

GASTROPODS FROM THE OTTA CONGLOMERATE

BY

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Abstract: The gastropods in the Otta Serpentine Conglomerate have been reexamined; preliminary identifications by Hedström are revised. Though there is some conflicting evidence, this predominant faunal element in the formation suggests an age of early in the Middle Ordovician.

In connection with study of Middle Ordovician gastropods from the Oslo area, it was necessary for the writer to examine briefly gastropods from the Otta Serpentine Conglomerate in central Norway (ØYEN, 1930). The nature of this fauna was indicated in a short paper by HEDSTRÖM (1930), but the fossils have not been discussed since that time. Because the age of the Otta Conglomerate is still an open question, the preliminary observations which have been made on the gastropods are given here. It should be clearly understood that further study of this group and other groups of fossils is required to firmly fix the age of the Otta fauna. It is a pleasure to acknowledge that the writer's trip to Norway and examination of type specimens in England were made possible through National Science Foundation grant 17911 to the Smithsonian Institution.

Hedström was engaged in a comprehensive study of the fauna at the time of his death in Stockholm, Sweden. The collection was then packed and returned to Oslo. In the material now available for study there are about 800 specimens, gastropods being by far the most common class represented. Hedström's lists show a curious mixture of both Early and Middle Ordovician forms and "American" and "European" genera. The lists are further remarkable, for, at least as far as the gastropods are concerned, there is virtually nothing on the

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generic level in common with the Middle Ordovician fauna of the Oslo area and little in common with the Upper Ordovician fauna.

The fossils clearly indicate the peculiar lithology of the Otta Conglomerate. Almost all are steinkerns; a few do retain traces of shell and growth lines. The metamorphic environment apparently modified the composition of the shells so much that almost all exfoliated when broken from the rock. It is not possible to determine whether the shells were eroded before deposition.

In keeping with the conglomeratic nature of the matrix, the collection is strongly sorted. More than three-fourths of the gastropods are referred to *Maclurites*. Almost all specimens of this genus are between two and three centimeters in maximum width. About a hundred specimens of *Pararaphistoma* are available and, again, almost all fall within this size range. The other genera vary in abundance from uncommon to exceedingly rare, but specimens smaller than one centimeter are so poorly represented as to be almost nonexistent.

The specimens figured by Hedström are available in Oslo. His figure references, where figures were given, and his determinations in lists are presented in the left column. My reidentifications and preliminary remarks are given to the right.

HEDSTRÖM, 1930:	Remarks:
<i>Temnodiscus</i> sp. Pl. II, fig. 6a, 6b	Compressed, anomphalous, possibly a <i>Sinuities</i> . Known from five specimens. Two other specimens of bellerophontaceans may be a related species.
<i>Bucania</i> sp.	Compressed, widely phaneromphalous. The shape resembles that of <i>Tropidodiscus</i> . Known from four specimens.
<i>Raphistoma</i> sp.	Lenticular upper surface, inflated basal surface, phaneromphalous with a sharp circumbilical ridge. Probably <i>Pararaphistoma</i> (<i>Pararaphistoma</i>). Most specimens show some resemblance to <i>P.</i> (<i>Pararaphistoma</i>) <i>scalitoides</i> (KOKEN) or <i>Liospira disciformis</i> Longstaff. More than one species may be present, but the material does not seem adequate to differentiate closely related species. Known from about 100 specimens.

- Raphistoma* n. sp. Ramp-like upper surface, long, gently inclined outer surface, and phaneromphalous with a sharp circumbilical ridge. General shape is similar to *Raphistoma striata* (Emmons). Known from about a dozen specimens.
- Pleurotomaria* sp. Not certainly identified in Hedström's material. Two specimens which may represent this taxon are indeterminate.
- Worthenia* sp. Moderately high spired, with distinct sutures, a gently inclined upper surface, and a rounded, cord-like periphery. Probably *Loxoplocus* (*Lophospira*) sp. indet. Known from five specimens.
- Clathrospira* n. sp.(?) Moderately low spired, with an inclined upper and lower surface, and a nearly vertical, short, outer whorl face. Not a *Clathrospira*, and generically indeterminate among the pleurotomariaceans. Known from one specimen.
- Eotomaria* n. sp. Moderately high spired, conical, with a sharp periphery, and a flattened anomphalous base. Possibly *Eotomaria*. Known from about 45 specimens.
- Gonionema* sp. Moderately high spired, incised sutures, an inclined outer whorl face below the periphery, and possibly with spiral ornament. Probably a pleurotomariacean, but generically indeterminate. Without growth lines, it is not possible even to consider reference to *Proturritella* (= *Gonionema*). Known from five specimens.
- Lesueurilla* n. sp. Hyperstropic with a slightly convex base, and inclined outer whorl face flaring outward near the base and a distinct upper keel. There is no doubt that this is *Lesueurilla rudis* Koken, the only gastropod described from the Otta Conglomerate (KOKEN, 1925). This species was known previously only from the impression of the upper surface. The convex basal surface indicates that this form is not a *Lesueurilla*. Probably it is a new genus related to *Maclurites*. Known from four specimens.

- Eccyliopterus* n. sp. Nearly planispiral, with a wide gently rounded outer whorl face and a deep umbilicus. Possibly this should be referred to *Lesueurilla*. Known from seventeen specimens.
Pl. II, fig. 2a, 2b
- Eccyliomphalus* sp. Rapidly expanding, incomplete whorl, with a subtrigonal outline and surmounted by a sharp crest. Probably this is correctly referred to *Eccyliomphalus* (= *Eccyliomphalus*). Known from one specimen.
Pl. I, fig. 11
- Maclurea* sp. Hyperstrophic, with a flattened slightly concave base, and strongly inclined outer whorl face giving a distinctly triangular section. This form is probably conspecific with *Maclurites sedgwicki* (Longstaff), though direct comparisons of Otta specimens with the types of this species have not yet been made. Known from more than four hundred specimens. Other specimens listed by Hedström under this same specific name have a more nearly vertical outer whorl face with the periphery near mid-whorl. They are probably conspecific with *M. salteri* (Longstaff), but again exact comparison still must be made. Known from about thirty specimens.
Pl. II, figs. 3a, 3b
- Trochonema* sp. Not found in the collection.
- Umbonellina* sp. Low-spined, holopeaform, with distinct sutures. Generic determination uncertain, possibly *Holopea*. Known from four specimens.
Pl. I, fig. 9
- Cyclonema* (?) n. sp. Moderately high-spined, incised suture, with a narrow rounded outer whorl face. Generically indeterminate, but definitely not *Cyclonema*. Known from one specimen.
Pl. I, fig. 12
- Subulites* sp. Relatively wide, with sutures distinct, and the outer whorl face slightly inflated between suture. Probably this should be referred to the typical subgenus of *Subulites*. Another specimen may be a second species. Known from four specimens.
Pl. II, fig. 5

Of the remaining fifty or so specimens, most are indeterminate; they include at least three additional species of genera listed above. In addition, there are three genera and species which were recognized by Hedström and recorded in manuscript, but are not mentioned in his paper. These give additional information on the age of the conglomerate.

Two specimens were identified as *Trochonema* (*Eunema*). A few traces of growth lines are still preserved; though they do not confirm this identification based only on the shape, they are not in conflict with it. Another nine specimens were identified as *Helicotoma*. They are extremely low spired, but other features of the upper surface, particularly in the raised rounded crest on the outer angulation, and the umbilicus, show that they are correctly identified. Finally, there is a single large, moderately well preserved steinkern identified as *Lesueurilla infundibulum* Koken; this identification is correct.

There is no question as to the Ordovician age of the fauna. The only suggestion of a Silurian age came from the presence of *Umbonellina*. The material is so poorly preserved that reference to that genus is not warranted. However, it is somewhat less easy to determine to which division of the Ordovician this fauna should be referred. This is particularly true if the original list is used as the sole source of information.

Precise correlations between Europe and North America are always difficult to determine. Correlations within the Ordovician system have been further complicated because various authors have used the term "Middle Ordovician" in several different senses. For purposes of this discussion, Middle Ordovician in the sense of COOPER (1956) should be understood.

In Sweden, *P.* (*Pararaphistoma*), *Lesueurilla*, and *Proturritella* are characteristic of the Lower Gray Orthoceras Limestone, *Eccyliomphalus* is characteristic of the Upper Gray Orthoceras Limestone. In Estonia, all four genera occur in unit B₃ and range at least part of the way through the unquestioned Middle Ordovician (C, D, E). *Lesueurilla*, and *P.* (*Pararaphistoma*), especially *P.* (*P.*) *scalitoides*, are characteristic of unit B₃. *Eccyliomphalus* and *Proturritella* are more common in unit C.

Since *Proturritella* cannot be demonstrated in the Otta fauna and *Eccyliomphalus* is not characteristic of the "Lower Ordovician", any opinions of Early Ordovician age derived from the gastropods must

rest on the occurrence of *Lesueurilla* and *Pararaphistoma*. As noted above, however, *Pararaphistoma* can be generically identified on general size and shape, but details of ornament and precise shape needed for specific identification are not preserved. The only clearcut indication of an Early Ordovician age is the single specimen of *L. infundibulum*.

To more than conterbalance this, there is the occurrence of a *Raphistoma* which resembles a form common in the Middle Ordovician Chazy Limestone of North America. *Trochonema* (*Eunema*) is characteristic of the slightly younger Middle Ordovician Quebec City Group, though it does range into the Upper Ordovician. *Helicotoma* is often thought to be only an indicator of Ordovician age; references to this genus in the Lower Ordovician seem to be based on misidentification. It is most common in the Middle Ordovician, but again it does occur in younger faunas.

Finally, there is the evidence of the abundant *Maclurites*. Even if one assumes that there has been considerable sorting, this genus so dominates the fauna that it must have been important in the life assemblage. In the Oslo District of Norway, *Maclurites* does not occur in the Middle Ordovician, but is confined to the Upper Ordovician stage 5. In Estonia, it also occurs in the Upper Ordovician unit E; reports of its occurrence in unit B₃ do not seem to be based on material which can be unequivocally identified.

In marked contrast, in the Girvan District of Scotland, the genus and the two species which have been tentatively identified in the Otta fauna occur in the Stinchar Limestone. The Stinchar Limestone is considered to be the approximate equivalent of the lower part of the Middle Ordovician Porterfield stage in America and the Caradoc in England (WILLIAMS, 1962, p. 59). In North America the oldest occurrence of *Maclurites* is in the Whiterock stage of earliest Middle Ordovician age. The genus is by all accounts most common in the later Middle Ordovician of America, but does range into the Upper Ordovician.

In summary, the Otta fauna does contain both "American" and "European" elements. The "American" part of the gastropod fauna strongly suggests a Middle Ordovician age. The rare "European" elements suggest an age of late Early Ordovician, or less likely, early Middle Ordovician. In balance, it would seem that the overwhelming weight of evidence is in favor of a Middle Ordovician age. The "European" elements in the fauna could be reworked from an older horizon.

Alternatively, they could be contemporaneous and only appear different because of facies difference rather than temporal difference. This later explanation may prove to be the more correct, as the Stinchar limestone in Scotland also contains both *Maclurites* and *Lesueurilla* (LONGSTAFF, 1924).

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