BRYOZOAIRES ACTUELS ET FOSSILES : BRYOZOA LIVING AND FOSSIL
F.P. BIGEY (Ed.)
Bull. Soc. Sci. Nat. Ouest Fr., Mém. HS 1
Nantes (FRANCE), 1991 : 291-298
ISSN 0758-3818 ; ISBN 2-908530-00-7

DISTRIBUTION OF BRYOZOANS IN THE PERMIAN SUCCESSION OF SVALBARD (PRELIMINARY DATA).

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ABSTRACT. – More than 300 samples have been collected through the Permian succession of Spitsbergen and Bjørnønya (Svalbard, Arctic Norway) and more than 90 previously described species from the major Palaeozoic bryozoan orders are identified. A brief description of the geological development through this succession is given, as well as faunal lists. The distribution of species makes it possible to correlate the investigated faunas of Svalbard with described faunas from Ellesmere Island, Greenland, Timan-Pechora and Novaya Zemlya. It is also possible to correlate lithological units within the Svalbard Archipelago as based on the bryozoan faunas.

KEY-WORDS. – Bryozoa, Permian, biostratigraphy, Svalbard, Arctic.

RÉSUMÉ. – Plus de 300 échantillons ont été recueillis dans la série permienne du Spitzberg et de Bjørnøya (Spitzberg, Arctique norvégien) et plus de 90 espèces déjà décrites, appartenant aux principaux ordres de Bryozoaires paléozoïques, ont été identifiées. Nous donnons ici une courte description de l'évolution géologique de cette série, ainsi que les listes fauniques. La répartition des espèces rend possible la corrélation des faunes étudiées au Spitzberg avec les faunes décrites dans l'Ile d'Ellesmere, au Groenland, dans la région Timan-Pechora et en Nouvelle-Zemble. Il est généralement possible de corréler les unités lithologiques dans l'archipel du Spitzberg même sur la base des faunes de Bryozoaires.

MOT-CLÉS. – Bryozoa, Permien, biostratigraphie, Spitzberg, Arctique.

INTRODUCTION

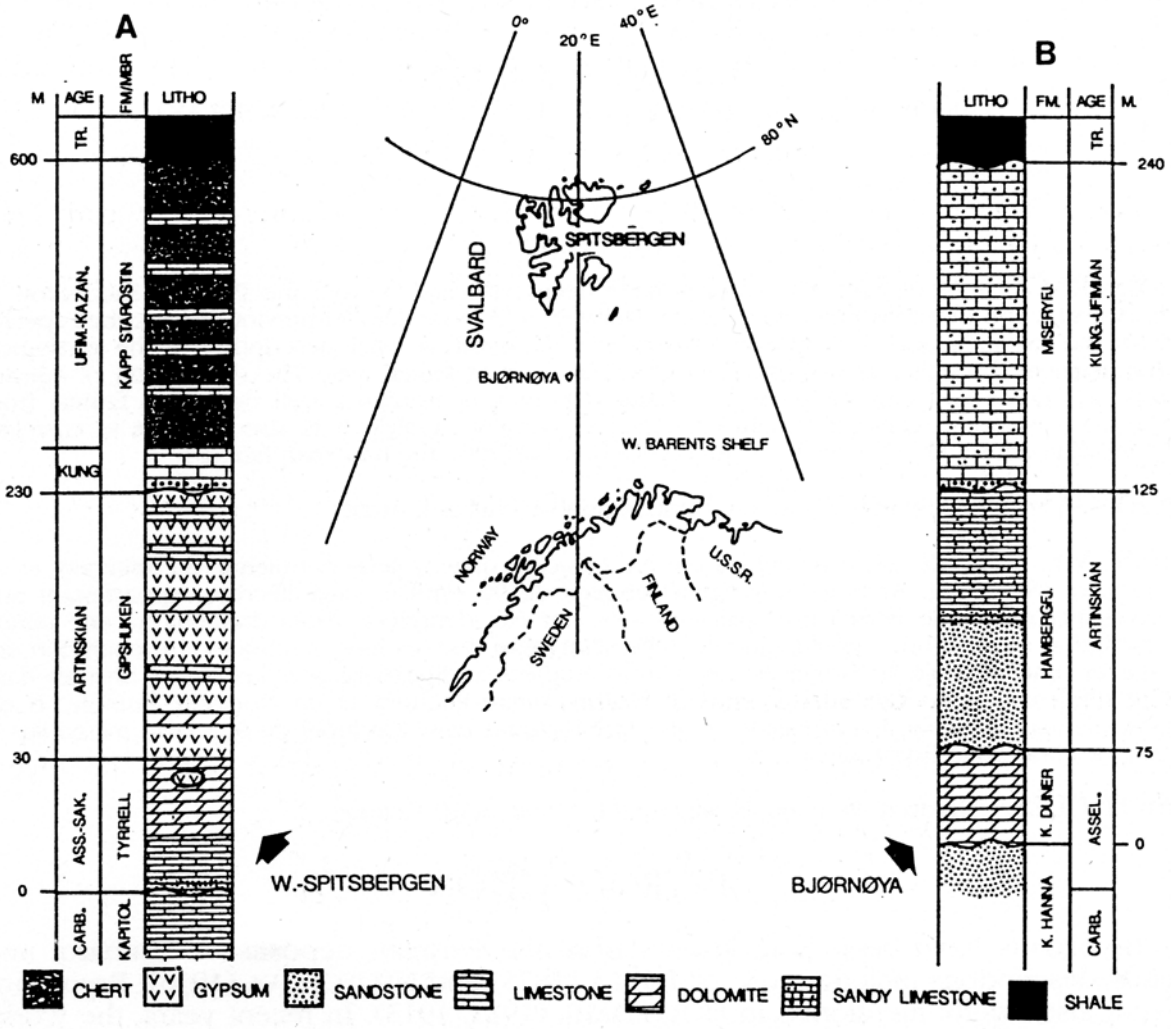
Bryozoans have been long known from the Permian deposits of Svalbard, and early descriptions include those of TOULA (1875) and NIKIFOROVA (1936). Bryozoans were also briefly mentioned in HOLTEDAHL (1911, 1913). In recent years, the works by MALECKI (1968, 1977) (revised *in* NAKREM, 1988) and MOROZOVA and KRUCHININA (1986) gave valuable new information on the Late Permian faunas. The only description of an Early Permian bryozoan: *Archimedes* aff. *magnus* CONDRA & ELIAS, 1944, was given by CZARNIECKI (1964).

The present study was initiated by the Norwegian Continental Shelf and Petroleum Technology Research Institute (IKU), Trondheim, in 1984 as a result of bryozoans being found in drilling samples from the Barents Shelf. To achieve biostratigraphic information from these bryozoan faunas, the project to describe onshore bryozoans

from Svalbard was started and the main purpose is of present a biostratigraphic succession that can be of regional use. Co-projects include study to fusulinids, palynomorphs and conodonts to provide stratigraphic control on sampled intervals.

GEOGRAPHICAL AND GEOLOGICAL FRAMEWORK

The Svalbard Archipelago comprises all islands in the area 74-81°N, 10-35°E, situated at the northwestern part of the Barents Shelf (Text-Fig. 1). The Upper Carboniferous and Permian successions comprise two lithological units (the Gipsdalen- and Tempelfjorden Groups) totalling some 700-800 m composite thickness in the area covered by the present study. The lithological descriptions below are in part based on WORSLEY and EDWARDS (1976), STEEL and WORSLEY (1984) and HELLEM and WORSLEY *(in prep.)*.



Text-Fig. 1. Geographical position of Spitsbergen (Svalbard) and Bjørnøya, with lithological columns (**A**: Spitsbergen; **B**: Bjørnøya) with thicknesses, ages and local formational names.

Texte-Fig. 1. Situation géographique du Spitzberg et de Bjørnøya et colonnes stratigraphiques (**A**: Spitzberg; **B**: Bjørnøya) avec épaisseurs, âges et noms locaux des formations.

SPITSBERGEN

The Upper Carboniferous Cadellfjellet/Kapitol Members and the Asselian-Sakmarian Tyrrellfjellet Member (Text-Fig. 1A) consist mainly of shallow marine limestones and dolomites, with minor amounts of clastics. The faunas are commonly composed of fusulinids, corals, crinoids and bryozoans. The Artinskian Gipshuken Formation is a thick gypsiferous/evaporitic sequence containing only minor calcareous partitions, with a restricted fauna of gastropods, small foraminifera, brachiopods and very few bryozoans. The Tempelfjorden Group is represented by the Kapp Starostin Formation (including the Vøringen Member; Text-Fig. 1A) in the studied areas. The Kungurian Vøringen Member consists of light grey grainstones and coquinal limestones with a prolific fauna of brachiopods, bryozoans and crinoids interpreted as representing a marine nearshore facies outside a transgressive barrier complex.

The upper part of the Kapp Starostin Formation (Ufimian-?Kazanian) consists of intercalated cherts and partly silicified limestones, with abundant bryozoans, brachiopods and sponges deposited under moderately deep marine conditions. The uppermost part of the Kapp Starostin Formation contains few fossils towards the conformable base of the Triassic, and it is debatable how much Upper Permian sediment is missing.

BJØRNØYA ("BEAR ISLAND")

The Lower Permian (Asselian) Kapp Dunér Formation is dominated by carbonate buildups (hydrozoan bioherms) and fusulinid rich beds, with coral faunas but few bryozoans. The overlying Hambergfjellet Formation consists of a sandy lower unit, and a reddish calcareous upper unit dated as Artinskian by fusulinids and conodonts. Brachiopods, corals and few bryozoans are the main faunal elements in this formation. The youngest Permian (?Kungurian-Ufimian/?Kazanian) Miseryfjellet Formation consists of yellow coloured sandy limestones overlying a basal conglomerate. The fauna contains abundant brachiopods (spiriferids and productids) and bryozoans. The age is debatable, as age diagnostic fossils are not common throughout this formation. These lithological units are included in Text-Fig. 1B.

BRYOZOAN FAUNAS

SPITSBERGEN

Cadellfjellet/Kapitol Members (Gzhelian)

Few bryozoan samples were collected from this unit as large intervals appeared barren, and the collected fauna is thus relatively small. 5 species are identified from these samples:

Ascopora magniseptata SHUL'GA-NESTERENKO, 1955
A. muromensis SHUL'GA-NESTERENKO, 1955
Rhombotrypella invulgata TRIZNA, 1948
R. arbuscula (EICHWALD, 1860)
Archimedes stuckenbergi NIKIFOROVA, 1938

This bryozoan fauna has species in common with both Upper Carboniferous and Lower Permian faunas of Timan and the Urals (USSR), as well as Ellesmere Island (Arctic Canada) (MOROZOVA & KRUCHININA, 1986).

Tyrrellfjellet Member (Asselian-Sakmarian)

Bryozoan samples were collected from four sections, 30 taxa (14 to species level) have been identified. The most important include:

Goniocladia tenuis SHUL'GA-NESTERENKO, 1933
Ramiporidra minuta (SHUL'GA-NESTERENKO, 1933)
Coscinium cyclops KEYSERLING, 1846

Rhombotrypella invulgata TRIZNA, 1948
Ascopora sterlitamakensis NIKIFOROVA, 1939
Ascopora grandis (KRUCHININA, 1973)
Rectifenestella veneris (FISCHER, 1837)
Fabifenestella permiana (STUCKENBERG, 1895)
Alternifenestella bifida (EICHWALD, 1860)
Flexifenestella grandis (SHUL'GA-NESTERENKO, 1936)
Polypora kutorgae STUCKENBERG, 1895

Most of these bryozoans have an Asselian to Sakmarian range, the uppermost faunas also have Artinskian affinities, as compared with faunas in the Urals, Timan and Ellesmere Island. These ages are slightly younger than those indicated by fusulinids, palynomorphs and conodonts.

Gipshuken Formation (Artinskian)

Parts of this mainly evaporitic sequence contain marine influenced partitions, but usually bryozoans and other shelly fossils appear as voids. Only near the top a slightly thicker limestone interval was observed, and better preserved bryozoans were collected. One fenestrate (*Polypora martis* FISCHER, 1837) is present, as well as one unidentified trepostome (*?Pseudobatostomella*). Voids after fenestrates are fairly common.

Kapp Starostin Formation (Kungurian- ?Kazanian)

Many samples were collected from the 20 m thick Vøringen Member (Kungurian) yielding a bryozoan fauna of 16 species. The faunas are characterized by encrusting and multilamellar trepostomes and cystoporates and firm fenestrates within the lowermost coarse lithologies. Finely branched cryptostomes and trepostomes are present in the upper, more shaly part. Important species include:

Cyclotrypa eximia MOROZOVA & KRUCHININA, 1986
C. distincta MOROZOVA & KRUCHININA, 1986
Meekopora sp.
Ramipora sp. cf. *hochstetteri* TOULA, 1875
Tabulipora greenlandensis ROSS & ROSS, 1962
Rhombotrypella arbuscula (EICHWALD, 1860)
R. alfredensis MOROZOVA & KRUCHININA, 1986
Dyscritella narjanmarica KRUCHININA, 1973
Streblascopora germana (BASSLER, 1929)
Rectifenestella araxensis (NIKIFOROVA, 1934)
Polyporella subcrotilla (TRIZNA, 1950)
Timanodictya nikiforovae MOROZOVA, 1966

These bryozoan faunas resemble the Kungurian faunas of the Timan-Pechora region, and thus support the Kungurian age indicated by conodonts and brachiopods.

The upper part of the Kapp Starostin Formation (the Svenskegga- and Hovtinden Members) were extensively sampled (> 50 sampled horizons), and the bryozoans fauna is very rich. 30 taxa have been identified; most of them to species level. There are two alternating associations of bryozoans through this succession:

(1) abundant *Ramipora hochstetteri* TOULA, 1875, finely branched trepostomes, cryptostomes and minute fenestellids in the cherty/fine grained lithologies, and (2) thick trepostomes, coarse/firm species of *Polypora, Acanthocladia* and *Reteporidra* in the partly silicified coarse limestone intervals.

This division may reflect the recurrent changing depositional environments (quiet/rough waters), or a selection through transport.

Most abundant in these associations are:

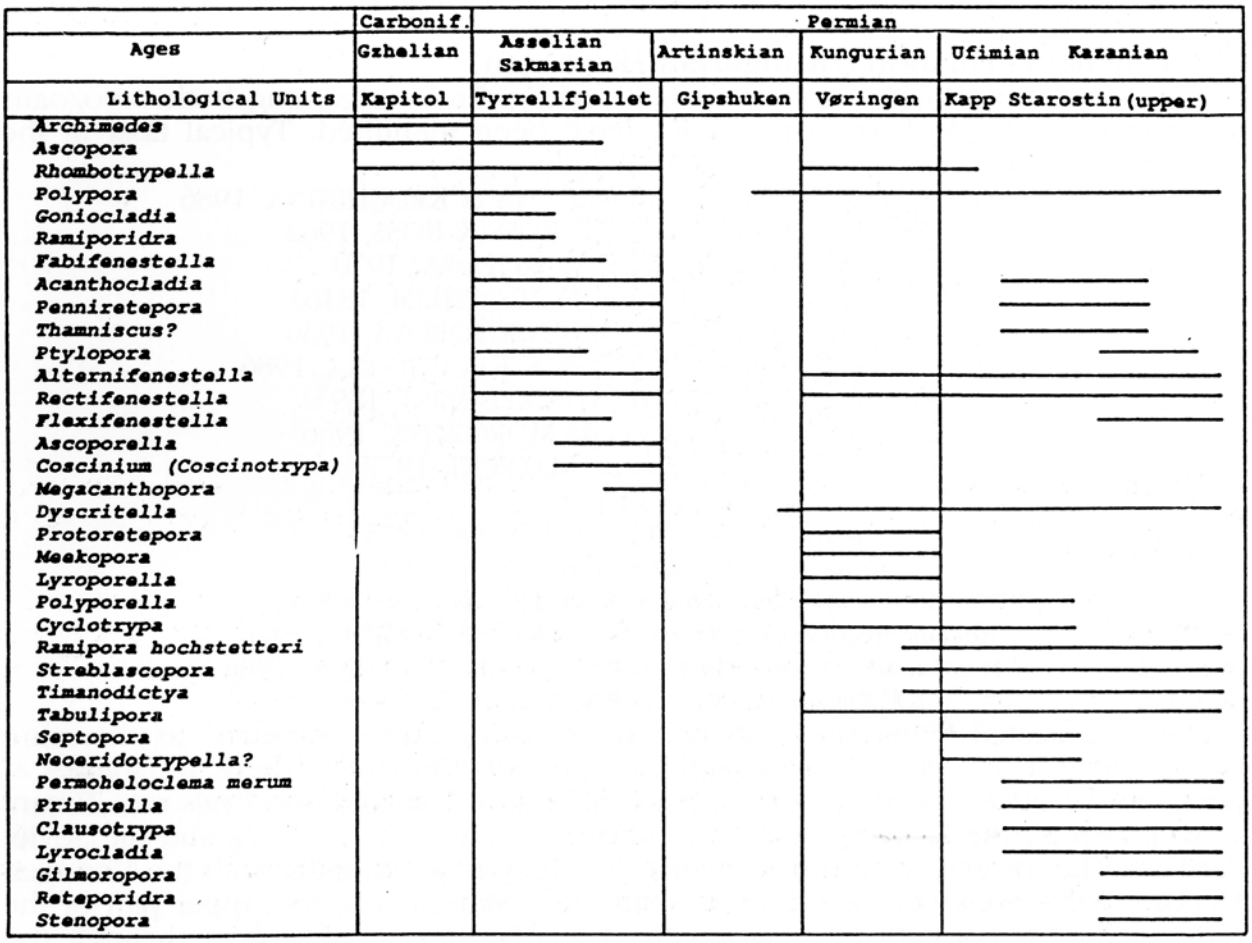
Ramipora hochstetteri TOULA, 1875
Permoheloclema merum OZHGIBESOV, 1983
Primorella polita ROMANCHUK & KISELEVA, 1968
Clausotrypa spinosa FRITZ, 1932

Associated species include:

Multilamellar ?*Neoeridotrypella* sp.
Stenopora timanensis MOROZOVA, 1970
Dyscritella parallela MOROZOVA, 1970
Rectifenestella pseudoretiformis (MOROZOVA, 1970)
Fabifenestella completa MOROZOVA & KRUCHININA, 1986
Alternifenestella greenharbourensis (NIKIFOROVA, 1936)
A. spitzbergenensis (NIKIFOROVA, 1936)
Lyrocladia vera MOROZOVA & KRUCHININA, 1986
Polypora kossjensis RAVIKOVICH, 1948
Timanodictya nikiforovae MOROZOVA, 1966
Gilmoropora heintzi (MALECKI, 1977)

The identified faunas resemble closely Ufimian faunas described from Ellesmere Island (Assistance Formation), Novaya Zemlya (Gerke and Savina Groups) and from the Soviet Far East (GORYUNOVA, 1970; MOROZOVA, 1970; MOROZOVA & KRUCHININA, 1986; ROMANCHUK & KISELEVA, 1968), the Kazanian of the southern Urals (MOROZOVA, 1970) as well as the Late Permian of British Columbia (FRITZ, 1932). Brachiopods (NAKAMURA *et al.* 1987) indicate a slightly younger age as compared with similar faunas from Central East Greenland.

The distribution of genera through the Permian succession of Spitsbergen is presented in Text-Fig. 2.



Text-Fig. 2. Distribution of bryozoan genera through the Permian of Spitsbergen.

Texte-Fig. 2. Distribution des genres de Bryozoaires dans le Permien du Spitzberg.

BJØRNØYA

Kapp Dunér Formation (Asselian)

Bryozoans are generally not common in this formation, and extensive dolomitization has destroyed much details in the shelly faunas. A single specimen of *Rhombotrypella* cf. *stuckenbergi* NIKIFOROVA, 1938, was found within the palaeoaplysinid bioherms, as well as indeterminate fenestrates. In the upper part of the formation, a distinct calcareous horizon containing fusulinids and bryozoans yielded a monospecific assemblage of *Ascopora sterlitamakensis* NIKIFOROVA, 1939. The latter species occurs in the Sakmarian of the Urals and Northern Timan (MOROZOVA & KRUCHININA, 1986), and the Tyrrellfjellet Member, Spitsbergen.

Hambergfjellet Formation (Artinskian)

Bryozoans were only collected from the upper 20 meters, and six species have been identified:

Dyscritella cf. *narjanmarica* KRUCHININA, 1973
Streblascopora germana (BASSLER, 1929)
Polyporella perfecta KRUCHININA & MOROZOVA, 1986
P. orientalis (EICHWALD, 1860)
Polypora martis FISCHER, 1837
Timanodictya dichotoma (STUCKENBERG, 1895)

The bryozoan fauna shows mixed age affinities, but Artinskian taxa are most common. Some species are also common with the Vøringen Member, Spitsbergen.

Miseryfjellet Formation (?Kungurian-?Kazanian)

This formation shows a great variability and richness regarding both bryozoans and brachiopods. 30 bryozoan species have been identified. Typical taxa in the lower part of the Miseryfjellet Formation include:

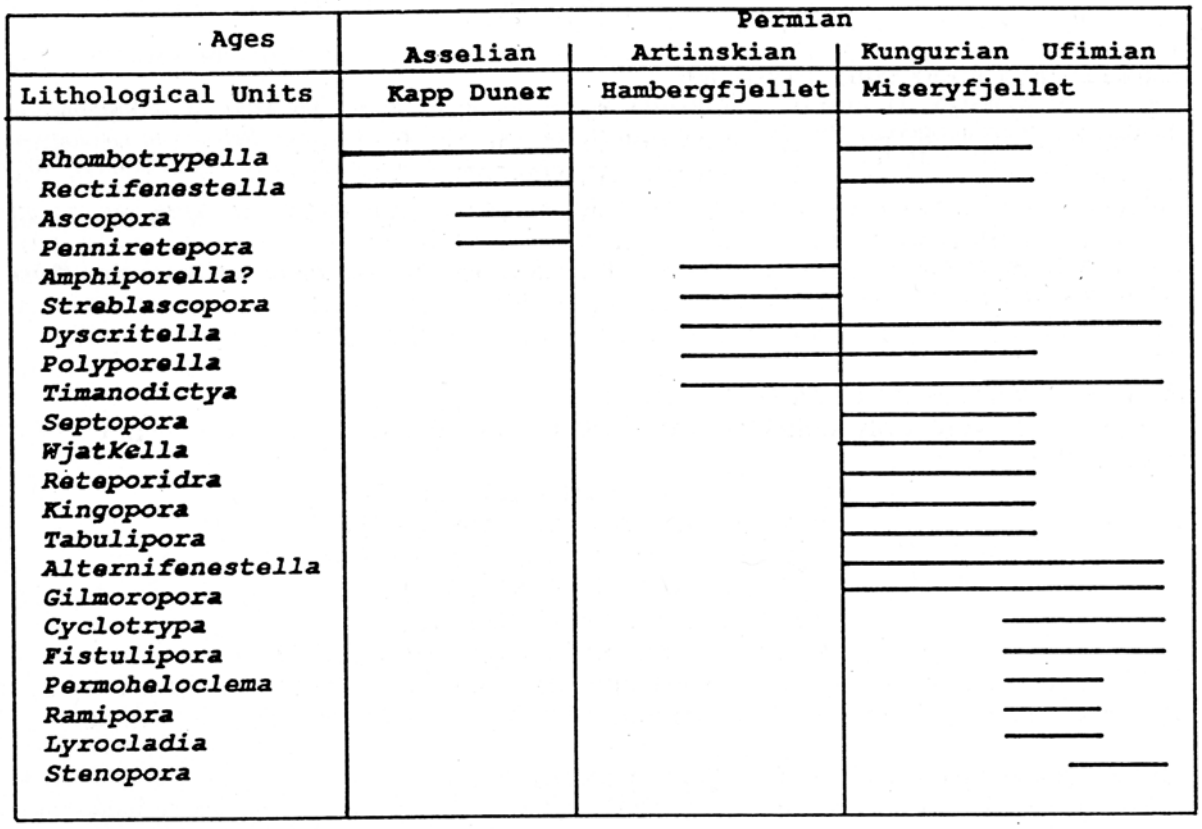
Rhombotrypella alfredensis MOROZOVA & KRUCHININA, 1986
Tabulipora greenlandensis ROSS & ROSS, 1962
Dyscritella bogatensis MOROZOVA, 1970
Rectifenestella retiformis (SCHLOTHEIM, 1816)
Septopora synocladiaformis NIKIFOROVA, 1936
Polyporella optima MOROZOVA & KRUCHININA, 1986
Kingopora micropora (STUCKENBERG, 1895)
Timanodictya nikiforovae MOROZOVA, 1966
Gilmoropora heintzi (MALECKI, 1977)

New species are introduced in the upper part:

Ramipora hochstetteri TOULA, 1875
Stenopora grandis MOROZOVA, 1970
Permoheloclema merum OZHGIBESOV, 1983
Rectifenestella cf. *gijigensis* (NEKHOROSHEV, 1959)
Lyrocladia cf. *vera* MOROZOVA & KRUCHININA, 1986
Polypora kossjensis RAVIKOVICH, 1948

The investigated fauna shows a mixture regarding age assignment, as there are both Early and Late Permian species throughout this formation. There are species in common with the Lower Permian of Eastern North Greenland, the Urals and Timan, as well as with the ~~Lower~~ Upper Permian of England (Zechstein), the Urals and the Soviet Far East. The lower part of this formation has species in common with the Vøringen Member while some species in upper part are common with the upper part of the Kapp Starostin Formation, Spitsbergen. The distribution of genera through the Permian succession of Bjørnøya is presented in Text-Fig. 3.

ACKNOWLEDGEMENTS. – Arctic Geoprogram (IKU, Trondheim), program manager Atle MØRK and its founding oil companies are thanked for economical support.



Text-Fig. 3. Distribution of bryozoan genera through the Permian of Bjørnøya.

Texte-Fig. 3. Distribution des genres de Bryozoaires dans le Permien de Bjørnøya.

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