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Polish palaeontological research in the Arctic

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The Arctic is a vast area comprising the northernmost continental regions of the Earth: Nova Zemlya, Svalbard, Greenland and the Canadian Arctic Archipelago. Because of their relatively easy accessibility, they are among the most frequently visited places of this region, with the Svalbard Archipelago being the most intensively used for scientific purposes and the best-studied one among them. Poland belongs to the most active states conducting research in this area. The history of our studies there goes back to 1932, when three Poles, Czesław Centkiewicz, Stanisław Siedlecki and Władysław Łysakowski, organised the first Polish expedition to the North, combined with wintering on Bear Island (Bjørnøya). By 1939, three more expeditions had been made. The war and the next decade have been the only longer break in our exploration history of this region, but from then on large expeditions to polar areas have been organised on an almost yearly basis.

The post-war scientific activity of Polish researchers on Spitsbergen (the largest island of Svalbard) started in the years 1957–1958 with an expedition organised by the International Geophysical Year Commission; 130 participants represented 23 scientific disciplines. It was then that K. Birkenmajer rendered services for palaeontology by collecting his first specimens, among others of corals (handed over to J. Fedorowski for systematisation) and lampshells (brachiopods), which S. Czarniecki offered to systematise. In the course of the next expeditions, lasting until 1962, meteorological, geodetic-astronomical and geomagnetic measurements were augmented with basic palaeontological studies. The effect of these expeditions was impressive, since they resulted in about 400 publications, including the first Polish work on fossil Arctic organisms. They were lampshells, which were used to establish a stratigraphy for the marine Carboniferous and Permian deposits in Hornsund (Birkenmajer & Czarniecki, 1960), later partly questioned (Birkenmajer, 1964; Fedorowski, 1965; Waterhouse, 1970).

Intensive studies on Spitsbergen were launched in the late 1950s and they were continued until the 1960s and 1970s; they yielded the largest proportion of palaeontological works. The knowledge of most of the fossil fauna of the Arctic was largely due to the collecting passion of the participants of expeditions organised to the Hornsund area (Fig. 1) in the years 1958–1962. K. Birkenmajer then gathered mainly corals from Treskelen, and S.K. Czarniecki collected lampshells and bryozoans from the Kapp Starostin Formation as well as corals

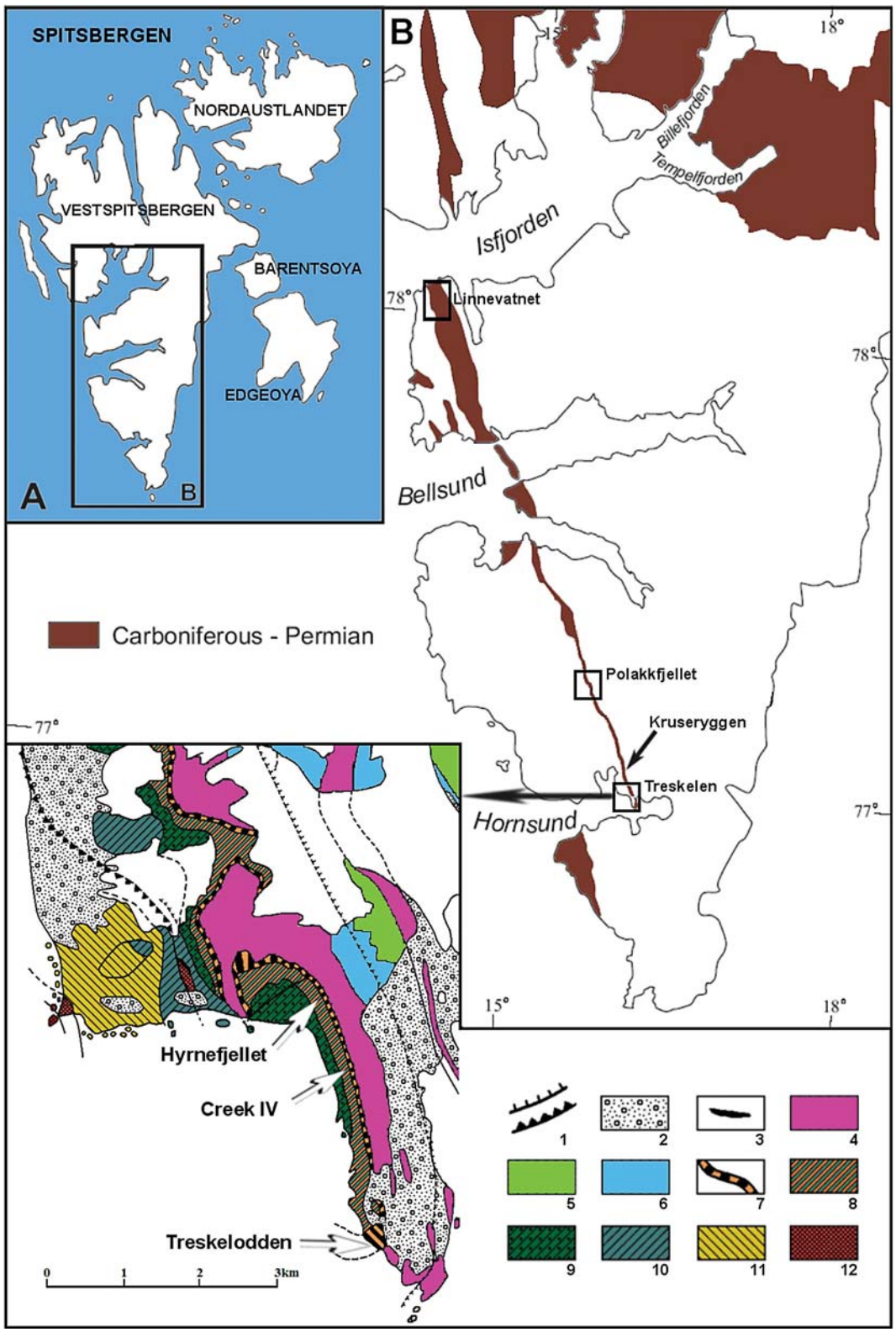

Fig. 1. Map of Spitsbergen presenting outcrops of Permian-Carboniferous rocks with the most important sites visited by Polish palaeontologists. 1 – faults; 2 – moraines; 3 – dolerite sills; 4 Triassic; 5 – Jurassic; 6 – Cretceous; 7 – Permian-Kapp Starostin Formation; 8 – Permian-Carboniferous – Treskelodden Formation; 9 – Upper Carboniferous; 10 – Lower Carboniferous; 11 – Devonian; 12 – Proterozoic.

and trilobites from the Treskelodden Formation. They both collected Devonian bivalves and snails. Those collections served later as material for a series of articles, edited by Birkenmajer, that appeared in 1964 in Studia Geologica Polonica, and in later years in other journals and monographs. One might state that this can be considered as the time (1964) when systematic palaeontological research began in the Arctic.

J. Fedorowski made a preliminary survey of Late Palaeozoic Rugosa corals (13 colony-forming species, 1 solitary species), while S. Siedlecki – together with E. Turnau – carried out a palynological study of culm (they described 5 taxa in the 4 genera identified there, of which 4 are probably new). S. Liszka examined Early Permian foraminifers from the Treskelodden layers (18 taxa, including 11 identified only to the genus level), and S. Czarniecki described bryozoans of the genus *Archimedes* (1 taxon). K. Birkenmajer distinguished in the Treskelodden Fm. the coral horizons applied until the present day. Four years later (1968), H. Osmólska described the trilobite material from this collection (9 taxa, including 1 new subgenus, 2 new species, and 4 new subspecies). In 1968, J. Małecki also availed himself with the collection while working on bryozoans. Then, 11 years later, the collection served K. Birkenmajer & J. Trammer (1975) to systematise Early Triassic conodonts (4 species, including 1 new), while 15 years later, teeth of Triassic sharks (5 species) were prepared from samples also gathered by K. Birkenmajer in the Hornsund region in the 1958–1962 period. Communications about these fossils were written by K. Birkenmajer & A. Jerzmańska (1979).

Owing to their abundance and qualitative diversity, Permian-Carboniferous corals have enjoyed unflagging interest, because – due to the then different geographical location of the continents (Fig. 2) – the corals then had ideal conditions for growth. On the basis of the fossil material collected in 1958 by K. Birkenmajer (70 specimens) and in 1960 by C. Czarniecki (100 specimens), J. Fedorowski wrote a comprehensive monograph (comprising 14 genera, including 2 new; 32 species, including 16 new; and 2 varieties, including 1 new), offering their first full palaeontological description. In his next work, J. Fedorowski discussed extensively the corals from the collections collected by Føyn and Heintz, participants of Norwegian expeditions to Spitsbergen in 1949. The results of these studies, among others 21 Rugosa taxa (including 1 new genus and 7 new species) and 5 Tabulata species (including 1 new), were published in the Norwegian scientific journal, Norsk Polarinstitutt Skrifter (Fedorowski, 1967).

On the basis of collections from the years 1960 and 1962 gathered by S. Siedlecki in the region of Spitsbergen's South Cape (Tokrossøya), J. Małecki (1968) published his second work, presenting the results of his study of Permian bryozoans (4 species, including 1 new). Four years later, J. Fedorowski (1972) presented his results concerning foraminifers and bryozoans, apart from Rugosa (2 species), from K. Birkenmajer's material collected in 1966 in Torell Land. A significant contribution was also his pioneering

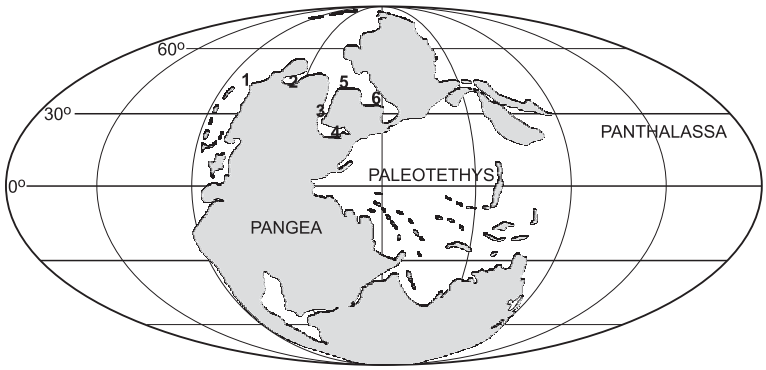

Fig. 2. Palaeogeography of the Middle Permian showing the distribution of Rugosa corals in the Cordillera-Arctic-Uralian realm (after Fedorowski & Bamber, 2001). 1 – Alaska; 2 – Sverdrup Basin; 3 – East Greenland; 4 – Central Europe Basin; 5 – Svalbard Archipelago; 6 – Timan.

palaeontological work on the Late Palaeozoic corals from Bear Island (Fedorowski, 1975), in which he described 15 taxa (including 3 new genera and 5 new species). The specimens for this work were collected by S. Siedlecki in 1964 and 1965. This collection was also used by J. Małecki to describe 16 species (including two new ones) of Permian bryozoans from southern Spitsbergen and Bear Island (Małecki, 1977).

After this period of field research, a break in the organisation of Polish polar expeditions occurred until the end of the 1960s. In 1969, a Spitsbergen Working Group was set up, headed by K. Birkenmajer, as part of the Geophysical Expeditions Commission of the Polish Academy of Sciences (PAN). Numerous specimens of the old flora and fauna were collected then in the areas of the Hornsund and Belsund fjords. One of the results was the work by S. Czarniecki (1969), who decided, on the basis of lampshells (27 genera, including 1 new, and 53 species, including 7 new), that the Treskelodden 'layers' (now Formation) were Late Carboniferous in age. This conclusion, contradicting that by K. Birkenmajer (1964) and J. Fedorowski (1965), was later corrected by J.B. Waterhouse (1970), who put down the lampshells described by S. Czarniecki (1969) as Lower Permian. Much later, Fedorowski et al. (2007) would establish the age of the Treskelodden Formation as Early Sakmarian Tastubian).

In the years 1974–1976, the then Department of Palaeozoology of the Polish Academy of Sciences prepared another series of research expeditions, on the initiative of G. Biernat. Although these expeditions were small, they provided an opportunity to compile proper documentation of detailed palaeoecological and sedimentological observations, and they also yielded rich palaeontological material (Biernat, 1975). The first expedition of this series (1974), led by K. Birkenmajer to the region of Hornsund and Polakkfjellet-Grimfjellet, collected, among other things, corals and lampshells from Permian and Carboniferous rocks. The second, organised in 1975 by H. Szaniawski, continued the research of the first, while extending it to cover the Early Palaeozoic – Cambrian and Ordovician – formations in the region of Hornsund (the Sofiekammen Ridge) and South Cape Land (Sørkapp Land). A year later, K. Małkowski & H. Szaniawski (1976) published, on the basis of the collections brought back by these expeditions, a preliminary communication about the conodont fauna, and three years later H. Szaniawski & K. Małkowski (1979) described Permian conodonts (including 1 new genus and 2 new species from the Kapp Starostin Formation). Two years later, R. Wrona (1977) was the first to describe charophyte gyrogonites from Devonian rocks found on Traunkammen. The third expedition (1976), headed by G. Biernat, carried out studies of Permian, Triassic and Jurassic formations in the region of the Bellsund, Van Keulen and Isfjord fjords (Biernat, 1977; Gaździcki & Trammer, 1977).

In 1979, the PAN Department of Palaeobiology mounted its fourth expedition, headed by G. Biernat, this time to the southern shore of Isfjord, near Coloradofjella, Belvedere, and Skansbukta, along the section from Elveneset to Deltaneset, and to the west of Isfjord, into the region of Kapp Starostin, Festningen, Kongresdalen, and Linnedalen (Małkowski & Hoffman, 1979). In the same year, K. Małkowski and R. Wrona conducted research on the Permian-Carboniferous, Triassic and Jurassic formations on the northern shore of the Bellsund and Van Mijen fjords as part of a Polish-American geophysical expedition organised by the PAN Institute of Geophysics and the University of St. Louis.

The material amassed during the four expeditions offered ever increasing insights into the Svalbard fauna. It provided a wealth of information for numerous scientific dissertations and publications that appeared in the 1980s and 1990s. For instance, K. Birkenmajer (1979) showed the coral fauna from shallow-marine Early Permian rocks to have been redeposited. J. Fedorowski & K. Birkenmajer (1980) described 12 species (including 2 new ones) of Rugosa corals. J. Fedorowski (1980) also presented an analysis of Permian-Carboniferous coral associations. G. Biernat & K. Birkenmajer (1981) described Permian lampshells, while A. Wierzbowski, C. Kulicki and H. Pugaczewska dealt with the numerous bivalves and ammonites (including 1 new species) of the Sassenfjorden region belonging to the latest Triassic

and the Jurassic. A year later, J. Fedorowski (1982a,b) presented his next two works. The first, concerning the conditions of sedimentation and the state of conservation of corals in the Treskelodden Formation, rested on his own extensive collection that he had gathered during his stay on Spitsbergen in 1975. The field observations that he had made then, made his research far from incidental, and the resulting monograph is now considered as the first comprehensive palaeoecological and palaeogeographical description of the area. His second 1982 work was based on the material collected by K. Birkenmajer in 1976, and referred to the Late Permian Rugosa corals from eastern Greenland. In this work, J. Fedorowski described 3 species, including a new one in a new genus, which he called *Allotropiochisma birkenmajeri* in honour of Prof. Birkenmajer.

In the same year, several more works appeared: A. Karczewski (1982) published on bivalves and snails from the Treskelodden and Kapp Starostin Formations in the Hornsund region (9 snail species and 3 bivalve species); R. Wrona (1982) described Early Cambrian phosphatised microfossils from the Hornsund region; K. Birkenmajer, H. Pugaczewska & A. Wierzbowski (1982) dealt with ammonites (6 taxa), belemnites (6 species), polychaetes (2 taxa) and bivalves (19 species) from the Jurassic-Cretaceous Janusfjellet Formation of eastern Spitsbergen; and A. Nowiński (1982) described Early Permian Tabulata corals from Hornsund. Later, A. Nowiński (1990, 1991) also described Permian-Carboniferous organisms from the coral horizons of Spitsbergen, and Tabulata from the Upper Carboniferous and Lower Permian of Spitsbergen (24 species, including 13 new). To the significant palaeontological works of this period belongs also a palaeoecological study of lampshells from Spitsbergen's Kapp Starostin Formation (Małkowski, 1988).

After a short break (1990–1993), a revival of scientific interest in palaeontology started again in 1994, and it still goes on. This is reflected by the appearance of articles and monographs the scope of which goes beyond the Svalbard Archipelago, including now the entire region of the Arctic except Siberia. The works that have been published since then include those by H. Szaniawski (1994) on Ordovician conodonts from southern Spitsbergen, E. Olempska & J. Błaszyk (1996) on ostracods, K. Małkowski (1998) on conodonts (again), and a number of studies authored and co-authored by J. Fedorowski, who published in 1997 also an article on the diachronism in the development and extinction of the Permian Rugosa corals, e.g. in the Cordillera-Arctic-Uralian realm. His taxonomic-biostratigraphic publication dealing with the Late Carboniferous colonial Rugosa corals of the Canadian Arctic Archipelago and written together with W.E. Bamber (Fedorowski & Bamber, 1998) described 14 species (including 9 new), and a geological study of Devon Island. This work greatly contributed to the elucidation of the island's palaeontological content (17 taxa); J. Fedorowski, W.E. Bamber & C. Stevens (1999) published an in-depth characterisation of the Permian corals of the Cordillera-Arctic-Uralian realm, and J. Fedorowski & W.E. Bamber (2001) addressed Middle Permian solitary corals of the Canadian Arctic Archipelago (8 species, including 4 new). A. Nowiński & M.K. Zapalski (2001) described new taxa of Tabulata corals from the Lower Permian of Spitsbergen. J. Fedorowski (2002) showed the stratigraphic and palaeogeographical significance of Middle Permian solitary Rugosa corals of the Sverdrup Basin from Arctic Canada, and published works (Fedorowski, 2006, 2007) concerning the palaeogeographical importance of the Middle Carboniferous limestones of British Columbia. E. Chwieduk (2007) dealt with the Permian corals of the Kapp Starostin Formation from Treskelen (3 genera and 5 species, including 2 new)

It is worthwhile to mention here explicitely one of the most recent publications by J. Fedorowski (2007), 'Lower Permian colonial rugose corals, western and northwestern Pangaea: taxonomy and distribution', because this is an excellent study providing a good overview of his achievements in the field of research methods on Rugosa corals. It is the present author's belief that this will turn out to be one of the most important works on the Rugosa taxonomy that have appeared over the last decades.

Out of other palaeontological studies that have appeared in the 21st century, those by

B. Błażejowski should be mentioned; he published on the teeth of sharks (4 species) from the Lower Triassic (Błażejowski, 2004) and characterised one foraminifer species (B. Błażejowski, A. Hołda-Michalska & K. Michalski, 2006).

Not all work on the Arctic palaeontological collections went smoothly, as several collections have changed places. Nowadays, the Institute of Geology of the Adam Mickiewicz University (AMU) in Poznań houses several thousand specimens (with a total weight of approx. 1.5 tonnes). Thus, this collection may well be the largest in the world.

A measurable result of the ongoing palaeontological studies is the growing number of described families, genera and species of corals from the Arctic. The oldest publication (Toula, 1875) mentions two species from central Vestspitsbergen (Nordfjorden). Later, some studies (Heritsch, 1929; Padget, 1954; Forbes et al., 1958; Tidten, 1972) appeared either on the basis of small collections, or without litho- and biostratigraphic implications. The material for these works was gathered by incidental Norwegian expeditions in the 19th and 20th century. Only a monograph by F. Heritsch (1939) contributed significantly to the knowledge of the Permian-Carboniferous corals of Spitsbergen. A more extensive study by Somerville (1997) documents the occurrence of representatives of 18 known Rugosa genera in the region of Isfjorden.

In contrast, the many Polish collections accumulated since the 1960s, as complete as possible, have a modern palaeontological character, which was initiated by J. Fedorowski (1964, 1965). In his later publications (Fedorowski, 1967, 1975, 1982, 1997; Fedorowski et al. ,1999, 2007; Fedorowski & Bamber, 2001), he gave scrupulous descriptions of the studies being carried on. These studies, although limited to a few exposures in Hornsund fjord, Greenland and Bear Island, have yielded a wide variety of forms of an exceptionally rich fauna. Nowadays, these areas, which are expanded to include the Canadian Arctic Archipelago (Bamber & Fedorowski, 1998; Fedorowski & Bamber, 2001, 2002; Gunning et al., 2006, 2007), are definitely the best and most comprehensively characterised Arctic regions in palaeontological terms. Thus, the present-day knowledge of the Arctic fossil fauna is largely due to Polish activity, whether collection-oriented, as in the first expeditions made in the late 1950s and early 1960s, or strictly palaeontological, as in those organised in the 1970s and 1980s and at the turn of the century.

The contribution of Polish palaeontologists to the identification of the Arctic fauna, even if restricted to new taxa in most systematic groups, is impressive as indicated by the following list.

RUGOSA corals

New family:

Kleopatrinidae Fedorowski et al., 2007

New genera:

1. *Cordillerastraea* Fedorowski et al., 2007
2. *Iskutella* Fedorowski et al., 2007
3. *Shastalasma* Fedorowski et al., 2007
4. *Sandolasma* Fedorowski et al., 2007
5. *Allotropiochisma* Fedorowski, 1982
6. *Arctophyllum* Fedorowski, 1975
7. *Fomichevella* Fedorowski, 1975
8. *Siedleckia* Fedorowski, 1975
9. *Heintzella* Fedorowski, 1967
10. *Hornsundia* Fedorowski, 1965
11. *Svalbardphyllum* Fedorowski, 1965

New species [the generic names of some species have changed, and some are used as synonyms of the species described in the monograph by Fedorowski et al. (2007); see also the notes in the following list]:

1. *Allotropiochisma euryphylloides* Chwieduk, 2007
2. *Allotropiochisma treskelense* Chwieduk, 2007
3. *Cordillerastraea complexa* Fedorowski et al., 2007
4. *Heintzella borealis* Fedorowski et al., 2007
5. *Iskutella gunningi* Fedorowski et al., 2007
6. *Kleopatrina grinnellensis* Fedorowski et al., 2007
7. *Lytvophyllum sustutense* Fedorowski et al., 2007
8. *Pararachnastraea lyallensis* Fedorowski et al., 2007
9. *Pararachnastraea wilsoni* Fedorowski et al., 2007

10. *Permastraea buttensis* Fedorowski et al., 2007
11. *Protowentzelella columellata* Fedorowski et al., 2007
12. *Sandolasma cooperi* Fedorowski et al., 2007
13. *Sandolasma elegans* Fedorowski et al., 2007
14. *Sandolasma stonei* Fedorowski et al., 2007
15. *Tschussovskenia dilata* Fedorowski et al., 2007
16. *Euryphyllum boreale* Fedorowski & Bamber, 2001
17. *Euryphyllum troldfjordense* Fedorowski & Bamber, 2001
18. *Lytvolasma canadense* Fedorowski & Bamber, 2001
19. *Ufimia arctica* Fedorowski & Bamber, 2001
20. *Petalaxis crassicolumnus* Bamber & Fedorowski, 1998
21. *Petalaxis ellesmerensis* Bamber & Fedorowski, 1998
22. *Petalaxis multilamellatus* Bamber & Fedorowski, 1998
23. *Petalaxis beauchampi* Bamber & Fedorowski, 1998
24. *Petalaxis thorsteinssoni* Bamber &Fedorowski, 1998
25. *Petalaxis baculatus* Bamber & Fedorowski, 1998
26. *Petalaxis parvus* Bamber & Fedorowski, 1998
27. *Cystolonsdaleia arctica* Bamber & Fedorowski, 1998
28. *Cystolonsdaleia carteri* Bamber & Fedorowski, 1998
29. *Allotropiochisma birkenmajeri* Fedorowski, 1982
30. *Protowentzelella longiseptata* Fedorowski, 1980
31. *Kleopatrina* (*Kleopatrina*) *svalbardense* Fedorowski, 1980
32. *Bothrophyllum timanioides* Fedorowski, 1975
33. "*Caninia*" *radiata* Fedorowski, 1975
34. *Orygmophyllum bradyseptatum* Fedorowski, 1975
35. *Siedleckia bjornoyana* Fedorowski, 1975
36. *Bothrophyllum orvini* Fedorowski, 1967
37. *Heintzella multiseptata* Fedorowski, 1967
38. *Kleopatrina rozkowskae* Fedorowski, 1967
39. *Protowentzelella? dubiosa* (Fedorowski, 1967) [= *Thysanophyllum dubiosum* Fedorowski, 1967]
40. *Protowentzelella minima* (Fedorowski, 1967) [= *Stylastraea minima* Fedorowski, 1967]
41. *Protolonsdaleiastraea composita* Fedorowski, 1967
42. *Kleopatrina* (*Kleopatrina*) *różkowskae* Fedorowski, 1967([since 2007 synonymous with *Kleopatrina rozkowskae* Fedorowski, 1967]
43. *Kleopatrina* (*Porfirievella*) *vesiculosa* Fedorowski, 1967 [since 2007 synonymous with *Protowentzelella variabilis* Fedorowski, 1965]
44. *Bothrophyllum permicum* Fedorowski, 1965
45. *Fischerina densiseptata* Fedorowski, 1965 [since 2007 synonymous with *Heintzella spitsbergensis* (Fedorowski, 1965)]
46. *Heintzella radiata* (Fedorowski, 1965) [= *Fischerina radiata* Fedorowski, 1965]
47. *Heintzella spitsbergensis* (Fedorowski, 1965) (= *Fischerina spitsbergensis* Fedorowski, 1965]
48. *Hornsundia lateseptata* Fedorowski, 1965
49. *Hornsundia lacunata* Fedorowski, 1965
50. *Kleopatrina atava* (Fedorowski, 1965) [= *Wentzelella atava* Fedorowski, 1965]
51. *Lonsdaleia similis* Fedorowski, 1965 [since 2007 synonymous with *Protowentzelella permica* (Fedorowski, 1965)]
52. *Protowentzelella gigantea* (Fedorowski, 1965) [= *Thysanophyllum giganteum* Fedorowski, 1965]
53. *Protowentzelella permica* (Fedorowski, 1965) [= *Lonsdaleia permica* Fedorowski, 1965]
54. *Protowentzelella variabilis* Fedorowski, 1965
55. *Stylastraea tenuiseptata* Fedorowski, 1965 [since 2007 synonymous with *Protowentzelella variabilis* Fedorowski, 1965]
56. *Svalbardphyllum pachyseptatum* Fedorowski, 1965

57. *Thysanophyllum arcticum* Fedorowski, 1965 [since 2007 synonymous with *Protowentzelella permica* (Fedorowski, 1965)]
58. *Thysanophyllum regressum* Fedorowski, 1965 [since 2007 synonymous with *Protowentzelella major* (Dobrolyubova, 1936)]
59. *Timania multiseptata* Fedorowski, 1965
60. *Tschussovskenia minor* Fedorowski, 1965

New subspecies and variety:

1. *Bothrophyllum timanioides nanum* Fedorowski, 1975
2. *Caninophyllum belcheri* (Harker) var. magnum Fedorowski, 1965

TABULATA corals

New species:

1. *Hayasakaia birkenmajeri* Nowiński, 1991
2. *Hayasakaia multispinosa* Nowiński, 1991
3. *Hayasakaia variabilis* Nowiński, 1991
4. *Neoroemeria permica* Nowiński, 1991
5. *Neoroemeria spitsbergensis* Nowiński, 1991
6. *Neosyringopora spitsbergensis* Nowiński, 1991
7. *Roemeripora hornsundensis* Nowiński, 1991
8. *Roemeripora media* Nowiński, 1991
9. *Syringopora kruseryggensis* Nowiński, 1991
10. *Syringopora stuckenbergi* Nowiński, 1991
11. *Tetraporinus kozlowskii* Nowiński, 1991
12. *Tetraporinus spinosus* Nowiński, 1991
13. *Tetraporinus spitsbergensis* Nowiński, 1991
14. *Armalites laminatus* Nowiński, 1982
15. *Fuchungopora arctica* Nowiński, 1982
16. *Hayasakaia compacta* Nowiński, 1982
17. *Roemeripora aspinosa* Nowiński, 1982
18. *Kueichowpora supracarbonica* Fedorowski, 1975

TRILOBITA

New subgenus:

1. *Archegonus* (*Phillibolina*) Osmólska, 1968

New genus:

1. *Archegonus* (*Cyrtoproeyus*) *anteriolatus* Osmólska, 1968
2. *Archegonus* (*Phillibolina*) *worsawensis* Osmólska, 1968

New subspecies:

1. *Archegonus* (*Phillibole*) *aprathensis richteri* Osmólska, 1968
2. *Archegonus* (*Phillibole*) *culmicus jugovensis* Osmólska, 1968
3. *Archegonus* (*Waribole*) *laevicauda acutifrons* Osmólska, 1968

AMMONOIDEA

New species:

1. *Harpoceras kopiki* Wierzbowski & Kulicki, 1981

BRACHIOPODA

New genus:

1. *Enigmalosia* Czarniecki, 1969

New species:

1. *Beecheria magna* Czarniecki, 1969
2. *Cranaena ? arctica* Czarniecki, 1969
3. *Enigmalosia sarytchevae* Czarniecki, 1969
4. *Neospirifer hornsundi* Czarniecki, 1969
5. *Schellwienella orvini* Czarniecki, 1969
6. *Tomiopsis petrankoi* Czarniecki, 1969
7. *Tomiopsis lata* Czarniecki, 1969

New subspecies:

1. *Composita argentea mutabilis* Czarniecki, 1969
2. *Rhynchopora arctica minima* Czarniecki, 1969
3. *Rhynchopora variabilis bicostatiformis* Czarniecki, 1969
4. *Sergospirifer occidentalis svalbardi* Czarniecki, 1969 moreover: *Cancrinella* sp. A, *Linoproductus* sp. A, *Marginifera* sp. A

BRYOZOA

New species:

1. *Hinganella heintzi* Małecki, 1977
2. *Septopora phyllata* Małecki, 1977
3. *Tabulipora siedleckii* Małecki, 1968

CONODONTA

New genus:

1. *Sweetocristatus* Szaniawski, 1979

New species:

1. *Neospathodus svalbardensis* Trammer, 1982
2. *Neostreptognathodus svalbardensis* Szaniawski, 1979
3. *Sweetocristatus arcticum* Szaniawski, 1979

MICROFOSSILS incertae sedis

1. *Hadimopanella apicata* Wrona, 1982;

SPORES

1. *Lophozonotriletes* sp. A
2. *Pityosporites* sp. A
3. *Sporonites* sp. A
4. *Sporonites* sp. B

The numbers of all the taxa (almost 400 in total) identified in the Arctic by Polish paleontologists are:
rugose corals: 145 species and lower-level taxa
tabulate corals : 30
brachiopods: 53
snails: 9
bivalves: 39
ammonites: 10
belemnites: 13
trilobites: 9
polychaetes: 3
foraminifers: 20
bryozoans: 21
conodonts: 20
fishes: 10
charophyte gyrogonites: 2
spores: 5

The Polish palaeontological research has, apart from its substantial contribution to taxonomic identification (mostly of Arctic invertebrates) also provided more insight into the palaeogeography and palaeoecology of this region. Owing to the identification of coral associations, with their radically different histories in the various zoogeographic provinces of the Carboniferous and Permian, we know today that – at least from the Late Carboniferous until the end of the Permian – the benthic world of marine organisms developed in two realms (Fedorowski, 1989; Fedorowski et al., 2007), separated on one side by a landmass extending nearly from pole to pole, and on the other side by a super-ocean occupying more than half the circumference of the globe (Fig. 2). In turn, qualitative changes in the coral associations and their depletion that can be observed starting with the upper part of the Early Permian are indicative of the climate cooling associated with the movement of the continental areas from subtropical to sub-Arctic regions. Besides, Rugosa corals, being excellent facies indicators and good so-called parafossils, also supply significant data for stratigraphy. It was mainly on the basis of corals that J. Fedorowski (1965) and J. Fedorowski & W.E. Bamber (2001) assigned the Treskelodden Formation from Spitsbergen to the Early Permian (Sakmarian). What is more, the issues addressed in the works by J. Fedorowski, also concerning questions of taxonomy in the context of character variability in the ontogenetic development of Rugosa, not only elucidate the complex processes of reconstruction of their structure, but also offer an insight into their systematics and phylogenesis based on taxonomic affinities.

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