Salterella rugosa (Early Cambrian: Agmata) on Nordaustlandet and Spitsbergen, Svalbard

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Abstract

Occurrence of *Salterella rugosa* Billings on Nordaustlandet, Svalbard, is reported for the first time. The rocks that produced these fossils belong to the upper part of the Kapp Sparre Formation. This unit can be correlated with the Oslobreen Dolomite in Ny Friesland (Spitsbergen, Svalbard) from which the same species has been reported earlier; these fossils have not been illustrated previously. In both areas many specimens are poorly preserved, and it is becoming increasingly evident that the difference between *Salterella* and *Volborthella* simply may be the result of loss of the outer shell in the *Volborthella*.

Introduction

During the Norsk Polarinstitutt's expedition in 1978, geologists investigated areas on Nordaustlandet, Svalbard, and one field party was responsible for a general survey in the area around the head of Murchisonfjorden (Fig. 1). The survey was performed to produce a better geologic map of the area, and to find new fossil localities. Previous knowledge of the local stratigraphy and palaeontology was based on work by Kulling (1934), who pointed out the Lower Cambrian fossiliferous beds at Sparreneset (Fig. 1), where the inarticulate brachiopods *Obolus* sp. and *Lingulella* sp. are found. The Lower Cambrian age of these beds has since then been accepted on Nordaustlandet, but correlation elsewhere was obscure.

However, the fossils found during the 1978 season have brought some new light upon the understanding of the Upper Hecla Hoek succession of this area, including new finds of Lower Camrian fossils on Krossøya (Fig. 1) where *Salterella rugosa* was found together with olenellid trilobites. These fossils were collected from beds of the Kapp Sparre Formation (Kulling 1934), a formation having a thickness of between 700 and 800 metres (see also Flood et al. 1969). On small islands northwest of Krossøya, an Ordovician fauna has been found, indicating a break in the succession from Middle Cambrian to Lower Ordovician time, comparable with the section west of Hinlopenstretet in Ny Friesland, Spitsbergen (Fortey and Bruton 1973, p. 2230).

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Salterella rugosa has previously been found in Ny Friesland (Hallam 1958); Gobbett and Wilson (1960) indicated its occurrence in the Oslobreen Dolomite. However, *Salterella* was not found in the rocks referred to as the Tokammane Formation by Fortey and Bruton (1973), even though the whole succession was carefully examined. In spite of apparent absence of *Salterella*, one may assume that the combined Oslobreen Sandstone and Dolomite equal the Tokammane Formation, and that the Lower Cambrian age established for both formations can be adapted for the beds in the westernmost part of Krossøya, Nordaustlandet.

Salterella from Krossøya, Nordaustlandet

The material examined in detail from Nordaustlandet originates from two rock samples, one of which has been cut to produce four thin sections (PMO 37861—1&2) and two polished sections (PMO 37861—3&4). The specimens were collected on August 9, 1978, by T.S. Winsnes and Ø. Lauritzen at the westernmost point of Krossøya, Nordaustlandet (Fig. 1). The material has been compared with the type lot of *Salterella rugosa* (see Yochelson 1977), and we are completely satisfied that the Krossøya form is conspecific.

Salterella specimens are abundant in light grey bioturbated bedded dolomite. The fossils stand in relief on the weathered surface on the rock (Pl.1, Fig. 5) and show no obvious current orientation. The polished surface appears darker grey than the weathered surface, so that the white individuals of *Salterella* stand out clearly. The thin sections have a grainy appearance because of the large interlocking crystals, but few impurities are intermixed with the calcite and dolomite. Except for *Salterella*, fossil fragments are exceedingly rare. The inner part of the *Salterella* conch is in marked contrast to the matrix, as the inner fillings consist of tiny grains (Pl. 1, Figs. 3 and 4); some of these grains may be dolomite, but others are opaque minerals. No feldspar or quartz was recognized in microscopic examination under polarized light. The grain size of carbonate in the central tube is somewhat larger than that of carbonate forming the inner deposits (Pl. 1, Fig. 1), but it is still far finer than that of the matrix.

Remnants of an outer wall occur occasionally (Pl. 1, Fig. 2), but on most specimens, only the laminated inner deposits remain (Pl. 1, Figs. 3 and 4).

Salterella from Ny Friesland, Spitsbergen

The Cambridge University material of *Salterella* that has been examined consists of nine thin sections. Hallam (1958, p. 74) first reported *Salterella* cf. *rugosa*, identified by Ch. Poulsen, from the Oslobreen Dolomite on Spitsbergen. His material was: A.46838 (Pl. 2, Fig. 3) from the east side of lower Polarisbreen, and A.46839 (Pl. 2, Fig. 1) and A.46840, both from the west face of Adromedafjellet, but presumably from different spots or different stratigraphic levels. We have confirmed that all the specimens are *S. rugosa* Billings. For

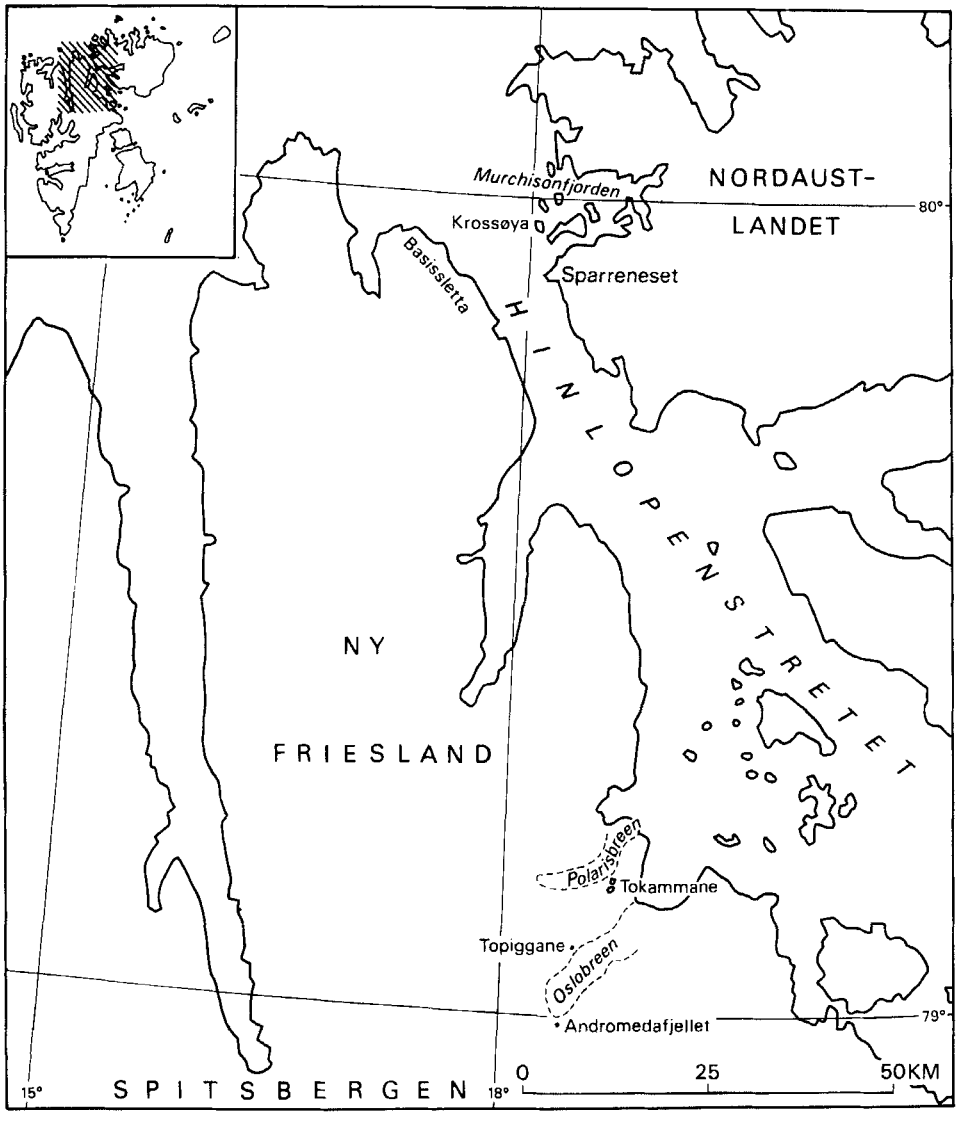

Fig. 1. *Location map showing the localities mentioned in the text.*

cataloguing purposes the illustrated specimens from A.46840 have been assigned numbers A.105687 (Pl. 2, Fig. 2) and A. 105688 (Pl. 2, Fig. 6).

Gobbett and Wilson (1960) found additional specimens and provided more precise information concerning the stratigraphic distribution, as well as a locality map. The published data have been supplemented by a few additional details on file at the Sedgwick Museum (Cambridge University, Cambridge, England). Gobbet and Wilson (1960) reported *Salterella* from subunit 1, 3, and 6, indicating a stratigraphic range of about 65 metres in the lower part of the Oslobreen Dolomite; they discarded reports of occurrence higher in

this 200 metre thick formation. All their available material also consists of only authentic *S. rugosa*, again compared with type material.

The Gobbett and Wilson fossils that we have examined are in six of the nine thin sections: A.50697 (Pl. 2, Fig. 4) from south Tokammane near Polarisbreen (Fig. 1), collected from the *Salterella* Bed at 105 metres above the base of the Oslobreen Sandstone, that is from subunit 6, about 60—65 metres above the base of the formation; two thin sections A.50698 and A.50699) from Nunatak W-139 near Polarisbreen (see Gobbett and Wilson 1960, p. 443, text-fig. 1B) were produced from a sample of the *Salterella* Bed at 90 metres above the base of the Oslobreen Sandstone, that is from near the top of subunit 3 or higher in the succession, at least 45 metres above the base of the formation; A.50700 from Topiggane near Oslobreen (Fig. 1), out of the *Salterella* Bed, again 90 metres above the base of the Oslobreen Sandstone; and A.50695 (Pl. 2, Fig. 5) from Topiggane near Oslobreen, 33 metres above the base of the formation, that is 63 metres above the base of the Oslobreen Sandstone, which is from near the middle of subunit 3.

The last section provides a minor local stratigraphic problem. If the thickness of the sandstone is taken as 30 metres, because of thinning southward, as discussed in the text, rather than as 45 metres, as given on the columnar section, all the collections labelled "*Salterella* Bed" are from the same unit. All thin sections having that designation are crowded with fossils. The matrix is less "grainy" in appearance than that in the thin sections from Krossøya, but the random distribution and abundance of specimens are comparable.

Stratigraphic significance

The occurrence of *Salterella rugosa* in rocks in the westernmost part of Krossøya, Nordaustlandet (Fig. 1), indicates that these sediments are to be correlated with the Oslobreen Dolomite in the Ny Friesland area in Spitsbergen. The two areas are separated by Hinlopenstretet (Fig. 1), but Krossøya is less than 20 kilometres from the Lower Cambrian beds of Basissletta, Ny Friesland (Fig. 1), where Fortey and Bruton (1973) mapped the Lower Palaeozoic succession. From Krossøya, it is about 110 kilometres to Adromedafjellet further south in Ny Friesland (Fig. 1).

The Kapp Sparre Formation is the youngest part of the Upper Hecla Hoek succession on Nordaustlandet, with fossiliferous dolomites overlying a quartzitic sandstone at Krossøya. Fossils have long been known from the upper part of the Kapp Sparre Formation, but the inarticulate brachiopods the rocks have yielded heretofore have only allowed generalized correlations to other areas. The discovery of *Salterella rugosa* on Krossøya, and the Ordovician fauna just northwest of it, provide an important tool for stratigraphic correlation elsewhere.

In a regional sense, these occurrences of *Salterella rugosa* demonstrate not only correlation within the Late Early Cambrian of Svalbard, but also between

Svalbard and the Forteau Formation of Labrador. The same species occurs in the Ella Ø Formation of East Greenland. Recently Peel and Yochelson (1981) have determined that *S. expansa* Poulsen from the Wulff River Formation in North-West Greenland is a junior subjective synonym of *S. rugosa*. This species also occurs in Sekwi Formation of the Mackenzie District, Canada (Fritz and Yochelson, unpubl.), making *S. rugosa* an exceedingly widespread species.

Discussion

In proposing an extinct phylum as the appropriate biological category for *Salterella,* Yochelson (1977) alluded to *Volborthella* Schmidt, described from the Early Cambrian of the Baltic area. Yochelson suggested that the two taxa might be congeneric, the differences being a result of solution of the outer wall in *Volborthella* (see Yochelson, Henningsmoen, and Griffin 1977). This contention is difficult to demonstrate in full as it would require complete gradation at a single locality from ideally preserved material to that strongly affected by solution. Nevertheless, we judge that the Svalbard fossils provide support for this interpretation. The Cambridge specimens may be variously designated as *Salterella* (Pl. 2, Figs. 1 and 2) or *Volborthella* (Pl. 2, Figs 3, 4 and 5). Breakage and wear after death are obvious (Pl. 2, Fig. 6). The stratigraphic data with the specimens are not sufficient to demonstrate interbedded *Salterella* and *Volborthella,* but at least the data do show that "*Volborthella*" (Pl. 2, Fig. 5) is found only 17 metres lower in the same formation and at the same locality as *Salterella* (A.50700, not illustrated).

The specimens from Krossøya (Pl. 1, Figs 1, 2, 3, and 4) demonstrate a modification on the outer shell wall. The most severely affected specimen from this locality (Pl. 1, Fig. 4) approaches, but does not quite reach the condition of a "*Volborthella*" (Pl. 2, Fig. 5), so this issue of similarity must remain open. This is not simply a matter of idle biologic speculation because the two genera are placed in different faunal provinces (Theokritoff 1979). Authors also differ in correlating the Early Cambrian strata with the Baltic units (Martinsson 1974) possibly being considered older than those of the Arctic regions (Cowie 1974).

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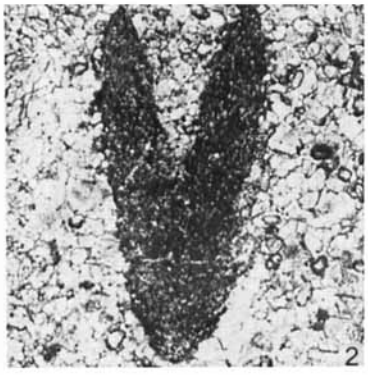
Plates 1–2

PLATE 1

Figs. 1—5 *Salterella rugosa* Billings.

All thin sections × 15; Figure 5, × 3.

Fig. 1. Westernmost on Krossøya. Paleontologisk Museum, Oslo No. 37861—1.
Fig. 2. Westernmost on Krossøya. Paleontologisk Museum, Oslo No. 37861—3.
Fig. 3. Westernmost on Krossøya. Paleontologisk Museum, Oslo No. 37861—3.
Fig. 4. Westernmost on Krossøya. Paleontologisk Museum, Oslo No. 37861—2.
Fig. 5. Surface showing abundant weathered specimens. Westernmost on Krossøya. Paleontologisk Museum, Oslo No. 37862.



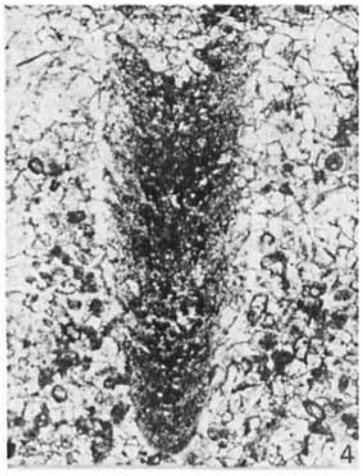


PLATE 2

Figs. 1—6 *Salterella rugosa* Billings.

All thin sections × 15.

Fig. 1. Oslobreen Dolomite; from west face of Adromedafjellet. Sedgwick Museum, Cambridge No. A.46839b.

Fig. 2. Oslobreen Dolomite; from west face of Adromedafjellet. Sedgwick Museum, Cambridge No. A.105687 (out of A.46840).

Fig. 3. Oslobreen Dolomite; from east side of Lower Polarisbreen. Sedgwick Museum,

Fig. 3. Oslobreen Dolomite; from east side of Lower Polarisbreen. Sedgwick Museum, Cambridge No. A.46838b.

Fig. 4. Oslobreen Dolomite; from south Tokammane. Sedgwick Museum, Cambridge No. A.50697b.

Fig. 5. Oslobreen Dolomite, 63 metres above base of Oslobreen Sandstone; from Topiggane, Oslobreen. Sedgwick Museum, Cambridge No. A.50695b.

Fig. 6. Oslobreen Dolomite; from west face of Adromedafjellet. Sedgwick Museum, Cambridge No. A.105688 (out of A.46840).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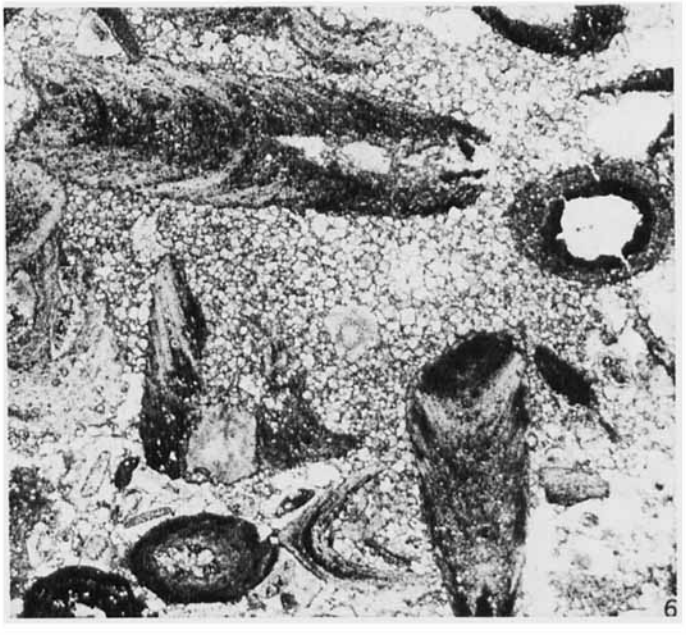
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