

NORSK POLARINSTITUTT  
SKRIFTER NR. 135

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S. H. BUCHAN, A. CHALLINOR,  
W. B. HARLAND, AND J. R. PARKER

THE TRIASSIC STRATIGRAPHY  
OF SVALBARD



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NORSK POLARINSTITUTT  
OSLO 1965

NORSK POLARINSTITUTT

*Middelthuns gate 27 b, Oslo 3, Norway*

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Hydrographic and topographic surveys make an important part of the work carried out by Norsk Polarinstittutt. A list of the published charts and maps is printed on p. 3 and 4 of this cover.

A complete list of publications, charts and maps is obtainable on request.

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**ÅRBØKER**

Årbok 1960. 1962. Kr. 15.00.

Årbok 1961. 1962. Kr. 24.00.

Årbok 1962. 1963. Kr. 28.00.

Årbok 1963. 1965. Kr. 35.00.

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PUBLISHED BY NORSK POLARINSTITUTT  
DISTRIBUTED BY OSLO UNIVERSITY PRESS  
OSLO 1965

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## Abstract

This paper reviews published accounts of the stratigraphy of Triassic rocks of Spitsbergen and also of Bjørnøya and the other islands of Svalbard. A detailed review of the history of research with a full bibliography is given. Measured sections with lithological descriptions and fossil occurrences resulting from work on Cambridge expeditions are published for the first time. The earlier work is collated with the later and, taking into account the situation in Vestspitsbergen and what is known from beyond, new stratigraphical units are defined. These are discussed in relation to variations in thickness, facies and age.

Although no critical palaeontological study has been undertaken, this paper includes an index to all Svalbard species as mentioned in the literature, with references to illustrations, descriptions, stratigraphical position and locality. Incorporated in this are those parts of the Cambridge collections which have been provisionally identified.

## I. INTRODUCTION

Triassic rocks are known to crop out extensively in the Svalbard archipelago. This paper sets out to review available knowledge of their stratigraphy.

The strata consist of marine and non-marine shales, siltstones and sandstones, often calcareous, with minor limestones; varying in thickness from a maximum of 1000 m to a minimum of less than 200 m. The soft shale and siltstone sequences tend to form low angle solifluxion slopes without scree, alternating with steeper bluffs, and much of the extensive outcrop area is poorly exposed in contrast with the craggy cherty carbonate Permian rocks beneath. The Palaeozoic – Mesozoic boundary is thus conspicuous.

The map (Fig. 1) shows outcrops extending along the west, north and east of the Mesozoic – Tertiary basin in Vestspitsbergen and in Barentsøya and Edgeøya. A much wider extent of Triassic rocks throughout the Barents Shelf may be suspected from the smaller outcrops in Bjørnøya and possible Triassic rocks in Hopen and Kong Karls Land.

The rocks along the west coast are intensely folded and thrust in a Tertiary deformation belt, and milder effects of both Mesozoic and Tertiary diastrophism and igneous activity are known further east. It is here that recent investigations prompted by the search for oil and assisted by helicopter transport were extended, especially to Sabine Land and Olav V Land (Vestspitsbergen) and to Barentsøya and Edgeøya. The detailed results of these investigations are not yet published and much will remain confidential. This paper is therefore limited to published descriptions and our own original observations.

The outcrops in Vestspitsbergen and Bjørnøya, long accessible to shipping, have yielded rich fossil collections, especially of ammonites and vertebrates, from

Fig. 1. Maps of Svalbard to show Triassic outcrops and place names.

- A. Svalbard except Bjørnøya
- B. Triassic outcrops in Spitsbergen
- C. Bjørnøya
- D. Kong Karls Land

The map is based on the Norsk Polarinstitut topographical map of Svalbard 1:500,000 sheets 1 and 3 Oslo 1964.

Outcrops are compiled as follows:

Oscar II Land, Dickson Land, Sabine Land and South East Olav V Land from Cambridge Surveys; Wedel Jarlsberg Land from RÓZYCKI 1959; Sørkapp Land from MAJOR and WINSNES 1955; Bjørnøya from HORN and ORVIN 1928; the remainder from ORVIN 1940 except where modified in Olav V Land and Gustav Adolf Land by HOLLAND 1961.

Place names referred to in this text are shown by number and are listed below in alphabetical order with appropriate map letter.

- |                         |                            |                            |
|-------------------------|----------------------------|----------------------------|
| 1. Adventfjorden B      | 35. Kaosfjellet B          | 69. Selmaneset B           |
| 2. Agardhbukta B        | 36. Kapp Johannesen B      | 70. Siegfjelllet B         |
| 3. Ahlstrandodden B     | 37. Kapp Lee B             | 71. Siksaken B             |
| 4. Akseløya B           | 38. Kapp Starostin B       | 72. Skuld C                |
| 5. Aldegondaberget B    | 39. Kapp Thordsen B        | 73. Sørkapp Land A         |
| 6. Aldegondabreen B     | 40. Kapp Toscana B         | 74. Sten de Geerfjellet B  |
| 7. Anderssonbukta B     | 41. Kapp Wijk B            | 75. Stensiöfjellet B       |
| 8. Barentsoya A B       | 42. Kistefjellet B         | 76. St. Jonsfjorden B      |
| 9. Bellsund A           | 43. Kong Karls Land A D    | 77. Storfjorden A B        |
| 10. Bertilryggen B      | 44. Kongressfjellet B      | 78. Stormbukta B           |
| 11. Bjørnøya A C        | 45. Kvalpyntfjellet B      | 79. Sticky Keep B          |
| 12. Botneheia B         | 46. Marmierfjellet B       | 80. Sturefjellet B         |
| 13. Bravaisberget B     | 47. Midterhuken B          | 81. Sveaneset B            |
| 14. De Geerdalen B      | 48. Milne Edwardsfjellet B | 82. Tjuvfjorden B          |
| 15. Diabasodden B       | 49. Miseryfjellet C        | 83. Torell Land A          |
| 16. Dickson Land A      | 50. Mistakodden B          | 84. Torellnesfjellet B     |
| 17. Draschedalen B      | 51. Mohnbukta B            | 85. Trehøgdene B           |
| 18. Duckwitzbreen B     | 52. Nathorst Land A        | 86. Treskelodden B         |
| 19. Edgeøya A B         | 53. Negerpynten B          | 87. Trygghamna B           |
| 20. Edlundfjellet B     | 54. Nordaustlandet A B     | 88. Tschermakfjellet B     |
| 21. Ekmanfjorden B      | 55. Nordenskiöld Land A    | 89. Tumlingodden B         |
| 22. Elfenbeinbreen B    | 56. Olav V Land A          | 90. Urd C                  |
| 23. Festningen B        | 57. Osbornebreen B         | 91. Van Keulenfjorden B    |
| 24. Flowerdalen B       | 58. Oscar II Land A        | 92. Vardebukta B           |
| 25. Fridtjovhamna B     | 59. Passhatten B           | 93. Vasskiltoppen B        |
| 26. Gestriklandkammen B | 60. Perthesfjella B        | 94. Verdande C             |
| 27. Grønfjorden B       | 61. Rammfjellet B          | 95. Vestspitsbergen A B    |
| 28. Gustaf Adolf Land A | 62. Reinodden B            | 96. Vikinghøgda B          |
| 29. Hahnfjella B        | 63. Rotundafjellet B       | 97. Vindodden B            |
| 30. Hopen A             | 64. Sabine Land A          | 98. Wallenbergfjellet B    |
| 31. Hornsund A B        | 65. Sassendalen B          | 99. Wedel Jarlsberg Land A |
| 32. Isfjorden A         | 66. Sassenfjorden B        | 100. Wichebukta B          |
| 33. Iskletten B         | 67. Saurieberget B         | 101. Wichmannfjellet B     |
| 34. James I Land A      | 68. Sauriedalen B          | 102. Wilhelmøya B          |

Due to the small area of Triassic outcrops in Sørkapp Land, they are shown in black but undifferentiated Triassic is intended for these.

Outcrops of Permian rocks have been reported from Edgeøya and Barentsoya (KING 1964, KLUBOV 1964, BUROV *et al.* 1964) but as no precise locations have been given, it has not been possible to incorporate them.



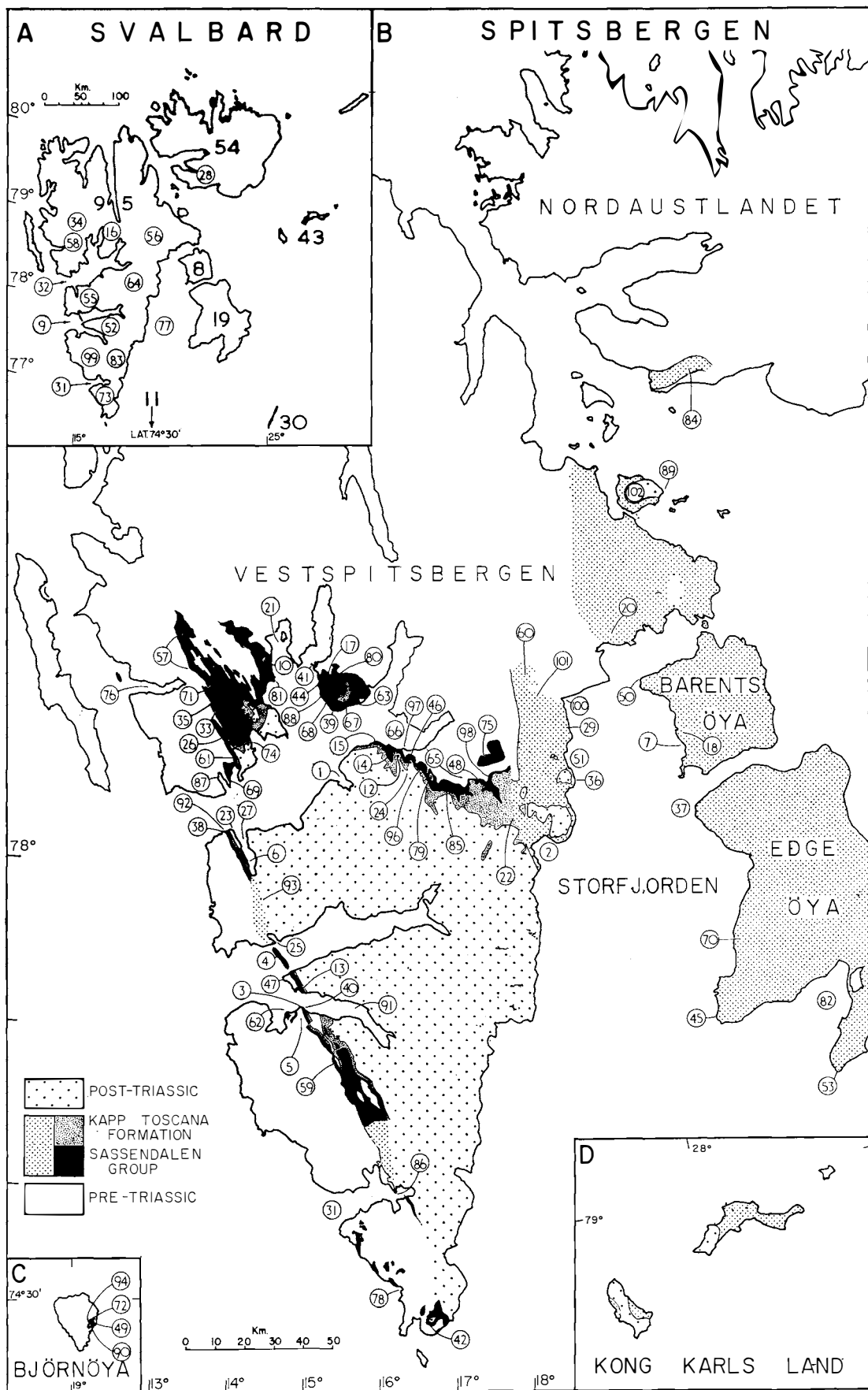


Fig. 1.

the earliest days of geological exploration. The historical review (Part II), the palaeontological index (Part V) and the bibliography (Part VI) outline the impressive researches which have been published. However, there was a peculiar lack of precise stratigraphical information which made it difficult to relate either the vertical distribution of fossils or the lateral variation of facies. We thus attempted to measure a number of vertical sections and describe them in sufficient detail to define stratigraphical units, and at the same time to collect fossils from known horizons so far as possible *in situ*. Our geological mapping has been done as part of structural studies of some of these areas, and detailed maps will be published with the structural papers elsewhere.

This work was done on the series of Cambridge expeditions, following some preliminary observations by one of us (W. B. H.) in 1959 and 1960. The need for this work became clear in reviewing the stratigraphy of Spitsbergen (HARLAND 1961). In 1961 some sections were measured as opportunity offered by A. CHALLINOR and J. L. CUTBILL (HARLAND 1962). Our first systematic study began with the use of a grant from the Department of Scientific and Industrial Research which enabled S. H. BUCHAN to devote a year to reviewing the literature and on the 1962 expedition, as leader of Party F, to measure Triassic sections readily accessible from all the coasts of inner Isfjorden. At the same time A. CHALLINOR, as leader of Party C, included similar work in the area to the west (HARLAND 1963).

In 1963 (HARLAND 1965) CHALLINOR continued this study. Indeed, throughout 3 and 4 field seasons respectively, J. L. CUTBILL and A. CHALLINOR, although their primary concerns were the investigations of the Carboniferous stratigraphy and the structure of the Tertiary deformation belt, nevertheless contributed much to our knowledge of detailed Triassic stratigraphy. At the same time J. R. PARKER began to study the Mesozoic succession of Nordenskiöld and Sabine Lands with special reference to variation in facies and structural disturbances, especially along the fault belts. More sections were thus measured and collections made. In 1964 J. R. PARKER continued this study further south, but mainly in Jurassic and Cretaceous rocks.

As a result of these studies we were able to view the variations in facies, at least in Vestspitsbergen, as a whole. The older stratigraphical names, in themselves useful for marker horizons, need supplementing for a comprehensive stratigraphical account and new names are accordingly defined here. The units have been chosen and the names proposed in the light of unpublished work in eastern and western Spitsbergen, and also after consultation with the Norsk Polarinstitut. We hope thus to have secured a scheme both consistent with that currently planned for the first official Norwegian geological map (1 : 100,000) and adequate to describe the rocks from a wider area.

The palaeontological details given in this paper have been derived solely from a study of the literature and no critical study has been made. Part V is thus an index to Spitsbergen literature integrating provisional identifications of the Cambridge collection.

Throughout this paper we have attempted to use place names in accordance with "The Place-Names of Svalbard" (Norsk Polarinstitut Skrifter Nr. 80 & Nr. 112, 1944 & 1958), and also on the latest published maps e. g. Svalbard

1 : 500,000 Sheet 1, Norsk Polarinstitut Oslo 1964. Localities found in the literature and not mentioned in these publications are interpreted as follows:

Anderson Berges (WITTENBURG 1911) = Anderssonbukta;  
Ahlstrandsberg (BÖHM 1912) = Aldegondaberget;  
Isfjord-Kolonie (MOJSISOVICS 1886) = Kapp Thordsen  
(there is a large abandoned mining hut to the north east of the point);  
Mt. Johannesen (TYRRELL 1933) = Kapp Johannesen (Domen);  
Nordhafen (BÖHM 1912) = Fridtjovhamna.

The various references to "Middle Hook" in Isfjorden are listed under Kapp Thordson as are the references to Svarta Klyften (ÖBERG 1877, MOJSISOVICS 1886). Bucht Lamont (WITTENBURG 1910) has not been located.

Our surveys in Oscar II Land resulted in proposals for new place names and three of these are used here to define stratigraphical members thus:

Siksaken, Kaosfjellet and Iskletten.

All these names and other names used throughout the text are listed in alphabetical order in the caption to Fig. 1 and their positions on the map are indicated by number.

One of us (W.B.H.) acknowledges a grant from the Department of Scientific and Industrial Research for the investigation of the "Stratigraphy and Structure of Spitsbergen" which provided for some of the field work and research assistance in this particular study. Two others (A.C. & J.R.P. respectively) acknowledge maintenance grants from the D.S.I.R. and Shell International Petroleum Company. We enjoyed a fruitful collaboration with American Overseas Petroleum Limited particularly in the field in 1962. It is difficult to specify our debt to our many colleagues in the field or laboratory. Indications of their part in the field are given in the expedition accounts (HARLAND, 1960, 62, 63 and 1965). Dr. T. GJELSVIK and his staff in the Norsk Polarinstitut have helped at many points, providing information, photographs and valuable discussion. Dr. E.T. TOZER advised us especially in ammonite zonation. Throughout the work Mrs. K. N. HEROD has assisted and especially in the preparation of this paper for the press as has Miss A. B. REYNOLDS who redrew the maps and charts.

## II. HISTORY OF PUBLISHED RESEARCH

The pattern of geological work on the Triassic rocks of Svalbard followed closely the general pattern of scientific work on these islands and has always been dependant on the expeditionary nature of research in remote areas.

The first geological work was carried out by the Swedish expeditions of the mid 19th century which were led mainly by A. E. NORDENSKIÖLD. These expeditions were continued in the late 19th and early 20th centuries under the leadership of G. DE GEER and A. G. NATHORST and were principally concerned with the collection of Triassic fossils. Nevertheless the first proposals regarding Triassic stratigraphy were made by B. HÖGBOM as a result of his participation in DE GEER's expedition of 1908 and within a few years the basis of the stratigraphical nomenclature as used until the present day had been evolved. Between 1900 and 1920 the main emphasis was on the collection and description of the vertebrate fauna through a series of expeditions from Uppsala led principally by E. A. STENSIÖ under the direction of C. WIMAN. Although Norway did not assume administrative responsibility for the Svalbard archipelago until 1925, regular Norwegian geological work began in 1906 and has contributed much to our knowledge at the present time. However, it was not until 1931, when H. FREBOLD, using the results of his own 1930 visit together with Norwegian observations, published detailed stratigraphical sections and their associated faunas, that a firm basis for Triassic research was established.

Possibly the first relevant work was that of J. LAMONT's second expedition to Spitsbergen in 1859. Collections were made from Tjuvfjorden (Deevie Bay) and Negerpynten (Black Point) on Edgeøya. LAMONT's observations were published in 1860, together with an appendix of identifications of the fossils by J. W. SALTER. Although their fossils were undated, they may well be the first recorded collection from rocks of Triassic age in Svalbard.

In 1865 G. LINDSTRÖM published identifications of some of the invertebrate fossils collected by C. W. BLOMSTRAND from south Dickson Land during TORREL's second expedition of 1861 and by NORDENSKIÖLD from Saurieberget, Kvalpyntfjellet (Whales Point) and Kapp Lee during the 1864 Swedish Academy of Science Expedition. LINDSTRÖM was thus the first to establish the presence of a Triassic sequence in Spitsbergen. Accounts of the geological work of these expeditions were published by BLOMSTRAND in 1864 (1861 expedition only) and by NORDENSKIÖLD in 1866 (English translation 1867). This latter paper contains a lithological map and sections, a list of the identified material and also notes the similarity of NORDENSKIÖLD's vertebrate finds with those of E. BELCHER from Exmouth Island in Arctic Canada.

In 1868 NORDENSKIÖLD returned to Spitsbergen and a thorough examination of the strata at Kapp Thordsen was included in the work of the expedition. The vertebrate collections of the 1864 and 1868 expeditions were studied by I. W. HULKE; although most of the material was fragmentary, descriptions of three species were published in 1873. DAMES (1895) also commented on these early collections of *Ichthyosaurus*.

Two years later, in 1870, H. WILANDER and NATHORST visited Kapp Thordsen to investigate the phosphorite deposits there, the occurrence of which had been reported by NORDENSKIÖLD. A collection of fossils was made and this comprised part of the fauna described by ÖBERG in 1877. In this paper ÖBERG also described invertebrates collected by NORDENSKIÖLD in 1868 and by himself and NORDENSKIÖLD during visits to south Dickson Land in 1872 and 1873. Vertebrate material from ÖBERG's collection was described by WIMAN (1910a).

The geological observations of the 1872 and 1873 expeditions were published by NORDENSKIÖLD in 1875. The non-marine clastic sequence, which in this paper is included at the top of the Triassic, was regarded by NORDENSKIÖLD as Jurassic and was thus excluded from his detailed Triassic sequence. The sequence of lithologies was established but no thicknesses were given.

NATHORST revisited Spitsbergen in 1882 with DE GEER and worked in the western coastal areas. A comprehensive account of his results was published in the following year and B. LUNGGREN published separately identifications and descriptions of the Triassic and Jurassic invertebrates collected by the expedition. Of the few Triassic fossils found, most were described by LUNGGREN as new species. A further publication by LUNGGREN in 1887 on this 1882 collection assigned to it a provisional Permian age. The sequence in which this fauna was found, with its main occurrence at the eastern end of Akseløya, is here regarded as Triassic, although until the publication of FREBOLD's paper of 1936 it was still thought to be Permian despite doubts expressed by P. v. WITTENBURG as early as 1912. The problem of the definition of the base of the Trias is discussed in Part IV.

The palaeontological work of E. V. MOJSISOVICS, published in 1886, was the earliest review of the Triassic ammonite fauna of the Arctic. In this paper the known ammonites from Vestspitsbergen collected by the early Swedish expeditions, were revised, redescribed and compared to the Russian fauna which was also described. The Vestspitsbergen fauna was split up into three groups: 'Posidonomyenkalk', 'Daonellenkalk' and 'Schichten mit *Halobia zitteli*'. The first two groups were given a Muschelkalk age and the third a Norian age. These early conclusions were largely repeated, in an abbreviated form, in a section on the Arctic province contributed by F. NOETLING in 1905 to F. FRECH's 'Lethaea Geognostica'. The section on Bjørnøya in NOETLING's work is a summary of J. G. ANDERSSON's 1900 paper.

Following the Swedish work of the 1880's little work was carried out on the Triassic until E. J. GARWOOD and J. W. GREGORY examined and collected from the Triassic sequence in Sassendalen during M. CONWAY's expedition of 1896. However, the stratigraphical terms which they established as a result of their work were not published until 1921 (GREGORY 1921) by which time WIMAN's terms, as set out in his 1910 paper, were in general use. The ammonites collected

on CONWAY's expedition were examined by L. F. SPATH (1921, 1934) and two vertebrate specimens were described by A. S. WOODWARD (1904).

In 1898 an expedition led by NATHORST visited Bellsund, Kong Karls Land and also Bjørnøya, the geology of which was investigated by ANDERSSON. The geological results were published in two syntheses: ANDERSSON 1900 (on Bjørnøya) and NATHORST 1910 (on Svalbard). J. BÖHM in 1899 published a preliminary note on the fauna of Bjørnøya, including brief descriptions, and this was followed in 1903 by a detailed paper on the fauna in which the 1899 material was revised and re-described, together with an account of a large number of new species and occurrences. The age of this fauna was established as Carnian on the basis of the ammonites *Trachyceras* and *Dawsonites*. NATHORST's collection from Bellsund, of which he published tentative identifications in 1910, was dealt with more systematically by BÖHM in 1912.

Also in 1898 a Russian expedition, a preliminary to the Arc of Meridian expeditions, visited North Spitsbergen, and fossiliferous rocks were discovered on Nordaustlandet by V. CARLHEIM-GYLLENSKÖLD. The fossils were later identified by DE GEER as Triassic.

The combined Swedish and Russian expeditions (1899–1902) for the measurement of an arc of meridian produced some important geological finds including the Triassic vertebrate remains collected from Edlundfjellet and Van Keulen-fjorden; these were later described by N. YAKOWLEW (1903). In 1910 WITTENBURG published an account of the Triassic fauna of Storfjorden, Edgeøya and Barentsøya based on the Arc of Meridian Survey collections. Apart from the four new bivalvia species described, most of the material was identified with previously published species. During the 1901 expedition DE GEER landed at Tumlingodden on Wilhelmøya to examine the Triassic sequence which there is overlain by Jurassic strata.

In 1907 A. HOEL, on ISACHSEN's expedition, collected fossils, mainly bivalves from the Lower Trias, at Kapp Thordsen. These were described, together with a bivalve fauna from Akseløya collected by NORBERG, in a paper by WITTENBURG in 1912.

In 1908 DE GEER led a large expedition to Vestspitsbergen to complete his exploration of Isfjorden. It included as geologists WIMAN and HÖGBOM. Many Triassic exposures were examined and collections were made. The fish horizon was noted for the first time.

In 1909 HÖGBOM collected Triassic material for WIMAN, especially saurians. Most of the specimens collected came from Tschermakfjellet and were presented to Uppsala University. As well as the vertebrates, plant remains were discovered above the '*Halobia* niveau'; they were described by W. GOTHAN (1910) who noted weak growth rings in the fossil wood.

From 1910 to 1930 WIMAN's papers on vertebrates dominated Triassic research. His first paper (1910a), on labyrinthodont remains, was based on material collected by DE GEER's 1908 expedition and by ÖBERG on the 1872 expedition; two species were described and illustrated. WIMAN's second paper in 1910 was much more comprehensive. In it he outlined the history of research on Triassic vertebrates and gave a rough section with aneroid thicknesses for the Trias in Isfjorden based

on HÖGBOM's measurement in 1908. He also published an outcrop distribution map and made the first detailed proposals for stratigraphical names, proposals that have since been followed.

In 1910 NATHORST wrote the first comprehensive review of Spitsbergen geology, combining a survey of previous observations with personal knowledge acquired during his visits in 1870, 1882 and 1898. He included long faunal lists, based on MOJSISOVICS (ammonites), WIMAN and WOODWARD (vertebrates), BÖHM (Bjørnøya invertebrates), GOTHAN (plants), and some provisional identifications from his own west coast collections (partly confirmed, partly revised and described in BÖHM 1912). The stratigraphical scheme to which the faunas were linked followed the proposals made by WIMAN earlier in the same year (1910b).

The major expedition of 1910 was the excursion of the 11th International Geological Congress (DE GEER 1910, LAMPLUGH 1910). The Isfjorden outcrops of the Trias were visited and collections of fossils were made. On Tschermakfjellet W. SALOMON found a bone bed below the fish horizon which had not previously been recorded and the vertebrates collected by him and J. OPPENHEIMER were presented to the Palaeontological Institute at Uppsala. In 1911 E. STOLLEY gave an account of some of the new observations of the excursion and described the two newly found species of *Nathorstites*.

In 1910 HÖGBOM again visited Spitsbergen to collect vertebrates, especially fish remains, and in both 1912 and 1913 expeditions were led by STENSIÖ (under WIMAN's direction) to collect Triassic vertebrate fossils. In 1913 ANDERSSON led an expedition to Sassendalen for the same purpose, and work on part of this collection was published by WIMAN in 1914. Eight new species of stegalocephalians were described and the outcrops of the Isfjorden area were commented on and illustrated, together with a geological sketch map of the Triassic outcrops of Sassendalen. WIMAN later (1916) also described, but did not name, a vertebra found by this expedition. Also in 1914 WIMAN's monograph on brachiopods and bivalves from the Permian was published, and, as a result of this re-examination of LUNDGREN's faunas, he pointed out that no species from the shales and sandstones immediately overlying the Permian cherts were of Permian age.

In 1914 the Norwegian Survey, under the leadership of HOEL and O. STAXRUD, measured part of the Festningen section of outer Isfjorden, including the Triassic sequence (see HOEL and ORVIN 1937).

In 1915 another expedition, again led by STENSIÖ under WIMAN's direction, collected vertebrates some of which were described by WIMAN (1916a) in his paper dealing with stegocephalians from the 'Posidonomya Shales'. The following year STENSIÖ returned to Spitsbergen to collect more vertebrates and in 1918 WIMAN published a short paper on an archosaurian vertebra found by this expedition on the north west face of Vikinghøgda (Hamilton Berg).

In 1917 HOEL and RÖVIG collected vertebrates from Hornsund which STENSIÖ examined and described (1918). His report noted this first record of rocks of Lower Triassic age from the Hornsund area and supported his conclusions not only from his own vertebrate identifications but from a comparison with WITTENBURG's Akseløya fauna. He correlated the vertebrate horizon found by HOEL and RÖVIG with that found on Tschermakfjellet by SALOMON in 1910.

In 1919 and 1920 three members of the Scottish Spitsbergen Syndicate, J. MATHIESON, G. W. TYRRELL and J. M. WORDIE, visited Storfjorden. Although much of their work was on the Jurassic and Cretaceous strata, the following Triassic sections were examined: Kapp Johannesen; south of Mistakodden (Changing Point) on Barentsøya; the coastal scarp on the north side of Duckwitzbreen on Barentsøya; and three sections near Kapp Lee on Edgeøya. TYRRELL's account of the results of these expeditions was published in 1933 together with an appendix on the fossils by J. WEIR and horizontal sections showing the structure along the west coast of Storfjorden.

In 1920 STENSIÖ collected vertebrates from the Trias of south Vestspitsbergen, inland between Hornsund and Sørkapp. Also during the summer of 1920, W. J. REYNOLDS made a collection of Middle Triassic fossils which was later sent to the British Museum, and cephalopods from this collection figure in SPATH's 1934 catalogue.

In 1923 a sledge party, led by N. E. ODELL, of the Merton College (Oxford) expedition, visited central Vestspitsbergen. In his report on this work, ODELL (1927) indicated Triassic outcrops to the east of his sledge route and stated that no Triassic was seen west of 20°E or north of 79°N. The observations of both this expedition and a subsequent Oxford Expedition to Nordaustlandet in 1924, which had mapped some Triassic outcrops, were compiled by K. S. SANDFORD in 1926.

In 1927 G. WATKINS led a Cambridge expedition to Edgeøya during the course of which N. L. FALCON examined and collected from the Triassic strata of which this island is largely composed. In his report on the geology of Edgeøya FALCON (1928) proposed a triple division of the exposed Trias into an 'Upper Sandstone Group', a 'Purple Shale Group' and an underlying 'Oil Shale Group'. The collections were examined by SPATH at the British Museum and part, at least, were lodged at the Sedgwick Museum, Cambridge, where they have been studied by one of us (S.H.B.). On the basis of these specimens, the stratigraphical scheme proposed in this paper has been extended to Edgeøya.

Also in 1927 the Hamberg Swedish Expedition visited Spitsbergen (GRIPP 1927) and the following year WIMAN published descriptions of specimens of *Grippia longirostris* collected by the expedition from the moraine of Elfenbeinbreen (Ivory Glacier) together with a detailed comparison of this species with other vertebrates. WIMAN redescribed the species in 1933 using material from A. LAGRELIUS' visits in 1929 and 1930 and from DE GEER's 1908 expedition. Further vertebrate material was collected by P. THORSLUND in 1929 and this was described by SÄVE-SÖDERBERGH (1936) together with material from STENSIÖ's expeditions of 1912–18.

In 1929 FREBOLD published his work on the Norwegian collections of Triassic material from Spitsbergen and Edgeøya. In two papers he outlined the stratigraphy as it was then known, systematically described the Triassic fauna and speculated about the palaeogeography of the Triassic period. This work was the first thorough investigation of the Triassic sequence in Svalbard and covered Grønfjorden, Edgeøya, Agardhbukta and Wichebukta. A further paper, published in 1930, dealt with the whole Mesozoic succession of Spitsbergen, largely con-



centrating on the Jurassic and Cretaceous. However, some mention is made of the Upper Trias, notably at Tumlingodden (Thumb Point) and a new variety of *Nathorstites* from there is described and figured. Also in 1930, FREBOLD's account of the fauna of the Lower Triassic 'fish horizon', based on previous collections, was published. This systematically described a number of ammonite species, four of which were new. The age of the fish horizon was discussed and the fauna split into two age groups. The beds immediately above were briefly discussed and some elements of their fauna were figured.

In 1930 FREBOLD and STAXRUD led a geological party of the Norwegian expedition which visited and collected from the Trias of Festningen, Kapp Wijk and Sassenfjorden. The results of this work were published the next year in FREBOLD's paper describing the Mesozoic of Isfjorden.

The ammonite fauna was again reviewed and revised by SPATH in his catalogue of Triassic cephalopoda in the British Museum (1934). The collections from Vestspitsbergen which were recorded in this catalogue were made by several expeditions: GARWOOD and GREGORY on CONWAY's expedition of 1896; G. W. LAMPLUGH on the International Geological Congress excursion of 1910; W. CHILD in 1911; REYNOLDS in 1920 and R. G. SEGNI in 1921. Unfortunately much of this material was poorly localized stratigraphically and most of the stratigraphic comments are therefore rather tentative. SPATH also had access to TYRRELL's collection from Storfjorden made in the summers of 1919 and 1920 and to FALCON's 1927 Edgeøya collection but he did not record any observations on this material. The first volume (Part IV) of this catalogue contains descriptions of the genera and species represented in the collection together with an introduction on the subdivision and correlation of the Triassic using ammonite faunas. The second volume (Part V, published 1951) discusses the classification of the Triassic ammonites and includes an extensive list of references. An additional collection from the 1939 Anglo-Norwegian-Swedish expedition was available at this time.

In 1934 the first Polish Spitsbergen Expedition visited the west coast of Vestspitsbergen and worked southwards from Bellsund into Wedel Jarlsberg Land and Torrell Land. A stratigraphical study in this tectonically disturbed area was made by S. Z. ROZYCKI but his results were not published until 1959. His work included a generalized Triassic section on Passhatten and he extended previous estimates of the area of the Triassic outcrop.

In 1935 FREBOLD reviewed Svalbard geology and included a useful summary of the Triassic succession together with a series of stratigraphic units defined on the basis of all previous observations on the Triassic together with his own. The review also contained a generalized correlation of this succession with Greenland, Canada and Northern Siberia.

The faunas of the uppermost Palaeozoic and lowermost Triassic were reviewed in detail by FREBOLD in 1936. These faunas were compared with those known from East Greenland and Russia and evidence was brought together to show that the lowest faunas found in the sandstone and shale sequence above the Permian cherts were indeed Triassic in age, as WIMAN (1914a) had presumed. A palaeontological account of this lowest Triassic fauna, based on the Norwegian collec-

tion made by ORVIN in 1921 from the Festningen section, was given by FREBOLD in 1939. Other collections from St. Jonsfjorden, Draschedalen, Akseløya, Ahlstrandodden and Hornsund were compared with the Festningen material.

For the period 1939–1945 we have no record of any geological research in Svalbard and the first post-war publication containing new information about the Triassic was that of LOWY (1949) who recorded the discovery of a nearly complete labyrinthodont skeleton (cf. *Gerr(h)othorax*) on Miseryfjellet by the 1948 Cambridge Bear Island Expedition.

In 1949 an Oxford expedition visited Torellnesfjellet in Nordaustlandet and in 1953 H. R. THOMPSON published an account of the geology of southern Nordaustlandet based on the work of this expedition. Six exposures of Triassic shale with dolerite intrusions were recorded. However, in a postscript to this paper, SANDFORD assigned a Jurassic age to these shales on the basis of a lithological comparison with the Tumlingodden section examined by M. F. W. HOLLAND in 1951. This interpretation is repeated in HOLLAND's paper in 1961, prepared by SANDFORD after HOLLAND's death; the paper incorporates the results of two further Oxford expeditions to Nordaustlandet and eastern Vestspitsbergen in 1951 and 1953. The work, as presented, is incomplete and re-examination of the several anomalous relationships of faunas in the sections described is needed to clarify the picture.

In 1951 FREBOLD again reviewed Svalbard geology in the context of the geology of the Barents Shelf. The Triassic section referring to Svalbard used a slightly enlarged terminology; faunas of the various horizons were listed and the horizons were related to photographs and profiles of the sequence. This paper is the most recent, if not the most complete, review of the stratigraphical scheme of the Triassic successions.

Polish expeditions were resumed in Hornsund in 1956 and 1960 and although the main work was concerned with pre-Triassic and Quaternary studies, further survey and stratigraphical descriptions were made (K. BIRKENMAJER 1960). No new palaeontological results have yet been published.

In 1961 B. KUMMEL revised a small element of the lower Triassic fauna of Vestspitsbergen: the arctoceratids. This work united all the species of *Arctoceras* in this fauna as growth stages of a single species – *Arctoceras blomstrandii* (LINDSTRÖM) – and also discussed some problems in dating the *Arctoceras* fauna in Spitsbergen. The work was based on the type material of LINDSTRÖM and ÖBERG and also on part of the extensive collections made by the Norsk Polarinstitut.

Preliminary geological results of the recent Russian activity in Svalbard were issued by the Institute for the Geology of the Arctic, Leningrad in 1964, including an account of the Triassic of Edgeøya by B. A. KLUBOV. One of us (W.B.H.) was welcomed to that institute in January 1965 and it may be useful to mention some current work there on Triassic stratigraphy and palaeontology. The Leningrad expeditions to Spitsbergen in 1962, 1963 and 1964 were under the direction of V. N. SOKOLOV. During these three seasons B. A. KLUBOV's party worked in Wilhelmøya, Barentsøya and Edgeøya. In 1962 T. M. PHELINA's party was concerned with Mesozoic reconnaissance and collecting at Festningen, south of Sassenfjorden and at Bellsund (north, south and Midterhukun). Among the

palaeontologists working on these collections were KORTCHINSKAYA (Triassic invertebrates) and N. D. VASSILEVSKAYA (Upper Triassic macroflora).

A number of authors have mentioned or reviewed briefly the Triassic rocks of Svalbard without including data or interpretations not previously published. These include DIENER 1916, WIMAN 1916c, O. NORDENSKIÖLD 1921, MAJOR et al. 1956 and HARLAND 1961. New information on the outcrops of Triassic rocks has, in some cases, been published on maps included in papers not primarily concerned with Triassic geology but deriving from previous field work. These papers include DE GEER 1910, HORN and ORVIN 1928, ORVIN 1940 and MAJOR and WINSNES 1955 and are marked in the bibliography as containing previously unpublished Triassic information.

### III. TRIASSIC SUCCESSION

#### Introduction

From a preliminary review of the literature it became clear to one of us (W.B.H.) that further advance in Triassic stratigraphy was handicapped by the lack of sufficient lithologically described measured sections whereby regional comparisons might be made and to which palaeontological and other data could be referred. Also for structural studies on the Tertiary deformation belt in Oscar II Land, it was found necessary by another of us (A.C.) to establish a series of lithostratigraphical units on the basis of which geological maps and cross sections could be prepared. Of the previous stratigraphical terminology referring to the Trias of Spitsbergen, the majority of the units had been based on particular fossiliferous horizons and the one purely lithostratigraphical scheme that had been proposed (GREGORY 1921) was not in general use.

It was therefore made a distinct objective of the 1962 expedition (party F, leader S.H.B.) to measure additional stratigraphical sections and collect afresh from rocks *in situ*. Subsequent Mesozoic work in 1963 and 1964 (J.R.P.) has tested and consolidated this work. In the course of our studies some thirty sections through Triassic rocks were measured and described and it is on the basis of these, together with published accounts, that the following scheme is proposed:

		Janusfjellet <sup>1</sup>			
		formation (Cretaceous and Jurassic)			
		Kapp Toscana	{ De Geerdalen member		
		formation	{ Tschermakfjellet member		
Sassendalen	}	Kongressfjellet	}		
				subgroup	Botneheia
					formation
					Sticky Keep
		formation	{ Kaosfjellet member		
			{ Iskletten member		
		Vardebukta	{ Siksaken member		
		formation	{ Selmaneset member		
Tempelfjorden <sup>2</sup>		Kapp Starostin			
group (Permian)		formation			

<sup>1</sup> Janusfjellet formation: name proposed by H. MAJOR (in lit.) for Aucella Shale appearing on Adventdalen geological map.

<sup>2</sup> Tempelfjorden group and Kapp Starostin formation: names proposed by J. L. CUTBILL and A. CHALLINOR in forthcoming scheme for Permian and Carboniferous stratigraphy; equivalent to Brachiopod cherts.

Twelve of these sections and seven previously published sections are presented graphically in Figs. 4–24. The lithostratigraphical units proposed are defined below and their relationship to established terms is shown in Fig. 2.

Regional variation of these rocks is outlined at the end of this chapter and is summarised in the fence diagram (Fig. 25).

Although the scheme proposed above is in many respects similar to that proposed by GREGORY, it was found necessary to erect this entirely new scheme as none of the units previously in use had been defined in accordance with the current practice of designation of a type section, definition of the base and top of the unit and description of lithologies. In this respect the recommendations of the International Subcommittee on Stratigraphic Terminology (HEDBURG 1961) have been followed in the preparation of this scheme and in the definitions of the stratigraphical units given below.

### **Stratigraphical units defined**

#### **SASSENDALLEN GROUP (F s)**

Equivalentents – none

Type Section – see formations

The unit is defined as the mainly shale siltstone sequence occurring between the Kapp Toscana formation above and the distinctive Permian Kapp Starostin formation below. The base is locally unconformable, and represents a non-sequence between Permian and Triassic. The top is less well defined and is discussed below.

The unit varies greatly in thickness (see Fig. 25). No information is available for the lower part of the section at Agardhbukta or in eastern Olav V Land. In Nordaustlandet, CUTBILL (private communication) estimated the thickness as approximately 150 m. THOMSON (1953) and HOLLAND (1961) gave no thickness.

Throughout Vestspitsbergen, with the exception of Sørkapp Land, the Sassendalen group can, on the evidence available, be divided into the three formations defined below (Vardebukta formation, Sticky Keep formation, Botneheia formation). However, in Sørkapp Land, the northeast, on Edgeøya, Barentsøya and Bjørnøya, these formations cannot be distinguished and only the Sassendalen group as a whole is recognised.

H. MAJOR (in lit.) suggested the use of a slightly different scheme for the Sassendalen area (Adventdalen Geological Map, 1 : 100,000 Norsk Polarinstittutt, in press). The divisions made are an upper Kongressfjellet formation defined with a type section at Kongressfjellet (Dickson Land, FREBOLD, 1931b) and a lower Vardebukta formation defined with a type section at Festningen (HOEL and ORVIN 1937). The Vardebukta formation is a good mapping unit and is used here, but the Kongressfjellet formation includes both Botneheia and Sticky Keep formations as defined below, and the lower part of the Kapp Toscana formation.

In Sassendalen the top of the Vardebukta formation is poorly defined, but can be mapped as a topographical ledge. Undoubtedly the best mapping horizon in

THIS PAPER		Previous Stratigraphical Nomenclature from Major et al. 1956	WEST COAST	ISFJORDEN AREA	
			Lundgren 1887 Frebald 1930b, 1936 Hoel and Orvin 1937	Majsiowics 1887 Noetling 1905 Frebald 1931	Nathorst 1910
KAPP TOSCANA FORMATION $\bar{K}_{xt}$	DE GEERDALEN MEMBER $\bar{K}_{xt1}$	<i>Mithorstites</i> Niveau	Fosse sandstone		
	TSCHERMAKFJELLET MEMBER $\bar{K}_{xt2}$	<i>Daonella</i> layers	<i>Lindstroemi</i> sandstone	<i>Halobia tieumanni</i> <i>Halobia zittelii</i>	<i>Halobia</i> limestone
SASSENDALLEN GROUP $\bar{K}_s$ KONGRESSFJELLET SUB-GROUP	BOTNEHEIA FORMATION $\bar{K}_b$		<i>Gymnotoceras</i> horizon	<i>Daonella</i> limestone	
			<i>Eutomoceras</i> horizon		
	STICKY KEEP FORMATION $\bar{K}_{sk}$	KAOSFJELLET MEMBER $\bar{K}_{sk1}$	Lower Saurian Niveau <i>Grippia</i> Niveau		
		ISKLETTEN MEMBER $\bar{K}_{sk2}$	<i>Posidonomya</i> layers	<i>Posidonomya</i> limestone	<i>Posidonomya</i> layers
VARDEBUKTA FORMATION $\bar{K}_v$	SIKSAKEN MEMBER $\bar{K}_v1$	<i>Retzia</i> limestone <i>Pseudomonotis</i> shale	<i>Retzia</i> limestone <i>Pseudomonotis</i> shale	base not defined	<i>Hustedia</i> limestone
	SELMANESET MEMBER $\bar{K}_v2$	<i>Myalina</i> shale <i>Claraia</i> zone	<i>Myalina</i> shale <i>Claraia</i> zone ( <i>Claraia</i> and <i>Ammoniten</i> niveau)		

Fig. 2. Correlation chart to show relationship of published stratigraphical names (in the form given in MAJOR et al. 1956) to the scheme proposed in this paper.

both eastern and western outcrop belts within the Sassendalen group is the top of the Sticky Keep formation as defined below. The top of the Sassendalen group is defined as the top of the cliff forming shales at the top of the Botneheia formation, and can be traced throughout Svalbard. The Upper Saurian Niveau used by MAJOR (in lit.) to define the top of the Kongressfjellet formation occurs above this, and is of local significance. For these reasons, the name "Kongressfjellet formation" is elevated to the rank of sub-group, but containing the Sticky Keep and Botneheia formations only.

#### VARDEBUKTA FORMATION ( $\bar{K}_v$ )

Equivalents – none, but includes the *Myalina* shale, *Pseudomonotis* shale, and *Retzia* limestone of LUNDGREN (1887) and the *Claraia* zone of FREBOLD (1936). The *Hustedia* limestone of NATHORST (1910) is a synonym for *Retzia* limestone.

Type Section – Festningen (Vardebukta) Figs. 15–17. Name suggested by H. MAJOR (in lit.) Thickness of unit in type section 253.5 m.

This lowermost formation of the Sassendalen group is characterised by sandstones, with varying amounts of interbedded siltstone, shaly siltstone, and shale. In the eastern outcrop belt in Sassendalen and Dickson Land the unit is usually scree covered, but the lithology can be determined from little-travelled scree as grey siltstone and sandstone. The top of the unit is a topographical ledge below

ISFJORDEN AREA					EDGEØYA	BJORNØYA
Wiman 190a, b, 1928	Stolley 1911	Gregory 1921	Spath 1921, 1934	Frebald 1930a, 1931	Falcon 1928	Andersson 1900
		Plateau flags			Sandstone and shale series	<i>Myophoria</i> sandstone
	<i>Lingula</i> sandstone	Upper Nodule bed				— ? —
Upper Saurian Niveau	<i>Nathorstites</i> Niveau				Blue and purple shales	Dark shales with clay ironstone nodules
	<i>Halobia</i> shales	Oozy Mound beds				
		limestone				
		Thin paper shales	Escarpment shales	<i>Ptychites</i> beds	<i>Gymnoceras</i> horizon	Oil shale series
		Middle Nodule bed limestone		not defined	<i>Eulomoceras</i> horizon	Shale with thin sandstones and limy concretions
Lower Saurian Niveau			Upper <i>Posidonomya</i> shales			
<i>Grappia</i> Niveau			Saurian bed			
Fish Niveau	<i>Arctoceras</i> layers	Black shales and yellow flags	Lower <i>Posidonomya</i> shales	<i>Arctoceras</i> horizon		
		Lowest Nodule bed	<i>Anasibirites</i> horizon	<i>Gomodiscus nodosus</i> horizon		

the soft shales of the lower part of the Sticky Keep formation. The base is extremely well marked and appears to be the Permian – Triassic boundary.

In the type section, and in similar thick sections in Oscar II Land, and south to Passhatten, the formation can be divided into an upper sandstone unit, the Siksaken member, and a lower shale-siltstone unit, the Selmaneset member. In the thinner sections of the Hornsund area in the western outcrop belt and in the fairly uniform eastern outcrop belt, these divisions cannot be recognised, but everywhere there is predominance of sandstone at the top of the unit.

#### SELMANESET MEMBER (R v<sub>1</sub>)

Equivalentents – none, but includes the *Myalina* shale of LUNDGREN (1887) and the *Claraia* zone of FREBOLD (1936).

Type section – Selmaneset (Trygghamna) Fig. 14. Thickness of unit in type section 136 m.

Defined as the dark grey often calcareous silty shales and shaly siltstones occurring below the lowest resistant bed of the Siksaken member, usually a hard calcareous siltstone, and above the Tempelfjorden group. Thin hard calcareous siltstone interbeds are common and the unit becomes sandy towards the top, with fine grained sandstones, silty limestones and clay-ironstone concretions. Fossils are not common, but bivalves, bone fragments and one ammonite have been found. There is little lithological variation.

### SIKSAKEN MEMBER (R<sub>v2</sub>)

Equivalents – none, but includes the *Pseudomonotis* shale and *Retzia* limestone of LUNDGREN (1887).

The *Hustedia* limestone of NATHORST (1910) is synonymous with LUNDGREN's *Retzia* limestone.

Type Section – Iskletten (Oscar II Land composite section) Figs. 12–14. Named from Siksaken where the unit shows well exposed sharp folds. Thickness of unit in type section 104 m.

An easily mapped unit, consisting of alternating grey calcareous siltstones and silty limestones, passing to calcarenite, light grey and white sandstones, hard siltstones and calcareous shales. Fossils are fairly common. The base is defined as the lowest resistant bed, and the top as the sharp change in lithology from cliff-forming siltstones and sandstones of this member to the soft silty darker shales of the lower part of the Sticky Keep formation (Iskletten member). The unit is only 35 m thick at Passhatten if the correlation is correct.

### STICKY KEEP FORMATION (R<sub>SK</sub>)

Equivalents – none, but includes the *Posidonomya* layers of NATHORST (1910) (replacing *Posidonomya* limestone of MOJSISOVICS (1886) and its synonyms), the Fish Niveau of WIMAN (1910a), the *Arctoceras* layers of STOLLEY (1911), the Lower *Posidonomya* shales of SPATH (1921) and the *Arctoceras* horizon of FREBOLD (1930a). The upper part contains the Lower Saurian Niveau and the *Grippia* Niveau of WIMAN (1910a and 1928) and the Saurian bed and the lower part of the Upper *Posidonomya* shales of SPATH (1921). The lower part contains the Lowest Nodule bed of GREGORY (1921), the *Anasibirites* horizon of SPATH (1921) and the *Goniodiscus nodosus* horizon of FREBOLD (1930a).

Type section – Vikinghøgda Figs. 4–5. Well developed on Sticky Keep to the east of Vikinghøgda. Thickness of unit in type section 121 m.

In Sassendalen and in the eastern outcrop belt a cliff-forming marker horizon occurs below the soft shales of the Botneheia formation. This usually forms a distinctive, easily mapped yellow weathering topographical ledge and consists of yellowish weathering dark grey siltstone and shaly siltstone with frequent interbeds of similar harder siltstone. These contrast with the soft, very dark grey phosphatic shales above. The lower part of the unit in this area consists of similar darker shales and shaly siltstone, somewhat softer, and contrasting with the upper sandstones of the Vardebukta formation. Septarian limestone concretions are common, especially in the lower part. Ammonites, bivalves and bone fragments are common.

The unit is fairly uniform in lithology and thickness in Sassendalen, but when traced eastwards the contacts between this formation and those above and below become less distinct. In Dickson Land and Ekmanfjorden, however, the formations



are easily recognizable. In Oscar II Land and in the western outcrop belt in northern Wedel Jarlsberg Land the unit is thicker (see Fig. 25), and can be divided lithologically into two members, an upper siltstone unit, the Kaosfjellet member, and a lower silty shale unit, the Iskletten member. South of Passhatten the units cannot be recognized.

#### ISKLETTEN MEMBER ( $\bar{R}_{SK_1}$ )

Equivalents – none, see above.

Type Section – Iskletten (Oscar II Land composite section) Figs. 12–14.

Thickness of unit in type section 154 m.

The unit is the lower shaly part of the Sticky Keep formation in the western outcrop belt and consists of interbedded dark grey, often calcareous silty shale, and grey and grey-green flaggy and laminated calcareous shaly siltstone. Grey septarian limestone concretions are common especially in the upper part, and hard yellow-weathering thin calcareous siltstone interbeds are common. Fossils are not particularly abundant, but ammonites and bivalves occur, especially in the limestone concretions. The unit is easily distinguishable between the cliff-forming members above and below (Kaosfjellet, and Siksaken members respectively). The unit is fairly uniform throughout.

#### KAOSFJELLET MEMBER ( $\bar{R}_{SK_2}$ )

Equivalents – none, see above.

Type Section – Iskletten (Oscar II Land composite section) Figs. 12–14.

Named from Kaosfjellet where the unit shows sharp small scale chevron folding. Thickness of unit in type section 76 m.

This siltstone marker unit which forms a distinctive cliff consists of yellow-brown weathering laminated shaly siltstones, thinly alternating with fragmented harder thin grey siltstones which are slightly calcareous, and weather orange and red-brown. The upper and lower contacts are marked by abrupt colour, lithological and resistance variation, especially with the black phosphatic shales of the Botneheia formation. The unit is only recognizable in the thicker sections of the western outcrop belt north of Wedel Jarlsberg Land, but equivalents of this member, and the Iskletten member below, can be found in the thinner sections of the eastern outcrop belt.

#### BOTNEHEIA FORMATION ( $\bar{R}_B$ )

Equivalents – none, but includes the Escarpment Shales of GREGORY (1921), the Oil Shale series of FALCON (1928), the lower part of the *Daonella* layers of WIMAN (1910a), the *Daonella* limestone of MOJSISOVICS (1886), the *Gymnotoceras* and *Eutomoceras* horizons of FREBOLD (1931) and the *Ptychites* beds and the upper part of the Upper *Posidonomya* shales of SPATH (1921).

Type Section – Vikinghøgda Figs. 4–5. Well exposed on Botneheia to the west of Vikinghøgda. Thickness of unit in type section 157 m.

This formation can be traced throughout Vestspitsbergen with the exception both of Sørkapp Land and the extreme north-east. It may occur in Edgeøya and Barentsøya, but no division of the Sassendalen group there can be made on existing information. It consists of a dark grey shale sequence weathering blue-black and dark grey. The upper shales are invariably papery, laminated and bituminous, passing locally to similar siltstones; they often contain large light yellow weathering concretions of grey silty limestone (Daonellenkalk of MOJSISOVICS, 1886) and always form a distinctive escarpment (Escarpment Shales of GREGORY, 1921, Oil Shale Series of FALCON 1928, *Ptychites* beds of SPATH, 1921). The base of these shales passes gradually into slope-forming softer shales with thin siltstone interbeds. These are distinctive in containing many small phosphatic nodules (up to 2 cms diameter, but usually smaller), weathering blue-black. The nodules also occur in siltstone and fine-grained sandstone interbeds and give the unit its general black colour. The nodules increase in abundance towards the base, where locally they make up 50 % of the rock. This contrasts markedly with the yellow siltstones of the Sticky Keep formation below. Fossils are common throughout, especially in the upper cliff-forming part, with ammonites, bivalves, bone fragments, worm tracks and plant remains.

At the top of the cliff-forming shales, marking the upper boundary of the formation, and of the Sassendalen group, a hard siltstone horizon occurs. This varies considerably in lithology and thickness but can be recognized everywhere in Svalbard, dividing the Sassendalen group from the Kapp Toscana formation. It varies from grey or yellow weathering siltstone, through calcareous siltstone, to limestone, but is often siliceous or cherty. It forms a thick marker bed in the western outcrop belt, but only a thin horizon in the eastern belt. The black shales below are, with little exception, cliff-forming, and contrast with the slope-forming grey shales with red ironstone concretions or light coloured sandstone of the lower part of the Kapp Toscana formation. The upper boundary is the only Triassic horizon which can be traced throughout Svalbard.

#### KAPP TOSCANA FORMATION (R KT)

Equivalents – none, see members.

Type Section – Kapp Toscana (Van Keulenfjorden) Figs. 18–20. Name suggested by H. E. KELLOGG (personal communication). Thickness of unit in type section 200 m.

The upper part of this formation may be of lower Jurassic age and this is discussed below (Part IV). The upper boundary is defined as the contact between the cliff forming sandstones and shales and the thin 'Lias' conglomerate, which is found throughout Spitsbergen as the base of the softer shales of the Janusfjellet formation above. The base of the Kapp Toscana formation is defined as the top of the Sassendalen group.

In general the formation consists of a largely non-marine sequence of fine to medium grained grey-green plant bearing sandstones, weathering greenish and brown, laminated to massive, interbedded with varying amounts of grey silty shales, shaly siltstones, and harder calcareous siltstones.

At Kapp Toscana, sandstones make up half of the total, but this varies considerably. South from Kapp Toscana, where the lowest beds are sandstones, to Passhatten, the amount of shale, grey and green in colour, increases, with frequent layers of small violet weathering clay-ironstone concretions, especially in the upper part, and rare beds of yellow weathering cone-in-cone marl. At Treskelodden the unit is mainly sandstone, but at Kistefjellet a much thinner sequence is mainly of shale in the lower part, with concretions and sandstones in the upper part. This is similar to the Bjørnøya sequence, but there the top is not seen. The lower shale with red concretions contains ammonite and marine bivalve faunas, but the sandstones on the whole are non-marine with plant remains.

The thick sections at Festningen and in Oscar II Land are mainly of sandstone with shale interbeds, but in the upper part grey-green and blue-grey shales with blue and purple weathering clay-ironstone concretions occur, these often containing bivalves. In this area the 'Lias' conglomerate consists of a thin conglomerate horizon, followed upwards by shales with similar blue and purple clay ironstone concretions with bivalves, cone-in-cone marls, and thin sandstone interbeds. This is similar to the upper part of the Kapp Toscana formation, but the contact is marked by the colour, lithological and resistance variation and more generally by the distinctive conglomerate.

In Ekmanfjorden and south Dickson Land the top of the formation is not present. Throughout the eastern outcrop belt to Agardhbukta two members can be recognized, a lower marine shale unit with red concretions, the Tschermakfjellet member, and an upper non-marine sandstone unit, the De Geerdalen member.

At Kapp Johannesen the base is not seen, but a thick sequence shows an upper part with grey-green and blue shales with clay-ironstone concretions, and a lower part with plant-bearing sandstones and shale interbeds. The amount of shale increases northwards, but this division into an upper marine part with shales and blue and purple clay-ironstone concretions with bivalves below the 'Lias' conglomerate member, and a lower plant-bearing shale unit with sandstone interbeds, can still be recognized at Wilhelmøya. The Edgeøya and Barentsøya sections show that the lower marine shales with concretions and the upper plant-bearing sandstones occur, similar to the eastern outcrop belt divisions.

Thus the Kapp Toscana formation shows a very variable sequence. A lower marine sequence exists in the eastern outcrop belt, with an upper non-marine sequence (plant-bearing sandstones and some coal seams), and is also recognized in Edgeøya, Barentsøya, Sørkapp Land, and Bjørnøya. This does not occur in the western outcrop belt north of Hornsund, where a lower non-marine sandstone sequence underlies an upper marine shale sequence containing concretions; a similar situation is also seen in the north-east on Kapp Johannesen and Wilhelmøya, but north-eastwards the sandstones pass gradually into shales of greater thickness.

Although there is an apparent increase in thickness into the Isfjorden basin (see Fig. 25), the formation as a whole thickens to the north-east.

#### TSCHERMAKFJELLET MEMBER ( $\bar{R}_{KT_1}$ )

Equivalents – none, but the lower part includes the Oozy Mound beds of GREGORY (1921) and the upper part of *Daonella* layers of WIMAN (1910a); the upper part includes the *Halobia* shales of STOLLEY (1911) (*Halobia* limestone of NOETLING 1905) and the *Nathorstites* Niveau of STOLLEY (1911). The Upper Saurian Niveau (WIMAN 1910b), the Upper Nodule bed (GREGORY 1921), the *Lindstroemi* sandstone (FREBOLD 1930b), the *Lingula* sandstone (STOLLEY 1911) and the *Myophoria* sandstone of Bjørnøya (ANDERSSON, 1900) are also included. The Blue and Purple Shales of FALCON (1928) cover the whole unit.

Type Section – Botneheia Figs. 5–6. Well developed on Tschermakfjellet in south Dickson Land. Thickness of unit in type section 63 m.

The unit is recognized only in the eastern outcrop belt from Ekmanfjorden to the head of Sassendalen, but may subsequently be recognized in Edgeøya, Barentsøya, Sørkapp Land and Bjørnøya. It consists of dark grey occasionally silty shales, grading locally to shaly siltstone and very fine grained sandstone, with small red weathering clay-ironstone concretions. These nodules give the unit a distinctive colour, and contain an ammonite and marine bivalve fauna. The lower contact is the top of the siliceous siltstone marker, and the top contact is the lowest hard sandstone of the De Geerdalen member. The thickness is variable and the sandstones may interdigitate with the shale. No representatives of this member are found in the west or north-east and it is possible that they have been replaced laterally by non-marine sandstones, or that the base of the De Geerdalen member is unconformable. No conclusive evidence is available for either suggestion. The member may however be represented by marine sandstones, e. g. *Lindstroemi* sandstone (FREBOLD 1930b), *Myophoria* sandstone (ANDERSSON 1900).

#### DE GEERDALEN MEMBER ( $\bar{R}_{KT_2}$ )

Equivalents – none, but includes the Plateau flags of GREGORY (1921) and possibly the Fosse sandstone of HOEL and ORVIN (1937).

Type Section – Botneheia Figs. 5–6. Named from De Geerdalen to the west of Botneheia. Thickness of unit in type section 190 m.

Recognized only with the Tschermakfjellet member in the eastern outcrop belt, but it may have representatives elsewhere (see above). It consists of the alternating non-marine grey-green sandstones and sandy shales between the lowest resistant sandstone horizon above the Tschermakfjellet shales and the 'Lias' conglomerate of the Janusfjellet formation. There is little variation in thickness in this area but the member is probably equivalent to the non-marine sandstone shale sequences elsewhere in Spitsbergen. Plant remains are frequent, and thin coal seams occur.

The distinction between this member and the one below is lost eastwards to Agardhbukta and the lowest sandstones may interdigitate.

*Sources*

**Stratigraphical sections**

The sections plotted in Figs. 4–24 are selected from published accounts and from new work of the Cambridge expeditions. Their sources are acknowledged below.

Bjørnøya	from ANDERSSON 1900
Edgeøya	from FALCON 1928
Kapp Johannesen and Duckwitzbreen	from TYRRELL 1933
Festningen	from HOEL and ORVIN 1937
Passhatten	from ROZYCKI 1959
Kistefjellet	from FREBOLD 1930 b
Van Keulenfjorden, Treskelodden and Wilhelmøya	from J. L. CUTBILL with J. D. LOWELL and R. L. HEDBERG of "Amoseas" party 1961.
Oscar II Land and Selmaneset	A. CHALLINOR leader of Party C on the Cambridge Spitsbergen Expedition 1962.
Vikingshøgda, Botneheia, Sticky Keep, Rotundafjellet, Tschermakfjellet, Kongressfjellet, Bertilryggen and Sveaneset	S. H. BUCHAN leader of Party F on the Cambridge Spitsbergen Expedition 1962.

In the text the sections will be referred to by the names below. The section numbers in each case at the top of the section are those in use in the Cambridge files, similarly the specimen numbers throughout are the field numbers of the Cambridge collections. The fossil names on the sections are from preliminary determinations only, except in the Festningen section, where the horizon numbers and fossil identifications are those given in HOEL and ORVIN 1937.

*Stratigraphical sections in order of plotting:*

Figures:

Legend to Figs. 4–24	3	Festningen (Nordenskiöld Land)	15–17
Vikingshøgda (Nordenskiöld Land)	4– 5	Van Keulenfjorden (Nathorst Land and Wedel Jarlsberg Land)	18–20
Botneheia (Nordenskiöld Land)	5– 6	Passhatten (Wedel Jarlsberg Land)	20
Sticky Keep (Nordenskiöld Land)	6– 7	Treskelodden	
Rotundafjellet (Dickson Land)	8	(Wedel Jarlsberg Land)	20–21
Tschermakfjellet (Dickson Land)	8– 9	Kistefjellet (Sørkapp Land)	22
Kongressfjellet (Dickson Land)	10	Bjørnøya	22
Bertilryggen and Sveaneset		Wilhelmøya	23
(James I Land)	11	Kapp Johannesen (Sabine Land)	23
Oscar II Land (composite)	12–14	Duckwitzbreen (Barentsøya)	23–24
Selmaneset (Oscar II Land)	14	Edgeøya	24

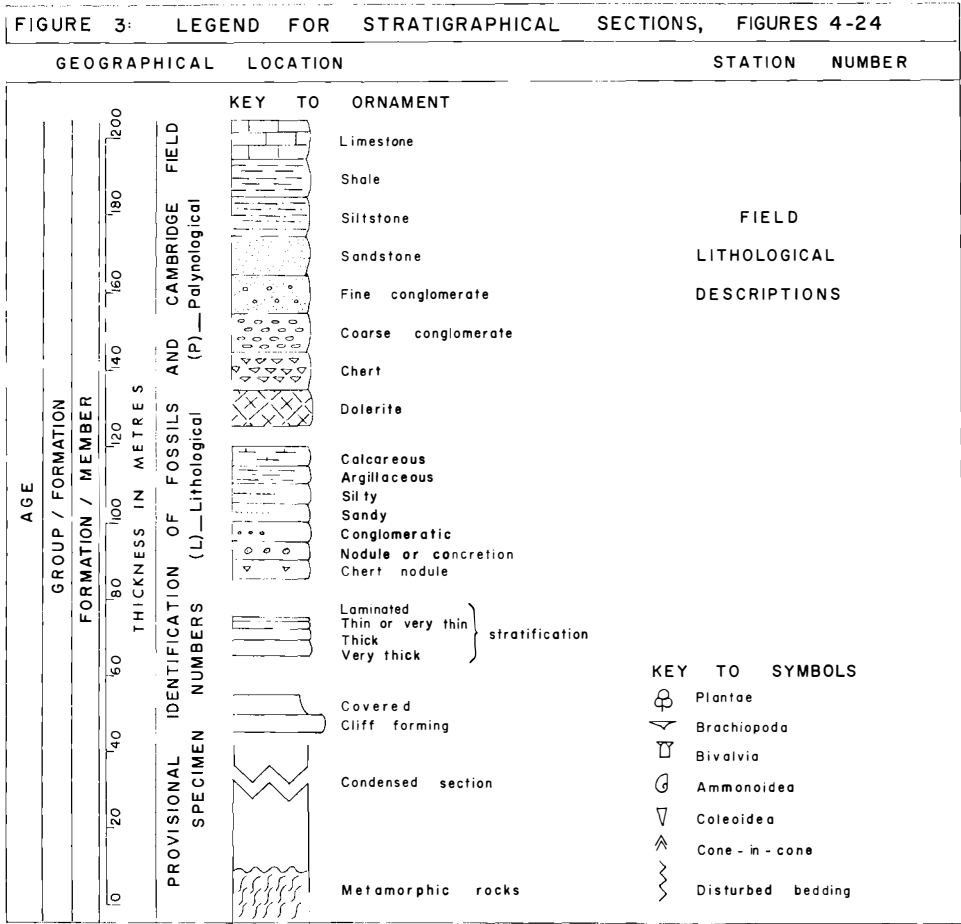


Fig. 3. Legend to measured stratigraphical sections (figures 4-24).  
 Abbreviations of the names of the stratigraphical units are given in the following table:

Kapp Toscana Formation $\bar{R}$ KT	}	De Geerdalen Member $\bar{R}$ KT <sub>2</sub>
		Tschermakfjellet Member $\bar{R}$ KT <sub>1</sub>
Sassendalen Group $\bar{R}$ S	}	Botneheia Formation $\bar{R}$ B
		Sticky Keep Formation $\bar{R}$ SK
		Vardebukta Formation $\bar{R}$ V
	}	Kaosfjellet Member $\bar{R}$ SK <sub>2</sub>
		Iskletten Member $\bar{R}$ SK <sub>1</sub>
		Siksaken Member $\bar{R}$ V <sub>2</sub>
		Selmaneset Member $\bar{R}$ V <sub>1</sub>

Fossil names have not been italicized.

### Regional variation

The fence diagram (Fig. 25) shows the known lateral variations in Triassic rocks, and indicates the existence of the deep Isfjorden basin centred on Festningen, the section thinning northwards onto the Nordfjorden block<sup>1</sup> and southwards from Passhatten to Treskelodden. In the Hornsund and Bellsund areas,

<sup>1</sup> Nordfjorden: fjord between south Dickson Land and Oscar II Land.

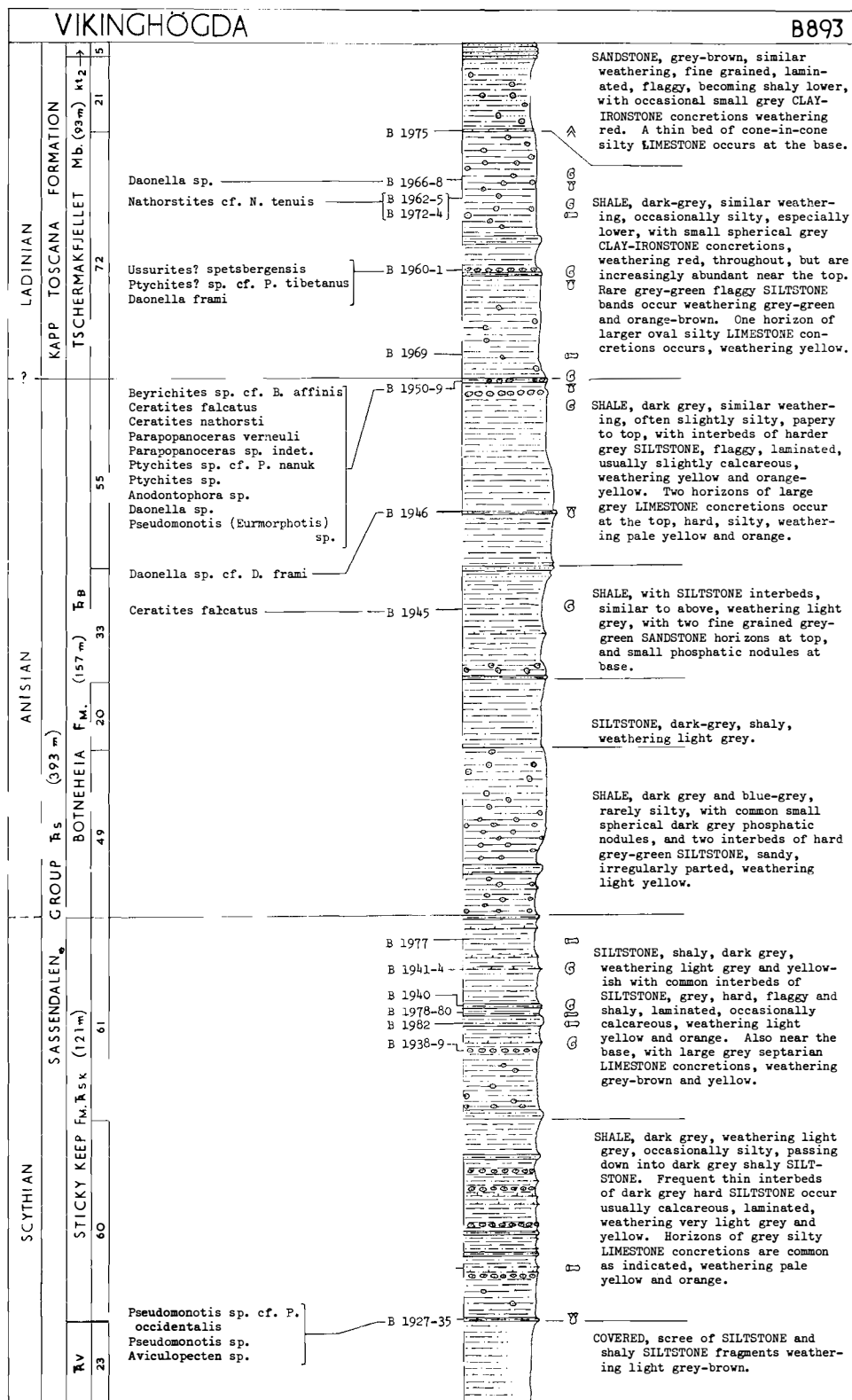


Fig. 4.





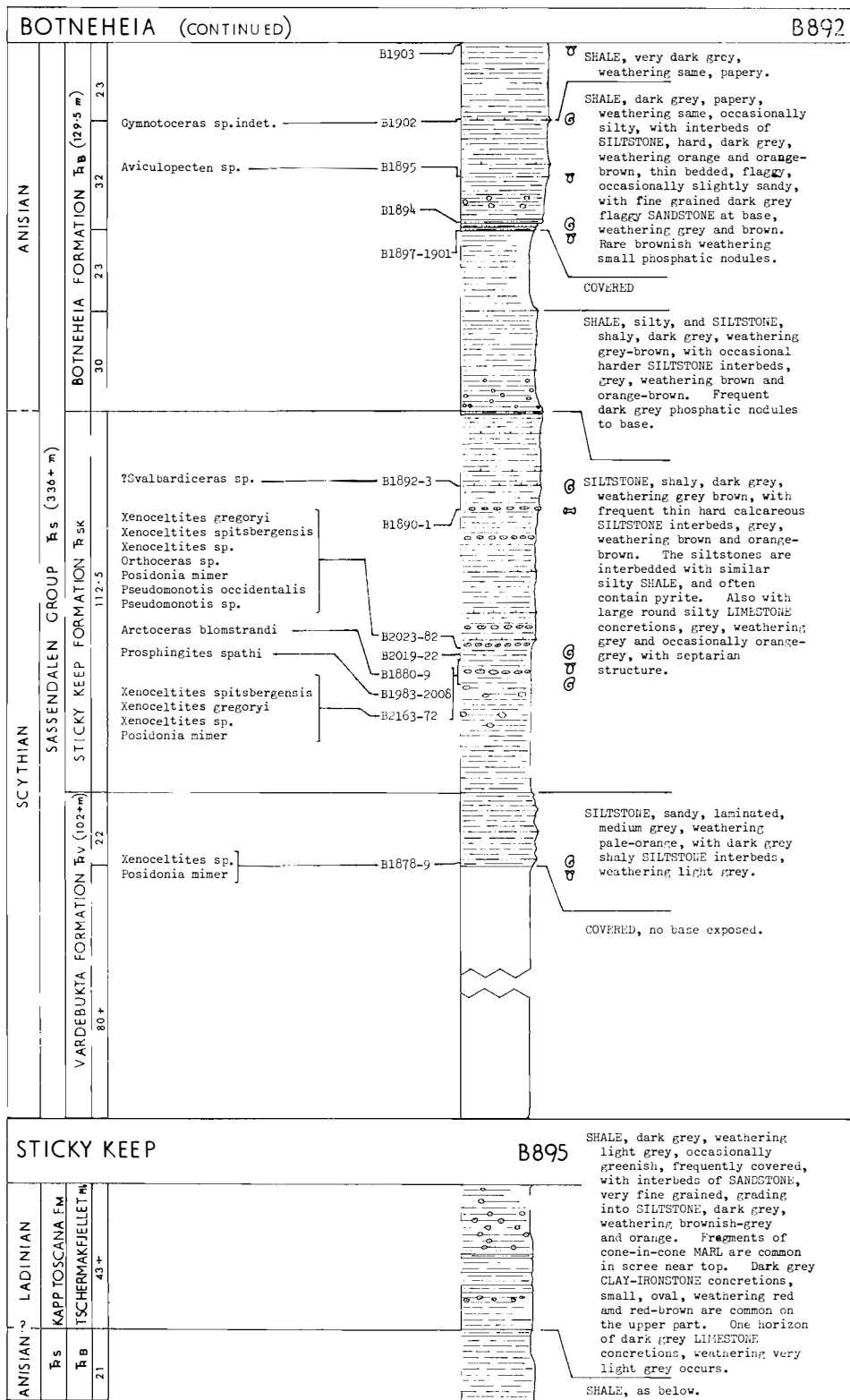


Fig. 6.

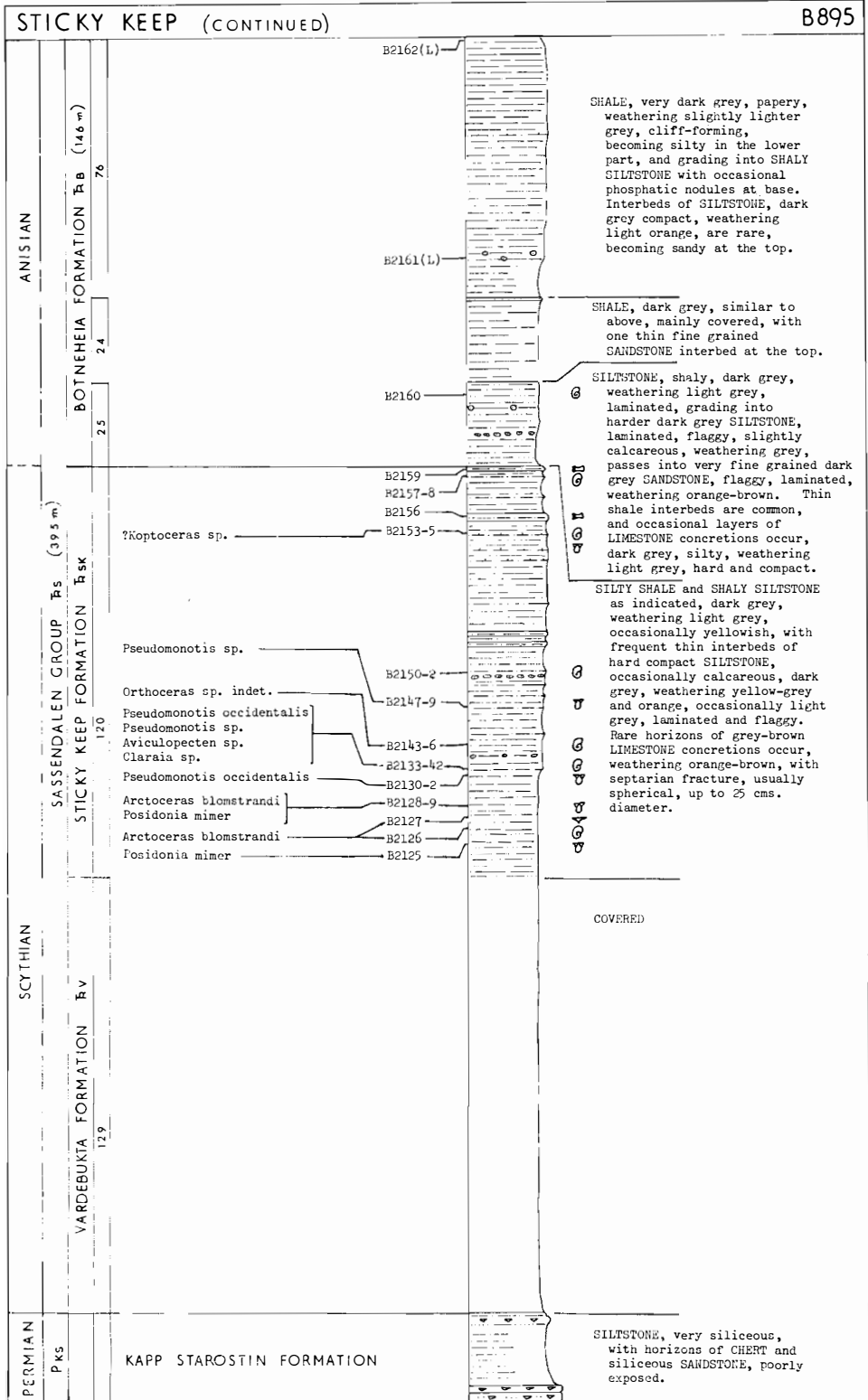


Fig. 7.

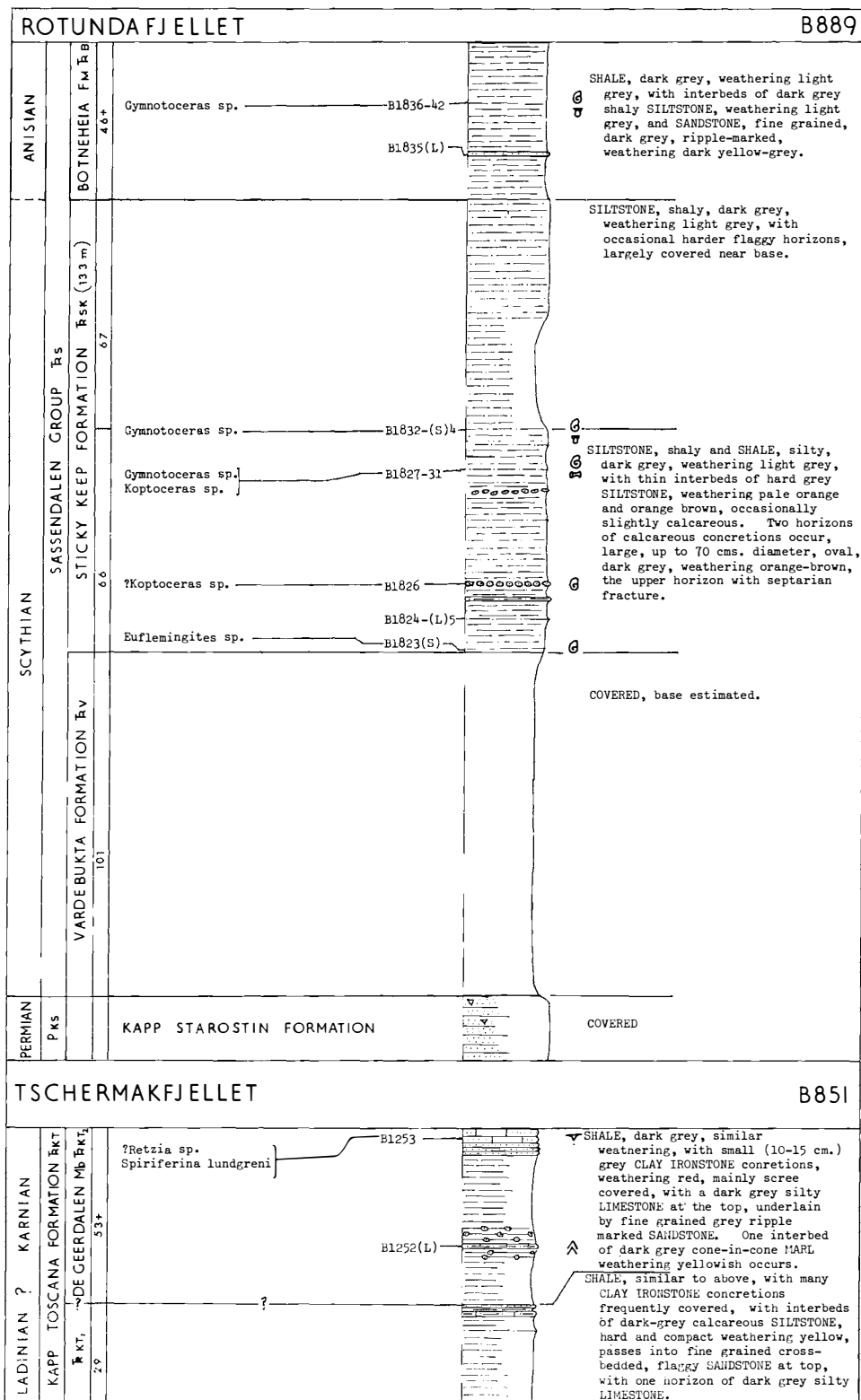


Fig. 8.



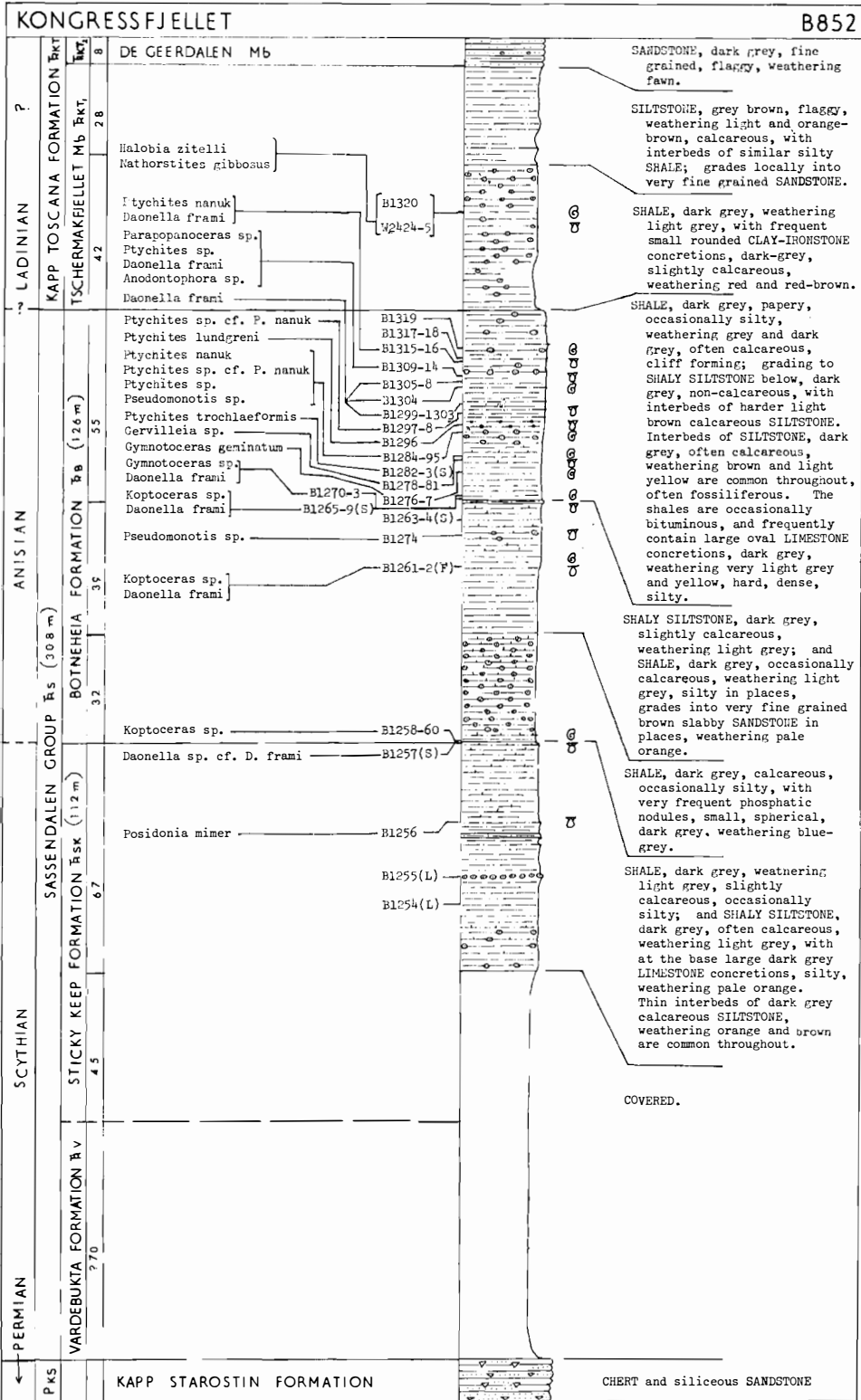


Fig. 10.

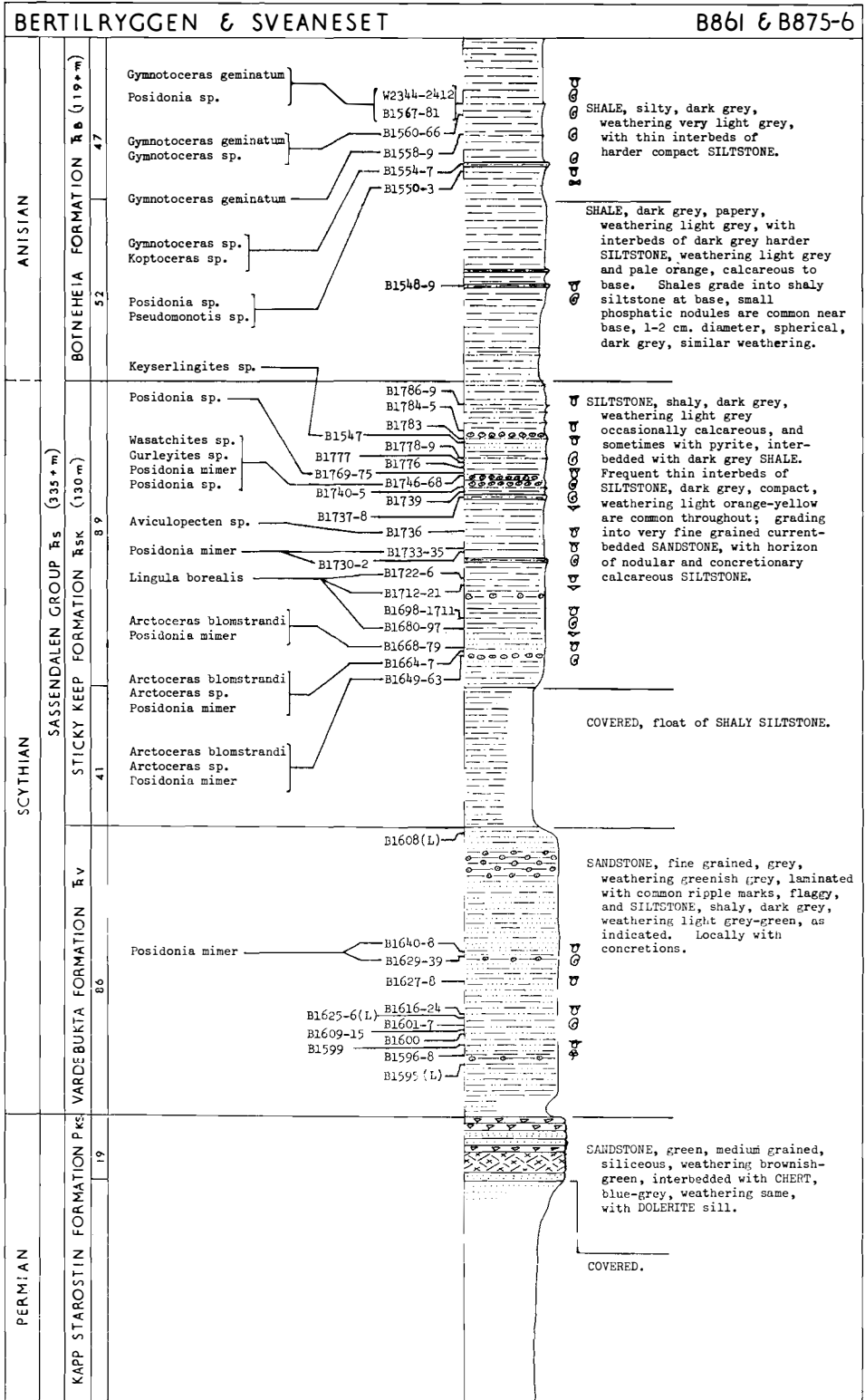


Fig. 11.

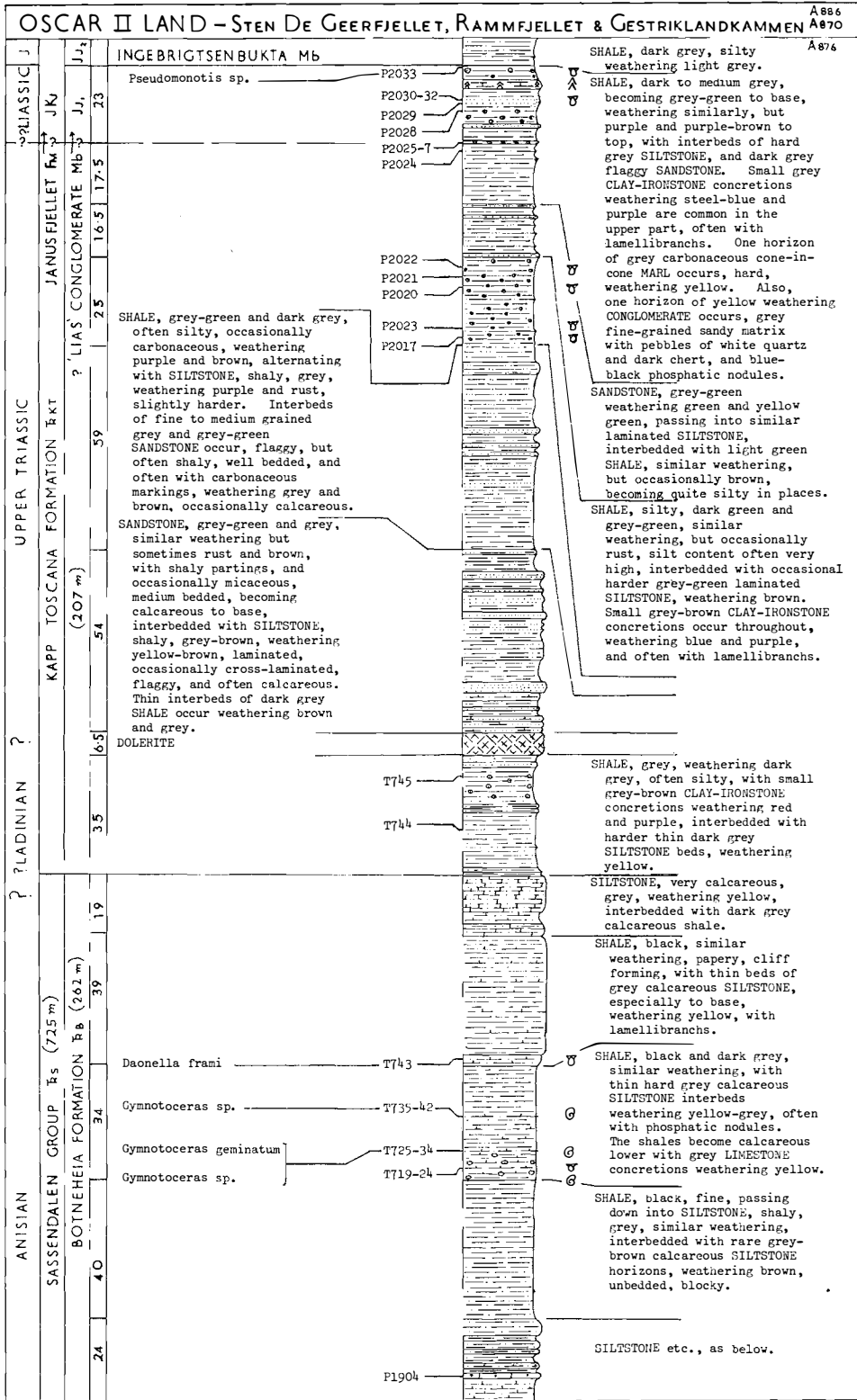


Fig. 12.

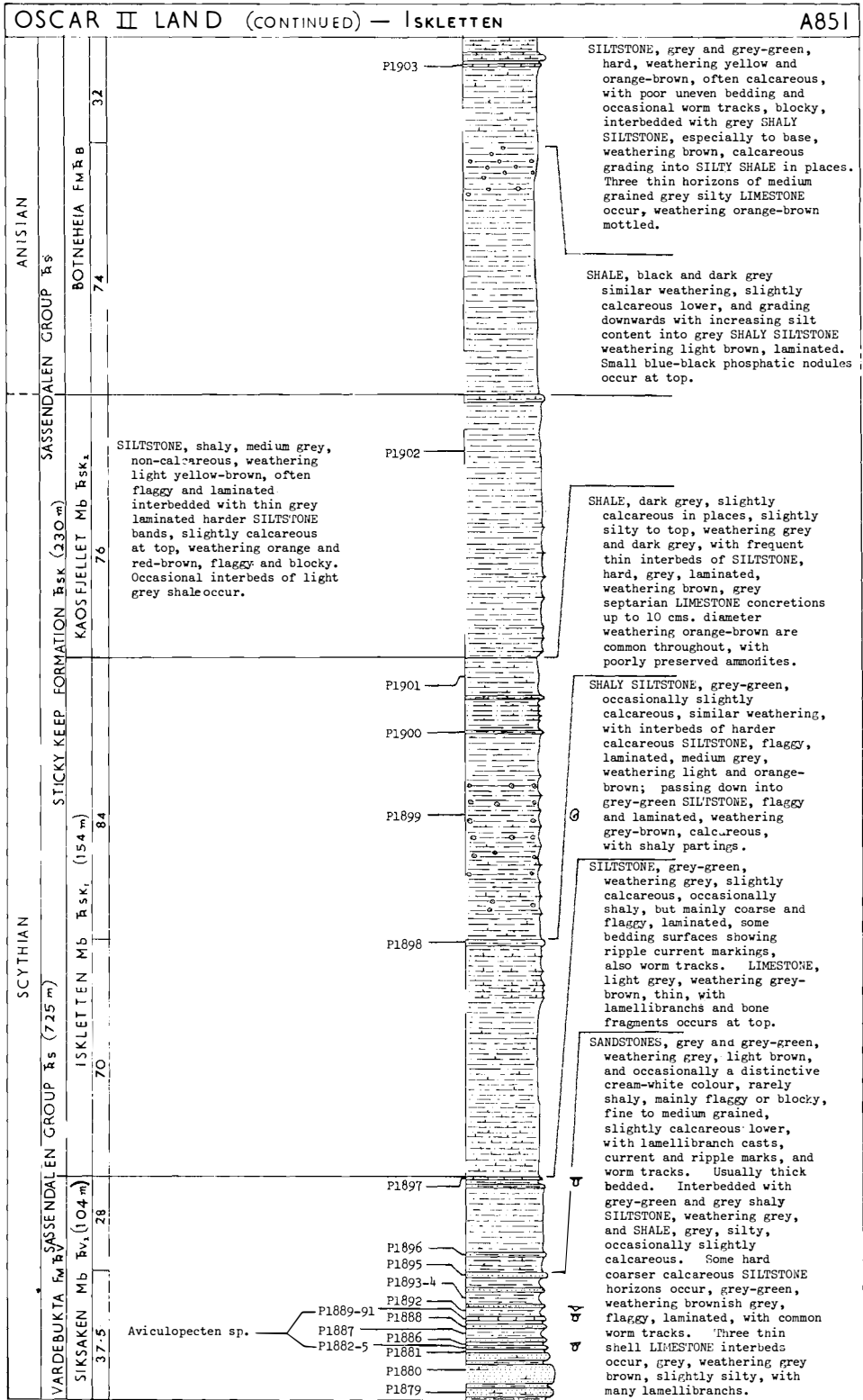


Fig. 13.



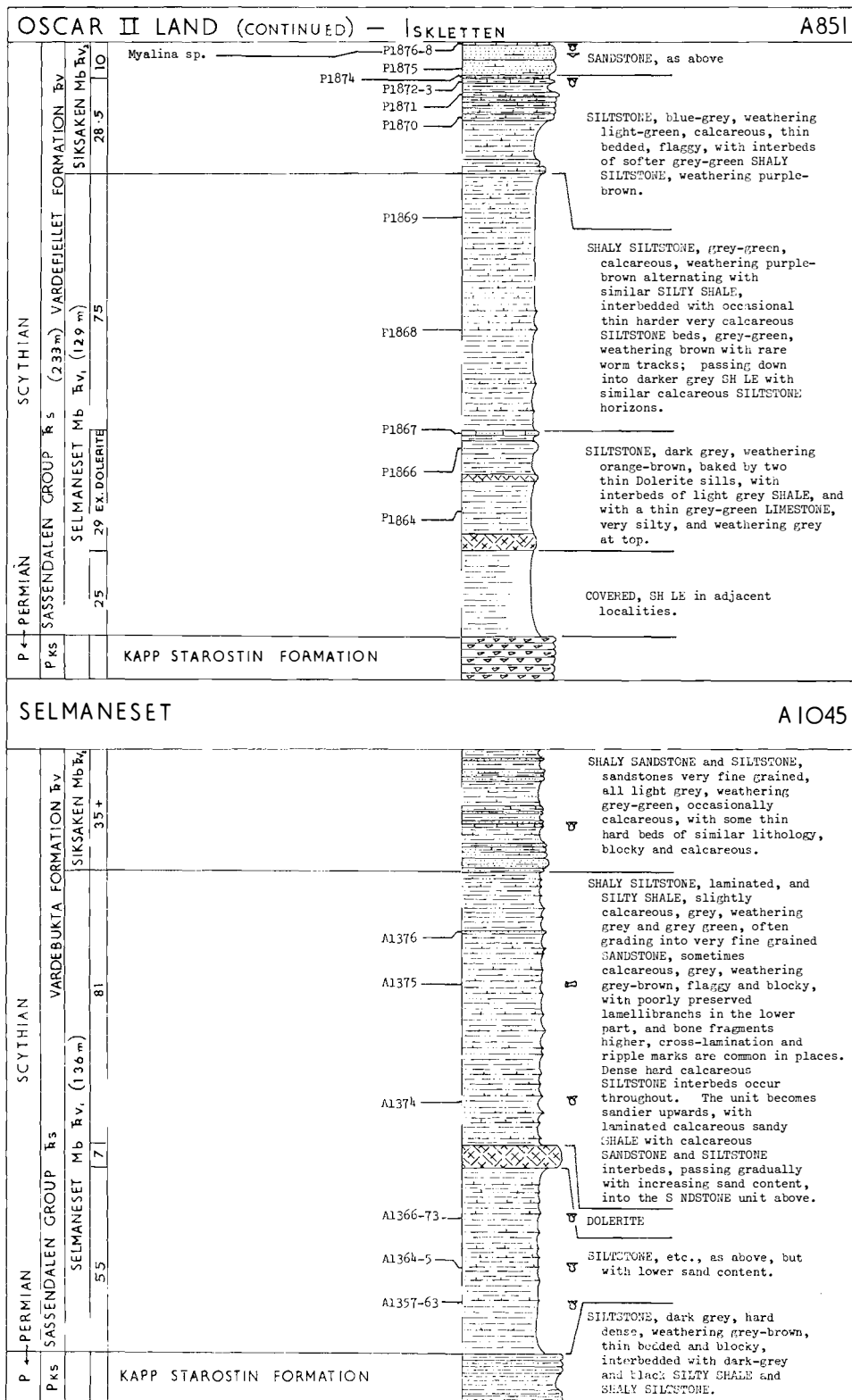


Fig. 14.



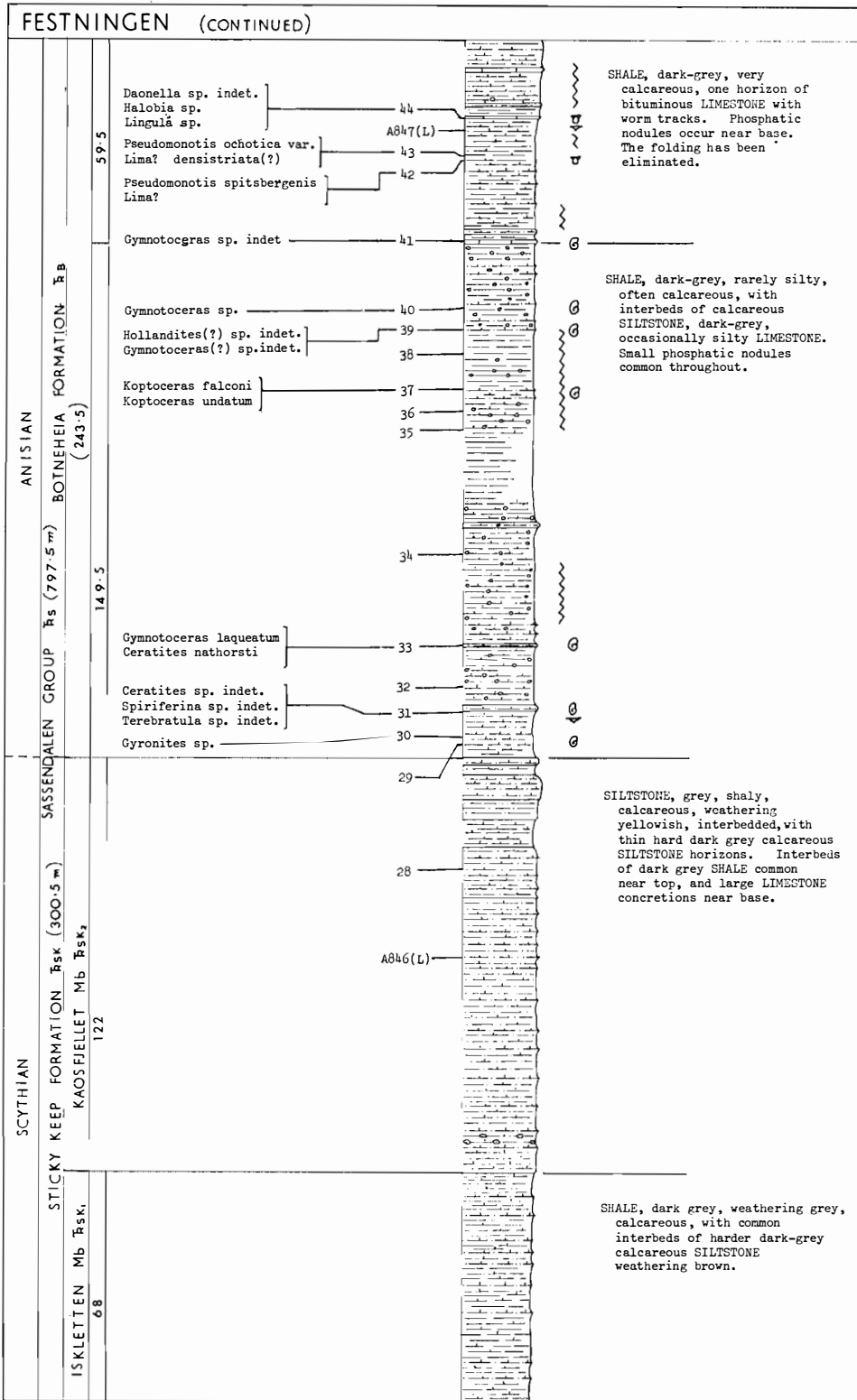


Fig. 16.

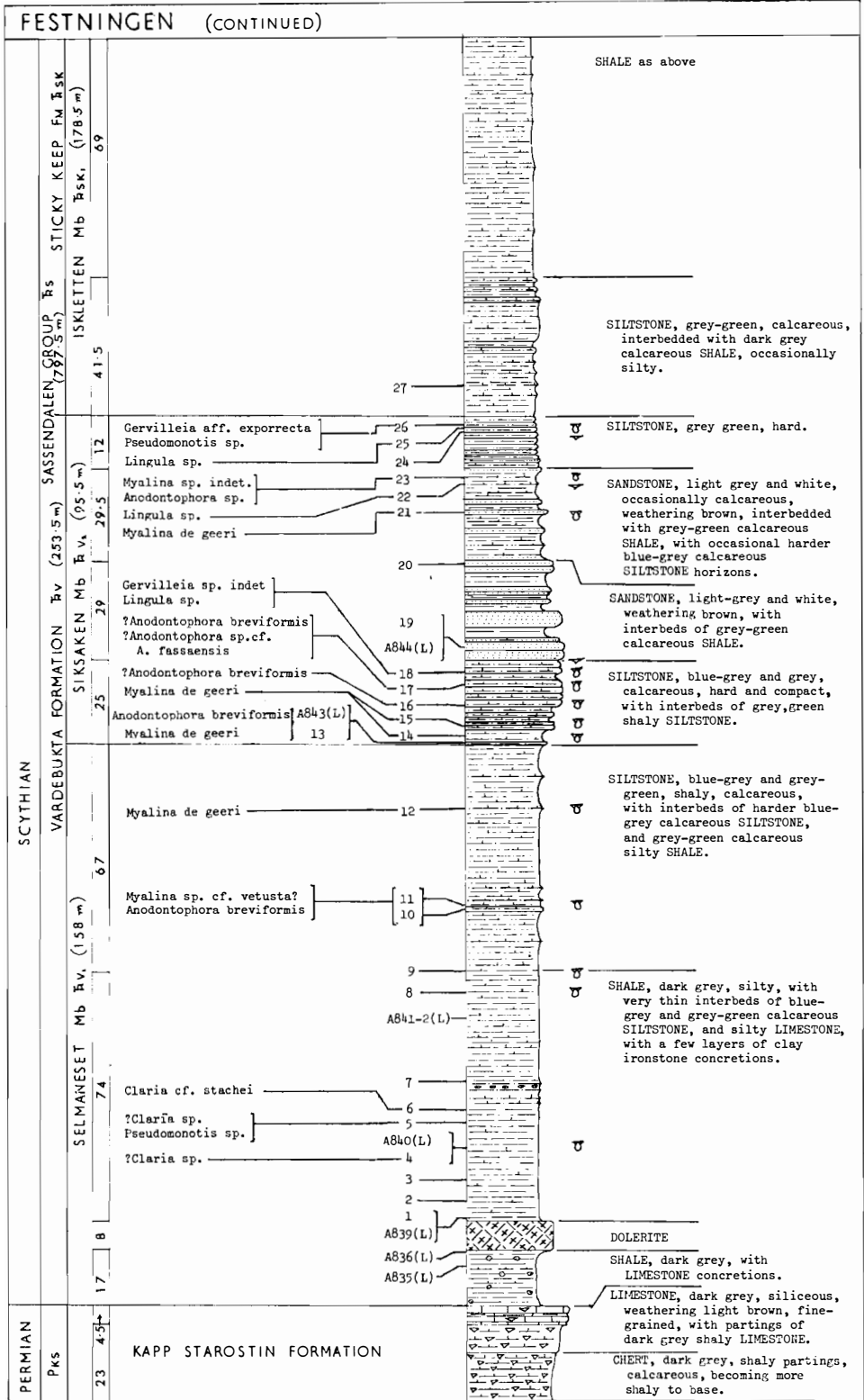
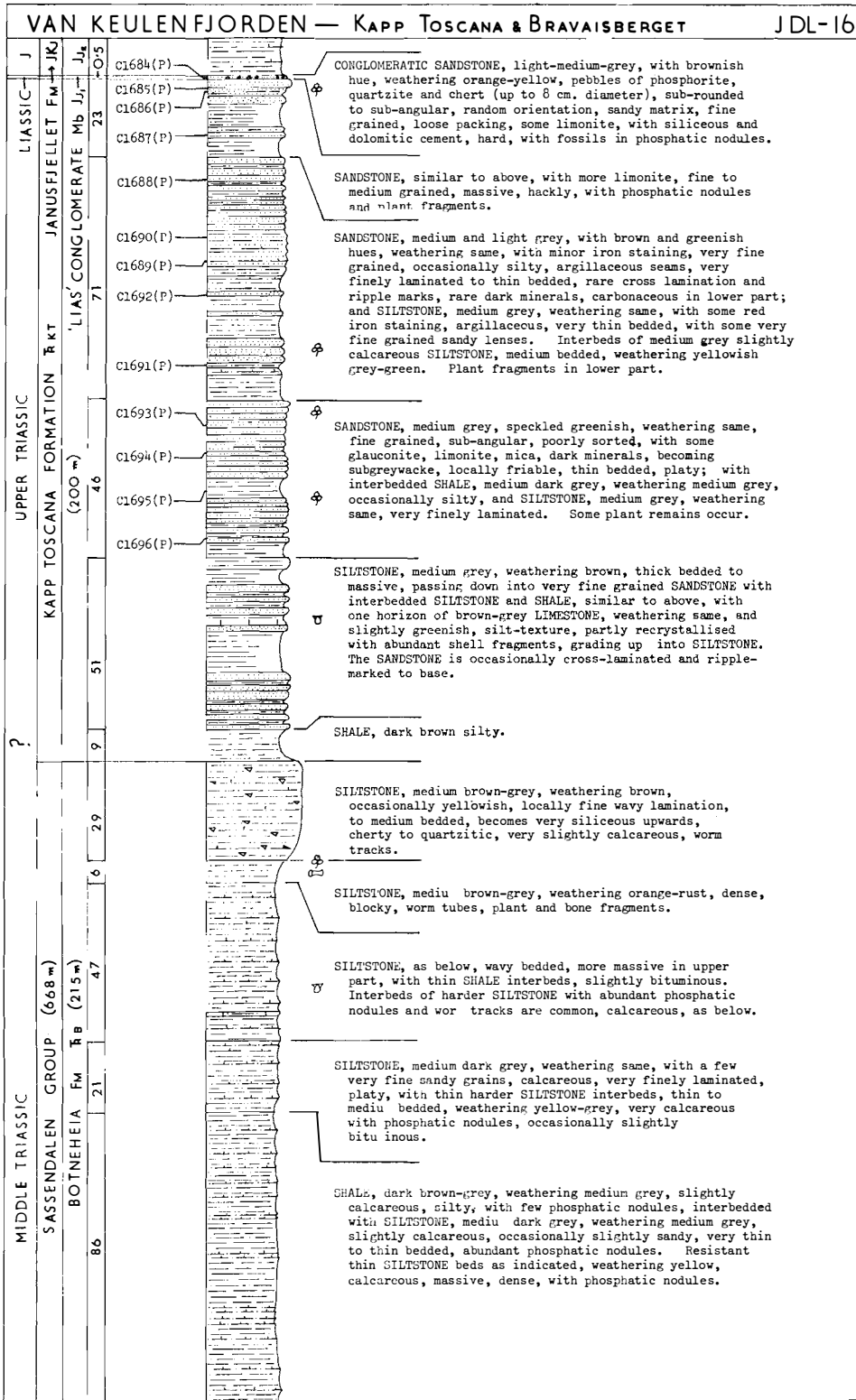


Fig. 17.





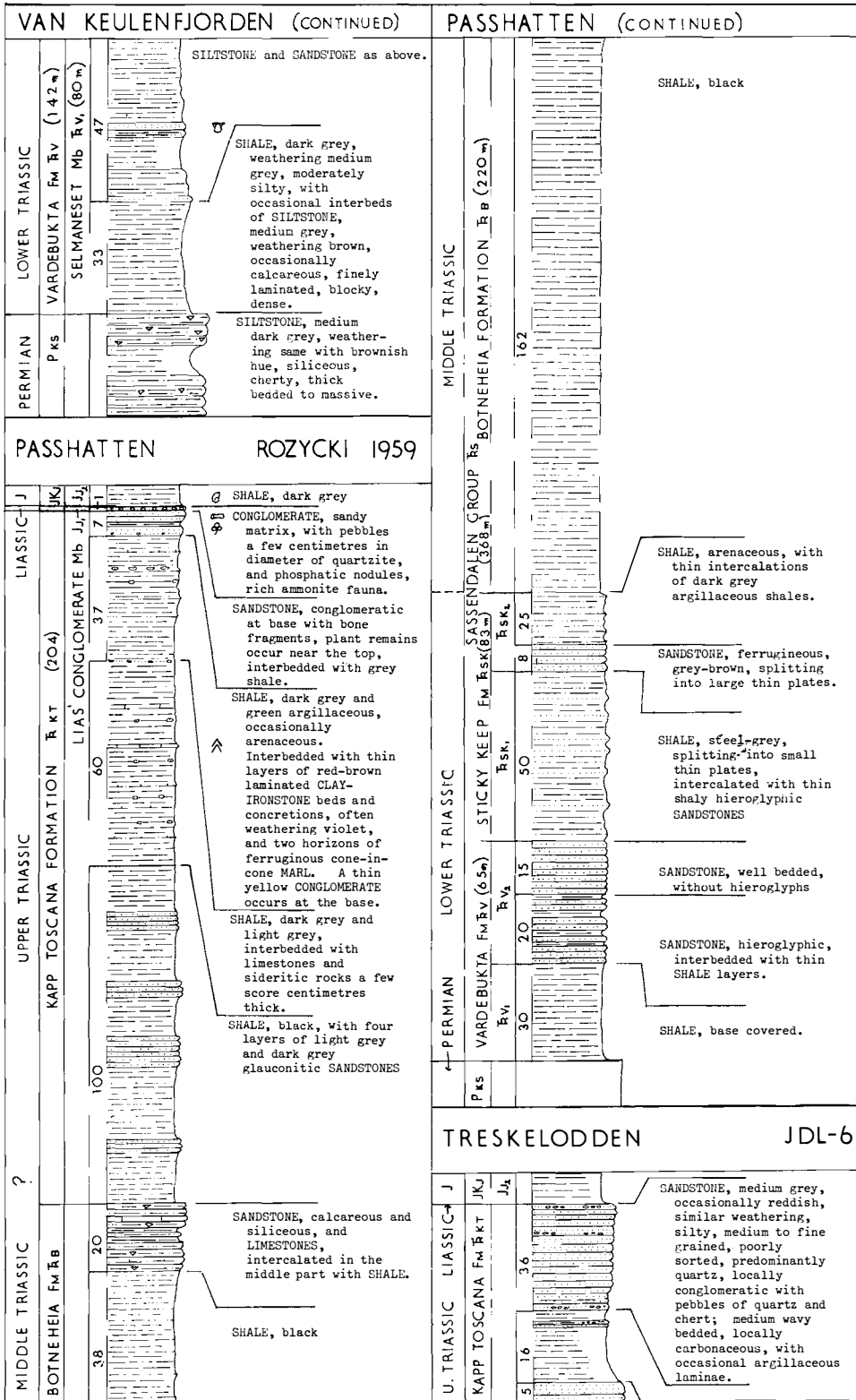


Fig. 20.

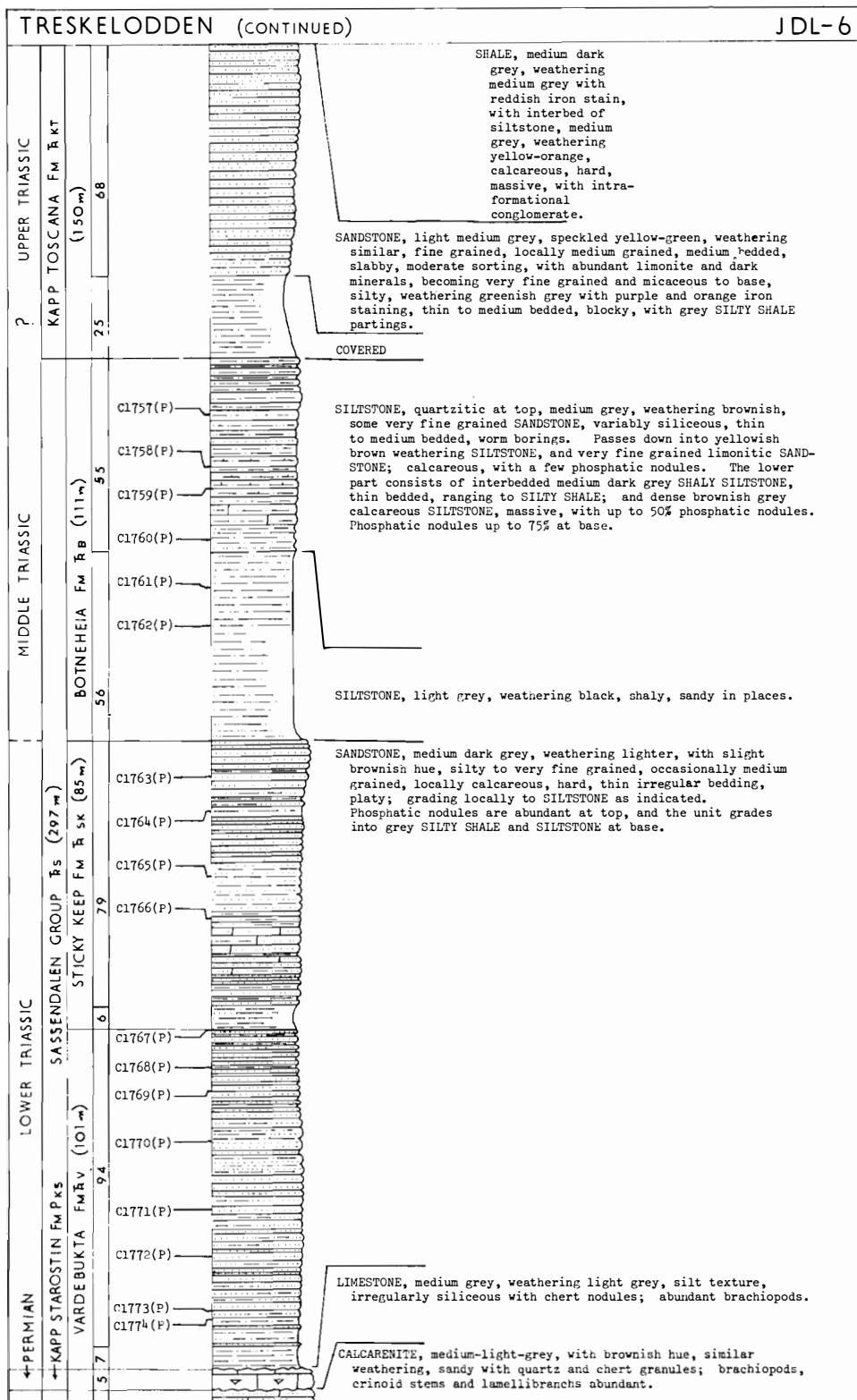


Fig. 21.









faults appear to have had a considerable effect on sedimentation. However, the suggestion that Mesozoic sedimentation was largely defined by the continuation of the Devonian graben (SOKOLOV 1964) does not appear to be supported by the available Triassic evidence.

The development of the various units away from the type sections in Norden-skiöld Land, Dickson Land, Festningen and Van Keulenfjorden is discussed below.

### *Oscar II Land*

One of us (A. C.) is preparing a structural account of this area in which the detail of the development of the Triassic and other rocks will be shown on maps and sections. Some of the place names below are mentioned for completeness but are not shown on Fig. 1.

The lower parts of the Sassendalen group occur to the north and in the east and west, while the higher parts of the group are seen only in the southern part of the area. The Kapp Toscana formation only occurs in the south-east of Oscar II Land (southern parts of Vermlandryggen, Dalslandfjella, Gestriklandkammen and Helsinglandryggen). The top of the Triassic is only seen in the extreme south. An almost complete undeformed sequence (upper part of Kapp Toscana formation missing) is seen in Bertilyggen and Lundbohm fjellet west of Ekmanfjorden, and also east of the boundary overthrust. In this area the Sassendalen group is divided into its three formations and the Kapp Toscana formation into two members. The increase in thickness from Ekmanfjorden to the central area with a slight lithological change, i.e. from the Nordfjorden block to the Isfjorden basin, is perhaps in part controlled by a fault line. The most northerly undoubted Triassic rocks occur in Gjerstadvjellet but the Vardebukta formation may occur in Brøggerhalvøya below the Tertiary unconformity.

### *Western Sørkapp Land*

Triassic rocks continue south from Treskelodden, as a narrow strip in the overthrust zone, to Keilhaufjellet (FREBOLD 1930 b p. 11; marked by ORVIN 1940 pl. 1, and by MAJOR and WINSNES 1955 fig. 1). At Treskelodden they rest on a thin representative of the Kapp Starostin formation (Figs. 20–21) and south of this on Carboniferous rocks. At Keilhaufjellet no base is seen but at Kistefjellet (Fig. 22) the Triassic rests unconformably on the Hecla Hoek (FREBOLD 1930 b). The outliers west of the overthrust zone, marked by MAJOR and WINSNES (1955 Fig. 1) and SIEDLECKI (1960 p. 94 Fig. 1), rest unconformably on lower Carboniferous and Hecla Hoek rocks. The section is very thin (175 m at Kistefjellet) but both the Sassendalen group and the Kapp Toscana formation appear to be represented. The normal faulting which affects these deposits and their thinness are probably related to movements on the Hornsund fault belt.

### *Nordautlandet*

The Triassic rocks in the south-western part of the island have been described by THOMSON (1953), but no thicknesses are given. J. L. CUTBILL (private comm.) suggested that a thin representative of the Sassendalen group is present (150 m) consisting mainly of shale. The upper cliff-forming shales are recognizable but

less distinctive. The Kapp Toscana formation above is mainly shale. No top is seen though SANDFORD (in THOMSON 1953) recorded possible Jurassic rocks (see Part II above).

### *Barentsøya and Edgeøya*

Both islands show a flat-lying but slightly warped and anticlinal sequence of the upper part of the Sassendalen group and a large part of the Kapp Toscana formation. Permian rocks have been reported from the east coast of Barentsøya (BUROV *et al.* 1964) and two Permian inliers on Edgeøya (KING 1964) but no details have been given. Small Jurassic outliers are found on Kvalpyntfjellet and at Negerpynten (WITTENBURG 1910). FALCON (1928) recorded an unconformity at Kvalpyntfjellet between his 'Purple Shale group' (= Tschermakfjellet member) and his 'Upper Sandstone group' (= De Geerdalen member), and thought that the former was absent south of Tjuvfjorden. ORVIN (1940 p. 31) mentioned this unconformity but correlated it with that at the base of the Triassic section on Kistefjellet, placing all the Triassic exposed there in the Upper Triassic. This correlation has been discounted on the present interpretation of the Kistefjellet section (see Fig. 22); the unconformity at Kvalpyntfjellet may be large scale crossbedding (see photograph in FALCON 1928).

As a result of recent Soviet work on Edgeøya an outline section of the Triassic rocks there has appeared (KLUBOV 1964). At least 700 metres of strata are exposed, the most notable feature being the thick development of sandstones at the top of the sequence (see Fig. 25).

The rocks on the west side of Barentsøya were described by TYRRELL (1933).

### *Kong Karls Land*

NATHORST (1901, 1910) reported no Triassic rocks, but ORVIN (1940 pl. 1) marked Trias as occurring beneath the Quaternary cover marked on NATHORST's maps. This may be correct since the lowest Jurassic rocks yield fossils older than any Jurassic known in Vestspitsbergen (POMPECKJ 1899).

### *Hopen*

Geological observations on the island of Hopen were made by WERENSKIOLD, HÖEG and BODYLEVSKY (in IVERSON 1926), and although HÖEG suggested an Upper Triassic age from plant materials BODYLEVSKY, on determination of a few bivalves, and NATHORST, on plant material collected by PRINCE ALBERT OF MONACO in 1898 (NATHORST quoted by WERENSKIOLD in IVERSON 1926), agreed on a Cretaceous age for the rocks. MAJOR *et al.* (1956) recorded only Jurassic - Cretaceous strata from Hopen.

### *Bjørnøya*

Triassic rocks occur on Miseryfjellet overlying the *Spirifer* limestone, and have been described by ANDERSSON (1900), BÖHM (1899, 1903), and HORN and ORVIN (1928). No fossils were found in the lower 126 m which appear to correlate with the Sassendalen group. The shale and *Myophoria* sandstone above this correlate with the Kapp Toscana formation.

## IV. DISCUSSION

### Palaeontological age

This summary is based on the extensive palaeontological literature referring to the Triassic of Spitsbergen and on the provisional identifications of specimens collected by the Cambridge expeditions.

Zonal schemes for the Triassic are given in SPATH (1934) and KUMMEL (1957) but for convenience the commonly used divisions of the Lower Triassic are tabulated below (see TOZER 1961 b). See also page 93.

Upper Scythian	}	Prohungaritan
		Columbitan
		Owenitan
Lower Scythian	}	Flemingitan
		Gyronitan
		Otoceratan

#### *Lower Triassic – Scythian*

The lowest formation of the Sassendalen group was originally believed to be either of Permian or Triassic age since no distinctive fauna had been found. The beds are very poorly fossiliferous, especially near the base (Selmaneset Member), and FREBOLD (1929 b, p. 10) was the first to record Triassic fossils from these strata, at Aldegondabreen, south of Festningen. Poorly preserved bivalves have since been found at Festningen. DINELEY (1958, p. 214), however, suggested that in the St. Jonsfjorden area, the shales above the Tempelfjorden group (= Brachiopod chert of DINELEY 1958, p. 213), termed by him the "Wittenburg facies", were either Lower Permian or Triassic in age, but gave no explanation. This doubt as to the age of the lowest Triassic was also shown in Arctic Canada (FORTIER *et al.*, 1963) in a similar situation, but these beds are now known to be of Lower Scythian age (see below). During the course of the mapping of the Vardebukta Formation from Trygghamna to north of St. Jonsfjorden by one of us (A.C.) it has been found that DINELEY's vast thickness of "Wittenburg facies" is due to repeated recumbent folds in the Vardebukta and Sticky Keep formations. Although not precisely identifiable, bivalves from the Selmaneset member at

Selmaneset were considered by E. T. TOZER (private communication) to be Triassic. The lowest specimen was from only 12 m above the top of the Permian. The bivalves identified from Festningen included *Claraia* cf. *stachei* BITTNER (FREBOLD, in HOEL and ORVIN, 1937), 38 m above the top of the Permian. The Lower Scythian ammonite? *Ophiceras* (FREBOLD, 1929 b, p. 10) was identified from Aldegondabreen. In 1963, on the east side of Osbornebreen (Oscar II Land), M. D. SEYMOUR of the Cambridge Spitsbergen Expedition found one poorly preserved ammonite in shales 20 m above the top of the Kapp Starostin formation. This has been provisionally identified as *Proptychites* cf. *rosenkrantzi* SPATH of Lower Scythian age.

In East Greenland a well developed Lower Scythian ammonite fauna occurs, characterized by *Proptychites*, *Ophiceras* and *Otoceras*, and was described by SPATH (1930). This has since been found, although less well developed, in the rocks previously thought to be of either Permian or Triassic age (TOZER, 1961 b) in Arctic Canada. The meagre Spitsbergen records given above are definitely Triassic and most probably represent a poorly developed Lower Scythian fauna comparable with East Greenland and Arctic Canada.

Above the lower poorly fossiliferous shales of the Selmaneset member, the sandstones and shelly limestones of the upper part of the Selmaneset member and of the Siksaken member contain a better preserved bivalve fauna with *Myalina de geeri* LUNDGREN and *Anodontophora breviformis* SPATH (see FREBOLD, 1936, pp. 317–325 and FREBOLD, 1939, pp. 39–40). This fauna occurs especially in the *Myalina* shale of LUNDGREN (1887) which was regarded by FREBOLD (loc. cit. and 1935, 1951) as being of Lower Scythian age and equivalent to the upper part of the Lower Scythian of East Greenland. This agrees with KUMMEL (1961) and TOZER (1961 b, p. 31) who put the higher *Arctoceras* fauna into the Owenitan division of SPATH (1934) at the base of the Upper Scythian.

SPATH (1921) recorded from his "*Anasibirites* horizon" (equivalent to the *Goniodiscus nodosus* horizon of FREBOLD (1930 a) and the Lowest Nodule Bed of GREGORY (1921), and probably occurring in the lower part of the Sticky Keep formation in Sassendalen) an ammonoid fauna of *Xenocelites*, *Gurleyites* (formerly *Anasibirites*) and *Arctopriionites* (formerly *Goniodiscus*). SPATH (1930, p. 82) and FREBOLD (1930 a, p. 33) placed this fauna, together with *Wasatchites* and *Euflemingites*, below the higher fauna with *Arctoceras* (especially *Arctoceras blomstrandii* (LINDSTRÖM)) and *Prospiringites* occurring in the *Arctoceras* layers of STOLLEY (1911) and *Posidonomya* layer of NATHORST (1910) (equivalents of the Sticky Keep formation: see FREBOLD 1929 a, pp. 297–298). Both faunas are placed at the top of the Scythian. TOZER (1961 b, pp. 30–31) regarded both faunas above as equivalent to the *Meekoceras* and *Wasatchites* faunas of northern Canada, of Owenitan age. Although both SPATH and FREBOLD believed *Wasatchites* to occur below *Arctoceras*, the reverse appears to be true in Arctic Canada, and KUMMEL (1961) placed the Spitsbergen Arctoceratid fauna in the same lowermost Upper Scythian Owenitan division.

Above the *Arctoceras* fauna in Spitsbergen, from the *Grippia* beds (*Grippia* Niveau of WIMAN, 1928) and the Lower Saurian Niveau (WIMAN, 1910 b, p. 126–128), FREBOLD (1931, p. 32) described a fauna of *Keyserlingites* and *Svalbardiceras*,

these beds correlating with the upper part of the Sticky Keep formation. The fauna probably represents the Prohunganitan division of the Upper Scythian. The Columbitan division is not represented and in Arctic Canada is also absent.

It would thus seem that in Spitsbergen the Lower Scythian is represented by a poorly preserved marine fauna, restricted to the Vardebukta formation, and the Upper Scythian by the common Arctic *Arctoceras* fauna, together with a higher *Keyserlingites-Svalbardiceras* fauna in the Sticky Keep formation. (The Upper Scythian may possibly include the upper part of the Vardebukta formation.)

There are no records of undoubted Anisian fossils from the Sticky Keep formation and the sharp lithological change between this and the Botneheia formation above probably represents a break in sedimentation and a time interval between the Scythian and Anisian, as in Arctic Canada (see TOZER, 1961 b).

#### *Middle Triassic, Anisian-Ladinian*

The Botneheia formation everywhere contains two lower ammonoid faunas of *Gymnotoceras* and *Eutomoceras*<sup>1</sup> with *Koptoceras* and *Daonella* locally, and an upper *Parapopanoceras* and *Ptychites* fauna, including *Ptychites* sp. cf. *P. trochlaeformis*; these have been described by many authors (see FREBOLD, 1935, 1951). No division into two faunas of *Parapopanoceras* with *Ptychites* sp. cf. *P. trochlaeformis*, and *Daonella frami* KITTL with *Ptychites nanuk* TOZER as in Arctic Canada (TOZER, 1961 b, p. 33–34) has been possible from the identifications given on the Cambridge sections. However, *Daonella frami* KITTL has been identified from various horizons and frequently occurs in quantity near the top of the cliff-forming shales. Subsequent collecting has resulted in the discovery of a *Parapopanoceras* fauna below the *Ptychites* fauna on Vikinghøgda and this may represent a twofold division.

All previous authors regarded the *Parapopanoceras* – *Ptychites*, and *Gymnotoceras* – *Eutomoceras* faunas as Anisian (see FREBOLD, 1935) and no Ladinian is recorded (see HARLAND, 1961), but TOZER (1961 b p. 33–34) has referred the *Daonella frami* fauna to the Anisian or Ladinian. It would thus seem that the Botneheia formation is of Anisian age, transitional to the Ladinian in the upper part.

In the Tschermakfjellet member of the Kapp Toscana formation which is found in the eastern outcrop belt, and its equivalents elsewhere, a well developed ammonoid fauna with *Nathorstites* predominates. This fauna also occurs in Bjørnøya, where it was regarded by BÖHM (1903) as Carnian on the basis of poorly preserved specimens referred to *Clionitites* [*Clionites*] and *Trachyceras*. This dating was accepted by FREBOLD (1929 a and b) and other authors, but TOZER (1961 b, p. 35), following the work of MCLEARN for the similar *Nathorstites* beds of Canada (in TOZER, 1961 b), considered that this fauna was of Ladinian age. This dating has been followed in our sections. TOZER (1961 b, p. 36), however, recorded *Halobia zitteli* LINDSTRÖM as occurring above the *Nathorstites* beds in Arctic Canada and referred this to the Carnian. *Halobia zitteli* has been recorded

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<sup>1</sup> The two faunas are incorrectly inverted in the tables in FREBOLD 1951 p. 76 and HARLAND 1961 p. 69, 103; see MAJOR *et al.* 1956 p. 35, 44.



in the Cambridge sections with *Nathorstites*, but always occurs above or at the top of the *Nathorstites* bearing beds, and could represent a transition from Ladinian to Carnian.

### *Upper Triassic – Carnian, Norian and Rhaetian*

The base of the Carnian may be represented by *Halobia zitteli* (see above) from the upper part of the Tschermakfjellet member, but above this only the non-marine sandstones of the Kapp Toscana formation occur. There are no satisfactory records of Norian fossils from Spitsbergen and this stage may be represented by the continental middle and upper parts of the formation. Plant remains described by NATHORST (1910, 1913) and BÖHM (1912) from Kapp Toscana and Reinodden indicate a Rhaetian age for the uppermost beds of the formation in this area. Plant-bearing sandstones with occasional coal seams are common throughout Vestspitsbergen and Edgeøya (see FALCON 1928, ORVIN 1940, ROZYCKI 1959) in the upper part of the Kapp Toscana formation, but marine incursions have been recorded from two localities. In southern Oscar II Land, blue-grey shales with clay-ironstone concretions containing poorly preserved bivalves occur. This is a similar lithology to the shales above the 'Lias' conglomerate on Ramfjellet but the fossils have not been identified. Shelly limestones are also recorded from the upper part of the Kapp Toscana formation at Wilhelmøya.

The uppermost part of the Kapp Toscana formation may be entirely of Rhaetian age, but comparable continental sandstone sequences of similar age in East Greenland and Arctic Canada are believed to contain a flora of Rhaeto-Liassic age.

In East Greenland HARRIS (summary 1937, 1961) recorded from the Cape Stewart formation of southern Jameson Land and Scoresby Sound a Rhaeto-Liassic flora, containing a lower *Lepidopteris* zone of Rhaetian age, and an upper *Thaumatopteris* zone of Hettangian age (see also CALLOMON 1961, p. 261). The Cape Stewart formation is overlain by sandstones and shales of the Neill Klintner formation of Pliensbachian and Toarcian age (CALLOMON 1961). The Sinemurian may also be present in the upper part of the Cape Stewart formation. This division of floral zones is directly comparable with the Rhaeto-Liassic floras of Sweden and other parts of Europe (HARRIS 1961).

ROZYCKI (1959 p. 66) considered that since the determination of the flora from Bellsund (NATHORST 1910, 1913) was based on comparison with the Scanian flora and that this has since been re-interpreted as a Rhaeto-Liassic flora, it is possible that the upper part of the Kapp Toscana formation may be lower Liassic in age. On the other hand, PCHELINA and her co-workers at the Institute for the Geology of the Arctic, Leningrad, have suggested (private communication) a pre-Rhaetian age for a macro-flora collected from the Upper Triassic of Sassendalen.

TOZER (1961 a p. 392) considered that the upper part of the mainly non-marine Heiberg formation of the Sverdrup basin of Arctic Canada with plant bearing sandstones and thin coal seams (very similar in lithology and age to the Kapp Toscana formation) may possibly be of Rhaeto-Liassic age. Above the Heiberg formation, the lower parts of the Savik (shales facies) and Wilkie Point (sand

facies) formations contain fossils identified as Toarcian by FREBOLD. Thus the Heiberg formation is definitely pre-Toarcian and possibly pre-Sinemurian since fossils of this age are recorded from the Borden Island formation on Borden Island (TOZER 1961 a). It would seem possible that the upper part of the Kapp Toscana formation previously referred to the Rhaetian may prove to be lower Liassic in part but owing to the present lack of definite evidence, the Kapp Toscana formation is here left within the Triassic.

The above discussion may be summarized as follows –

Kapp Toscana formation	{ ? Liassic ? Rhaetian
De Geerdalen member	
Tschermakfjellet member	{ ? Carnian Ladinian
Botneheia formation	{ ? Ladinian Anisian
Sticky Keep formation	U. Scythian
Vardebukta formation	L. Scythian

### Permian — Triassic boundary

With the exception of western Sørkapp Land, Triassic rocks everywhere overlie the Permian Tempelfjorden group without apparent unconformity. There is a very sharp break of lithology, colour and especially hardness at the contact, which probably marks an interval of non-deposition or marine regression. No conglomerates have ever been found at the base of the Triassic. In some cases it is possible that the Lower Triassic rests on various horizons of the Kapp Starostin formation but since a facies change occurs in the latter this is difficult to determine. No evidence of erosion is seen on the upper surface.

In Sørkapp Land, however, the Triassic rocks lie unconformably on progressively older rocks towards the south; at Treskelodden only a few metres of Tempelfjorden group remain while at Kistefjellet the Triassic rests on Hecla Hoek.

The Permian–Triassic boundary thus represents a non-sequence or gently undulating unconformity on a large scale with a local unconformity in the south.

### Triassic — Jurassic boundary

Everywhere, with the exception of a narrow zone along the Inland Fault Belt (ORVIN 1940) south from Sassenfjorden where the Jurassic part of the Janusfjellet formation and, in places, the Kapp Toscana formation are absent, the

'Lias' conglomerate of the Janusfjellet formation overlies the Kapp Toscana formation.

The Middle and Upper Toarcian beds, now included in the 'Lias' conglomerate, probably represent an original deposit which was removed and redeposited as a phosphatic conglomerate before the Bathonian–Callovian transgression. It is not known how much of the Kapp Toscana formation was removed prior to this transgression, but there is little evidence of angular unconformity between the 'Lias' conglomerate and Kapp Toscana formation.

### **Facies**

The Triassic rocks in Spitsbergen have, in common with the whole Mesozoic succession, a preponderance of marine shales and siltstones, with continental sandstones in the upper part, and suggest a platform or epeirogenic environment of deposition. The lower part of the Sassendalen group consists of fine grained flaggy sandstones, probably formed under shallow water marine conditions, with interbedded shales and siltstones and contains a sparse fauna of bivalves and ammonites. This is followed by the main marine shale sequence which continues into the lower part of the Kapp Toscana formation. The dominant rock type is thin-bedded grey to black bituminous shale and harder, yellow-weathering siltstones are common; the upper part is characterized by the occurrence of red weathering clay ironstone nodules. Fossils are fairly abundant, ammonites, bivalves and vertebrates being the most common, and the facies as a whole is reminiscent of parts of the Liassic rocks of Britain (LAMPLUGH 1910). The upper non-marine sequence is of grey-green, flaggy, cross-bedded sandstones alternating with sandy shales. Thin coal seams and frequent plant remains are present and suggest deposition under lagoonal or continental conditions.

Recorded macrofossils are listed in the palaeontological index in Part V below. The nature of the palaeontological facies is indicated by numbers of species entries as follows:

Plantae, 4; Echinodermata, 5; Brachiopoda, 28; Bivalvia, 146; Gastropoda, 13; Scaphopoda, 2; Cephalopoda, 134; Crustacea, 3; Vertebrata, 67. The vertebrates consist mostly of fish and (marine) saurians. The latter fossils, at least, appear to be more abundant in distinctive horizons.

The widespread silts, often with disseminated carbonaceous plant material, first suggested that a rich palynological assemblage might be obtained and, in view of the rich Lower Carboniferous assemblage found to the north of the Mesozoic basin, this was sought for some years. N. F. HUGHES, who has investigated our samples, commented (private communication) that the most useful palynological samples come from Wilhelmøya where high Triassic assemblages are indicated, and that distinguishable spores have also been obtained from the (?) Upper Triassic of the Sticky Keep section. These studies have not been completed but the dearth of spores in the main Mesozoic and Tertiary basin excites curiosity. N. F. HUGHES has suggested (private communication) that this could be due to diagenesis resulting from the superincumbent load of Mesozoic

and Tertiary rocks, or to mild metamorphic effects of Mesozoic dolerite intrusion, or even to later thrusting and folding. Even in the Tertiary rocks spore extraction has proved to be somewhat difficult (MANUM 1962). The rank of coal fragments is too high for successful extraction of spores. The plentiful small organic fragments, probably of wood or cuticle, were generally unrecognizable. Partly from the occurrence of some pollen samples N. F. HUGHES postulated that deposition was rather far from the shoreline at most times, in a basin of restricted marine connections but with a large supply of organic material. Although Triassic coal seams have been reported by trappers (ORVIN 1940) there is no reliable record of any occurrence of economic importance.

FALCON (1928) was the first to record the presence of bitumen in the Triassic rocks of Edgeøya. The only published details to amplify this come from the investigations of the Leningrad geologists and as their preliminary report may not be generally available the main information which comes from Edgeøya (KLUBOV 1964) is repeated here in full:

“Abundant viscous bitumen and drops of semi-fluid oil occur in the limestone lenses of the Ladinian argillites near Kapp Lee. In 220 (out of 260) characteristic Upper Triassic specimens collected in 1962 from Edgeøya, the amount of Bitumen A present (as extracted by chloroform) was found to be between 0.01 and 0.1 %. The bulk of the bitumen has a secondary origin.”  
(Translated by J. L. CUTBILL.)

With regard to Vestspitsbergen, PCHELINA (1964) remarked that the rocks of the Olenekian Stage (Upper Scythian approximately) and of the Middle Triassic are bituminous.

### **Comparison with other Arctic successions**

FREBOLD (1935, 1951) compared the Spitsbergen Triassic rocks with similar rocks in other parts of the European Arctic. Since then much literature has been published, especially concerning Greenland, the Canadian Arctic, Franz Joseph Land and Northern Siberia. The principal features of these successions are shown in Fig. 26.

#### *Arctic Canada*

In the Sverdrup Basin of Arctic Canada a striking parallel development of Triassic rocks with those of Spitsbergen is seen. The Arctic Canadian rocks were described recently by TOZER (1961 a & b, 1963), FORTIER *et al.* (1963) and DOUGLAS *et al.* (1963); a brief summary is given below with comparison to Spitsbergen.

A threefold division of Triassic rocks in the Sverdrup basin was made by TOZER. The lower division consists of the mainly non-marine sandstone conglomerate Bjorne formation of the basin margin and the equivalent marine shale-siltstone Blind Fjord formation of the basin proper. A similar state exists in the middle division with the marginal marine calcareous siltstone-sandstone Schei Point formation being equivalent to the massive grey and black shale-siltstone and calcareous siltstone Blaa Mountain formation in the basin. The upper division, the mainly non-marine Heiberg formation, occurs throughout. TOZER (1961 b,

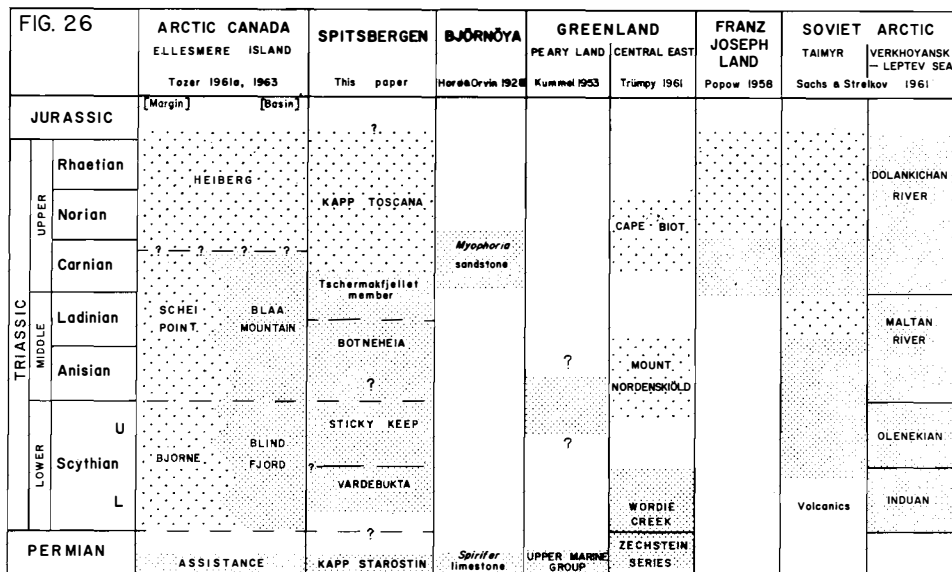


Fig. 26. Correlation chart to show the development of the Triassic rocks of the Arctic. Close stipple indicates marine facies and open stipple indicates non-marine or lagoonal facies.

p. 8) described the Bjorne/Schei Point and equivalent Blind Fjord/Blaa Mountain junction as marking an abrupt change of lithology and marking a time horizon between the Anisian and Scythian (but see below). Scythian fossils occur up to the top of the Blind Fjord formation, but the Bjorne formation is very poorly fossiliferous, containing only bivalves. The Blind Fjord formation itself is poorly fossiliferous but contains occasional horizons with well preserved lower and upper Scythian faunas (see TOZER, 1961 b).

Thicknesses in Arctic Canada are much greater than in Spitsbergen as indeed is the whole succession in the Sverdrup basin. In Spitsbergen, the Vardebukta formation correlates extremely well in lithology and age with the lower part of the Blind Fjord formation, but has a higher sandstone content and a poor ammonite fauna. It would appear to be transitional to the Bjorne formation lithology which contains only bivalves. The Sticky Keep formation in Spitsbergen would correlate with the upper part of the Blind Fjord formation, its upper contact with the Botneheia formation representing the Anisian/Scythian boundary as in Canada. Although Anisian faunas occur immediately above the Blind Fjord/Blaa Mountain junction in most localities (TOZER, 1961 b), TOZER (1963 Table 1) considered the base of the Blaa Mountain formation in northern Axel Heiberg Island and north-western Ellesmere Island to be Upper Scythian.

The Blaa Mountain and equivalent Schei Point formations contain faunas varying in age from Anisian to Carnian. In Spitsbergen, comparable lithologies and faunas are found in the Botneheia formation and the lower Kapp Toscana formation (Tschermakfjellet member). Phosphatic nodules are common in the lower Schei Point formation and red concretions with *Halobia* in the Middle Shale member of the Blaa Mountain formation. However, the higher Carnian faunas found in both formations in Canada are not found in Spitsbergen. The

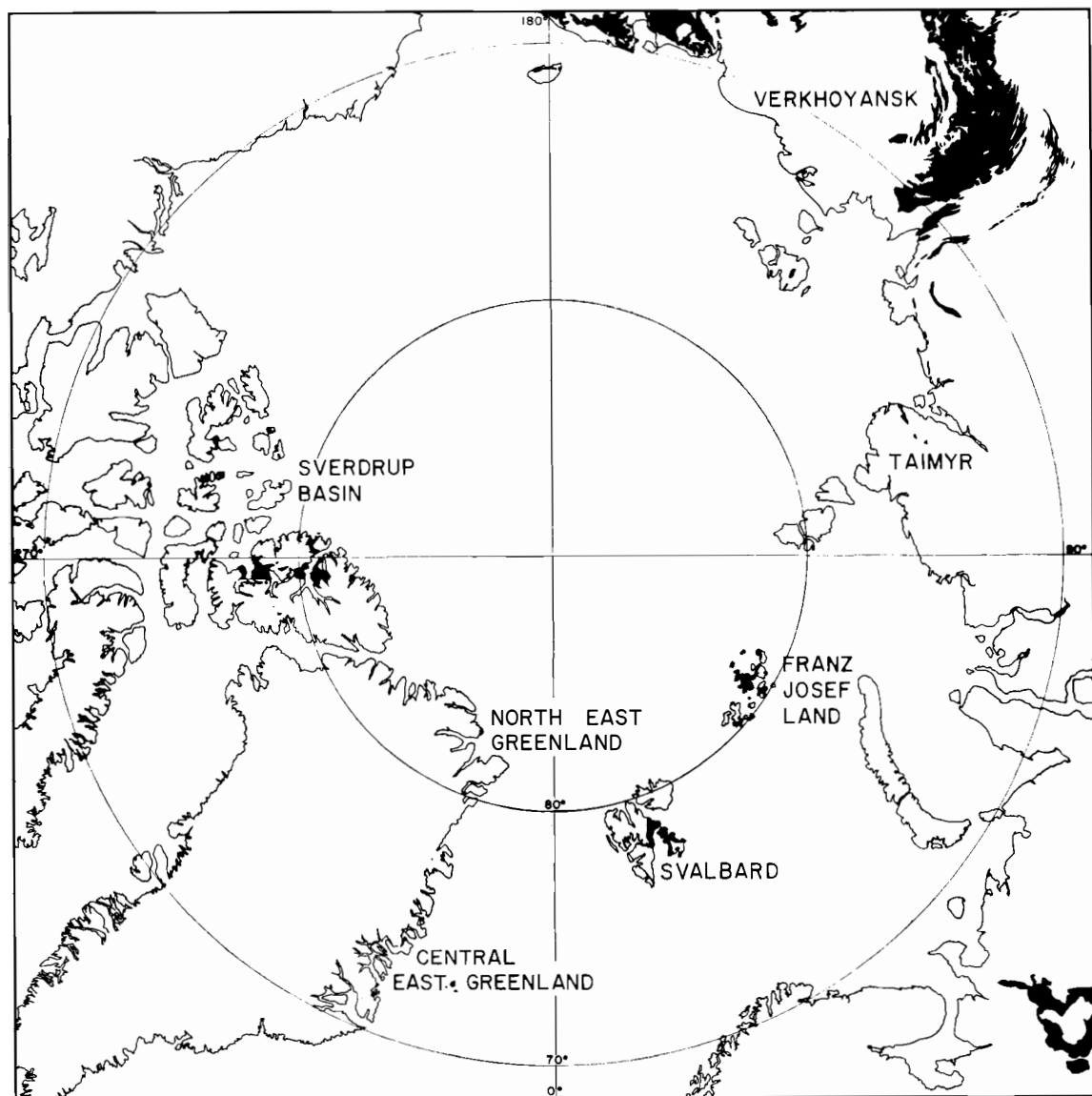


Fig. 27. Map of the Arctic showing the principal outcrops of Triassic sedimentary rocks; based on the Geological map of the Arctic prepared by the First International Symposium on Arctic Geology, 1960.

non-marine Heiberg formation of Canada has a transitional junction with the Blaa Mountain/Schei Point formations below but contains marine fossils in red clay-ironstone concretions in the lower part (TOZER, 1961 b, p. 25). No exact correlation of the Blaa Mountain/Schei Point and Heiberg formations with the Botneheia and Kapp Toscana formations of Spitsbergen is possible, but an interesting similarity in faunas and lithologies occurs. In Arctic Canada the Heiberg formation is transitional, and interdigitates with the upper member of the Blaa Mountain Formation. Although the section in Spitsbergen is much thinner, a similar situation is found and it is possible that the non-marine parts

of the Kapp Toscana formation (De Geerdalen member), interdigitating with the marine Tschermakfjellet member, may represent the same conditions as the Heiberg formation. However, the non-marine sequence in Spitsbergen begins much earlier and the upper members of the Blaa Mountain formation have non-marine equivalents in Spitsbergen. A similar Rhaetian or Rhaeto-Liassic flora exists at the top of both Heiberg and Kapp Toscana formations. The upper marine development in Spitsbergen probably represents a facies variation to the north-east as the unit passes from non-marine sandstone to marine shale. The marker horizon at the top of the Botneheia formation, which probably represents a time horizon in Spitsbergen, has no parallel in Canada but is probably equivalent in age to the lower boundary of the Lower Calcareous member of the Blaa Mountain formation (see TOZER, 1963, table 1, and 1961 b, fig. 6). The Triassic/Jurassic, and Triassic/Permian contacts are extremely well marked in both Arctic Canada and Spitsbergen and probably represent time horizons. In the south of Spitsbergen, the sandy facies of the Sassendalen group at Treskelodden and Kistefjellet can be compared to the Bjorne/Schei Point transition, but the variation eastwards to shale represents a local Spitsbergen change, as does the variation in the Kapp Toscana formation above.

#### *North Greenland*

630 metres of Triassic rocks in east Peary Land were investigated by J. C. TROELSEN in 1948-9 and contain, in the lower part, a fish fauna regarded by E. NIELSEN as equivalent to that of the Lower Triassic of Spitsbergen. The upper part of the succession contains an ammonite fauna (KUMMEL 1953) with *Pearylandites troelseni* KUMMEL, *Groenlandites nielseni* KUMMEL, *Parapopanoceras* cf. *P. tetsa* McLEARN, *Beyrichites* cf. *B. affinis* (MOJSISOVICS), and *Leiophyllites* sp. These faunas range at least from Upper Scythian to Anisian and show very close affinities with Spitsbergen.

#### *East Greenland*

TRÜMPY (1961) noted the contrast between the Triassic successions of East Greenland and those of all other Arctic lands. In Central East Greenland, a small basin of deposition with marine connections appears to have persisted across the Permian-Triassic boundary and some of the oldest Triassic faunas are known from here.

This lowest marine deposit, first described at Kapp Stosch and known as the Wordie Creek formation, is rich in ammonites (*Glyptophiceras*, *Ophiceras*, *Vishnmites* etc.). It is of lowest Lower Scythian age. It is overlain by the Mount Nordenskiöld formation of reddish (and grey) sandstones, silts and arkosic and gypsiferous rocks with a marine member near the top. TRÜMPY compared this to the British Bunter and it could be in part Anisian. Above is the Cape Biot formation of red continental deposits similar to the British Keuper. The ages of these two higher red formations are only approximately known and they have no lithological parallel in Spitsbergen. The basin appears to have been supplied from land to the east as if neither the Greenland nor the Norwegian sea existed then.

### *Franz Josef Land*

Although older accounts mention only Jurassic and Cretaceous rocks, POPOW (1958) recorded marine Carnian and this is overlain by a lagoonal-continental sequence of probable Norian to Lower Liassic age (SACHS and STRELKOV 1961).

### *Soviet Arctic mainland*

Whereas the Russian basins show predominantly continental successions analogous to the west European situation, the eastern half of the Taimyr peninsula and great areas of the Leptev Sea coast and Verkhoyansk contain many marine successions (SACHS and STRELKOV, 1961). West of the Lena River, volcanic facies are found at the base of the Triassic, followed by distinctive marine upper Induan marine faunas. Upper Scythian and Anisian are not so well represented and the Ladinian consists predominantly of continental beds. Marine Carnian was followed by lagoonal facies of Norian and Rhaetian age. East of the Lena River, in Verkhoyansk, at a greater distance from Spitsbergen, the Scythian succession is represented by a relatively complete marine succession, divided into the Olenekian stage above and the Induan below, each well defined by ammonite zones, and this succession may eventually provide one of the principal standards for correlation. However, the definitions of these stages, as used by SACHS and STRELKOV (see Fig. 26), have been modified in a new scheme for the Lower Triassic by KIPARISOVA and POPOW (abstract 1964). In this the *Flemingites* zone is including within the *Owenites* zone, the boundary between the two stages being put between the *Gyronites* zone and the extended *Owenites* zone and not between the *Flemingites* zone and the old *Owenites* zone as previously.

## **Location of Spitsbergen in Triassic time**

The remarkable similarity of Triassic, and indeed of late Palaeozoic and Mesozoic, stratigraphy in Spitsbergen, the Canadian Arctic, and Peary Land, coupled with the dissimilarity of these areas with central East Greenland, led one of us (HARLAND, in press) to suggest a position for Spitsbergen to the north and east of Greenland almost adjacent to Ellesmere Island. This reconstruction depends on Greenland being relatively further south, in contact with Labrador. This is similar in some respects to other hypothesis of continental drift. The other arguments for this exact position, and the earlier and later events which moved Spitsbergen first away from near its present position relative to Greenland and then back again, will not be repeated.

This hypothesis shares with others the postulation of an open Arctic Ocean basin, even though the northward continuation of the Atlantic Ocean was probably then closed. Throughout the Arctic areas marine conditions prevailed until Norian and Rhaetian time, when non-marine sandstones, shales and coals were formed.

The Triassic palaeolatitude of Spitsbergen has not been determined directly by palaeomagnetic work, as no suitable rocks have been found. However, in Greenland, the Cape Biot formation served this purpose well, as did the Eo-Triassic, and results from there proved sufficiently consistent with those from Europe and America to hazard a guess as to the contemporary position of Spitsbergen.

Palaeomagnetic determinations in East Greenland (BIDGOOD and HARLAND,



1961) suggested a shift of pole, between Lower and Middle to Upper Triassic, from 61°N 179°E to 72°N 150°E with an inclination changing from 64° to 71°. This implies palaeolatitudes of 45° and 56°. Spitsbergen, on the above reconstruction, would have been say, 12–13° further north, which gives Spitsbergen palaeolatitudes from Lower to Middle and Upper Trias of 57° increasing to 68°N. It is not suggested that this method has an accuracy which could distinguish reliably such a movement within a period, but this postulated movement lies in the curve obtained from older and younger rocks generally, and may be useful as an initial postulate. Extrapolation from palaeolatitude maps of Europe (IRVING 1964) would suggest that the Triassic latitude of Spitsbergen was still lower, possibly between 40° and 50°N.

### Oil prospects

International interest in the possibility of oil in Spitsbergen has already given rise to recent expeditions by four or five groups. The Cambridge work has not been directly concerned with this and little has yet been published on these aspects of Spitsbergen geology (e.g. KING 1964, SOKOLOV 1964). Some basic observations may however be useful.

- (1) The palaeolatitude of Spitsbergen from Upper Palaeozoic through Mesozoic time (see above) would certainly lead to the expectation of suitable climates for the formation of marine oil bearing deposits.
- (2) Oil indications are well known from Triassic rocks (NATHORST 1910, FALCON 1928, ORVIN 1940, PCHELINA 1964 and KLUBOV 1964) and this information is summarized in the section on facies above.
- (3) Within the Triassic succession, sandstones, especially in the Kapp Toscana formation, provide suitable reservoir rocks of medium permeability and porosity.
- (4) In much of the eastern area (e. g. Edgeøya) the Triassic rocks are deeply eroded (KLUBOV 1964), even to the Permian (KING 1964), which may limit the magnitude of Triassic prospects, but the shales of the lower Trias can act as a cap rock to the Palaeozoic sequence.
- (5) In the area of the main Tertiary basin, Triassic rocks are overlain by fine grained Jurassic and Cretaceous deposits quite adequate to prevent the escape of Triassic or older petroleum.
- (6) Much then depends on the structures in Mesozoic and Tertiary rocks, which is not the subject of this paper. It is clear however that the belt of intense Tertiary deformation west of the main Tertiary outcrop would preclude feasible prospects. On the other hand the structures immediately to the east of this belt (LIVSHITS 1964), which greatly diminish in intensity eastwards and are to some extent controlled by the main fault belts, are known to make further investigation desirable.
- (7) Permafrost generally extends down to a depth of 300 m except under large areas of water or ice.
- (8) In conclusion, investigation of some structures by drilling seems warranted<sup>1</sup> (e. g. SOKOLOV 1964).

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<sup>1</sup> The Cambridge Spitsbergen Expedition 1965 reported privately that American Overseas Petroleum Limited had arranged to begin drilling in the Bellsund area.

## V. INDEX TO SVALBARD TRIASSIC FOSSILS

This index has been compiled from the principal publications relating to the Triassic palaeontology of Svalbard, these being listed in the bibliography. In addition, provisional identifications (based on this literature) of the Cambridge collections are here included. The intention has been to provide, in readily accessible form, the geographical location and stratigraphical position of the material referred to in the index and so encourage its study and comparison. No critical palaeontological study has been made and this index is not presented as a contribution to systematic palaeontology. Thus the synonymies given here will be found to be quite incomplete, being taken only from the Svalbard literature referred to above. It has not been possible to extend this compilation to a wider literature and so make the synonymies exhaustive but this limited treatment can be justified as it provides a series of cross-references where none existed before and also effects some economy in the size of presentation of the index.

References in which the record of a particular fossil is merely quoted from previous work have in general been omitted. Thus the majority of the fossil lists in FREBOLD 1935 for instance are not indexed here.

Provisional identifications of the Cambridge collections have been made largely by reference to the Svalbard literature as listed in the bibliography. Consequently, although many new species may be present, only two species previously unrecorded from Svalbard have been recorded, namely *Pseudomonotis occidentalis* (WHITEAVES) and *Ptychites nanuk* TOZER. It is apparent that a detailed critical study of a large part of the Svalbard Triassic fauna is needed and the following index may provide a useful basis for this.

Abbreviations of stratigraphical units:

	Kapp Toscana formation	}	De Geerdalen member
	R <sub>KT</sub>		R <sub>KT<sub>2</sub></sub>
			Tschermakfjellet member
			R <sub>KT<sub>1</sub></sub>
	Botneheia formation	}	
	R <sub>B</sub>		
Sassendalen group	Sticky Keep formation	}	
R <sub>5</sub>	R <sub>SK</sub>		
	Vardebukta formation	}	
	R <sub>V</sub>		

## Plantae

### *Dadoxylon septentrionale* GOTHAN

GOTHAN 1910, p. 8, pl. 1, figs. 4–8, pl. 2, fig. 1. ⚭ KT<sub>2</sub>. Kapp Thordsen.

### *Equisetites* cf. *scanicus* STERNB.

NATHORST 1910, p. 359. Van Keulenfjorden.  
FREBOLD 1935. ⚭ KT<sub>2</sub>. Reinodden.

### *Nilssonia* ? sp.

NATHORST 1910, p. 359, Van Keulenfjorden.

### *Podozamites lanceolatus* L. and H.

NATHORST 1910, p. 359, Van Keulenfjorden.  
FREBOLD 1935. ⚭ KT<sub>2</sub>. Reinodden.

### *Pterophyllum* cf. *aequale* BRGN.

NATHORST 1910, p. 359. Van Keulenfjorden.  
FREBOLD 1935. ⚭ KT<sub>2</sub>. Reinodden.

### *Taeniopteris* sp.

NATHORST 1910, p. 359, Van Keulenfjorden.

## Echinodermata

### cf. *Aspidura raibliana* TOULA

ANDERSSON 1900. Bjørnøya.

### *Cidaris* sp.

ANDERSSON 1900. Bjørnøya. BÖHM 1903, p. 8, (a) pl. 1, figs. 4, 5; (b) pl. 1, fig. 2 (two forms).

### *Encrinurus* sp. indet.

LINDSTRÖM 1865, p. 8, pl. 1, figs. 14, 15.

### *Ophioderma* sp.

BÖHM 1903, p. 8, pl. 1, fig. 3. Bjørnøya.

### *Pentacrinus* sp.

ANDERSSON 1900. Bjørnøya. BÖHM 1903, p. 7, pl. 1, figs. 12, 13, 14.

## Brachiopoda

### *Aulacothyris* sp.

See *Terebratulata wittenburgi*  
FREBOLD

### *Crania lundgreni* ANDERSSON

ANDERSSON 1900, p. 266. Bjørnøya.

### *Crania tetrica* BÖHM

BÖHM 1903, p. 11, pl. 1, fig. 6. Urd.

### *Discina barentsi* BÖHM

BÖHM 1903, p. 10, pl. 1, figs. 10, 11. ⚭ KT<sub>1</sub>  
(*Myophoria* sandstone). Miseryfjellet.

### *Discina spitzbergensis* LUNDGREN

See *Orbiculoidea spitzbergensis*  
LUNDGREN

### *Hustedia remota* EICHWALD

WITTENBURG 1912, p. 948. ⚭ V (*Retzia* limestone).

### *Lingula arctica* WITTENBURG

WITTENBURG 1910, p. 37, pl. 1, fig. 7.  
«Bucht Lamont».

### *Lingula borealis* BITTNER

FREBOLD 1939, p. 21, pl. 2, fig. 13. ⚭ V  
(*Myalina* shale etc.). Bellsund, Festningen,  
Hornsund. C.S.E. Bertilryggen B1680,  
B1712, B1716, B1718, B1726.

### *Lingula lindströmi* BÖHM

NATHORST 1910, p. 358. Bellsund. BÖHM  
1912, p. 3, pl. 1, figs. 1–4. Text-fig. 2.  
Midterhuken, Reinodden. SPATH 1921, p.  
348. ⚭ B (*Daonella* beds). Sassendalen.

### *Lingula polaris* LUNDGREN

including *Lingula* sp.

(LINDSTRÖM 1865).

LINDSTRÖM 1865, p. 8, pl. 1, fig. 13. LUND-  
GREN 1883, p. 20, pl. 2, fig. 14. ANDERSSON  
1900. Urd. BÖHM 1903, p. 9, pl. 1, figs. 7–9.  
Urd. NOETLING 1905. Isfjorden. WITTEN-  
BURG 1910, p. 32. Edlundfjellet, Kvalpynt-  
fjellet. RÓZYCKI 1959.

### *Lingula* cf. *tenuissima* BITTNER

FREBOLD 1939, p. 22, pl. 2, fig. 14. ⚭ V  
(*Myalina* shale etc.). Bellsund, Festningen,  
Hornsund.

### *Lingula* sp.

See *Lingula polaris* LUNDGREN.

*Orbiculoidea spitzbergensis* LUNDGREN  
including *Discina spitzbergensis*  
(LUNDGREN 1887).

LUNDGREN 1887, p. 13, figs. 1–3. STENSIÖ  
1921, p. XVII. Kongressfjellet. FREBOLD 1939,  
p. 22, pl. 2, figs. 15–16.  $\bar{R}$  V (*Retzia* limestone,  
*Pseudomonotis* shale). Akseløya, Draschedalen.

*Retzia arctica* BÖHM

BÖHM 1903, p. 14, pl. 1, figs. 29, 30, 31. Urd.

*Retzia nathorsti* LUNDGREN

LUNDGREN 1887, p. 15, figs. 4, 5.  $\bar{R}$  V (*Retzia*  
limestone). Akseløya, Bellsund. WITTENBURG  
1912, p. 948.  $\bar{R}$  V (*Hustedia* limestone).  
FREBOLD 1939, p. 23, pl. 2, figs. 20, 21.  $\bar{R}$  V  
(*Retzia* limestone). Akseløya, Hornsund.

*Rhynchonella* sp.

LUNDGREN 1883, p. 20. ANDERSSON 1900.  
BÖHM 1903, p. 14, pl. 1, fig. 32. Urd.  
WITTENBURG 1910, p. 33.

*Spirifer* sp.

See *Spiriferina lundgreni* BÖHM

*Spiriferina* aff. *fragilis* SCHLOTH.

ANDERSSON 1900. Bjørnøya.

*Spiriferina* sp. ex. aff. sp.

*kossenensis* ZUGM.

BÖHM 1903, p. 12, pl. 1, figs. 33–34. Urd.

*Spiriferina lindströmi* BÖHM

BÖHM 1903, p. 12, pl. 1, figs. 24–27. Urd.  
WITTENBURG 1910, p. 33. Edlundfjellet.  
FREBOLD 1935.  $\bar{R}$  KT<sub>1</sub> (*Myophoria* sandstone).  
Bjørnøya.

*Spiriferina lundgreni* BÖHM

including *Spirifer* sp.

(LUNDGREN 1883).

LUNDGREN 1883, p. 20, pl. 2, fig. 16. BÖHM  
1903, p. 13, pl. 1, fig. 28. Tschermakfjellet.  
C.S.E. Tschermakfjellet B1253, Edgeøya 38a.

*Spiriferina* aff. *raripecta* BITTNER

ANDERSSON 1900. Bjørnøya.

*Spiriferina* sp.

ANDERSSON 1900. BÖHM 1903, p. 11, pl. 1,  
fig. 1. Urd.

*Spiriferina* div. sp.

BÖHM 1903.

*Terebratula teres* (BÖHM)

BÖHM 1903, p. 15, pl. 1, figs. 15–23. Urd.

*Terebratula* cf. *paronica* TOMMASI

ANDERSSON 1900. Bjørnøya.

*Terebratula wittenburgi* FREBOLD

including *Terebratula?* sp. (LUNDGREN  
1887) and *Aulacothyris* sp.

(WIMAN 1914 a).

LUNDGREN 1887, p. 7.  $\bar{R}$  V (*Retzia* limestone).  
WIMAN 1914a, p. 21. FREBOLD 1939, p. 24,  
pl. 2, figs. 17, 18.  $\bar{R}$  V (*Retzia* limestone,  
*Myalina*-shale). Akseløya, Bellsund.

*Terebratula?* sp.

See *Terebratula wittenburgi*

FREBOLD

## Bivalvia

*Anodontophora breviformis* SPATH

including *Anoplophora* (*Myacites*)  
*fassaensis* var. *brevis*

(WITTENBURG 1912).

WITTENBURG 1912, p. 947. Akseløya. FREBOLD  
1939, p. 18, pl. 2 fig. 19, pl. 3, fig. 11.  
 $\bar{R}$  V Bellsund, Festningen.

*Anodontophora* cf. *canalensis* BITTNER

including *Anoplophora* (*Myacites*)  
*canalensis* (WITTENBURG 1912).

WITTENBURG 1912, p. 947. Akseløya.  
FREBOLD 1939, p. 19, pl. 2, fig. 9. Akseløya,  
Bellsund, Festningen.

*Anodontophora* cf. *fassaensis*

(WISSMANN) MÜNSTER

including *Anoplophora* (*Myacites*)  
*fassaensis* (WITTENBURG 1912).

WITTENBURG 1912, p. 947. Akseløya. FREBOLD  
1939, p. 19, pl. 3, fig. 10.  $\bar{R}$  V Bellsund,  
Festningen.

*Anodontophora wittenburgi* BÖHM

BÖHM 1912, p. 10, pl. 1, fig. 16. Reinodden.  
FREBOLD 1929 b, p. 12, pl. 1, figs. 9–10.  
Aldegondabreen.

- Anoplophora (Myacites) canalensis* CAT. See *Anodontophora* cf. *canalensis* BITTNER.
- Anoplophora ephippium* BÖHM  
BÖHM 1903, p. 44, pl. 5, figs. 34, 35. Urd.
- Anoplophora (Myacites) fassaensis* WISSMANN  
See *Anodontophora* cf. *fassaensis* (WISSMANN) MÜNSTER
- Anoplophora (Myacites) fassaensis* WISSMANN var. *brevis* BITTNER  
See *Anodontophora brevisformis* SPATH
- Anoplophora (Myacites)* aff. *praeorbicularis* BITTNER  
WITTENBURG 1912, p. 947. Akseløya.
- Arca inflata* ÖBERG  
ÖBERG 1877, p. 17, pl. 5, fig. 7. NATHORST 1910  $\bar{R}$  B (*Daonella* shales).
- Avicula bitterni* BÖHM  
BÖHM 1903, p. 26, pl. 3, figs. 1, 2, 3. Urd.  
WITTENBURG 1910, p. 32. Kvalpyntfjellet.
- Avicula polaris* KITTL.  
WITTENBURG 1910, p. 34. Mohnbukta.
- Avicula sola* ÖBERG  
ÖBERG 1877, p. 18, pl. 5, fig. 8. STENSIÖ 1921. Bellsund.
- Avicula* cf. *sola* ÖBERG  
See *Avicula (Oxytoma)* sp.
- Avicula (Leptodesma) torelli* BÖHM  
BÖHM 1903, p. 25, pl. 3, figs. 13, 16, 17, 21, 26. Urd. WITTENBURG 1910, p. 33. Edlundfjellet.
- Avicula* sp. ex. aff. *bockhii* BITTNER  
BÖHM 1903, p. 24, pl. 3, fig. 19. Urd.
- Avicula* n. sp.  
ANDERSSON 1900. Bjørnøya.
- Avicula* sp.  
ANDERSSON 1900. BÖHM 1903, p. 24, text-fig. 4. Urd.
- Avicula (Oxytoma)* sp.  
including *Avicula* cf. *sola* (NATHORST 1910).  
ANDERSSON 1900. NATHORST 1910, p. 358.  
BÖHM 1912, p. 6, pl. 1, fig. 8. Aldegonda-berget.
- Aviculopecten* sp.  
SALTER in LAMONT 1860. Negerpynten.
- Aviculopecten lindströmi* LUNDGREN  
LUNDGREN 1887, p. 19, figs. 13, 14. Bellsund.  
FREBOLD 1939, p. 7, pl. 2, figs. 3, 4.  $\bar{R}$  V Akseløya.
- Aviculopecten tenuistriatus* BÖHM  
BÖHM 1903, p. 23, pl. 3, fig. 20. Urd.
- Aviculopecten toulai* LUNDGREN  
LUNDGREN 1887, p. 19, fig. 9. Bellsund.  
FREBOLD 1939, p. 8, pl. 2, figs. 1, 1a, 2, 5, 5a.  
 $\bar{R}$  V Akseløya.
- Aviculopecten wimani* NATHORST  
See *Pecten wimani* BÖHM
- Bakewellia ursina* BÖHM  
BÖHM 1903, p. 34, pl. 3, figs. 12, 15, 18. Urd.
- Cardita* sp.  
BÖHM 1903, p. 47, pl. 5, fig. 22. Urd.
- Cardinia* (?) *ovula* KITTL.  
WITTENBURG 1910, p. 32. Kvalpyntfjellet.
- Cassianella tectiformis* BÖHM  
BÖHM 1903, p. 29, pl. 4, figs. 15, 16. Skuld.  
WITTENBURG 1910, p. 32. Kvalpyntfjellet.
- Ceromya* sp.  
ANDERSSON 1900. Bjørnøya.
- Claria* cf. *stachei* BITTNER  
FREBOLD 1939, p. 8, pl. 1, figs. 13, 14.  $\bar{R}$  V Festningen.
- Cucullaea (Macrodon?) cherieanus* BÖHM  
BÖHM 1903, p. 39, pl. 4, fig. 24. Urd.

*Cucullaea (Macrodon?)* sp.  
BÖHM 1903. Urd.

*Cucullaea* sp.  
ANDERSSON 1900. Bjørnøya.

cf. *Cuspidaria semiradiata* STOPP.  
BÖHM 1903, p. 49, pl. 5, fig. 30. Urd.

*Daonella arctica* MOJSISOVICS  
FREBOLD 1951.

*Daonella* cf. *cassiana* MOJSISOVICS  
ANDERSSON 1900. Bjørnøya.

*Daonella de geeri* BÖHM  
including *Halobia de geeri*  
(NATHORST 1910).  
NATHORST 1910, p. 358. Bellsund. BÖHM  
1912, p. 9, pl. 1, figs. 13–15, Text-fig. 3.

*Daonella* cf. *dubia* (GABB)  
WEIR 1933, p. 692, pl. 1, fig. 22. Kapp Lee.

*Daonella frami* KITTL.  
WITTENBURG 1910, p. 33. Kapp Lee. C.S.E.:  
Botneheia: B1920, B2189, B2191. Kongress-  
fjellet: B1300 (?juv.assem.), B1301, B1303,  
B1304, B1305, B1306, B1307, B1308, B1310,  
B1313, B1316. Oscar II Land: T743.  
Tschermafjellet: B1247, B1257 (cf.), B1261,  
B1269, B1273. Vikinghøgda: B1946, B1961.

*Daonella lindströmi* MOJSISOVICS  
NOETLING 1905. Isfjorden. WITTENBURG  
1910. Kapp Lee. FREBOLD 1929b.  $\bar{K}$  B (*Daonella*  
beds). Sauriedalen. HOLLAND 1961.  
Hahnfjella.

*Daonella loveni* BÖHM  
BÖHM 1903, p. 33, pl. 3, figs. 22, 25, 30, 31.  
 $\bar{K}$  K T<sub>1</sub> (*Myophoria* sandstone). Urd.  
WITTENBURG 1910, p. 33. Kapp Lee.

*Dimyodon paterna* BÖHM  
BÖHM 1903, p. 18, pl. 2, fig. 25. Urd.

*Dimyodon* sp.  
ANDERSSON 1900. Bjørnøya.

*Eumorphotis artus* BÖHM  
BÖHM 1903, p. 27, pl. 2, figs. 9, 16, 18. Urd.

*Eumorphotis* n. sp. ex. aff. *telleri*  
BITTNER  
BÖHM 1903, p. 29. Urd.

*Eumorphotis vagans* BÖHM  
BÖHM 1903, p. 29, pl. 2, figs. 17, 24.  $\bar{K}$  K T<sub>1</sub>  
(Clay ironstone), Miseryfjellet.

*Eumorphotis variabilis* BÖHM  
See *Pseudomonotis (Eumorphotis)*  
*variabilis* BÖHM

*Gonodon* sp.  
ANDERSSON 1900. Bjørnøya.

*Gervilleia bennetti* BÖHM  
BÖHM 1903, p. 36, pl. 4, figs. 13, 17. Skuld.  
WITTENBURG 1910, p. 32. Kvalpyntfjellet.

*Gervilleia* sp. ex. aff. *costata* SCHLOTH.  
BÖHM 1903. Urd.

*Gervilleia* aff. *exporrecta* (LEPSIUS ?)  
BITTNER  
FREBOLD 1939, p. 15, pl. 3, fig. 12.  $\bar{K}$  V.  
Draschedalen, Festningen.

*Gervilleia lowenighi* BÖHM  
BÖHM 1903, p. 36, pl. 3, figs. 4–7, 9–11.  
 $\bar{K}$  K T<sub>1</sub> (Clay ironstone), Miseryfjellet;  
 $\bar{K}$  K T<sub>1</sub> (*Myophoria* sandstone), Urd. WITTEN-  
BURG 1910, p. 32, 33. Kvalpyntfjellet, Siegel-  
fjellet. FREBOLD 1929 b, Vasskiltoppen.

*Gervilleia nordenskiöldii* BÖHM  
BÖHM 1903, p. 35, pl. 3, fig. 8. Urd.

*Gervilleia polydonta* STROMB.  
WITTENBURG 1912, p. 947. Akseløya.

*Gervilleia spitzbergensis* WITTENBURG  
WITTENBURG 1910, p. 36, pl. 1, fig. 6.  
Kvalpyntfjellet.

*Gervilleia philippii* ANDERSSON  
ANDERSSON 1900. Bjørnøya.

*Gervilleia* n. sp.  
ANDERSSON 1900. Bjørnøya.

*Gervilleia?* sp.  
HOLLAND 1961, p. 31. Perthesfjella.

*Gonodon* sp. ex. aff. *astartiformis*

MÜNST.

BÖHM 1903, p. 48, pl. 5, figs. 10, 11. Skuld.

*Gonodon modestus* BÖHM

BÖHM 1903, p. 49, pl. 5, figs. 23, 24. Urd.

WITTENBURG 1910, p. 32, 33. Edlundfjellet, Kvalpyntfjellet.

*Gryphaea keilhau* BÖHM

BÖHM 1903, p. 16, pl. 1, figs. 35, 37, 38, 44–46, 50–52. Urd. FREBOLD 1935.  $\bar{R}$  KT<sub>1</sub> (*Myophoria* sandstone).

*Gryphaea skuld* BÖHM

BÖHM 1903, p. 17, pl. 1, figs. 36, 39, 40, 41. Skuld. C.S.E.: Botneheia. B2017.

*Gryphaea* sp. nov.

FREBOLD 1929a, p. 308, pl. 2, figs. 16–17. Wichebukta.

*Gryphaea* sp.

BÖHM 1903, p. 17, pl. 1, fig. 49. Urd.

*Halobia de geeri* BÖHM

See *Daonella de geeri* BÖHM

*Halobia lommeli* WISSMANN

LINDSTRÖM 1865, p. 6, pl. 2, figs. 8–10. Kapp Thordsen, Kapp Lee. ÖBERG 1877, p. 16, pl. 5, fig. 2.

*Halobia neumayeri* BITTNER

BÖHM 1903, p. 32, pl. 3, fig. 29. NOETLING 1905. Isfjorden.

*Halobia zitteli* LINDSTRÖM

LINDSTRÖM 1865, p. 6, pl. 1, figs. 6–12, pl. 2, fig. 11. Kapp Thordsen. ÖBERG 1877, p. 16, pl. 5, figs. 3–4. LUNDGREN 1883, p. 19. BÖHM 1903, p. 30, pl. 3, fig. 27. Kapp Thordsen. NOETLING 1905, p. 207, pl. 33, fig. 1. Kapp Thordsen. WITTENBURG 1910, p. 32–33. Kapp Lee, Mohnbukta, Siegel-fjellet, Stensiöfjellet. FREBOLD 1929a, p. 308. WEIR 1933. Duckwitzbreen, Kapp Lee, Mistakodden. HOLLAND 1961. Hahnfjella. C.S.E.: F1631, F1641; Botneheia: B1923, B1924, B2012, B2018. Kongressfjellet: B1320. Tschermakfjellet: B1358, B1362, B1379, B1384 (cf.).

*Halobia* n. sp.

HOLLAND 1961. Perthesfjella.

*Halobia* sp.

BÖHM 1903, p. 32, pl. 3, fig. 32. Urd.

WITTENBURG 1910, p. 32. Kvalpyntfjellet.

SANDFORD in THOMPSON 1953. Torellnes-fjellet.

?*Hoernesia* sp.

SPATH 1921, p. 299.

*Homomya forsbergi* BÖHM

ANDERSSON 1900. BÖHM 1903, p. 49, pl. 5, fig. 33. Urd.

*Lima (Mantellum) biarata* BÖHM

ANDERSSON 1900. BÖHM 1903, p. 19, pl. 1, figs. 42, 43. Skuld. FREBOLD 1929b. Vasskil-toppen.

*Lima* aff. *lineata* SCHLOTH.

(cf. *spitzbergensis* LUNDGREN).

ANDERSSON 1900. Bjørnøya.

*Lima rijpi* BÖHM

BÖHM 1903, p. 21, pl. 2, fig. 6. Skuld.

*Lima (Plagiostoma) spitzbergensis*

LUNDGREN

including *Lima spitzbergensis* (LUNDGREN 1883).

LUNDGREN 1883, p. 20, pl. 2, fig. 17. BÖHM 1903, p. 19, pl. 1, fig. 48, pl. 2, figs. 2, 3. STENSIÖ 1921. Tschermakfjellet.

*Lima spitzbergensis* LUNDGREN

See *Lima (Plagiostoma) spitzbergensis*

LUNDGREN

*Lima striatoides* BÖHM

BÖHM 1899, p. 326. Miseryfjellet. ANDERSSON 1900. BÖHM 1903, p. 18, pl. 2, fig. 1.  $\bar{R}$  KT<sub>1</sub> (*Myophoria* sandstone), Misery-fjellet. WITTENBURG 1910, p. 32–33. Kvalpyntfjellet.

*Lima swenanderi* BÖHM

ANDERSSON 1900. BÖHM 1903, p. 20, pl. 2, figs. 7, 8, 15, 21. Skuld, Urd. WITTENBURG 1910, p. 32, 33. Anderssonbukta. Kvalpyntfjellet.

*Macrodon buchi* BÖHM

BÖHM, 1903, p. 39, pl. 34, figs. 11, 14. Urd.

*Macrodon dieneri* BÖHM

NOETLING 1905, p. 209, pl. 33, fig. 2. Urd.

*Macrodon duneri* BÖHM

BÖHM 1903, p. 39, pl. 4, fig. 25. WITTENBURG 1910, p. 32. Kvalpyntfjellet.

*Macrodon cf. formosissimus* D'ORBIGNY

ANDERSSON 1900. Bjørnøya.

*Megalodon poolei* BÖHM

BÖHM 1903, p. 47, pl. 5, figs. 18, 19. Urd.

*Megalodon rotundatus* BÖHM

BÖHM 1903, p. 48, pl. 5, figs. 15, 16. Urd.

?*Megalodus* sp.

ANDERSSON 1900. Bjørnøya.

*Modiola* aff. *raibliana* BITTNER

BÖHM 1903, Text-fig. 6. Urd.

*Monotis* cf. *albertii* GOLDFUSS

LINDSTRÖM 1865. Kapp Thorsden.

*Monotis albertii* GOLDFUSS sp. var.

See *Pseudomonotis (Eumicrotis?) arctica* BÖHM

*Monotis boreas* ÖBERG

ÖBERG 1877, p. 17, pl. 5, fig. 5. NATHORST 1910. ⚭ SK (Fish niveau), Isfjorden.

*Monotis filigera* LINDSTRÖM

LINDSTRÖM 1865, p. 7. Saurieberget.

*Monotis* sp. indet.

LINDSTRÖM 1865, p. 7, pl. 1, fig. 17. LUNDGREN 1883, p. 19.

*Myalina* sp. indet. ?sp. nov.

FREBOLD 1939, p. 18, pl. 3, fig. 8.

*Myalina de geeri* LUNDGREN

including *Myalina* sp.

(FREBOLD 1931).

LUNDGREEN 1887, p. 24, fig. 8. FREBOLD 1931, pl. 4, figs. 1, 2, 3, 4. FREBOLD 1939, p. 15, pl. 3, figs. 1, 2, 3, 6, 7. ⚭ V (*Myalina* shales), Bellsund, Festningen.

*Myalina* cf. *vetusta* BITTNER

FREBOLD 1939, p. 17, pl. 3, figs. 4, 5. ⚭ V (*Myalina* shales), Festningen, Ahlstrandodden.

*Myalina* sp.

see *Myalina de geeri* LUNDGREN

*Myoconcha anderssoni* ANDERSSON

ANDERSSON 1900. Bjørnøya.

*Myoconcha perlonga* ANDERSSON

ANDERSSON 1900. Bjørnøya.

*Myophoria nathorsti* DAMES

BÖHM 1899, p. 325. Miseryfjellet. ANDERSSON 1900. Edlundfjellet. BÖHM 1903, pl. 5, figs. 1-3, 7-9, 17, 20, 21, 27. Skuld, Urd. NOETLING 1905, p. 209, pl. 33, figs. 4-5. Urd. WITTENBURG 1910, p. 32. Kvalpyntfjellet. FREBOLD 1935. ⚭ KT<sub>1</sub> (*Myophoria* sandstone).

*Myophoria tennei* DAMES.

BÖHM 1899, p. 325. Miseryfjellet. ANDERSSON 1900. BÖHM 1903, p. 42, pl. 4, figs. 23, 26, 28, 30. Urd. WITTENBURG 1910, p. 32. Kvalpyntfjellet.

*Myophoria urd* BÖHM

ANDERSSON 1900. BÖHM 1903, p. 43, pl. 5, figs. 28-32. Urd. NOETLING 1905, p. 209, pl. 33, figs. 6-7. Urd.

*Mysidioptera buchi* BÖHM

BÖHM 1903, p. 21, pl. 1, figs. 53, 54. Urd. WITTENBURG 1910, p. 33. Siegfelfjellet.

*Nucula* sp.

SALTER in LAMONT 1860. Negerpynten.

*Nucula elongata* ÖBERG

ÖBERG 1877, p. 18, pl. 5, fig. 6. NATHORST 1910, ⚭ B (*Daonella* shales).

*Nucula* cf. *subobliqua* D'ORBIGNY

ANDERSSON 1900. Bjørnøya.

*Nucula triangularis* BÖHM

BÖHM 1903, p. 41, pl. 4, fig. 27. Miseryfjellet.

*Ostrea keilhavi* ANDERSSON

ANDERSSON 1900. Bjørnøya.



?*Ostrea* sp.

BÖHM 1903, pl. 1, fig. 47. Urd.

*Palaeoneilo lunaris* BÖHM

BÖHM 1903, p. 40, pl. 4, fig. 18. Urd.

*Palaeoneilo tobieseni* BÖHM

BÖHM 1903, p. 40, pl. 4, figs. 21, 22. Urd.

*Palaeoneilo* sp.

BÖHM 1903, p. 41, pl. 4, fig. 19, Text-fig. 7.  
Urd. HOLLAND 1961. Perthesfjella.

*Pecten* cf. *microtis* BITTNER

BÖHM 1912, p. 4. Reinodden.

*Pecten nordenskiöldi* BÖHM

BÖHM 1912, p. 4, pl. 1, figs. 5–6. Fridtjovhamna, Reinodden.

*Pecten nordenskiöldi* LUNDGREN

(non BÖHM)

LUNDGREN 1887, Fig. 6. FREBOLD 1939, p. 14, pl. 2, figs. 7, 8.

*Pecten öbergi* LUNDGREN

See *Pecten (Entolium) öbergi*

LUNDGREN

*Pecten wimani* BÖHM

including *Aviculopecten wimani*

(NATHORST 1910)

NATHORST 1910, p. 358. Bellsund. BÖHM 1912, p. 5, pl. 1, fig. 7. Reinodden.

*Pecten (Bittnerella) damesi* BÖHM

BÖHM 1903, p. 22, pl. 2, fig. 22. Urd.

*Pecten (Entolium)* aff. *discittes*

SCHLOTH. (cf. *öbergi* LUNDGREN)

ANDERSSON 1900.

*Pecten (Entolium) öbergi* LUNDGREN

including *Pecten öbergi* (LUNDGREN 1883) and *Pecten* sp. (BÖHM 1899)

LUNDGREN 1883, p. 19, pl. 2, fig. 15. BÖHM 1899, p. 326. Miseryfjellet. ANDERSSON 1900. BÖHM 1903, p. 21, pl. 2, figs. 14, 20. WITTENBURG 1910, p. 32, 33. Edlundfjellet, Kvalpyntfjellet. STENSIÖ 1921. Botneheia, Tschermakfjellet.

*Pecten (Velopecten) damesi* ANDERSSON

ANDERSSON 1900. Bjørnøya.

*Pecten* sp.

See *Pecten (Entolium) öbergi*

LUNDGREN

*Pecten* sp.

BÖHM 1903, p. 22, pl. 2, figs. 4, 5. Skuld.

WITTENBURG 1910, p. 32. Kvalpyntfjellet.

*Pecten* sp. indet.

LINDSTRÖM 1865, p. 8, pl. 1, fig. 16.

FREBOLD 1929a, p. 308. Wichebukta.

*Pholodomya franciscaae* BÖHM

BÖHM 1903, p. 50, pl. 5, figs. 25, 26, 36. Urd.

*Pinna heeri* BÖHM

BÖHM 1903, p. 38, pl. 5, figs. 4–6. Urd.

WITTENBURG 1910. Edlundfjellet.

*Pinna lima* BÖHM

BÖHM 1903, p. 38, pl. 5, figs. 12–14. Urd.

*Pinna* cf. *raibliana* PARONA

ANDERSSON 1900. Bjørnøya.

*Placunopsis* sp.

BÖHM 1903, p. 18. Skuld.

*Pleurophorus anderssoni* BÖHM

BÖHM 1903, p. 45, pl. 4, figs. 4–7, 9, 10.

Skuld, Urd. WITTENBURG 1910. Kvalpyntfjellet.

*Pleurophorus perlongus* BÖHM

BÖHM 1903, p. 46, pl. 4, figs. 1–3, 8. WITTENBURG 1910, p. 32. Kvalpyntfjellet.

*Posidonia mimer* ÖBERG

ÖBERG 1877, p. 15, pl. 5, figs. 9–14. SANDFORD in THOMPSON 1953. Torellnesfjellet.

C.S.E.: Bertilyggen: B1631, B1632, B1640, B1650, B1653, B1654, B1655, B1656, B1659, B1660, B1661, B1662, B1663, B1664, B1668, B1669, B1670, B1672, B1679, B1732, B1734, B1761, B1765, B1767. Botneheia: B1879, B1882, B1884, B1885, B1887, B1889, B1983, B2007, B2008, B2031, B2166, B2168, B2169, B2171. Kongressfjellet: B1256. Sticky Keep: B2125, B2128.

*Posidonia* sp.

LINDSTRÖM 1865. Kapp Thordsen.

*Posidonia tenuissima* BÖHM

BÖHM 1912, p. 8, pl. 1, figs. 11, 12. FREBOLD 1929b, p. 12, pl. 1, fig. 8. Aldegondabreen.

*Posidonomya backlundii* WITTENBURG

WITTENBURG 1910, p. 33, 36, pl. 1, figs. 4, 5. Siegfjället.

*Posidonomya mimer* ÖBERG

WITTENBURG 1910, p. 33. Siegfjället.  
SPATH 1921, p. 300, 304. ⚭ SK (*Posidonomya* shales). HOLLAND 1961. Wichmannfjellet.  
C.S.E.: Dickson Land G1429.

*Posidonomya* sp.

FREBOLD 1935.

*Pseudomonotis bjona* LUNDGREN

See *Pseudomonotis (Eurmorphotis) bjona* LUNDGREN

*Pseudomonotis boreas* (ÖBERG):

C.S.E. H 1168 (new record) Kongressfjellet

*Pseudomonotis occidentalis*

(WHITEAVES) (new record) . .  
C.S.E.: Botneheia: B2037, B2048, P2049 (cf.), B2052 (cf.), B2080 (cf.). Marmierfjellet: Q463-4. Sticky Keep: B2130, B2134-5. Vikinghøgda: B1928 (cf.).

*Pseudomonotis ochotica* KAYS

See *Pseudomonotis ochotica* KEYS.  
var. *densestriata* TELL.

*Pseudomonotis ochotica* KEYS var.

*denestriata* TELL including *Pseudomonotis ochotica* (NATHORST 1910)  
NATHORST 1910, p. 358. Bellsund. BÖHM 1912, p. 6, pl. 1, fig. 9. Bellsund. FREBOLD 1929. ⚭ B. Festningen.

*Pseudomonotis tolmatschewi*

WITTENBURG  
WITTENBURG 1910, p. 33, 35, pl. 1, figs. 2, 3. Anderssonbukta.

*Pseudomonotis* cf. *venetiana* HAUER

See *Pseudomonotis (Eurmorphotis) bjona* LUNDGREN

cf. *Pseudomonotis (Claraia) aurita* (HAUER)

SPATH 1921, p. 300. ⚭ SK (*Posidonomya* shales), Sticky Keep.

*Pseudomonotis (Claria)? cf. clarai* (EMMRICH)

HOLLAND 1961. Wichmannfjellet.

cf. *Pseudomonotis (Claraia) decidens* (BITTNER)

SPATH 1921, p. 299. ⚭ SK (*Posidonomya* shales). Sassendalen.

*Pseudomonotis (Claraia) cf. stachei*

BITTNER  
FREBOLD 1939, p. 8, pl. 1, figs. 13, 14. Festningen.

*Pseudomonotis (Eumicrotis?) arctica*

BÖHM including *Monotis albertii* sp. var. (NATHORST 1910).  
NATHORST 1910, p. 358. Bellsund. BÖHM 1912, p. 7, pl. 1, fig. 10.

*Pseudomonotis (Eumicrotis)*

*spitzbergensis* BÖHM  
BÖHM 1903, p. 27, pl. 2, figs. 10-13. Tschermakfjellet. NOETLING 1905. Bellsund.  
WITTENBURG 1910, p. 32. Kvalpyntfjellet.  
BÖHM 1912, p. 7. Ahlstrandodden.

*Pseudomonotis (Eumorphotis)*

cf. *multiformis* BITTNER  
FREBOLD 1939, (a) p. 9, pl. 1, figs. 1, 1a, pl. 2, fig. 6; (b) p. 10, pl. 1, figs. 2, 3. Draschedalen, Kongressfjellet.

*Pseudomonotis (Eumorphotis)*

*tschernychevi* WITTENBURG  
WITTENBURG 1910, p. 32, 34, pl. 1, fig. 1. Edlundfjellet. WEIR 1933, p. 691, pl. 1, figs. 3, 8. Kapp Lee.

*Pseudomonotis (Eumorphotis) variabilis*  
BÖHM including *Eumorphotis*  
*variabilis* (BÖHM 1903)

BÖHM 1903, p. 28, pl. 2, figs. 19, 23. Urd.  
WITTENBURG 1910, p. 32. Kvalpyntfjellet.

*Pseudomonotis (Eumorphotis) sp. indet.*  
FREBOLD 1939, p. 11, pl. 1, figs. 4, 5.

*Pseudomonotis (Eumorphotis) bjona*  
LUNDGREN including *Pseudomonotis*  
*bjona* (LUNDGREN 1887) and  
*Pseudomonotis cf. venetiana*  
(WITTENBURG 1912).

LUNDGREN 1887, figs. 11, 12. WITTENBURG  
1912, p. 947. FREBOLD 1939, p. 12, pl. 1,  
figs. 6–12. Ƒ V (*Pseudomonotis* marls), Bell-  
sund.

*Pseudomonotis sp.*

HOLLAND 1961. Perthesfjella, Wichmann-  
fjella.

*Rhynchopterus perma* BÖHM

BÖHM 1903, p. 30, pl. 4, fig. 12. Urd.

*Trigonia buchi* ANDERSSON

ANDERSSON 1900. Bjørnøya.

*Trigonia margaritifera* BÖHM

BÖHM 1903, p. 43, pl. 4, figs. 31–33. Skuld.  
NOETLING 1905, p. 209, pl. 33, fig. 3. Skuld.

## Gastropoda

*Bellerophon borealis* SPATH

FREBOLD 1939, p. 20, pl. 2, figs. 11, 11a, 12.  
Ƒ V (*Myalina* shale), Akseløya.

*Eustylus sp.*

ANDERSSON 1900. Bjørnøya.

*Natica sp.*

ANDERSSON 1900. Bjørnøya.

*Pleurotomaria (Sisenna) conwentzi*

BÖHM

See *Sisenna conwentzi* BÖHM

*Pleurotomaria (Worthenia) sp.*

ANDERSSON 1900. Bjørnøya.

*Promalthidia parva* BÖHM

BÖHM 1903, p. 53, pl. 6, figs. 12, 13. Misery-  
fjellet.

*Promalthidia sp. ex. aff. turritellae*  
DKR.

BÖHM 1903, p. 52, pl. 6, figs. 2–8. Urd.

*Promalthidia sp.*

ANDERSSON 1900. Bjørnøya.

*Protonerita sp.*

BÖHM 1903, p. 52, pl. 6, fig. 11. Bjørnøya.

*Sisenna conwentzi* BÖHM

including *Pleurotomaria (Sisenna)*  
*conwentzi* (ANDERSSON 1900)

ANDERSSON 1900. BÖHM 1903, p. 51, pl. 6,  
figs. 1, 9, 10, 16. Urd.

*Sisenna sp. ex. aff. descendensis* KOKEN

BÖHM 1903, p. 52, pl. 6, fig. 2. Miseryfjellet.

*Undularia pertica* BÖHM

BÖHM 1903, p. 53, pl. 6, fig. 15. Urd.

*Undularia sp.*

ANDERSSON 1900. Bjørnøya.

*Worthenia bifurca* BÖHM

BÖHM 1903, p. 50, pl. 6, fig. 14. Urd.

## Scaphopoda

*Dentalium cf. arctum* PICHLER

BÖHM 1903, p. 54. Urd.

*Dentalium boreale* BÖHM

BÖHM 1903, p. 53, pl. 6, figs. 17, 33, 36. Urd.

## Cephalopoda

*Agathiceras sp.*

ANDERSSON 1900. Bjørnøya.

*Ammonites gaytani* KLIPSTEIN var. ?

See *Ammonites trochleaeformis*  
(LINDSTRÖM)

?*Ammonites triplicatus* SOWERBY

ÖBERG 1877, p. 15, pl. 2, figs. 10, 11. Sassenfjorden.

In part to *Gymnotoceras geminatum* (MOJSISOVICS).

*Ammonites trochleaeformis* (LINDSTRÖM)

including *Nautilus trochleaeformis*

(LINDSTRÖM 1865) and *Ammonites*

*gaytani* (LINDSTRÖM 1865)

LINDSTRÖM 1865, p. 3, pl. 1, fig. 2, p. 5, pl. 2, figs. 5–7. Saurieberget. ÖBERG 1877, p. 4, pl. 1, figs. 1–5.

In part to *Ptychites euglyphus* MOJSISOVICS and in part to *Ptychites trochleaeformis* (LINDSTRÖM).

*Ammonites* sp. indet.

FREBOLD 1929a, p. 299, pl. 1, fig. 4. Agardhbukta. FREBOLD 1929b, p. 11, pl. 1, fig. 7. Grønfjorden. p. 14, pl. 1, fig. 12. Kapp Thordsen. p. 15, pl. 1, fig. 13. Kapp Thordsen.

*Ammonites* gen. and sp. indet.

FREBOLD 1939, p. 21, pl. 1, fig. 15. Festningen.

*Anasibirites* sp.

see *Gurleyites freboldi* SPATH

*Arctoceras blomstrandii* (LINDSTRÖM)

including: (in part) *Ceratites?* *blomstrandii* (LINDSTRÖM 1865), *Ceratites blomstrandii* (ÖBERG 1877), (in part) *Ceratites costatus* (ÖBERG 1877), *Ceratites öbergi* (MOJSISOVICS 1886), *Ceratites (?Flemingites) öbergi* (NOETLING 1905), *Ceratites lindströmi* (MOJSISOVICS 1886), *Ceratites simplex* (MOJSISOVICS 1886), *Ceratites polaris* (MOJSISOVICS 1886), *Ceratites (Robustites) polaris* (NOETLING 1905), *Ceratites whitei* (MOJSISOVICS 1886), *Ceratites* indet. (MOJSISOVICS 1886), *Ceratites* nov. f. indet. (MOJSISOVICS 1886), (in part) *Ceratites spetsbergensis* (ÖBERG 1877), *Arctoceras?* *costatum* (SPATH 1921), *Arctoceras costatum* (SPATH 1934), *Arctoceras öbergi* (SPATH 1921, 1934), *Arctoceras* cf. *öbergi* (FREBOLD

1930a), *Arctoceras lindströmi* (SPATH 1921, 1934), *Arctoceras simplex* (SPATH 1921, 1934), *Arctoceras polare* (SPATH 1921, 1934), *Arctoceras whitei* (FREBOLD 1930a)

LINDSTRÖM 1865, p. 4, pl. 1, fig. 3. Kapp Thordsen. ÖBERG 1877, p. 11, 13–14; pl. 3, figs. 1–4; pl. 4, figs. 1c, 3. Kapp Thordsen. MOJSISOVICS 1886, p. 30–37, pl. 6, figs. 2–7; pl. 7, figs. 1–6; pl. 8, figs. 1–3. ⚭ SK (*Posidonomya* limestone) Kapp Thordsen. NOETLING 1905, p. 206, pl. 29, figs. 7–9. Isfjorden. STOLLEY 1911, Isfjorden. SPATH 1921, p. 299, 302. Marmierfjellet. FREBOLD 1930a, p. 18–19, pl. 5, figs. 1–3. Kapp Wijk, Vikinghøgda. SPATH 1934, p. 257–263, figs. 88, 89. ⚭ SK (*Posidonomya* beds) Kapp Wijk, Marmierfjellet, Sassendalen, Trehøgdene. KUMMEL 1961. C.S.E.: H1192, H1199, G1436, F1097. Bertilyggen: B1651, B1652, B1654, B1655, B1656, B1657, B1659, B1660, B1661, B1664, B1667, B1668, B1669, B1673, B1674, B1675, B1676, B1677. Botneheia: B1888, B1993 (?), B1997 (?), B1998, B2003, B2004, B2005, B2008, B2165, B2170, B2172. Oscar II Land: P1854, P1855. Saurieberget: B1331, B1338. Sauriedalen: Ø11 (cf.), Ø12, Ø13 (cf.), Ø24, Ø28, Ø32, Ø33, Ø60, Ø61. Sticky Keep: B2126, B2127, B2128.

*Arctoceras costatum* (ÖBERG)

see *Arctoceras blomstrandii* (LINDSTRÖM)

*Arctoceras?* *costatum* (ÖBERG)

see *Arctoceras blomstrandii* (LINDSTRÖM)

*Arctoceras lindströmi* BÖHM

BÖHM 1899, p. 325, Miseryfjellet. ANDERSSON 1900.

*Arctoceras lindströmi* (MOJSISOVICS)

see *Arctoceras blomstrandii* (LINDSTRÖM)

*Arctoceras öbergi* (MOJSISOVICS)

see *Arctoceras blomstrandii* (LINDSTRÖM)

*Arctoceras* cf. *öbergi* (MOJSISOVICS)

see *Arctoceras blomstrandii* (LINDSTRÖM)

*Arctoceras polare* (MOJSISOVICS)  
see *Arctoceras blomstrandii*  
(LINDSTRÖM)

*Arctoceras simplex* (MOJSISOVICS)  
see *Arctoceras blomstrandii*  
(LINDSTRÖM)

*Arctoceras whitei* (MOJSISOVICS)  
see *Arctoceras blomstrandii*  
(LINDSTRÖM)

*Arctoceras* sp.  
HOLLAND 1961. Hahnfjella.

*Arctoceras* ? sp.  
SPATH 1921, p. 297.

*Arctoprionites nodosus* (FREBOLD)  
including *Prionites* sp. nov. (SPATH  
1921) and *Goniodiscus nodosus*  
(FREBOLD 1930a)  
SPATH 1921, p. 301. FREBOLD 1930a, p. 8,  
pl. 1, figs. 1–7; pl. 2, fig. 2. ⚭ SK (Fish  
niveau, *Posidonomya* limestone). Flower-  
dalen, Vikinghøgda. SPATH 1934, p. 340,  
pl. 16, fig. 5; pl. 17, fig. 1. Marmierfjellet,  
Sassenfjorden, Trehøgdene. C.S.E. Oscar II  
Land: P1859, P1860, P1861.

*Arctoprionites tyrrelli* SPATH  
including (in part) *Goniodiscus* ? sp.  
(SPATH 1921)  
SPATH 1921, p. 301. Trehøgdene. SPATH  
1934, p. 342, pl. 14, fig. 5; pl. 17, fig. 6.  
Trehøgdene.

*Arctoprionites* sp. nov. ?  
including *Prionites* sp. nov. aff.  
*tuberculatus* (SPATH 1921)  
SPATH 1921, p. 301. SPATH 1934, p. 341,  
pl. 18, fig. 1; pl. 14, fig. 4. Trehøgdene.

*Atractites* sp. ?  
SPATH 1921, p. 297. Sassendalen.

*Beyrichites affini* MOJSISOVICS  
FREBOLD 1930a, p. 25, pl. 6, figs. 4, 4a, 5.  
⚭ SK (Lower Saurian niveau) Milne Ed-  
wardsfjellet. C.S.E. Vikinghøgda: B1959 (cf.)

*Ceratites* indet. aff. *arctico* MOJSISOVICS  
including (in part) *Ceratites laqueatus*  
(ÖBERG 1877)  
ÖBERG 1877, p. 8, pl. 2, fig. 9. MOJSISOVICS  
1886, p. 55, pl. 9, fig. 10. ⚭ B (*Daonella*  
limestone) Kapp Thordsen.

*Ceratites arcticus* MOJSISOVICS  
MOJSISOVICS 1886, p. 55, pl. 9, fig. 9. ⚭ B  
(*Daonella* limestone) Kapp Thordsen,  
Midterhuken.

*Ceratites blomstrandii* LINDSTRÖM  
see *Arctoceras blomstrandii* (LIND-  
STRÖM) under ÖBERG 1877 and also  
MOJSISOVICS 1886, p. 29, pl. 6, fig. 8. ⚭ SK  
(*Posidonomya* limestone) Kapp Thordsen.

*Ceratites ? blomstrandii* LINDSTRÖM  
LINDSTRÖM 1865, p. 4, pl. 1, figs. 3–5.  
Kapp Thordsen.  
In part to *Arctoceras blomstrandii*  
(LINDSTRÖM)

*Ceratites concentricus* ÖBERG  
ÖBERG 1877, p. 15, pl. 2, fig. 12. Diabas-  
odden.

*Ceratites costatus* ÖBERG  
ÖBERG 1877, p. 13, pl. 4, figs. 3–4. Kapp  
Thordsen. NOETLING 1905, p. 206, pl. 29,  
fig. 9.  
In part to *Arctoceras blomstrandii*  
(LINDSTRÖM)

*Ceratites falcatus* MOJSISOVICS  
MOJSISOVICS 1886, p. 56, pl. 9, fig. 11. ⚭ B  
(*Daonella* limestone) Kapp Thordsen. C.S.E.  
Vikinghøgda: B1945, B1953, B1971.

*Ceratites* nov. f. ind. aff. *falcato*  
MOJSISOVICS 1886, p. 57, pl. 9, fig. 12. ⚭ B  
(*Daonella* limestone), Kapp Thordsen.

*Ceratites furcatus* ÖBERG  
see *Meekoceras furcatum* (ÖBERG)

*Ceratites geminatus* MOJSISOVICS  
see *Gymnotoceras geminatum*  
(MOJSISOVICS)

- Ceratites* ind. aff. *geminato*  
MOJSISOVICS  
MOJSISOVICS 1886, p. 50, pl. 9, figs. 4, 8.  
⌘ B (*Daonella* limestone), Kapp Thordsen.
- Ceratites laqueatus* LINDSTRÖM  
LINDSTRÖM 1865, p. 5, pl. 2, figs. 3, 4.  
Saurieberget. ÖBERG 1877, p. 8, pl. 2, figs.  
7–9, Kapp Thordsen. MOJSISOVICS 1886, p.  
51, pl. 9, figs. 1, 2. Kapp Thordsen, Saurie-  
berget. FREBOLD 1929 b, p. 19. Kapp  
Thordsen.  
In part to *Ceratites* indet. aff. *arctico*  
MOJSISOVICS, in part to *Ceratites*  
*nathorsti* MOJSISOVICS, and in part to  
*Gymnotoceras laqueatum*  
(LINDSTRÖM)
- Ceratites* cf. *laqueatus* LINDSTRÖM and  
*nathorsti* MOJSISOVICS  
FREBOLD 1929b, p. 25. ⌘ B Festningen.
- Ceratites lindströmi* MOJSISOVICS  
see *Arctoceras blomstrandii*  
(LINDSTRÖM)
- Ceratites malmgreni* LINDSTRÖM  
LINDSTRÖM 1865, p. 4, pl. 2, figs. 1, 2.  
Kapp Thordsen, Saurieberget. ÖBERG 1877,  
p. 10, pl. 2, figs. 1–6. Kapp Thordsen, Saurie-  
berget.  
In part to *Parapopanoceras malmgreni*  
MOJSISOVICS and in part to *Parapo-*  
*panoceras verneuili* MOJSISOVICS
- Ceratites (Hollandites)* sp. indet. aff.  
*montis bovis* SMITH  
FREBOLD 1929a, p. 304, pl. 1, fig. 7. Grøn-  
fjorden.
- Ceratites nathorsti* MOJSISOVICS  
including (in part) *Ceratites laqueatus*  
(ÖBERG 1877).  
ÖBERG 1877, p. 8, pl. 2, fig. 8. Saurieberget.  
MOJSISOVICS 1886, p. 53, pl. 9, fig. 3. ⌘ B  
Saurieberget. NOETLING 1905, p. 206, pl. 29,  
fig. 5. ⌘ B (*Daonella* limestone). Kapp  
Thordsen. C.S.E. Vikinghøgda: B1955.
- Ceratites öbergi* MOJSISOVICS  
see *Arctoceras blomstrandii*  
(LINDSTRÖM)
- Ceratites (?Flemingites) öbergi*  
MOJSISOVICS  
See *Arctoceras blomstrandii*  
(LINDSTRÖM)
- Ceratites polaris* MOJSISOVICS  
See *Arctoceras blomstrandii*  
(LINDSTRÖM)
- Ceratites (Robustites) polaris*  
MOJSISOVICS  
See *Arctoceras blomstrandii*  
(LINDSTRÖM)
- Ceratites simplex* MOJSISOVICS  
See *Arctoceras blomstrandii*  
(LINDSTRÖM)
- Ceratites spetsbergensis* ÖBERG  
In part to *Arctoceras blomstrandii*  
(LINDSTRÖM) and in part to *Ussurites?*  
*spetsbergensis* (ÖBERG)
- Ceratites vega* ÖBERG  
ÖBERG 1877, p. 14, pl. 4, fig. 2. Kapp  
Thordsen. MOJSISOVICS 1886, p. 47, pl. 2,  
fig. 15. ⌘ SK (*Posidonomya* limestone) Kapp  
Thordsen. STOLLEY 1911.
- Ceratites whitei* MOJSISOVICS  
See *Arctoceras blomstrandii*  
(LINDSTRÖM)
- Ceratites (Gymnotoceras?)* sp. indet. ex.  
aff. *Gymnotoceras hersheyi* SMITH  
FREBOLD 1929b, p. 27, pl. 3, figs. 7, 8. ⌘ B  
Festningen.
- Ceratites* ind.  
See *Arctoceras blomstrandii*  
(LINDSTRÖM)
- Ceratites* nov. f. indet.  
See *Arctoceras blomstrandii*  
(LINDSTRÖM)
- Ceratites* nov. f. indet.  
MOJSISOVICS 1886, p. 54, 57, pl. 9, figs. 5, 6.  
⌘ B (*Daonella* limestone).

- Ceratites* sp. indet.  
FREBOLD 1929b, pl. 3, figs. 9, 10. ⚭ B Festningen.
- Cladiscites* ? sp.  
WEIR 1933. Kapp Lee.
- Clionites barentsi* BÖHM  
BÖHM 1903, p. 54, pl. 6, fig. 18. Urd.  
FREBOLD 1935. ⚭ KT<sub>1</sub> (*Myophoria* sandstone).
- Clionites* (?) aff. *fairbanksi* and *compressus* HYATT and SMITH  
FREBOLD 1929a, p. 306, pl. 2, fig. 15. Wichebukta.
- Clionites spinosus* BÖHM  
BÖHM 1903, p. 56, pl. 6, figs. 19, 20. Urd.
- Czekanowskites* ? sp. nov.  
FREBOLD 1930a, p. 20, pl. 4, figs. 1, 1a, 1b.  
⚭ SK (Fish niveau), Vikinghøgda.
- Danubites? Xenodiscus?* nov. gen.  
SPATH 1921, p. 302.  
In part to *Xenoceltites gregoryi* SPATH, in part to *Xenoceltites spitsbergensis* SPATH and in part to *Xenoceltites subevolutus* SPATH
- Danubites?* sp.  
SPATH 1921, p. 349. Isfjorden.
- Danubites* cf. *evolutus* WAAGEN  
FREBOLD 1930a, p. 16, pl. 3, fig. 6. ⚭ B (Fish niveau), Kapp Wijk.
- ?*Danubites strongi* HYATT and SMITH  
SPATH 1921, p. 303, 304.
- Dawsonites canadensis* WHITEAVES  
See *Trachyceras (Dawsonites) canadense* WHITEAVES
- Dawsonites canadensis* WHITEAVES var. nov. *eliminata* BÖHM  
BÖHM 1903, p. 57, pl. 6, figs. 31, 32, 34, 35. Urd. Verdande.
- ?*Dawsonites* sp.  
BÖHM 1903, p. 58, pl. 7, figs 1–3. Urd.
- ?*Diplosirenites* sp.  
BÖHM 1903, p. 59, pl. 6, figs. 23, 24, 37. Urd.
- Euflemingites* sp.  
SPATH 1951, p. 5. C.S.E. Rotundafjellet: B1823.
- Eutomoceras* ex. aff. *laubei* MEEK  
FREBOLD 1929b, p. 25, pl. 2, figs. 5–7. ⚭ B, Festningen.  
In part to *Koptoceras falconi* SPATH and in part to *Koptoceras undulatum* SPATH
- ?*Eutomoceras* sp.  
ANDERSSON 1900. Bjørnøya.
- ?*Flemingites* sp.  
SPATH 1921, p. 300. SPATH 1951, p. 5.
- Flemingites* ? sp. indet.  
FREBOLD 1929b, p. 10, pl. 1, figs. 3, 4. Aldegondabreen.
- Goniodiscus nodosus* FREBOLD  
See *Arctoprionites nodosus* (FREBOLD)
- Goniodiscus* sp. nov. aff. *nodosus*  
FREBOLD  
FREBOLD 1930a, p. 11, pl. 2, figs. 1, 1a. ⚭ SK (Fish niveau), Sassendalen.
- Goniodiscus* sp.  
See *Hemiprionites garwoodi* SPATH
- Goniodiscus?* sp. (three forms)  
SPATH 1921, p. 300–301. Trehøgdene.  
In part to *Arctoprionites tyrrelli* SPATH
- Grypoceras? nordenskiöldi* LINDSTRÖM  
SPATH 1921, p. 297. Grønfjorden, Kapp Starostin.
- Gurleyites freboldi* SPATH  
including *Anasibirites* sp. (SPATH 1921) and *Anasibirites* sp. (FREBOLD 1930 a)  
SPATH 1921, p. 301. FREBOLD 1930a, p. 11. SPATH 1934, p. 339, pl. 14, figs. 3a, b, 7a, b; pl. 15, figs. 1a–c. ⚭ SK (*Posidonomya* beds), Trehøgdene.

- Gymnotoceras falcatum* (MOJSISOVICS)  
See *Gymnotoceras laqueatum*  
LINDSTRÖM
- Gymnotoceras geminatum* (MOJSISOVICS)  
including (in part)? *Ammonites tripli-*  
*catus* (ÖBERG 1877) and *Ceratites*  
*geminatus* (MOJSISOVICS) 1886)  
ÖBERG 1877, p. 15, pl. 2, fig. 11. Sassen-  
fjorden. MOJSISOVICS 1886, p. 49, pl. 9, figs.  
7, 13, 14. ⚭ B (*Daonella* limestone), Diabas-  
odden, Kapp Thordsen, Midterhukken, Sau-  
rieberget. SPATH 1921, p. 349. Diabasodden,  
Trehøgdene. FREBOLD 1929a, p. 303. SPATH  
1934, p. 433. Diabasodden, Kapp Starostin,  
Trehøgdene, Van Keulenfjorden. C.S.E.  
Bertilryggen: B1558, B1566–7, B1569–71,  
B1575–6, B1578–9, W2344, W2347, W2350–  
52, W2356, W2361, W2364, W2367, W2369–  
70, W2375–6, W2378, W2381–2, W2386,  
W2391–2, W2398, W2402, W2409. Kon-  
gressfjellet: B1276. Oscar II Land: T726–7.
- Gymnotoceras laqueatum* (LINDSTRÖM)  
including *Ceratites laqueatus* (LIND-  
STRÖM 1865), (in part) *Ceratites laque-*  
*atus* (ÖBERG 1877), *Ceratites laqueatus*  
(MOJSISOVICS 1886) and *Gymnotoceras*  
*falcatum* (SPATH 1921).  
LINDSTRÖM 1865, p. 5, pl. 2, figs. 3, 4.  
ÖBERG 1877, p. 8, pl. 2, fig. 7. MOJSISOVICS  
1886, p. 51, pl. 9, figs 1, 2. SPATH 1921, p.  
349. Sassenfjorden. SPATH 1934, p. 432.  
Isfjorden, Sassendalen, Sassenfjorden, Tre-  
høgdene. C.S.E. Tschermakfjellet: B1235–7,  
B1240, B1242.
- Gymnotoceras* sp. aff. *laqueatum*  
LINDSTRÖM  
FREBOLD 1929a, p. 303, pl. 1, fig. 8. Grøn-  
fjorden.
- ?*Gymnotoceras* cf. *laqueatus* LINDSTRÖM  
SPATH 1921, p. 348.
- Gymnotoceras todtmanneae* FREBOLD  
FREBOLD 1929a, p. 302, pl. 1, fig. 6. Grøn-  
fjorden.
- Gymnotoceras* (?) sp. indet.  
FREBOLD 1929b, p. 26. ⚭ S<sub>3</sub>, Festningen.
- Gyronites aplanatus* WHITE  
STOLLEY 1911, p. 19, fig. 5. Kapp Thordsen.  
STENSIÖ 1921. ⚭ SK (Fish niveau), Bertil-  
ryggen, Marmierfjellet.
- ?*Gyronites aplanatus* WHITE  
SPATH 1921, p. 303–4. Sassendalen.
- Gyronites nathorsti* BÖHM  
including *Meekoceras* (*Gyronites*)  
*nathorsti* (BÖHM 1912)  
NATHORST 1910, p. 358. BÖHM 1912, p. 11,  
pl. 1, figs. 17–19. Bellsund. WITTENBURG  
1912, p. 947. Bellsund. SPATH 1921, p. 347.  
Bellsund.
- Gyronites?* sp.  
See *Svalbardiceras spitsbergense*  
FREBOLD
- Hemiprionites garwoodi* SPATH  
including *Gomiodiscus* spp.  
(SPATH 1921)  
SPATH 1921, p. 300. SPATH 1934, p. 336,  
pl. 16, figs. 1, 3; pl. 17, fig. 3, 5. Trehøgdene.  
KUMMEL 1961.
- Hollandites* cf. *organi* WHITE  
FREBOLD 1929b, p. 16, pl. 2, figs. 3–4.  
Tschermakfjellet.
- Hollandites* sp. indet.  
FREBOLD 1929b, p. 16, pl. 2, fig. 2. Grøn-  
fjorden.
- Hollandites* (?) sp. indet.  
FREBOLD 1929b, p. 26, ⚭ B, Festningen.
- ?*Hungarites* sp.  
BÖHM 1903, p. 60, pl. 7, figs. 4, 5. Urd.
- Keyserlingites* cf. *subrobustus*  
MOJSISOVICS  
FREBOLD 1929b, p. 12, pl. 2, figs. 8, 9.  
Kapp Thordsen.
- Keyserlingites* sp.  
FREBOLD 1931, p. 14. Botneheia.
- Keyserlingites* sp. nov.  
See *Wasatchites tridertinus* SPATH



- Keyserlingites* n. sp.  
HOLLAND 1961, p. 32. Hahnfjella.
- Koptoceras falconi* SPATH  
including (in part) *Eutomoceras* ex.  
aff. *laubei* (FREBOLD 1929b)  
FREBOLD 1929b, pl. 2, fig. 7. ⚭ B Festningen.  
SPATH 1951, p. 12. C.S.E. Tschermakfjellet:  
B1216, B1218.
- Koptoceras undulatum* SPATH  
including (in part) *Eutomoceras* ex.  
aff. *laubei* (FREBOLD 1929 b)  
FREBOLD 1929b, pl. 2, fig. 5. ⚭ B, Festningen.  
SPATH 1951, p. 12.
- Lecanites* cf. *ophioneus* WAAGEN  
See *Xenocelites subevolutus* SPATH
- Lecanites* (?) *spitzbergensis* FREBOLD  
See *Svalbardiceras spitzbergense*  
FREBOLD
- Longobardites* cf. *nevadanus*  
HYATT and SMITH  
FREBOLD 1929a, p. 302, pl. 1, figs. 11, 12.  
Grøn fjorden.
- Meekoceras furcatum* (ÖBERG)  
including *Ceratites furcatus*  
(ÖBERG 1877)  
ÖBERG 1877, p. 13, pl. 3, figs. 5, 6. MOJSISOVICS  
1886, p. 80, pl. 10, figs. 18, 19. ⚭ SK  
(*Posidonomya* limestone), Kapp Thordsen.
- Meekoceras* cf. *keyserlingi* MOJSISOVICS  
FREBOLD 1930a, p. 18, pl. 4, fig. 5. ⚭ SK  
(Fish niveau), Kapp Wijk. KUMMEL 1961.
- Meekoceras* (*Gyronites*) *nathorsti* BÖHM  
See *Gyronites nathorsti* BÖHM
- Meekoceras* sp. indet.  
FREBOLD 1929b, p. 11, pl. 1, figs. 1, 2. Grøn-  
fjorden.
- Meekoceras* (?) sp. indet.  
FREBOLD 1929b, p. 13, pl. 1, fig. 11. Kapp  
Thordsen.
- Monophyllites spetsbergensis* (ÖBERG)  
See *Ussurites ? spetsbergensis* (ÖBERG)
- Monophyllites* cf. *spetsbergensis* (ÖBERG)  
see *Ussurites ? spetsbergensis* (ÖBERG)
- Monophyllites* sp. cf. *sphaerophyllum*  
HAUER  
SPATH 1921, p. 348. Sticky Keep.
- Monophyllites* nov. sp. BÖHM  
ANDERSSON 1900. BÖHM 1903, p. 60, pl. 7,  
figs. 40, 41. Skuld.
- Nathorstites concentricus* (ÖBERG)  
WEIR 1933, p. 691, pl. 1, fig. 17. HOLLAND  
1961. Perthesfjella.
- Nathorstites gibbosus* STOLLEY  
STOLLEY 1911, p. 119, pl. 9, figs. 1, 1a, 1b,  
2, 2a. Kapp Thordsen. HOLLAND 1961.  
Perthesfjella. C.S.E. F1630. South Dickson  
Land: W2424. Tschermakfjellet: B1372 (cf.),  
B1375, B1385.
- Nathorstites gibbosus* STOLLEY var.  
*globosa* FREBOLD  
FREBOLD 1929a, p. 305, pl. 2, figs. 7, 8.  
Kapp Lee.
- Nathorstites gibbosus* STOLLEY var.  
*intermedia* FREBOLD  
FREBOLD 1929a, p. 305, pl. 2, figs. 4-6.  
Kapp Lee.
- Nathorstites gibbosus* STOLLEY var.  
*plana* FREBOLD  
FREBOLD 1929a, p. 305, pl. 2, figs. 1-3.  
Kapp Lee. FREBOLD 1930b, p. 60, pl. 22,  
figs. 1, 1a. Tumlingodden.
- Nathorstites globosus* BÖHM  
BÖHM 1903, p. 67, pl. 7, figs. 45-49. Bjørnøya.
- Nathorstites lindströmi* BÖHM  
BÖHM 1903, p. 64, pl. 7, figs. 17, 18, 25-27,  
33, 34, 37, 38, 39. Urd. NOETLING 1905,  
p. 209, pl. 33, figs. 12-13. Urd. FREBOLD  
1929b. Stormbukta, Vasskiltoppen. FREBOLD  
1935. ⚭ KT<sub>1</sub> (*Myophoria* sandstone), Bjørn-  
øya.

- Nathorstites lenticularis* WHITEAVES  
BÖHM 1903, p. 61, pl. 7, figs. 6–14, 44.  $\bar{\text{R}}$  KT<sub>1</sub>  
(Clay ironstone nodules and *Myophoria*  
sandstone). Urd. NOETLING 1905, p. 209,  
pl. 33, figs. 9–11. Miseryfjellet. WITTEN-  
BURG 1910, p. 33. Anderssonbukta, Kapp  
Lee. FREBOLD 1929b, p. 18, pl. 3, figs. 1–3.  
De Geerdalen. C.S.E. Kapp Lee: S.M.  
F372–4 (presented by British Museum  
(Natural History)).
- Nathorstites* cf. *mcconnelli* WHITEAVES  
BÖHM 1903, p. 63. Urd. C.S.E. Tschermak-  
fjellet: B1371.
- Nathorstites mojsvari* BÖHM  
BÖHM 1903, p. 65, pl. 7, figs. 15, 16, 19–21,  
28–30, 32, 35, 36. Bjørnøya.
- Nathorstites mojsvari* var. *applanata*  
BÖHM  
BÖHM 1903, p. 66, pl. 27, figs. 22, 23, 31.  
Urd.
- Nathorstites tenuis* STOLLEY  
STOLLEY 1911, p. 118, pl. 9, figs. 3, 3a, 4.  
FREBOLD 1929a, p. 306, pl. 2, figs. 9–12.  
Kapp Lee. HOLLAND 1961. Perthesfjella.  
C.S.E. Botneheia: B1925 (cf.), B2085.  
Tschermakfjellet: B1365 (cf.). Vikinghøgda:  
B1965 (cf.).
- Nathorstites* sp.  
BÖHM 1903, p. 64. Urd. WITTENBURG 1910,  
p. 33. Siegfjelllet.
- Nautilus nordenskiöldi* LINDSTRÖM  
LINDSTRÖM 1865, p. 3, pl. 1, fig. 1. Saurie-  
berget. ÖBERG 1877, p. 4, pl. 5, fig. 1. Kapp  
Thordsen. MOJSISOVICS 1886, p. 99, pl. 16,  
fig. 3.  $\bar{\text{R}}$  B (*Daonella* limestone), Saurieberget.  
In part to *Nautilus sibyllae*  
MOJSISOVICS
- Nautilus sibyllae* MOJSISOVICS  
including (in part) *Nautilus nordenskiöldi*  
(ÖBERG 1877)  
ÖBERG 1877, p. 4, pl. 5, figs. 1a, 1b. MOJSISO-  
VICS 1886, p. 100, pl. 16, fig. 2.  $\bar{\text{R}}$  B (*Daonella*  
limestone), Kapp Thordsen.
- Nautilus trochleaeformis* LINDSTRÖM  
See *Ptychites trochleaeformis*  
(LINDSTRÖM)
- ?*Olenikites sigmatoideus* MOJSISOVICS  
SPATH 1921, p. 299.
- Ophiceras* (?) sp.  
FREBOLD 1929b, p. 10, pl. 1, figs. 5, 6.  
Aldegondabreen.
- Orthoceras* sp.  
SPATH 1921, p. 297. Sassendalen.
- Paracladiscites* cf. *diluturnus*  
MOJSISOVICS  
FREBOLD 1929a, pl. 1, figs. 13, 14, 15.  
Wichebukta.
- Parapopanoceras hyatti* MOJSISOVICS  
including *Popanoceras hyatti*  
(MOJSISOVICS 1886)  
MOJSISOVICS 1886, p. 67, pl. 14, fig. 7.  $\bar{\text{R}}$  B  
(*Daonella* limestone), Saurieberget.
- Parapopanoceras malmgreni*  
(LINDSTRÖM) including *Ceratites*  
*malmgreni* (LINDSTRÖM 1865), (in  
part) *Ceratites malmgreni* (ÖBERG  
1877), *Popanoceras malmgreni*  
(MOJSISOVICS 1886) and *Popanoceras*  
(? *Proarcestes*) *malmgreni*  
(NOETLING 1905)  
LINDSTRÖM 1865, p. 4, pl. 2, figs. 1, 2.  
Saurieberget. ÖBERG 1877, p. 10. Kapp  
Thordsen, Saurieberget. MOJSISOVICS 1886,  
p. 68, pl. 15, fig. 1.  $\bar{\text{R}}$  B (*Daonella* limestone),  
Saurieberget. NOETLING 1905, p. 207, pl. 29,  
fig. 1.  $\bar{\text{R}}$  B (*Daonella* limestone), Saurieberget.  
FREBOLD 1951.
- Parapopanoceras torelli* MOJSISOVICS  
including *Popanoceras torelli*  
(MOJSISOVICS 1886)  
MOJSISOVICS 1886, p. 67, pl. 14, fig. 8.  $\bar{\text{R}}$  B  
(*Daonella* limestone), Saurieberget. FREBOLD  
1951.
- Parapopanoceras verneuli* MOJSISOVICS  
including (in part) *Ceratites malm-*  
*greni* (ÖBERG 1877), *Popanoceras*  
*verneuli* (MOJSISOVICS 1886) and  
*Popanoceras* (? *Proarcestes*) *verneuli*  
(NOETLING 1905)  
ÖBERG 1877, p. 10, pl. 11, figs. 1–3, 6. Kapp  
Thordsen, Saurieberget. MOJSISOVICS 1886,

- p. 69, pl. 15, figs. 5–9.  $\bar{r}$  B (*Daonella* limestone), Saurieberget. NOETLING 1905, p. 207, pl. 29, fig. 2.  $\bar{r}$  B (*Daonella* limestone), Saurieberget. FREBOLD 1929a, p. 301, pl. 1, figs. 9, 10. Grønfyorden. FREBOLD 1929b, p. 19. Kapp Thordsen. FREBOLD 1951. C.S.E. Vikinghøgda: B1950 (juv.).
- Popanoceras hyatti* MOJSISOVICS  
See *Parapopanoceras hyatti*  
MOJSISOVICS
- Popanoceras malmgreni* (LINDSTRÖM)  
See *Parapopanoceras malmgreni*  
(LINDSTRÖM)
- Popanoceras* (?*Proarcestes*) *malmgreni*  
LINDSTRÖM  
See *Parapopanoceras malmgreni*  
(LINDSTRÖM)
- Popanoceras torelli* MOJSISOVICS  
See *Parapopanoceras torelli*  
MOJSISOVICS
- Popanoceras verneuli* MOJSISOVICS  
See *Parapopanoceras verneuli*  
MOJSISOVICS
- Popanoceras* (?*Proarcestes*) *verneuli*  
MOJSISOVICS  
See *Parapopanoceras verneuli*  
MOJSISOVICS
- Popanoceras* div. indet.  
MOJSISOVICS 1886, p. 69, pl. 15, figs. 2–4.  
 $\bar{r}$  B (*Daonella* limestone), Kapp Thordsen.
- Prionites* sp. nov. aff. *tuberculatus*  
WAAGEN  
See *Arctoprionites* sp. nov.?
- Prionites* sp. indet. aff. *tuberculatus*  
WAAGEN  
FREBOLD 1930a, p. 16, pl. 3, fig. 7.  $\bar{r}$  SK  
(Fish niveau), Wallenbergfjellet.
- Prionites* sp. nov.  
See *Arctoprionites nodosus* (FREBOLD)
- Prospiringites spathi* FREBOLD  
including *Prospiringites?* sp. nov.  
(SPATH 1921)  
SPATH 1921, p. 298, 301. FREBOLD 1930a,  
p. 20, pl. 4, figs. 2, 3, 3a.  $\bar{r}$  SK (Fish niveau,  
*Posidonomya* limestone), Sassendalen. SPATH  
1934, p. 195, pl. 13, figs. 1a–e, 2. Marmier-  
fjellet, Sassenfyorden, Trehøgdene. C.S.E.  
Botneheia: B1983, B1988, B1990, B1991 (cf.),  
B1999, B2167. Oscar II Land: P1850.
- Prospiringites?* sp. nov.  
See *Prospiringites spathi* FREBOLD
- Protrachyceras sverdrupi* KITTL  
WITTENBURG 1910, p. 34. Tumlingodden.
- Pseudosagoceras grippi* FREBOLD  
FREBOLD 1929a, p. 298, pl. 1, fig. 2. Agardh-  
bukta.
- Ptychites concentricus* ÖBERG  
SPATH 1921, p. 351.  $\bar{r}$  B– $\bar{r}$  KT<sub>1</sub> (*Daonella*  
layers).
- Ptychites euglyphus* MOJSISOVICS  
including (in part) *Ammonites trochle-*  
*aeformis* (ÖBERG 1877)  
ÖBERG 1877, p. 4, pl. 1, figs. 2, 3. MOJSISO-  
VICS 1886, p. 94, pl. 14, figs. 1–3.  $\bar{r}$  B (*Dao-*  
*nella* limestone), Kapp Thordsen, Saurie-  
berget. FREBOLD 1929b, Botneheia, Kapp  
Thordsen, Sauriedalen, Vindodden.
- Ptychites* cf. *euglyphus* MOJSISOVICS  
FREBOLD 1929b. Botneheia, Sauriedalen.
- Ptychites latifrons* MOJSISOVICS  
MOJSISOVICS 1886, p. 95, pl. 13, figs. 5–6.  
 $\bar{r}$  B (*Daonella* limestone), Kapp Thordsen,  
Saurieberget. NOETLING 1905, pl. 29, fig. 4.  
 $\bar{r}$  B (*Daonella* limestone), Kapp Thordsen.  
FREBOLD 1929b. Kapp Thordsen, Vindodden.
- Ptychites lundgreni* MOJSISOVICS  
MOJSISOVICS 1886, p. 90, pl. 13, fig. 4, pl. 14,  
fig. 4,  $\bar{r}$  B (*Daonella* limestone), Saurieberget.  
SPATH 1921, p. 351. FREBOLD 1929b, Vind-  
odden. C.S.E. Kongressfjellet, B1296.
- Ptychites nanuk* TOZER (new record)  
C.S.E. Botneheia: B1912 (cf.), B1915 (cf.),  
B2174, B2176 (cf.), B2179, B2189 (cf.).  
Kongressfjellet: B1287 (cf.), B1289, B1292,  
B1297 (cf.), B1315. Vikinghøgda: B1957 (cf.).

*Ptychites nordenskjöldi* MOJSISOVICS

MOJSISOVICS 1886, p. 92, pl. 13, fig. 3.  $\bar{R}$  B (*Daonella* limestone), Saurieberget. NOETLING 1905, pl. 29, figs. 3a–b.  $\bar{R}$  B (*Daonella* limestone), Saurieberget. FREBOLD 1929b. Vindodden.

*Ptychites* ? sp. cf. *tibetanus*

MOJSISOVICS

SPATH 1921, p. 348. C.S.E. Vikinghøgda: B1961 (cf.).

*Ptychites trochleaeformis* (LINDSTRÖM) including *Nautilus trochleaeformis* (LINDSTRÖM 1865) and (in part) *Ammonites trochleaeformis* (ÖBERG 1877)

LINDSTRÖM 1865, p. 3, pl. 1, fig. 2. Saurieberget. ÖBERG 1877, p. 4, pl. 1, fig. 1. MOJSISOVICS 1886, p. 89, pl. 12, figs. 1–2, pl. 13, fig. 1.  $\bar{R}$  B (*Daonella* limestone), Kapp Thordsen, Saurieberget. FREBOLD 1929b. Vindodden. C.S.E.: G1517–19, G1522–25, G1527–29, G1544. Kongressfjellet: B1282.

*Ptychites* cf. *trochleaeformis* LINDSTRÖM

SPATH 1921, p. 348. Sticky Keep.

*Ptychites* ind.

MOJSISOVICS 1886, p. 92, pl. 13, fig. 2.  $\bar{R}$  B (*Daonella* limestone), Saurieberget.

cf. *Styrites tropitifformis* MOJSISOVICS

ANDERSSON 1900, Bjørnøya.

*Svalbardiceras spitzbergense* FREBOLD including *Gyronites* ? sp. (SPATH 1921) and *Leconites* (?) *spitzbergensis* (FREBOLD 1929 a).

SPATH 1921, p. 303. FREBOLD 1929a, p. 299, pl. 1, fig. 1. Agardhbukta. FREBOLD 1930a, p. 24, pl. 6, figs. 1, 1a, 2, 3.  $\bar{R}$  SK (*Grippia* niveau, Lower Saurian niveau). SPATH 1934, p. 251, fig. 85. C.S.E.: W2442a–b.

*Tellerites furcatus* (ÖBERG) MOJSISOVICS

NOETLING 1905, pl. 29, fig. 10. Kapp Thordsen.

*Tellerites* sp. juv. aff. *furcatus* (ÖBERG)

SPATH 1921, p. 301. SPATH 1934, p. 224, text-fig. 73e, pl. 4, fig. 3. Trehøgdene.

*Tellerites oxynotum* FREBOLD

FREBOLD 1930a, p. 22, pl. 4, figs. 4, 4a. Kapp Thordsen. KUMMEL 1961.

*Trachyceras (Dawsonites) canadense*

WHITEAVES including *Dawsonites canadensis* (BÖHM 1903).

BÖHM 1903, p. 56, pl. 6, figs. 25–30. Urd, Verdande. NOETLING 1905, p. 209, pl. 33, fig. 8. FREBOLD 1935,  $\bar{R}$  KT<sub>1</sub> (*Myophoria* sandstone).

*Trachyceras* aff. *margaritosum*

MOJSISOVICS

ANDERSSON 1900. Bjørnøya.

*Trachyceras ursinum* BÖHM

BÖHM 1899, p. 325. Miseryfjellet. ANDERSSON 1900. Urd.

*Trachyceras* sp.

BÖHM 1903, p. 56, pl. 6, figs. 21, 22. Urd. FREBOLD 1935.  $\bar{R}$  KT<sub>1</sub> (*Myophoria* sandstone).

*Tropigastrites* ? cf. *polygyratus* SMITH

SPATH 1921, p. 349. Sassendalen.

*Ussurites* ? *spetsbergensis* (ÖBERG)

including (in part) *Ceratites spetsbergensis* (ÖBERG 1877) and *Monophyllites spetsbergensis* (MOJSISOVICS 1886).

ÖBERG 1877, p. 14, pl. 4, figs. 1a–b. MOJSISOVICS 1886, p. 72, pl. 11, figs. 20–21.  $\bar{R}$  SK (*Posidonomya* limestone). SPATH 1921, p. 349. SPATH 1934, p. 300, pl. 10, figs. 1–2. Flowerdalen, Sassenfjorden. C.S.E. Bertilyggen: B1495, B1497, B1499, B1500. Botneheia: B1914. Vikinghøgda: B1960.

*Wasatchites tridentinus* (SPATH)

including *Keyserlingites* sp. nov. (SPATH 1921).

SPATH 1921, p. 301. Trehøgdene. SPATH 1934, p. 352, pl. 15, figs. 2a–c, pl. 16, figs. 2a–b, 4.  $\bar{R}$  SK (*Posidonomya* beds), Trehøgdene. KUMMEL 1961.

*Xenodiscus* aff. *bittneri*

HYATT and SMITH

FREBOLD 1929a, p. 301, pl. 1, fig. 5. Grøn-fjorden.

*Xenodiscus* cf. *comptoni* DIENER

In part to *Xenoceltites gregoryi* SPATH  
and in part to *Xenoceltites*  
*subevolutus* SPATH

*Xenoceltites gregoryi* SPATH

including (in part) *Danubites?* *Xenodiscus?* (SPATH 1921), and (in part) *Xenoceltites* cf. *comptoni* (FREBOLD 1930 a)

SPATH 1921, p. 302. FREBOLD 1930a, p. 15. SPATH 1934, p. 129, pl. 5, fig. 3; pl. 6, figs. 4–5; pl. 11, figs. 3–4, 6. Trehøgdene. KUMMEL 1961. C.S.E. Botneheia: B2028, B2030, B2037–8, B2040, B2043–5, B2049–51, B2054, B2058, B2063, B2072–3, B2078, B2081, B2164.

*Xenoceltites spitzbergensis* SPATH

including (in part) *Danubites?*,  
*Xenoceltites?* (SPATH 1921)

SPATH 1921, p. 302. SPATH 1934, p. 128, pl. 9, figs. 1–2; pl. 11, figs. 5, 7–8. Trehøgdene. KUMMEL 1961. C.S.E. Botneheia: B1884, B2027–8, B2033–6, B2039, B2041, B2046–8, B2057, B2059, B2062, B2064–71, B2074–6, B2079–80, B2082, B2164, B2208. Flowerdalen: B2208.

*Xenoceltites subevolutus* SPATH

including (in part) *Danubites?*, *Xenodiscus?* (SPATH 1921), (in part) *Xenodiscus* cf. *comptoni* (FREBOLD 1930 a) and *Lecanites* cf. *ophioneus* (FREBOLD 1930 a)

SPATH 1921, p. 302. FREBOLD 1930a, p. 12, 14, pl. 3, figs. 1–5.  $\bar{\text{R}}$  SK (Fish niveau), Vikinghøgda. SPATH 1934, p. 130, pl. 2, fig. 2; pl. 8, fig. 2; pl. 9, fig. 4; pl. 11, fig. 2. Trehøgdene.

**Crustacea**

*Estheria minuta* (ALBERTI)

WEIR 1933, pl. 1, fig. 2. Kapp Johannesen.

*Estheria* sp.

BÖHM 1912, p. 12. Bellsund.

*Macruridarum* sp.

BÖHM 1903, p. 68, pl. 7, fig. 42. Urd.

**Vertebrata**

*Aciolepis arctica?* STENSIÖ

See *Boreosomus arcticus* (WOODWARD)

*Acrodus oppenheimeri* STENSIÖ

STENSIÖ 1921, p. 21, pl. 3, figs. 1–11.  $\bar{\text{R}}$  KT<sub>1</sub> (Upper Saurian niveau), Botneheia, Sauriebergeret, Tschermafjellet.

*Acrodus scaber* STENSIÖ

STENSIÖ 1921, p. 20, pl. 1, fig. 20. Kongressfjellet.

*Acrodus spitzbergensis* (HULKE)

HULKE 1873, p. 10. Sauriebergeret. STENSIÖ 1918, p. 76. Hornsund. STENSIÖ 1921, p. 10, pl. 2, figs. 1–19.  $\bar{\text{R}}$  SK (Lower Saurian niveau), Hornsund, Kapp Thordsen, Vikinghøgda. FREBOLD 1935.  $\bar{\text{R}}$  SK (*Grippia* niveau, Lower Saurian Niveau).

*Acrodus vermiformis* STENSIÖ

STENSIÖ 1921, p. 18, pl. 2, figs. 20, 21. Kapp Thordsen, Vikinghøgda. FREBOLD 1935.  $\bar{\text{R}}$  SK (*Grippia* niveau).

*Acrolepis arctica* WOODWARD

See *Boreosomus arcticus* (WOODWARD)

*Acrolepis?* spp.

WOODWARD 1912, p. 293.  $\bar{\text{R}}$  B– $\bar{\text{R}}$  KT<sub>1</sub> (*Daonella* beds), Kapp Thordsen, Sveancset.

*Acrorhabdus asplundi* STENSIÖ

STENSIÖ 1921, p. 233, pl. 30, figs. 1, 2,  $\bar{\text{R}}$  SK (Fish niveau), Stensiöfjellet.

*Acrorhabdus bertili* STENSIÖ

STENSIÖ 1921, p. 223, pl. 31, pl. 32, figs. 2–5.  $\bar{\text{R}}$  SK (Fish horizon), Botneheia, Stensiöfjellet, Trehøgdene.

*Acrorhabdus latistriatus* STENSIÖ

STENSIÖ 1921, p. 235, pl. 29, fig. 4, pl. 30, figs. 3–5.  $\bar{\text{R}}$  SK (Fish niveau), Stensiöfjellet.

*Aphaneramma rostratum* WOODWARD

WOODWARD 1904, p. 173, pl. 12, figs. 1–9. Sticky Keep. WIMAN 1914b, p. 17, pl. 5, figs. 1–6.  $\bar{\text{R}}$  SK (Fish niveau), Stensiöfjellet, Sticky Keep.

*Axelia elegans* STENSIÖ

STENSIÖ 1921, p. 106, pl. 16, figs. 6, 7, pl. 17, figs. 1, 2. ⚭ SK (Fish niveau), Kongressfjellet.

*Axelia robusta* STENSIÖ

STENSIÖ 1921, p. 90, pl. 11–15, pl. 16, figs. 1–5. ⚭ SK (Fish niveau), Botneheia, Dickson Land, Ekmanfjorden, Kongressfjellet, Marmierfjellet, Milne Edwardsfjellet, Sassen-dalen, Stensiöfjellet, Trehøgdene, Vikinghøgda.

*Belonorhynchus wimani* WOODWARD

WOODWARD 1912, pl. 14, fig. 3–6. Sassenfjorden.

In part to *Saurichlys ornatus*

STENSIÖ and in part to *Saurichlys wimani* (WOODWARD)

*Belonorhynchus* sp.

ANDERSSON 1900. BÖHM 1903, p. 68, pl. 7, fig. 43. Urd.

*Birgeria mougeoti* (AGASSIZ)

STENSIÖ 1921, p. 151, pl. 20, fig. 6; pl. 21; pl. 22, figs. 1–3; pl. 23, figs. 1–3; pl. 24, figs. 1, 2, Text-figs. 61–68. ⚭ SK (Fish niveau), Kongressfjellet, Marmierfjellet, Milne Edwardsfjellet, Stensiöfjellet, Sticky Keep, Trehøgdene, Vikinghøgda. FREBOLD 1935. ⚭ SK (Fish niveau, *Grippia* niveau).

*Birgeria* sp.

STENSIÖ 1921, p. 199, pl. 24, fig. 3. Bertilryggen.

*Boreosomus arcticus* (WOODWARD)

including *Acrolepis arctica* (WOODWARD 1912) and *Aciolepis arctica?* (STENSIÖ 1918)

WOODWARD 1912, p. 292–93, pl. 14, fig. 2. STENSIÖ 1918, p. 77. ⚭ SK (Fish niveau), Kapp Thordsen, Isfjorden. STENSIÖ 1921, p. 211, pl. 27, fig. 2. ⚭ SK (Fish niveau), Hornsund, Kongressfjellet, Marmierfjellet, Sassenfjorden.

*Boreosomus reuterskiöldii* STENSIÖ

STENSIÖ 1921, p. 215, pl. 22, fig. 4; pl. 27, fig. 3; pl. 28, fig. 1. ⚭ SK (Fish niveau), Kongressfjellet, Marmierfjellet, Stensiöfjellet, Sturefjellet, Trehøgdene.

*Boreosomus? scaber* STENSIÖ

STENSIÖ 1921, p. 221, pl. 24, fig. 4; pl. 26, fig. 3; pl. 35, fig. 4. ⚭ SK (Fish niveau, Lower Saurian niveau), Bertilryggen, Botneheia, Marmierfjellet, Vikinghøgda. FREBOLD 1935. ⚭ SK (*Grippia* niveau, Lower Saurian niveau, Fish niveau).

*Boreosomus* sp.

STENSIÖ 1921, p. 219, pl. 29, figs. 1–3. ⚭ KT<sub>1</sub> (Upper Saurian niveau), Kongressfjellet, Marmierfjellet, Sveanaset, Tschermakfjellet, Vikinghøgda.

*Capitosaurus polaris* WIMAN

WIMAN 1914b, p. 21, pl. 8. Kapp Thordsen.

*Ceratodus* sp.

STENSIÖ 1921, p. 42, pl. 3, fig. 19. ⚭ SK (Lower Saurian niveau), Vikinghøgda.

*Coelacanthus guttatus* WOODWARD

See *Sassenia? guttata* (WOODWARD)

*Colobodus altilepis* WOODWARD

See *Perleidus woodwardi* STENSIÖ

*Cyclotosaurus? spitzbergensis* WIMAN

WIMAN 1914b, p. 22, pl. 9, fig. 1. ⚭ SK (Fish niveau), Stensiöfjellet.

*Ekbainacanthus tschernyschewi*

YAKOWLEW

YAKOWLEW 1903, p. 180, pl. 3, figs. 1–9. Edlundfjellet, Van Keulenfjorden.

*Glaucolepis gyrolepidoides* STENSIÖ

including *Gyrolepis?* sp.

(STENSIÖ 1918)

STENSIÖ 1918, p. 76, Kapp Thordsen. STENSIÖ 1921, p. 201, pl. 25, figs. 1, 2. ⚭ SK (Fish niveau), Kongressfjellet. FREBOLD 1935. ⚭ SK (Fish niveau, *Grippia* niveau).

*Glaucolepis* sp.

FREBOLD 1935. ⚭ SK (Lower Saurian niveau).

*Grippia longirostris* WIMAN

WIMAN 1928, p. 184, figs. 1–6. Agardhbukta.

*Gyrolepis?* sp.

See *Glaucolepis gyrolepidoides* STENSIÖ

*Hyobodus microdus* STENSIÖ

STENSIÖ 1921, p. 8. Vikinghøgda. FREBOLD 1935. ⚭ S<sub>2</sub> (*Grippia* niveau).

*Hyobodus rapax* STENSIÖ

STENSIÖ 1921, p. 3, pl. 1, figs. 1, 2. Vikinghøgda. FREBOLD 1935. ⚭ SK (*Grippia* niveau).

*Hyobodus sasseniensis* STENSIÖ

including *Hyobodus* sp. (STENSIÖ 1918) STOLLEY 1911, p. 115. Hornsund, Isfjorden. STENSIÖ 1918, p. 76. Kapp Thordsen. STENSIÖ 1921, p. 5, pl. 1, figs. 3–10. Vikinghøgda. FREBOLD 1935. ⚭ SK (*Grippia* niveau).

*Hyobodus* sp.

See *Hyobodus sasseniensis* STENSIÖ

*Ichthyosaurus nordenskiöldii* HULKE

See *Mixosaurus nordenskiöldii* HULKE

*Ichthyosaurus polaris* HULKE

See *Pessosaurus polaris* HULKE

*Ichthyosaurus* spp.

WIMAN 1910b, p. 143, pl. 10, figs. 29–40.

*Ichthyosaurus* sp.

WIMAN 1910b, p. 143, pl. 10, figs. 24–27. ⚭ SK (Lower Saurian niveau), Kapp Thordsen.

*Labyrinthodon* sp.

See *Lonchorrhynchus?* sp.

*Lonchorrhynchus övergi* WIMAN

WIMAN 1910a, p. 35, pl. 2, figs. 2–2d. WIMAN 1914b, p. 14, pl. 3, figs. 1–3, pl. 4, figs. 1–8. ⚭ SK (Fish niveau), Bertilryggen, Kapp Thordsen. Stensiöfjellet, Sticky Keep, Trehøgdene. WIMAN 1916a, p. 220, pl. 16, fig. 2. WIMAN 1917, p. 238, pl. 13, fig. 5.

*Lonchorrhynchus?* sp.

including *Labyrinthodon* sp. (WIMAN 1910 b)

WIMAN 1910a, p. 35, pl. 2, figs. 1–1c. WIMAN 1914b, p. 17, fig. 8. ⚭ SK (Fish niveau), Marmierfjellet, Sticky Keep.

*Lyrocephalus euri* WIMAN

WIMAN 1914b, p. 10, pl. 1, figs. 1–6; pl. 2, figs. 1–6; pl. 3, fig. 4. ⚭ SK (Fish niveau), Stensiöfjellet, Sticky Keep, Sturefjellet, Trehøgdene. WIMAN 1916a, p. 216, pl. 16, figs. 3, 4. ⚭ SK (Fish niveau), Stensiöfjellet, Wallenbergfjellet.

*Mixosaurus nordenskiöldii* HULKE

including *Ichthyosaurus nordenskiöldii* (HULKE 1873)

HULKE 1873, p. 4. WIMAN 1910b, p. 129, pl. 5, 6. Isfjorden.

*Mylacanthus lobatus* STENSIÖ

STENSIÖ 1921, p. 108, pl. 18, figs. 1, 4. ⚭ SK (Fish niveau), Stensiöfjellet, Wallenbergfjellet.

*Mylacanthus spinosus* STENSIÖ

STENSIÖ 1921, p. 110, pl. 19, fig. 3; pl. 20, fig. 2. Kongressfjellet, Stensiöfjellet. FREBOLD 1935. ⚭ SK (Fish niveau).

*Myriolepis?* sp.

See *Pygopterus de geeri* STENSIÖ

*Omphalosaurus* sp.

STENSIÖ 1921. ⚭ SK (Lower Saurian niveau).

*Palaeobates polaris* STENSIÖ

STENSIÖ 1921, p. 34, pl. 3, figs. 12–18. ⚭ SK (Fish niveau), Stensiöfjellet.

*Palaeobates* n.sp.

STENSIÖ 1921, p. 39, pl. 1, figs. 28, 29. Hornsund, Vikinghøgda. FREBOLD 1935. ⚭ SK (*Grippia* niveau).

*Peltostega erica* WIMAN

WIMAN 1916a, p. 210, pl. 15, figs. 1–3; pl. 16, fig. 1. ⚭ SK (Fish niveau), Stensiöfjellet.

*Perleidus woodwardi* STENSIÖ

including *Colobodus altilepis* (WOODWARD 1912)

WOODWARD 1912, p. 296–7, pl. 14, figs. 7, 7a–c. Sassenfjorden. STENSIÖ 1921, p. 257, pl. 28, fig. 3; pl. 33, 34, pl. 35, figs. 1–3. ⚭ SK (Fish niveau), Kongressfjellet, Rotundafjellet, Sassenfjorden, Stensiöfjellet, Sticky Keep, Sturefjellet, Tschermakfjellet.

*Pessopteryx arctica* WIMAN

WIMAN 1910b, p. 143, pl. 10, fig. 1. ♂ SK  
(Lower Saurian niveau), Kapp Thordsen.

*Pessopteryx minor* WIMAN

WIMAN 1910b, p. 143, pl. 10, figs. 3, 3a.  
♂ SK (Lower Saurian niveau), Kapp  
Thordsen.

*Pessopteryx misseri* WIMAN

WIMAN 1910b, p. 139, pl. 8, figs. 1–34, pl. 9,  
figs. 1–37a. ♂ SK (Lower Saurian niveau),  
Kapp Thordsen.

*Pessopteryx pinguis* WIMAN

WIMAN 1910b, p. 143, pl. 10, figs. 2, 2a.  
♂ SK (Lower Saurian niveau), Kapp  
Thordsen.

*Pessosaurus polaris* HULKE

including *Ichthyosaurus polaris*  
(HULKE 1873) and *Schastasaurus*  
*polaris* (YAKOWLEW 1903)

HULKE 1873, p. 3. YAKOWLEW 1903, p. 194.  
WIMAN 1910b, p. 136, pl. 7, figs. 1–7; pl. 10,  
fig. 28. ♂ KT<sub>1</sub> (Upper Saurian niveau),  
Kapp Thordsen, Midterhuken, Sassenfjorden.

*Phalarodon nordenskiöldii* (HULKE)

STENSIÖ 1921.

*Platysomus nathorsti* STENSIÖ

STENSIÖ 1921, p. 251, pl. 27, fig. 4, pl. 28,  
fig. 2, pl. 32, fig. 1. ♂ SK (Fish niveau),  
Marmierfjellet, Sticky Keep, Trehøgdene.

*Platysomus* sp.

STENSIÖ 1921, p. 252. ♂ SK (Fish niveau),  
Trehøgdene.

*Platystega depressa* WIMAN

WIMAN 1914b, p. 20, pl. 6, figs. 5, 6. ♂ SK  
(Fish niveau), Sassendalen, Stensiöfjellet.

*Polyacrodus angulatus* STENSIÖ

STENSIÖ 1921, p. 31, pl. 1, fig. 27. Kongress-  
fjellet.

*Polyacrodus pyramidalis* STENSIÖ

STENSIÖ 1921, p. 29, pl. 1, figs. 21–26.  
Bertilryggen.

*Pygopterus de geeri* STENSIÖ

including *Myriolepis*? sp.

(WOODWARD 1912)

WOODWARD 1912, p. 293. Sassenfjorden.  
STENSIÖ 1921, p. 203, pl. 25, fig. 3; pl. 26,  
figs. 1, 2; pl. 27, fig. 1. ♂ SK (Fish niveau),  
Kongressfjellet, Milne Edwardsfjellet,  
Sassenfjorden, Stensiöfjellet, Trehøgdene.

*Sassenia tuberculata* STENSIÖ

STENSIÖ 1921, p. 85, pl. 10. ♂ SK (Fish  
niveau), Stensiöfjellet, Sticky Keep, Tre-  
høgdene.

*Sassenia?* *guttata* (WOODWARD)

including *Coelacanthus guttatus*

(WOODWARD 1912)

WOODWARD 1912, p. 291, pl. 14, figs. 1, 1a,  
1b. STENSIÖ 1921, p. 88. ♂ SK (Fish niveau),  
Botneheia.

*Saurichthys elongatus* STENSIÖ

STENSIÖ 1925, p. 146, pl. 21–24; pl. 25,  
figs. 1–4; pl. 32, fig. 3; pl. 34, figs. 1, 2. ♂ SK  
(Fish niveau), Bertilryggen, Kongressfjellet,  
Marmierfjellet, Milne Edwardsfjellet, Rotun-  
dajfellet, Stensiöfjellet, Trehøgdene, Viking-  
høgda.

*Saurichthys hamiltoni* STENSIÖ

STENSIÖ 1925, p. 153, pl. 26, figs. 1–5; pl. 27–  
31; pl. 32, figs. 1, 2, 4; pl. 33, figs. 1–3; pl. 34,  
fig. 2. ♂ SK (Fish niveau), Milne Edwards-  
fjellet, Stensiöfjellet, Trehøgdene.

*Saurichthys ornatus* STENSIÖ

includes (in part) *Belonorhynchus*  
*wimani* (WOODWARD 1912)

WOODWARD 1912, p. 293–295. Sassenfjorden.  
STENSIÖ 1925, p. 13, pl. 1–16; pl. 26; fig. 2,  
Text-figs. 1–12, 14, 16–29. ♂ SK (Fish  
niveau), Milne Edwardsfjellet, Stensiöfjellet,  
Trehøgdene.

*Saurichthys wimani* (WOODWARD)

includes (in part) *Belonorhynchus*  
*wimani* (WOODWARD 1912)

WOODWARD 1912, p. 293–295. Sassenfjorden.  
STENSIÖ 1925, p. 133, pl. 17–20, pl. 26,  
fig. 6. ♂ SK (Fish niveau).

*Saurichthys* sp.

FREBOLD 1935. ♂ SK (Lower Saurian niveau).



*Schastasaurus polaris* YAKOWLEW  
See *Pessosaurus polaris* HULKE

*Scleracanthus asper* STENSIÖ  
STENSIÖ 1921, p. 111, pl. 17, fig. 3; pl. 18, fig. 2; pl. 19, figs. 1, 2; pl. 20, fig. 1.  $\bar{\text{R}}$  SK (Fish niveau), Kongressfjellet, Milne Edwardsfjellet, Stensiöfjellet.

*Semionotus* (?) sp.  
WOODWARD 1912, p. 296. Kapp Wijk.

*Tertrema acuta* WIMAN  
WIMAN 1914b, p. 21, pl. 6, fig. 7; pl. 7, fig. 1.  $\bar{\text{R}}$  SK (Fish niveau), Sticky Keep. WIMAN 1917, p. 229, pl. 11, 12, 13, figs. 1-4.

*Wimania? multistriata* STENSIÖ  
STENSIÖ 1921, p. 81, pl. 8, figs. 2-7; pl. 9, fig. 1.  $\bar{\text{R}}$  SK (Fish niveau), Kongressfjellet, Milne Edwardsfjellet, Rotundafjellet, Sticky Keep, Trehøgdene.

*Wimania sinuosa* STENSIÖ  
STENSIÖ 1921, p. 53, pl. 4-7, pl. 8, fig. 1.  $\bar{\text{R}}$  SK (Fish niveau), Kongressfjellet, Stensiöfjellet.

*Wimania ?* sp.  
STENSIÖ 1921, p. 79, pl. 9, figs. 2, 3.  $\bar{\text{R}}$  SK (Fish niveau), Milne Edwardsfjellet, Trehøgdene.

Dr. E. T. TOZER has drawn our attention to the following additional reference: PETRENKO, V. M. 1963: Some important finds of early Triassic fossils from Spitsbergen; Scientific Research Institute of Arctic Geology, Scientific Notes, Palaeontology and Biostratigraphy, Fasc. 3, p. 50-54, pl. 1, Leningrad. Two species are recorded: *Otoceras* sp. indet. from Lusitaniadalen (Sassenfjorden) and *Posidonia arenea* TOZER from Festningen, Vindodden and Wahlbergøya (Nordaustlandet).

## VI. BIBLIOGRAPHY OF THE TRIASSIC STRATIGRAPHY OF SVALBARD AND OTHER REFERENCES CITED

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## Appendix

Since this paper was set in type we have seen the latest scheme of «Lower Triassic and ammonoid zones of Arctic Canada» based on unusually complete sections in Ellesmere and Axel Heiberg Islands (E. T. TOZER, *Geological Survey of Canada*, Paper 65-12, Ottawa 1965). We summarize it here without comment except to remark that according to our palaeogeographical interpretation, apart from Peary Land, this was the nearest known Triassic succession to Spitsbergen.

### LOWER TRIASSIC

SPATH 1934	TOZER 1965		sub-zones		
	stages	zones			
Prohungaritan Columbitan	} Spathian	{ <i>Keyserlingites subrobustus</i> <i>Nordophiceras pilatum</i>	{ <i>Wasatchites tardus</i> <i>Meekoceras gracilitatis</i>		
Owenitian				Smithian	<i>Arctoceras blomstrandii</i>
Flemingitan	} Dienerian	{ <i>Paranorites sverdrupi</i> <i>Proptychites candidus</i>			
Gyronitan				} Griesbachian	U { <i>Pachyproptychites strigatus</i> <i>Ophiceras commune</i>
Otoceratan					

The Smithian-Dienerian boundary is thus equivalent to the division between the Upper and Lower Eo-trias (or Scythian), and Induan and Olenekian of KIPARISOVA and POPOV (1956 and 1961, not 1964).

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