

# Note

## *Scenella barrandei* (Mollusca) from the Middle Cambrian of Baltoscandia

VIVIANNE BERG-MADSEN & JOHN S. PEEL

Berg-Madsen, V. & Peel, J. S.: *Scenella barrandei* (Mollusca) from the Middle Cambrian of Baltoscandia. *Norsk Geologisk Tidsskrift*, Vol. 66, pp. 81–86, Oslo 1986. ISSN 0029–196X.

*Metoptoma barrandei* Linnarsson, 1879 is redescribed on the basis of the holotype from the Exsulans Limestone (Middle Cambrian) of Scania, southern Sweden, and additional specimens of similar age from the Mjøsa district of southern Norway and from Bornholm, Denmark. The low, cap-shaped shell, with fine radiating ribs crossing concentric growth lines, promotes assignment to *Scenella* Billings, 1872, originally described from the Lower Cambrian of Canada.

V. Berg-Madsen, *Paleontologiska Institutionen, Box 558, S-751 22 Uppsala, Sweden. Present address: Geological Institute, Box 6801, S-10691, Stockholm, Sweden.*

J. S. Peel, *Grønlands Geologiske Undersøgelse, Øster Voldgade 10, DK-1350 København K, Denmark.*

The horizon of the Exsulans Limestone is widely recognised in the Middle Cambrian of Baltoscandia, and in several areas it can be recognised as the first well-developed carbonate deposit. One minor but widespread member of its fauna is a small cap-shaped fossil described by Linnarsson (1879) as *Metoptoma barrandei*. The species is recorded from Denmark, Norway and Sweden but, with one exception (Henningsmoen 1962), subsequent authors have maintained its generic assignment to *Metoptoma* Phillips, 1836, a name widely employed during the last century for Lower Palaeozoic cap-shaped shells. *Metoptoma*, however, is a gastropod now considered to range in age from the Lower Carboniferous to the Permian (Knight et al. 1960) and Linnarsson's species should clearly be placed elsewhere. Available specimens of *M. barrandei* have been examined with prompt assignment to *Scenella* Billings, 1872, originally described from the Lower Cambrian of Newfoundland, Canada. The systematic position of *Scenella* is the subject of some debate in the literature, but the genus is here considered to be an untorted mollusc, a monoplacophoran in the sense of several recent authors.

The holotype of *Scenella barrandei* was collected by von Schmalensée at Kiviks-Esperöd in Scania (Fig. 1C) in 1877 and described by Linnarsson (1879). Additional possible fragments from the Exsulans Limestone at Andrarum were noted, and the identification of these were con-

firmed by Linnarsson (1882). A similar, but undetermined specimen was mentioned from slightly older strata at Gislöv. None of these additional specimens, nor the ones mentioned by Dames (1881) from the equivalent *Acrothele granulata* conglomerate on Öland, are now available for study. Lindström (1888) reported other unlocated material in his list of Swedish fossil faunas in the collections of the Swedish Museum of Natural History, Stockholm.

Grönwall (1902) collected six specimens from the Exsulans Limestone at Borregård, Bornholm (Fig. 1), but only four of these are currently available at the Geological Museum, Copenhagen. The collections of Christian Poulsen in the same institution contain two specimens from the same locality and recent field work has produced three additional specimens. The Bornholm specimens are much smaller than Linnarsson's original, a feature of the fauna from the Danish Exsulans Limestone and Kalby marl in general, when compared to Scania (Berg-Madsen 1981).

Strand (1929) recorded 4 specimens from the Mjøsa district of southern Norway, but only two of these have been located in the Palaeontological Museum, Oslo. The best preserved of these, the original of Strand (1929, fig. 3a) is illustrated here (Fig. 3A). Henningsmoen (1962) tentatively assigned the species to *Helcionella*, a genus considered by some authors to lie in close connection with *Scenella* (Runnegar & Jell 1976).

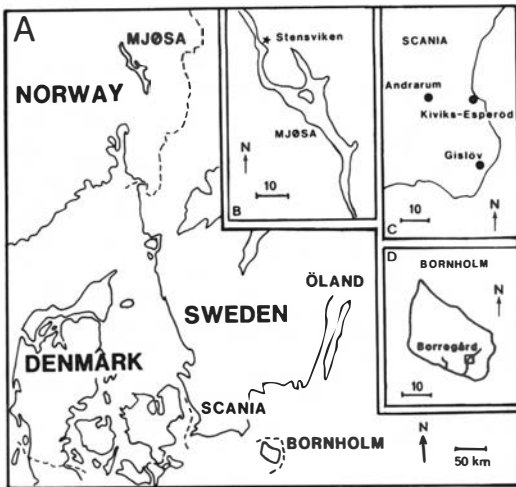


Fig. 1. Map of localities in Baltoscandia (A), the Mjøsa district of Norway (B), Scania, Sweden (C), and Bornholm, Denmark (D).

### Systematic description

#### Genus *Scenella* Billings, 1872

*Type species.* – *Scenella reticulata* Billings, 1872 from the Lower Cambrian of Conception Bay, Newfoundland, Canada.

*Discussion.* – There is a considerable disagreement concerning the suprageneric classification of *Scenella*. Knight & Yochelson (1960) questionably assigned the genus to the family Palaeacmaeidae of the monoplacophoran order Tryblidiodidae, the latter also including 'classical' monoplacophorans such as *Pilina* Koken, 1925, *Neopilina* Lemche, 1957 and *Tryblidium* Lindström, 1884.

Horný (1965a,b) considered *Tryblidium*-like forms to belong to a subclass Tergomya, characterised by muscle scars forming a partial ring on the dorsal surface, behind the apex. The subclass Cyclomya of Horný (1965a,b) included forms in which the apex lay within the ring of muscles. *Scenella* was assigned to the Cyclomya on the basis of muscle scars described by Rasetti (1954) from the Middle Cambrian of British Columbia. Starobogatov (1970) did not recognise Horný's subclasses. Following an interpretation of the supposed function of muscles based on muscle scar patterns, he excluded *Scenella* from the Monoplacophora.

Runnegar & Jell (1976) recognised a family Scenellidae, excluding *Palaeacmaea* Hall &

Whitfield, 1872. The latter was placed in a family Palaeacmaeidae, together with *Palaeophacmaea* Donaldson, 1962. Yochelson & Stanley (1981) subsequently removed Donaldson's genus from the Mollusca and suggested that this fate should also be shared by *Scenella*, a step formalised by Yochelson & Gil Cid (1984). Runnegar & Jell (1976) placed the scenellidae within the superfamily Helcionellacea of the redefined monoplacophoran order Cyrtoneurida Horný, 1963. Knight et al. (1960) had regarded helcionellaceans as gastropods, while Starobogatov (1970) had not included the Helcionellacea within the Monoplacophora.

Harper & Rollins (1982) considered only the Tergomya of Horný (1965a,b) to be true monoplacophorans. *Scenella*, a cyclomyan *sensu* Horný, was thus excluded from the Monoplacophora and transferred to the gastropods.

The present material offers no new clues as to the placement of *Scenella* within the host of contradicting attempted classifications mentioned above. The thesis of Harper & Rollins (1982) concerning a very restricted class Monoplacophora, equal to the Tergomya of Horný, offers an attractive grouping of one lineage of untorted molluscs. Its implication, however, that all other previously supposed monoplacophorans are torted gastropods is not immediately acceptable. Groups such as the helcionellaceans may be untorted, but not tergomyan monoplacophorans. The complexity of this early period in molluscan history is emphasised by the recent description by Linsley & Kier (1984) of a new class of untorted molluscs, the Paragastropoda. Paragastropods resemble torted gastropods in their anisotrophic, conspiral, coiling, while *Scenella* and all the untorted molluscs mentioned in the previous discussion have cap-shaped, isostrophically coiled shells.

Arguments presented by Yochelson & Stanley (1981) and Yochelson & Gil Cid (1984) concerning the possible coelenterate affinities of *Scenella* or many species assigned to *Scenella* illustrate some of the difficulties associated with the classification of Cambrian faunas. It is considered premature, however, to contemplate such a drastic step as excluding *Scenella* from the Mollusca, particularly at a time when the classification of early molluscs is in its present stage of flux.

*Scenella barrandei* (Linnarsson, 1879)  
Figs. 2, 3.

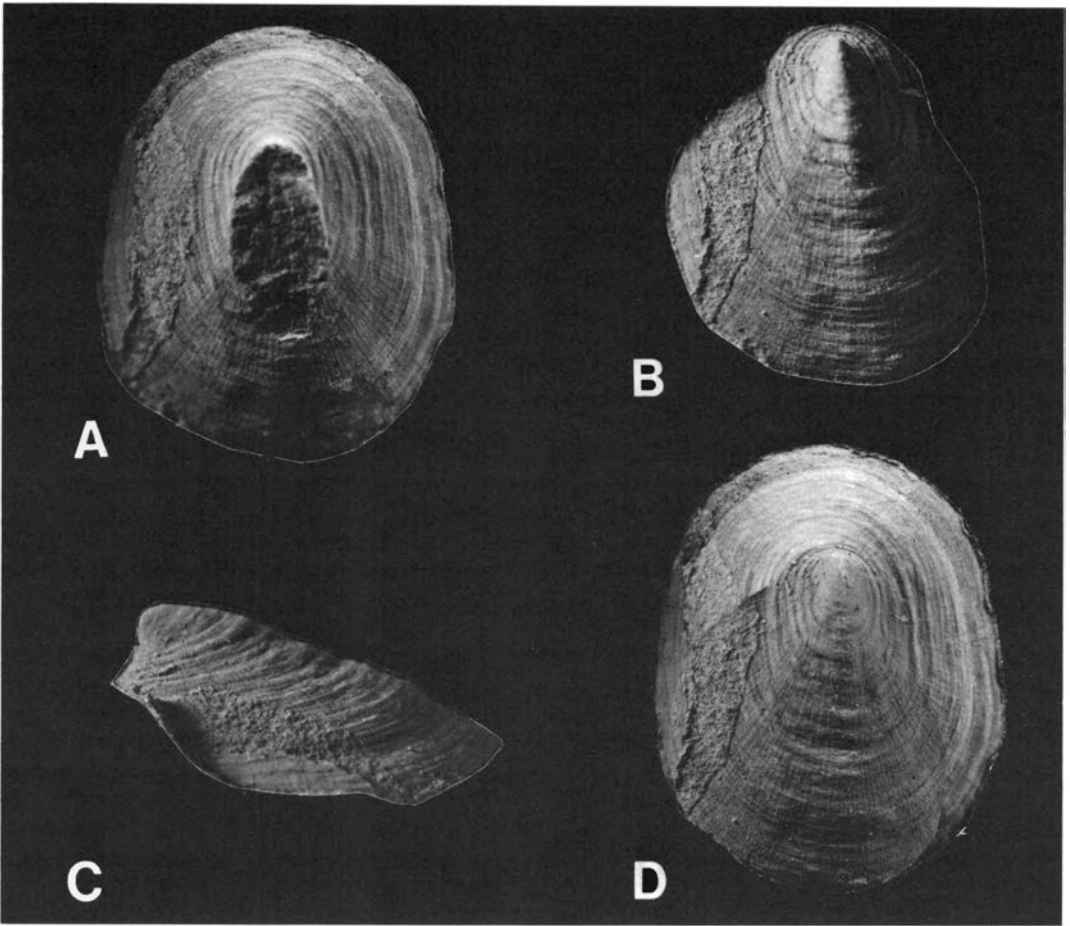


Fig. 2. *Scenella barrandei* (Linnarsson, 1879), holotype, SGU Type No. 4532a,b,  $\times 4.5$ ; Exsulans Limestone, Middle Cambrian, Kiviks-Esperöd, Scania, Sweden. A, dorsal view; B, postero-dorsal view of latex impression of counterpart to A, showing the arched dorsum of early growth stages; C, lateral view of B; D, photographic restoration produced by combining A and B.

*Metoptoma barrandei* Linnarsson, 1879, p. 24, pl. 3, figs. 35–37.

?*Metoptoma* sp. Dames, 1881, p. 420.

?*Metoptoma barrandei* Linnarsson, 1882, p. 7.

*Metoptoma barrandei* Grönwall, 1902, pp. 21, 41–42, 166.

*Metoptoma barrandei* Strand, 1929, p. 342, pl. 1, figs. 3a–b.

*Helcionella?* *barrandei* Henningsmoen, 1962, p. 22.

?*Metoptoma barrandei* Martinsson, 1974, p. 204.

*Metoptoma barrandei* Berg-Madsen, 1981, p. 226.

*Holotype*. – Geological Survey of Sweden

(SGU), Uppsala, Type No. 4532a,b, counterparts of the same specimen figured here as Fig. 2.

*Other figured material*. – Palaeontological Museum, Oslo, PO 25303 (Fig. 3A); Geological Museum, University of Copenhagen, Nos. MGUH 1668 (Fig. 3D–F), MGUH 16.781 (Fig. 3G,H), MGUH 16.782 (Fig. 3B,C).

*Description*. – A small, cap-shaped, bilaterally symmetrical mollusc with sub-central apex; the apex lying nearer to the margin interpreted as anterior. In dorsal view, the periphery is ovoid, with an approximate length:width ratio of 4:3. The anterior and posterior margins tend toward parallelism, with a slight posterior widening in

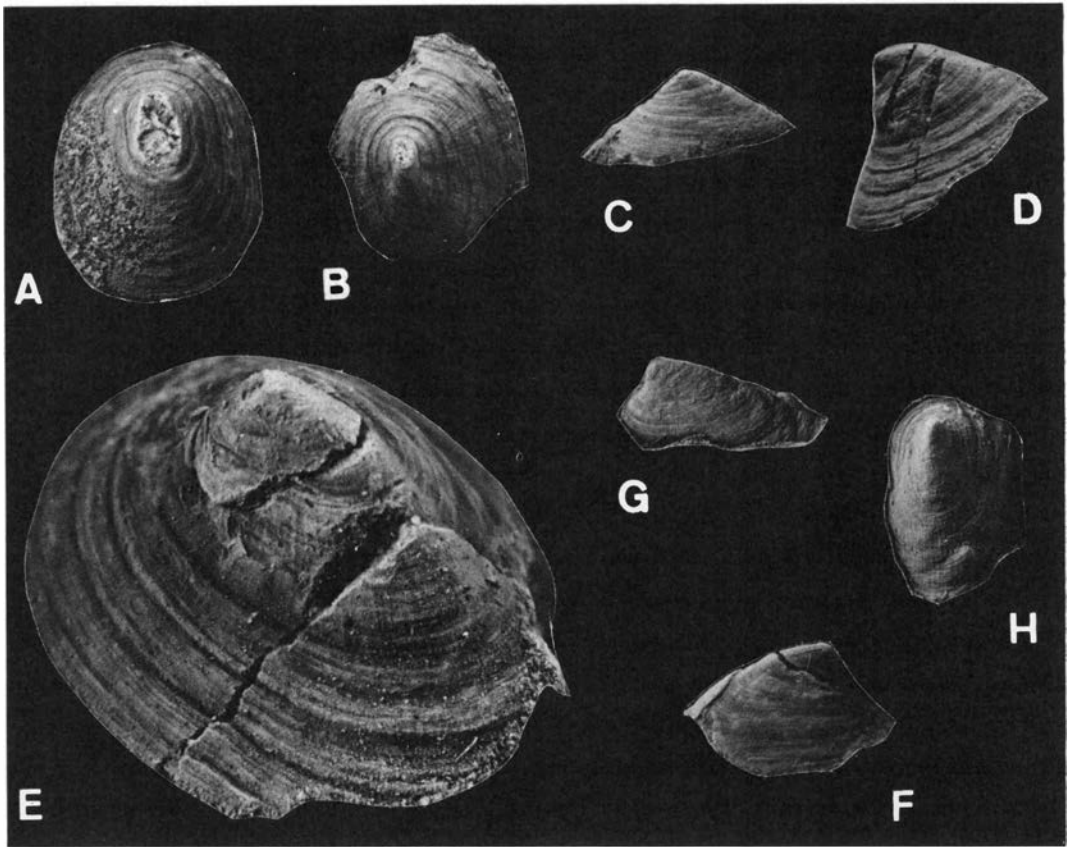


Fig. 3. *Scenella barrandei* (Linnarsson, 1879). A, dorsal view PMO 25303, Stensviken, zone 1c  $\beta$ , Mjøsa district, Norway,  $\times 3.5$  (Strand 1929, fig. 3a). B, C, dorsal and lateral views, MGUH 16.782, Exsulans Limestone, Borregård, Bornholm, Denmark,  $\times 5$ . (C. Poulsen collection). D, lateral view, MGUH 1668, Exsulans Limestone, Borregård, Bornholm, Denmark,  $\times 4.5$  (Grönwall 1902). E, oblique lateral view, as D,  $\times 10$ . F, lateral view, as D, E,  $\times 3.5$ . G, H, MGUH 16.781, Exsulans Limestone, Borregård, Bornholm, Denmark, lateral and dorsal views of latex impression  $\times 5$ . Note the repaired shell injury (small swelling) to the lower right in H (collected by V. Berg-Madsen 1981).

larger specimens (Fig. 2A). Smaller specimens and earlier growth stages show an apparent slight narrowing toward the posterior. In lateral view, the anterior face is concave beneath the slightly overhanging apex, but becomes slightly convex as the margin is approached. The posterior face is shallowly convex, but somewhat irregular, due to the rugose growth ornament. The protoconch is not certainly known, but was seemingly shallowly cap-shaped. Early growth stages often show a pronounced arching of the dorsal surface posterior to the apex (Fig. 2B); the arching becomes subdued with growth such that a more uniformly convex dorsum characterises the adult.

Ornamentation of concentric, rugose growth lines crossed by fine radiating threads. Shell thickness, structure and musculature unknown.

*Discussion.* – Growth ornamentation of *Scenella barrandei* is irregular in its expression (Fig. 2C), but a tendency towards the periodic development of more conspicuous growth elements is evident (Fig. 3A,E). The holotype from Scania is larger, perhaps more mature, than the examples from Norway and Denmark, and clearly shows allometric growth. The allometry is indicated by the loss of the arched dorsum, which is conspicuous in the early stages of the holotype (Fig. 2B) but also characterises the specimens from Bornholm (Fig. 3B,H). In addition, smaller specimens and earlier growth stages seem to narrow posteriorly, whereas the fully grown holotype narrows slightly anteriorly.

In the absence of definitive paired muscle scars of the type described by Rasetti (1954), place-

ment of Linnarsson's species in *Scenella* cannot be conclusive. It is, however, considered to be the most satisfactory generic assignment at this time. The generic name *Metoptoma* Phillips, 1836, is widely used in older literature for Lower Palaeozoic cap-shaped molluscs. However, the holotype of *Metoptoma oblonga* Phillips, 1836, the type species, is from the Lower Carboniferous of England, and Knight et al. (1960) considered this genus of patellinid gastropod to range from the Lower Carboniferous to the Permian. *Metoptoma* has an apex which overhangs the periphery, whereas the apex is more centrally placed in *S. barrandei*. Muscle scars in *Metoptoma* take the form of a horse-shoe shaped band below the apex, in contrast to 6 pairs of discrete muscle scars in *Scenella* (Rasetti 1954).

*Scenella barrandei* seemingly has a more quadrate form in dorsal perspective than *S. reticulata* Billings, 1832, as illustrated by Knight (1941, pl. 2, fig. 5a). Both species have conspicuous, cord-like radial lines, which are more prominent than the fine striations recorded by Knight (1941) in *Helcionella subrugosa*.

*H. subrugosa* (d'Orbigny, 1850), the type species of *Helcionella* Grabau and Shimer, 1909, shows more strongly rugose growth ornamentation than *S. barrandei*.

Runnegar & Jell (1976, Fig. 9C, 1–10) refer to *Helcionella*, a species which they consider to approach *Latouchella* Cobbold, 1921 in form. In this, coiling is better developed than in any of the above described species, causing the apex to be hooked in lateral aspect, the transverse ornament is strongly plicate and the apertural margins are flared.

*Kalbyella poulsenii* Berg-Madsen & Peel, 1978 is distinguished from *Scenella barrandei* by its diminutive size, elongate form with anterior apex, and the radial ornamentation.

**Distribution.** – The holotype of *Scenella barrandei* was collected from the type locality of the Exsulans Limestone, at the beach south of Kiviks-Esperöd (Fig. 1). A few unlocated specimens were recorded from the Exsulans Limestone at Andrarum by Linnarsson (1882). The Norwegian specimen from Stensviken was collected from a level containing the characteristic Exsulans Limestone fauna – zone 1c $\beta$  in Norway. All specimens from Bornholm were collected from the Exsulans Limestone at Borregård. *Scenella barrandei* thus seems to be currently restricted to

the *Ptychagnostus gibbus* Zone in the Middle Cambrian of Scandinavia.

**Acknowledgments.** – Jan Ågård, Institute of Historical Geology and Palaeontology, Copenhagen, took the photographs. David L. Bruton, Oslo, Sven Laufeld, Uppsala, and Søren Floris, Copenhagen kindly loaned specimens in their care. J. S. Peel publishes with permission of the Director, Geological Survey of Greenland. MGUH, PMO and SGU denote specimens in the Geological Museum, Copenhagen, Palaeontological Museum, Oslo, and Geological Survey of Sweden, Uppsala, respectively. This is a contribution to Project Tornquist (IGCP Accession No. 86).

Manuscript received January 1985

## References

- Berg-Madsen, V. 1981: The Middle Cambrian Kalby and Borregård Members of Bornholm, Denmark. *Geol. För. Sthlm. Förh.* 103, 215–231.
- Berg-Madsen, V. & Peel, J. S. 1978: Middle Cambrian monoplacophorans from Bornholm and Australia, and the systematic position of the bellerophonitiform molluscs. *Lethaia* 11, 113–125.
- Dames, W. 1881: Geologische Reisenotizen aus Schweden. *Zeitschr. Deutsch. geol. Gesell.* 33, 405–441.
- Grönwall, K. A. 1902: Bornholms Paradoxideslag og deres fauna. *Danm. geol. unders., 2 række*, 13, 230 pp.
- Harper, J. A. & Rollins, H. B. 1982: Recognition of Monoplacophora and Gastropoda in the fossil record: a functional morphological look at the bellerophonit controversy. *Proc. 11th N. Amer. Paleont. Convention* 1, 227–232.
- Henningsmoen, G. 1962: Liste over fossiler fra mellom-kambrium in Norge. *Fossil-Nytt – Årsber. Pal. Mus., Oslo*, 17–24.
- Horný, R. J. 1965a: On the systematical position of *Cyrtolites* Conrad, 1838 (Mollusca). *Čas. národ. Muz., odd. přírod.* 134, 8–11.
- Horný, R. J. 1965b: *Cyrtolites* Conrad, 1938 and its position among the Monoplacophora (Mollusca). *Sb. národ. Muz. Praha* 21B, 2, 57–70.
- Knight, J. B. 1941: Paleozoic gastropod genotypes. *Geol. Soc. America, Special Paper* 32, 510 pp.
- Knight, J. B., Cox, L. R., Keen, A. M., Batten, R. L., Yochelson, E. L. & Robertson, R. 1960: Systematic descriptions (Archaeogastropoda). In Moore, R. C. (edit.) *Treatise on Invertebrate Paleontology I, Mollusca 1*, *Geol. Soc. America & Kansas Univ. Press*, 1169–1310.
- Knight, J. B. & Yochelson, E. L. 1960: Monoplacophora. In Moore, R. C. (edit.) *Treatise on Invertebrate Paleontology I, Mollusca 1*, *Geol. Soc. America & Kansas Univ. Press*, 1177–1184.
- Lindström, G. 1888: List of the fossil faunas of Sweden. I, Cambrian and Lower Silurian. 24 pp. Norstedt, Stockholm.
- Linnarsson, G. 1879: Om faunan i kalken med *Conocoryphe exsulans* ("Coronatuskalken"). *Sver. geol. unders.* C 35, 31 pp.
- Linnarsson, G. 1882: De undre paradoxideslagren vid Andrarum. *Sver. geol. unders.* C 54, 47 pp.
- Linsley, R. M. & Kier, W. M. 1984: The Paragastropoda: a proposal for a new class of Paleozoic Mollusca. *Malacologia* 25, 241–254.

- Martinsson, A. 1974: The Cambrian of Norden. In Holland, C. D. (ed.) *Lower Palaeozoic Rocks of the World 2*, London, Wiley, 300 pp.
- Rasetti, F. 1954: Internal shell structures in the Middle Cambrian gastropod *Scenella* and the problematic genus *Stenothecoides*. *J. Paleont.* 26, 59–66.
- Runnegar, B. & Jell, P. A. 1976: Australian Middle Cambrian molluscs and their bearing on early molluscan evolution. *Alcheringa* 1, 109–138.
- Starobogatov, Y. I. 1970: Systematics of Early Paleozoic Monoplacophora. *Paleont. J.* 1970, 3, 293–302.
- Strand, T. 1929: The Cambrian beds of the Mjøsen district in Norway. *Nor. Geol. Tidsskr.* 10, 308–362.
- Yochelson, E. L. & Gil Cid, D. 1984: Reevaluation of the systematic position of *Scenella*. *Lethaia* 17, 331–340.
- Yochelson, E. L. & Stanley, G. D. 1981: An early Ordovician patelliform gastropod *Palaelophacmaea*, reinterpreted as a coelenterate. *Lethaia* 15, 323–330.