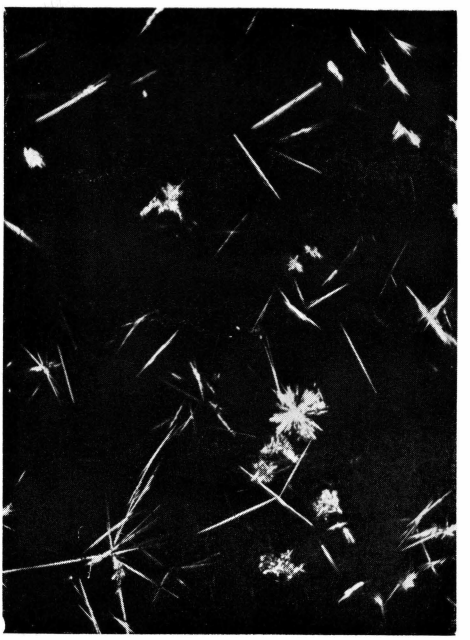


Fig. 3.

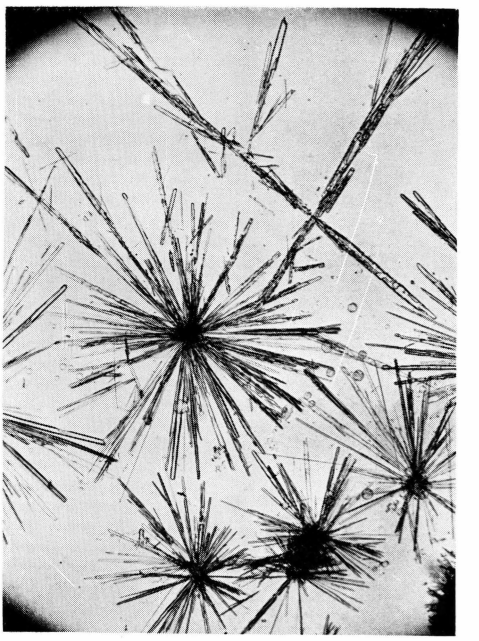


Fig. 4.

Plate 7.

Fig. 1. Novochlorophaeic acid from Sanst. Clad. exsicc. 238 recrystallized of G. A. W. 120×.

Fig. 2. Residue of extract of *Cladonia nemoxyna* in acetone recrystallized of G. E. Large crystals: Nemoxynic acid (= homosekika acid). 150×.

Fig. 3. Fumarproticetraric chinoline obtained by recrystallization of fumarprotocetraric acid with G. A. Q. 120×.

Fig. 4. Residue after extract of *Parmelia physodes* recrystallized of G. E. Coarse crystals: Atranoric acid. Curved needles: Physodic acid. 75×.

Fig. 1.

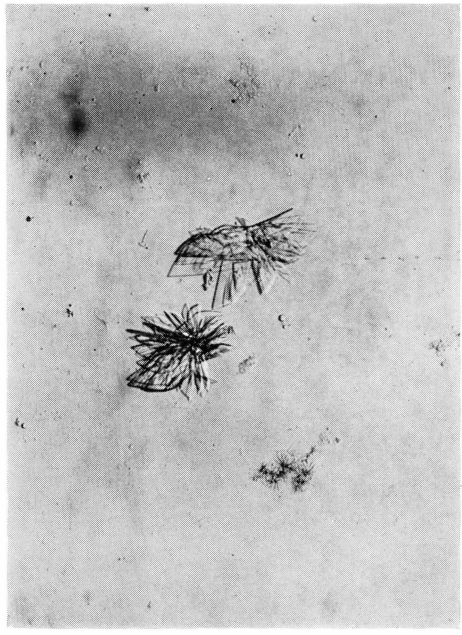


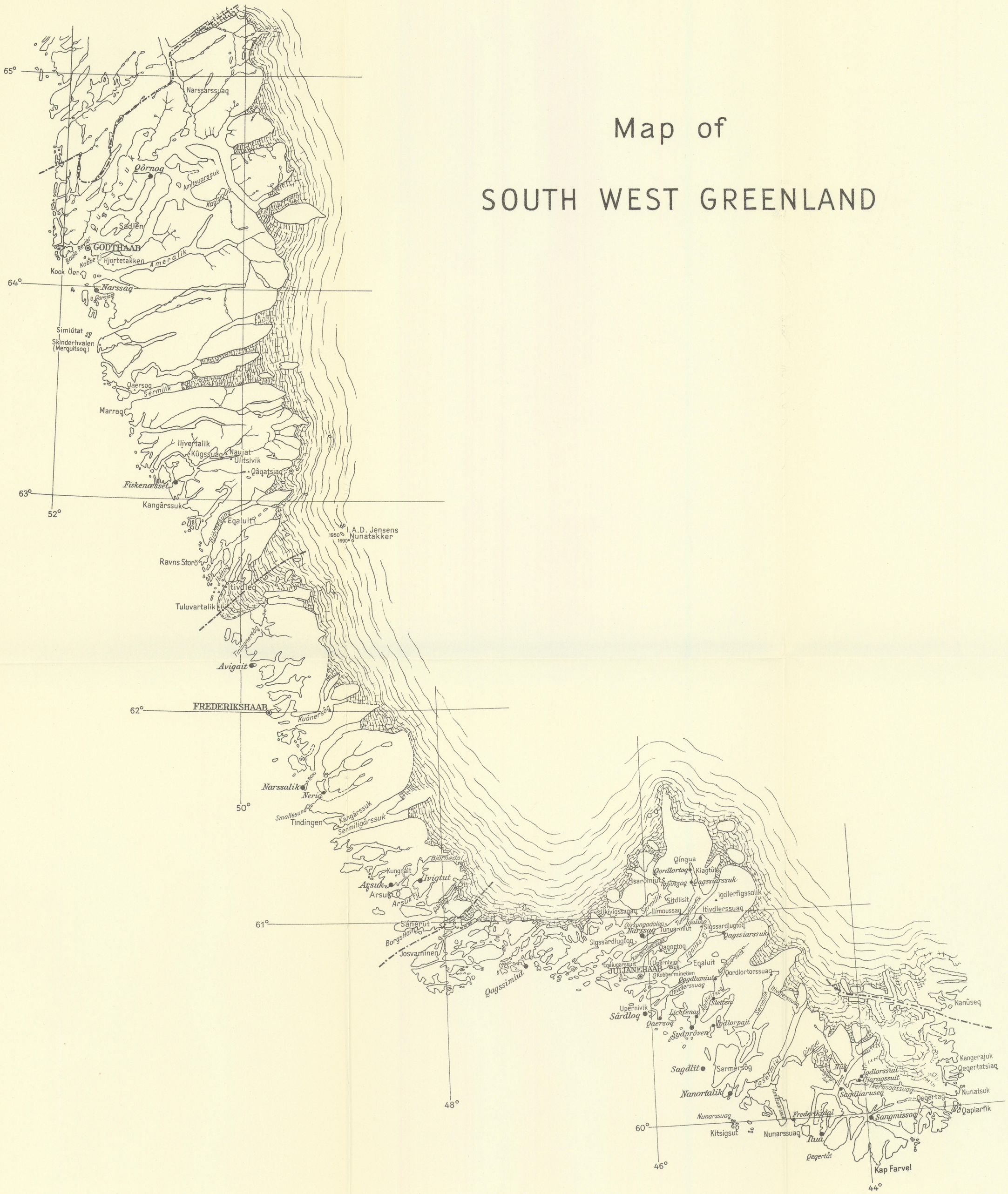
Fig. 2.

Fig. 3.

Fig. 4.

Map of

SOUTH WEST GREENLAND



Reproduceret ved geodætisk institut. København 1949