

## **A contribution to the lichen flora of J. A. D. Jensens Nunatakker, Frederikshåb District, South West Greenland**

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**Abstract** – This paper lists 52 taxa of lichens from J. A. D. Jensens Nunatakker in South West Greenland. 30 entries are new to the nunataks. Notes on the distribution of the collected species are given. The age of some large thalli of *Rhizocarpon geographicum*, *R. inarense* and *Pseudephebe minuscula* is roughly estimated. The colonization of lichens on the nunataks is discussed.

**Lichen flora / Lichenometri / *Rhizocarpon geographicum* / *Rhizocarpon inarense* / *Pseudephebe minuscula* / J. A. D. Jensens Nunatakker / Greenland**

### **INTRODUCTION**

The very inhospitable locality, J. A. D. Jensens Nunatakker, situated on the Greenland Inland Ice c. 25 km from the nearest ice-free area in Frederikshåb District, have been visited by two partly botanical expeditions prior to the present investigation. In 1878 the geologist, A. Kornerup, collected lichens during a Danish expedition lead by lieutenant J. A. D. Jensen (Johnstrup, 1879). The expedition used 11 days to move across the ice to the nunataks under very harsh weather conditions. The weather was also bad during the 7 days spent on the nunataks. Kornerup collected 26 taxa of lichens (Branth & Grønlund, 1888). A small, mainly Norwegian, expedition visited the nunataks in 1967. 38 species of lichens were brought home by this expedition (Gjærevoll & Ryvarde, 1977). In 1966 and 1968 S. Frederiksen and L. B. Jørgensen studied the flora on some nunataks located somewhat south of J. A. D. Jensens Nunatakker (Frederiksen, 1971). These Danish botanists report on 21 macrolichens from two nunataks. Previously Schwarzenbach (1961) investigated some nunataks in East Greenland. The author investigated the lichen flora on two of the five nunataks belonging to J. A. D. Jensens Nunatakker in the summer of 2009 during a more general study of the lichens occurring in the area between 62°37'N and 63°14'W in South West Greenland. It is his intention to publish the 500 lichen specimens collected by the expedition in the near future.

### **MATERIAL AND METHODS**

#### **Study area**

J. A. D. Jensens Nunatakker, the most isolated ones in Greenland, is situated c. 75 km from the icerim of Frederikshåbs Isblink (Fig. 1). The central

nunatak, Hestekoer (alt. 1520 m a. s. l.), is the largest and is composed of amphibolite and biotite gneiss. The present expedition had a short helicopter stop near Amfibolityggen on this nunatak. However, about three days were spent on Gnejstoppen (alt. 1670 m a. s. l.) just north of Hestekoer. The geological conditions of this nunatak are similar to those of Hestekoer with belts of dark amphibolite in the pale gneiss. A lateral moraine on Amfibolityggen indicates the position of the ice a little more than hundred years ago (Gjærevoll & Ryvarden, 1977).

Floristically and climatically, the nunataks are located in the low arctic, oceanic region (Jensen, 1999). At first sight they look very desolate, but a floristic analysis reveals patches with a fairly rich flora with mosaics of heath communities and snow-patch communities, in particular on Hestekoer. On Gnejsryggen I noted the following phanerogams: *Cardamine bellidifolia* L., *Cerastium alpinum* L., *Luzula confusa* Lindb., *Papaver radicum* Rottb., *Saxifraga caespitosa* L., *S. oppositifolia* L., *S. rivularis* L. and *S. tenuis* (Wahlenb.) H. Sm., all occurring on some small patches with soil. The rocks are more or less densely covered by lichens. The lichen flora and the climatic conditions of Paamiut have previously been outlined by the author (Hansen, 2008a). The climate prevailing on the nunataks is harsh compared with that of Paamiut with a comparatively great temperature amplitude between day and night and snow storms even during summer. However, the annual precipitation is presumably somewhat smaller than that of Paamiut.

### Collection and Identification

Collection of lichens was carried out at numerous sample plots on two of the five nunataks (Fig. 1). The collected material, a total of 88 lichen specimens, was studied with Zeiss light microscopes and determined by the author. An (\*) in front of the name in the list of lichens indicates that the taxon is an addition to the lichen flora of J. A. D. Jensens Nunatakker. The specimens are deposited at the Botanical Museum, University of Copenhagen (C). The nomenclature in the list follows Santesson *et al.* (2004).

### LIST OF LICHENS

*Alectoria nigricans* (Ach.) Nyl. — I: Gnejstoppen, 62°50'N, 48°55'W, on gravelly soil together with *Alectoria ochroleuca*, *Cetraria nigricans* and *Thamnolia vermicularis*, E. Hansen 4 July 2009. A common, bi- and circumpolar, terricolous lichen (Hansen, 1995).

*Alectoria ochroleuca* (Hoffm.) Massal. — I: Gnejstoppen, 62°50'N, 48°55'W, on gravelly soil, E. Hansen 4 July 2009. A common, bi- and circumpolar, terricolous lichen (Smith *et al.*, 2009).

*Allantoparmelia alpicola* (Th. Fr.) Essl. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock together with *Pseudephebe minuscula*, E. Hansen 4 July 2009. A widespread, circumpolar, saxicolous lichen (Hansen, 1995).

\* *Arctoparmelia centrifuga* (L.) Hale — II: Hestekoer, 62°49'N, 48°55'W, on amphibolite rock together with *Miriquidica nigroleprosa*, E. Hansen 6 July 2009. A common, circumpolar, saxicolous lichen (Thomson, 1984; Hansen, 1995).

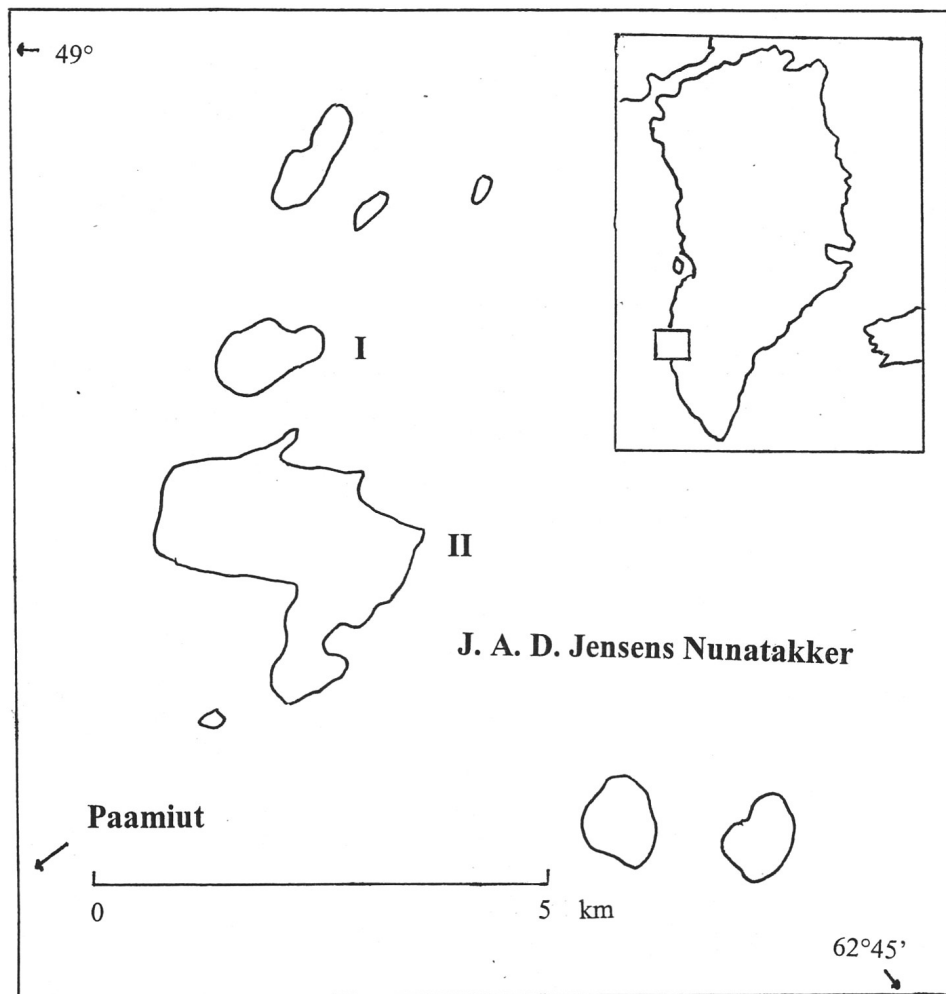


Fig. 1. Location of the investigation area in South West Greenland. I: Gnejstoppen II: Hesteskoen. The inlay map of Greenland shows the position of J. A. D. Jensens Nunatakker.

\* *Arthrorhaphis citrinella* (Ach.) Poelt — I: Gnejstoppen, 62°50'N, 48°55'W, on soil and mosses, E. Hansen 5 July 2009. A common, terricolous lichen with a worldwide distribution (Smith *et al.*, 2009).

\* *Aspicilia mastoidea* (Lynge) Th. Fr. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock together with *Lecidea lapicida* var. *pantherina* and *Tremolecia atrata*, E. Hansen 4 July 2009. A somewhat scattered, circumpolar, saxicolous lichen (Thomson, 1997).

\* *Brodoa oroarctica* (Krog) Goward — II: Hesteskoen, 62°49'N, 48°55'W, on amphibolite rock, E. Hansen 6 July 2009. A widespread, circumpolar, saxicolous lichen (Hansen, 2008b).

\* *Calvitimela armeniaca* (DC.) Hafellner — I: Gnejstoppen, 62°50'N, 48°55'W, on gneissic rock and amphibolite rock together with, for example, *Rhizocarpon inarense*, *R. superficiale* and *Sporastatia testudinea*, E. Hansen 4 July & 5 July 2009; II: Hestekoeno, 62°49'N, 48°55'W, on amphibolite rock, E. Hansen 6 July 2009. A common, bi- and circumpolar, saxicolous lichen with a distinct preference for windswept habitats (Thomson, 1997; Smith *et al.*, 2009).

*Candelariella canadensis* H. Magn. — I: Gnejstoppen, 62°50'N, 48°55'W, on mineral soil, E. Hansen 4 July 2009; II: Hestekoeno, 62°49'N, 48°55'W, on mineral soil together with *Protoparmelia pezizoides*, E. Hansen 6 July 2009. A widespread, probably circumpolar, terricolous lichen known so far from arctic North America, Greenland and the Himalayas (Westberg, 2010).

\* *Candelariella vitellina* (Hoffm.) Müll. Arg. — II: Hestekoeno, 62°49'N, 48°55'W, on amphibolite rock together with *Lecanora polytropa* and *Pseudephebe minuscula*, E. Hansen 6 July 2009. A cosmopolitan, saxicolous lichen (Hansen, 2009).

*Cetraria islandica* (L.) Ach. — I: Gnejstoppen, 62°50'N, 48°55'W, on soil, E. Hansen 5 July 2009. A common, cosmopolitan, terricolous lichen (Smith *et al.*, 2009).

\* *Cetraria nigricans* Nyl. — I: Gnejstoppen, 62°50'N, 48°55'W, on gravelly soil in rock fissure, E. Hansen 5 July 2009; II: Hestekoeno, 62°49'N, 48°55'W, on gravelly soil, E. Hansen 6 July 2009. A widespread, circumpolar, terricolous lichen (Hansen, 1995).

\* *Cladonia borealis* S. Stenroos — I: Gnejstoppen, 62°50'N, 48°55'W, on soil, E. Hansen 4 July 2009. A common and widespread, circumpolar, terricolous lichen (Hansen, 2008b).

\* *Cladonia macrophyllodes* Nyl. — I: Gnejstoppen, 62°50'N, 48°55'W, on plant remains, E. Hansen 5 July 2009. A widespread, circumpolar, terricolous lichen (Hansen, 1995).

*Flavocetraria cucullata* (Bellardi) Kärnefelt & Thell — I: Gnejstoppen, 62°50'N, 48°55'W, on soil and on *Racomitrium lanuginosum* tussock, E. Hansen 4 July 2009. A common, circumpolar, terricolous lichen (Hansen, 1995).

*Flavocetraria nivalis* (L.) Kärnefelt & Thell — I: Gnejstoppen, 62°50'N, 48°55'W, on soil together with *Flavocetraria cucullata*, E. Hansen 4 July 2009. A common, bi- and circumpolar, terricolous lichen (Smith *et al.*, 2009).

\* *Lecanora intricata* (Ach.) Ach. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock, E. Hansen 5 July 2009. A common and probably cosmopolitan, saxicolous lichen (Smith *et al.*, 2009).

*Lecanora polytropa* (Ehrh. ex Hoffm.) Rabenh. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock together with *Pseudephebe minuscula*, *Tremolecia atrata* and *Umbilicaria virginis*; II: Hestekoeno, 62°49'N, 48°55'W, on amphibolite rock together with *Candelariella vitellina* and *Protoparmelia badia*, E. Hansen 6 July 2009. A common, cosmopolitan, saxicolous lichen (Smith *et al.*, 2009).

\* *Lecidea atrobrunnea* (Ramond ex Lam. & DC.) Schaer. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock together with *Rhizocarpon inarense*, E. Hansen 5 July 2009; II: Hestekoeno, 62°49'N, 48°55'W, on amphibolite rock, E. Hansen 6 July 2009. A widespread, bi- and circumpolar, saxicolous lichen (Nimis, 1993).

*Lecidea lapicida* (Ach.) Ach. var. *lapicida* f. *ochracea* (Nyl.) Vain. — I: Gnejstoppen, 62°50'N, 48°55'W, on amphibolite rock, E. Hansen 5 July 2009. A widespread, circumpolar, saxicolous lichen (Hansen, 1995).

\* *Lecidea lapicida* (Ach.) Ach. var. *pantherina* Ach. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock, E. Hansen 4 July 2009; II: Hestekoens, 62°49'N, 48°55'W, on amphibolite rock together with *Xanthoria elegans*, E. Hansen 6 July 2009. A common, circumpolar and probably cosmopolitan, saxicolous lichen (Smith *et al.*, 2009).

\* *Melanelia hepatizon* (Ach.) Thell — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rocks, E. Hansen 4 & 5 July 2009. A common, circumpolar, saxicolous lichen (Hansen, 1995).

\* *Miriquidica leucophaea* (Flörke ex Rabenh.) Hertel 6 Rambold — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock, E. Hansen 4 July 2009. A somewhat scattered, bi- and circumpolar, saxicolous lichen with preference for metal-rich rocks (Smith *et al.*, 2009).

\* *Miriquidica nigroleprosa* (Vain.) Hertel & Rambold var. *nigroleprosa* — II: Hestekoens, 62°49'N, 48°55'W, on amphibolite rock, E. Hansen 6 July 2009. A somewhat scattered, probably circumpolar, saxicolous, saxicolous lichen (Smith *et al.*, 2009).

\* *Ochrolechia tartarea* (L.) A. Massal. — II: Hestekoens, 62°49'N, 48°55'W, on amphibolite rock, E. Hansen 6 July 2009. A widespread, bi- and circumpolar, saxicolous lichen (Thomson, 1997; Smith *et al.*, 2009).

\* *Ophioparma ventosa* (L.) Norman — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock, E. Hansen 4 July 2009; II: Hestekoens, 62°49'N, 48°55'W, on amphibolite rock, E. Hansen 6 July 2009. A widespread, circumpolar, saxicolous lichen with a preference for windswept habitats (Hansen, 1995, 2008b).

\* *Orphniospora moriopsis* (A. Massal) D. Hawksw. — I: Gnejstoppen, 62°50'N, 48°55'W, on gneissic rock together with *Pseudephebe minuscula*, *Rhizocarpon grande* and *Umbilicaria nylanderiana*, E. Hansen 5 July 2009. A common, circumpolar, saxicolous lichen (Hansen, 1995).

\* *Pertusaria geminipara* (Th. Fr.) C. Knight ex Brodo — I: Gnejstoppen, 62°50'N, 48°55'W, on *Racomitrium lanuginosum* tussock, E. Hansen 4 July 2009. A widespread, bi- and circumpolar, muscicolous lichen (Thomson, 1997).

\* *Pleopsidium chlorophanum* (Wahlenb.) Zopf — I: Gnejstoppen, 62°50'N, 48°55'W, on gneissic rock and amphibolite rock, E. Hansen 4 & 5 July 2009; II: Hestekoens, 62°49'N, 48°55'W, on amphibolite rock, E. Hansen 6 July 2009. A widespread, bi- and circumpolar, saxicolous lichen (Hansen, 1995; Smith *et al.*, 2009).

\* *Porpidia flavicunda* (Ach.) Gowan — I: Gnejstoppen, 62°50'N, 48°55'W, on amphibolite rock together with *Tremolecia atrata*, E. Hansen 4 July 2009; II: Hestekoens, 62°49'N, 48°55'W, on amphibolite rock together with *Rhizocarpon geographicum*, E. Hansen 6 July 2009. A widespread, bi- and circumpolar, saxicolous lichen (Hansen, 1995; Smith *et al.*, 2009).

\* *Protopannaria pezizoides* (Weber) P. M. Jørg. & S. Ekman — II: Hestekoens, 62°49'N, 48°55'W, on mineral soil, E. Hansen 6 July 2009. A widespread, bi- and circumpolar, terricolous lichen (Hansen, 1995; Smith *et al.*, 2009).

\* *Protoparmelia badia* (Hoffm.) Hafellner — I: Gnejstoppen, 62°50'N, 48°55'W, on manured siliceous rock, E. Hansen 4 July 2009; II: Hestekoens, 62°49'N, 48°55'W, on amphibolite rock, E. Hansen 6 July 2009. A common, cosmopolitan, saxicolous lichen (Smith *et al.*, 2009).

\* *Pseudephebe minuscula* (Nyl. ex Arnold) Brodo & D. Hawksw. — I: Gnejstoppen, 62°50'N, 48°55'W, on gneissic and amphibolite rocks, E. Hansen 4 & 5 July 2009; II: Hestekoens, 62°49'N, 48°55'W, on amphibolite rock, E. Hansen 6 July 2009. A common, bi- and circumpolar, saxicolous lichen (Hansen, 2008b).

***Rhizocarpon geographicum*** (L.) DC. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rocks including amphibolite rocks, E. Hansen 4 & 5 July 2009; II: Hesteskoen, 62°49'N, 48°55'W, on amphibolite rock, E. Hansen 6 July 2009. A common, cosmopolitan (in cold regions), saxicolous lichen (Smith *et al.*, 2009).

\* ***Rhizocarpon grande*** (Flörke) Arnold — I: Gnejstoppen, 62°50'N, 48°55'W, on gneissic rock, E. Hansen 5 July 2009. A common, circumpolar, saxicolous lichen (Hansen, 1995).

\* ***Rhizocarpon inarense*** (Vain.) Vain. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rocks, E. Hansen 4 & 5 July 2009. A common, circumpolar, saxicolous lichen (Hansen, 1995).

\* ***Rhizocarpon jemtlandicum*** (Malme) Malme — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock together with *Rhizocarpon inarense*, E. Hansen 5 July 2009. A widespread, circumpolar, saxicolous lichen (Hansen, 1995).

\* ***Rhizocarpon pusillum*** Runemark — I: Gnejstoppen, 62°50'N, 48°55'W, on *Sporastatia testudinea* on siliceous rock, E. Hansen 4 July 2009. A widespread, circumpolar, saxicolous lichen (Hansen, 1995).

\* ***Rhizocarpon superficiale*** (Schaer.) Vain. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rocks, E. Hansen 4 & 5 July 2009. A common, bi- and circumpolar, saxicolous lichen (Hansen, 1995; Smith *et al.*, 2009).

\* ***Rhizocarpon viridiatrum*** (Wulfen) Körb. — I: Gnejstoppen, 62°50'N, 48°55'W, on *Tremolecia atrata* on amphibolite rock, E. Hansen 5 July 2009. A somewhat scattered, bi- and circumpolar, saxicolous lichen (Smith *et al.*, 2009). The species has recently been found at the north coast of Greenland (Hansen, 2009).

***Sphaerophorus fragilis*** (L.) Pers. — I: Gnejstoppen, 62°50'N, 48°55'W, on *Racomitrium lanuginosum* tussock, E. Hansen 4 July 2009. A common, circumpolar, saxicolous lichen (Hansen, 1995).

\* ***Sporastatia testudinea*** (Ach.) A. Massal. — I: Gnejstoppen, 62°50'N, 48°55'W, on gneissic and amphibolite rocks, E. Hansen 4 & 5 July 2009. A widespread, bi- and circumpolar, saxicolous lichen (Smith *et al.*, 2009).

\* ***Stereocaulon arcticum*** Lyngé — I: Gnejstoppen, 62°50'N, 48°55'W, on gravelly soil together with *Alectoria nigricans*, E. Hansen 5 July 2009. A somewhat scattered, circumpolar, terricolous lichen (Lamb, 1977).

\* ***Stereocaulon glareosum*** (L. I. Savicz) H. Magn. — II: Hesteskoen, 62°49'N, 48°55'W, on soil together with *Protopannaria pezizoides*, E. Hansen 6 July 2009. A common, bi- and circumpolar, terricolous lichen (Lamb, 1977).

***Thamnomia vermicularis*** (Sw.) Schaer. — I: Gnejstoppen, 62°50'N, 48°55'W, on *Cetraria nigricans* tussock, E. Hansen 4 July 2009. A common, bi- and circumpolar, terricolous lichen (Hansen, 2008b).

***Tremolecia atrata*** (Ach.) Hertel — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous including amphibolite rocks, E. Hansen 4 & 5 July 2009. A common, cosmopolitan, saxicolous lichen with preference for iron-rich rocks (Smith *et al.*, 2009).

***Umbilicaria lyngei*** Schol. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock, E. Hansen 4 July 2009. A common, circumpolar, saxicolous lichen (Hansen, 1995).

\* ***Umbilicaria nylanderiana*** (Zahlbr.) H. Magn. — I: Gnejstoppen, 62°50'N, 48°55'W, on gneissic rock, E. Hansen 4 July 2009. A common, cosmopolitan (except Africa), saxicolous lichen (Smith *et al.*, 2009).

*Umbilicaria proboscidea* (L.) Schrad. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock, E. Hansen 4 July 2009. A common, bi- and circumpolar, saxicolous lichen (Smith *et al.*, 2009).

*Umbilicaria rigida* (Du Rietz) Frey — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous rock together with *Orphniospora moriopsis*, E. Hansen 4 July 2009. A somewhat scattered, circumpolar, saxicolous lichen (Hansen, 1995).

*Umbilicaria virginis* Schaer. — I: Gnejstoppen, 62°50'N, 48°55'W, on siliceous and amphibolite rocks, E. Hansen 4 & 5 July 2009. A common, circumpolar, saxicolous lichen (Hansen, 1995).

*Xanthoria elegans* (Link) Th. Fr. — II: Hesteskoen, 62°49'N, 48°55'W, on amphibolite rock, E. Hansen 6 July 2009. A common, bi- and circumpolar, saxicolous lichen (Smith *et al.*, 2009).

## ESTIMATION OF THE AGE OF SELECTED LICHENS

The maximum diameter of some large, more or less circular thalli of *Rhizocarpon geographicum*, *R. inarense* and *Pseudephebe minuscula* occurring on some gneissic rocks at c. 1500 m a. s. l. on Gnejstoppen was measured. The age of the thalli was calculated on the basis of a rough estimate of the growth rate of the lichens. It hardly extends 8-10 mm 100 years<sup>-1</sup> for *Rhizocarpon geographicum* and *R. inarense*, respectively, and 50 mm 100 years<sup>-1</sup> for the more fast-growing macrolichen, *Pseudephebe minuscula*. Because of the harsh climatic conditions prevailing on the nunataks, the growth rates are stipulated as somewhat lower than the values previously estimated for the three lichens in southern Greenland (Beschel 1958, 1961; Hansen, 2010a). The largest thallus of *Pseudephebe minuscula* on Gnejstoppen measures 30 cm (diam.) and accordingly is approximately 300 years old. The maximum diameter of the largest thallus of *Rhizocarpon geographicum* on the nunatak is 13 cm, which mean that this species probably is more than 800 years old. *Rhizocarpon inarense* appears to grow slightly faster than *R. geographicum* on the nunatak, as the diameter of the largest thalli of this species measures about 5 cm more than that of the largest thalli of *R. geographicum*. It is here assumed that the two species originally colonized the rocks almost at the same time. These two *Rhizocarpon* species are the oldest lichens occurring on Gnejstoppen. *Pseudephebe minuscula* evidently colonized the rocks far later than the *Rhizocarpons*. Although the yellow *Rhizocarpons* are able to survive for some time under a layer of snow and ice their growth indicates that at least the tops of the nunataks have been almost totally ice-free in 8-900 years and possibly in an even longer period (see also the concluding chapter).

## CONCLUSION

Most of the 52 lichens reported on in the present paper are widespread lichens, and all except a few species, for example, *Pleopsidium chlorophanum*, *Rhizocarpon pusillum*, *R. viridiatrum* and *Umbilicaria lyngei*, are known from the Paamiut area (Hansen, 2008a). As regards their climatic preferences in Greenland

most lichen taxa are indifferent climatically. Five species, viz. *Allantoparmelia alpicola*, *Arthrurhaphis citrinella*, *Ochrolechia tartarea*, *Lecidea lapicida* var. *pantherina* and *Protopannaria pezizoides*, have a somewhat oceanic distribution (Hansen, 2010b). *Rhizocarpon pusillum* is the only lichen with a somewhat continental distribution in Greenland. Like *Umbilicaria lyngei*, *Rhizocarpon pusillum* is common in more northern parts of Greenland (Hansen, 1995). Diaspores of these two lichens might have been transported from such areas, but more likely they originate from neighbouring, so far unknown populations occurring on the mainland. From here the diaspores probably have been transported by the wind over ice- and snow-covered surfaces. Lichen colonization occurs usually after a few decades, when a rock face becomes free of ice (Benedict, 1981; Werner, 1990; Hansen & Hasholt, 2009). J. A. D. Jensens Nunatakker have presumably been covered by ice during the last glaciation and are not older than c. 10000 years (Gjærevoll & Ryvarden, 1977). However, in this long period snow and ice in combination with strong winds might have prevented or retarded lichen growth on several occasions, which means that the present lichen flora only represents the latest of a number of lichen generations since the end of the last, extensive glaciation. This hypothesis remains to be proved.

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