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The present work is a systematical study of Upper Ordovician bivalves from the Oslo Region, Norway. The material for this study is from collections at Paleontologisk Museum, Oslo (PMO). No new material was collected by me. Previous work has not been done on the Bivalvia of the Upper Ordovician of Norway. H. & T. Soot-Ryen (1960) studied the Middle Ordovician bivalves of the Oslo Region. Only one species — Similodonta spjeldnaesi — described by these authors was found in the Norwegian Upper Ordovician. The other bivalves are compared with those occurring in the Leptaenakalk in Dalarna, Sweden. They are also related to the North American forms in the Trentonian and Cincinnatian series; and finally to the forms recorded in the Drummuck group, Scotland. The stratigraphical distribution and the Norwegian occurrence of the different species are shown in Table 1. The districts from which the fossils were collected are shown on the locality map (Fig. 1).

All the specimens studied were prepared mechanically to free them from matrix. Before photographing, each specimen was coated with dilute black opaque and then by ammonium chloride sublimate. The classification employed herein is that of Moore (ed.) 1969.

Systematic descriptions
Family CTENODONTIDAE Wörhmann, 1893
Genus Tancrediopsis Beushausen, 1895
Type species. — Ctenodonta contracta Salter, 1859.

Tancrediopsis planodorsata (Ulrich, 1892)
Fig. 2, A
Tellinomya planodorsata Ulrich, 1892: 217, fig. 3.
Fig. 1. Districts of the Oslo Region mentioned in the text. (After Henningsmoen 1960).
Table 1. Stratigraphical distribution and Norwegian occurrence of Upper Ordovician bivalves.

<table>
<thead>
<tr>
<th>Species</th>
<th>Horizons</th>
<th>Ashgillian</th>
<th>Districts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper Caradocian</td>
<td>4ca</td>
<td>4cβ-γ</td>
</tr>
<tr>
<td>Tancrediopsis planodorsata</td>
<td>(Ulrich, 1892)</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Ctenodonta dubia (Hall, 1847)</td>
<td>(H. &amp; T. Soot-Ryen, 1960)</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Similodonta spjeldnaesi</td>
<td>Nuculites aff. planulatus Conrad, 1841</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Nuculites sp.</td>
<td>Cyrtodontula ventricosa (Hall, 1847)</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Cyrtodontula cf. truncata (Ulrich, 1890)</td>
<td>Cyrtodontula sp.</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>gen. &amp; sp. uncertain</td>
<td>Cyrtodontula sp.</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Ambonychia radiata (Hall, 1847)</td>
<td>Cleionychia corrugata (Lindström, 1880)</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Cleionychia pulchella (Lindström, 1880)</td>
<td>Cleionychia sp.</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Cleionychia cf. primitiva (Isberg, 1934)</td>
<td>Cleionychia aff. rhomboidea</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Ulrich, 1892</td>
<td>Ulrich, 1892</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Cleionychia sp. 1</td>
<td>Cleionychia sp. 2</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Ambonychia sp.</td>
<td>Ambonychia sp.</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>A pterineid (gen. and sp. uncertain)</td>
<td>Semicorallidomus whitfieldi</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Isberg, 1934</td>
<td>Goniophorina volvens Isberg, 1934</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Modiolopsis nilsoni (Hisinger, 1837)</td>
<td>Modiolopsis leptenaenum Isberg, 1934</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Modiolopsis exilis Billings, 1874</td>
<td>Cuneamya sp. 1</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Cuneamya sp. 2</td>
<td>Cuneamya sp. 3</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>Cuneamya sp. 3</td>
<td>Gen. &amp; sp. uncertain</td>
<td>×</td>
<td></td>
</tr>
</tbody>
</table>

Material. – One left valve (PMO 10070).

Locality and horizon. – Western point of Frognøya, Ringerike district. Stage 4ca, Lower Tretaspis Shale, Upper Caradocian.

Description. – Although no internal structure is observed, the present specimen is related to Ulrich’s species according to its peculiar outline: Posterior side long with subacute extremity and almost straight dorsal side; anterior end rounded; ventral margin broadly convex with a more strongly convex anterior edge; surface with fine concentric and a few stronger growth lines.
The Norwegian specimen is 10 mm long and 6 mm high. *T. planodorsata* has been recorded from the upper third of the Trenton shales of Minnesota. The present species differ from *T. gibberula* (Salter 1859) and *T. contracta* (Salter 1859) by its longer and more straight posterior side.

**Genus Ctenodonta Salter, 1852**

*Type species.* — *Tellinomya nasuta* Hall 1847.

*Ctenodonta dubia* (Hall, 1847)

Fig. 2, B

[Tellinomya dubia](#) Hall 1847: 153, pl. 34, fig. 6a-f.

**Material.** — Internal mold of a left valve (PMO 9717).

**Locality and horizon.** — Terneholmen, Asker, Oslo-Asker district. Stage 4cβ, Upper Tretaspis Shale, Lowermost Ashgillian.

**Remarks.** — No remarkable difference is observed between the Norwegian species and that figured by Hall. They both share the following characters: Test subequilateral with a nearly central umbo, anterior extremity rounded, posterior one narrower with a slightly oblique truncation. Ornamentation and internal features are lacking in the present specimen. The Norwegian species is 11 mm long and 7 mm high, it is smaller than Hall’s species. The present species is originally described from the Trenton Shale at Middleville, Trenton Falls, Herkimer and other places in New York.

**Family PRAENUCULIDAE McAlester, 1968**

**Genus Similodonta Soot-Ryen, 1964**

*Type species.* — *Tellinomya similis* Ulrich, 1892.

*Similodonta spjeldnaesi* (H. & T. Soot-Ryen, 1960)

Fig. 2, C

[Ctenodonta spjeldnaesi](#) H. & T. Soot-Ryen 1960: 87, pl. 1, figs. 3–6, text-fig. 1


**Material.** — One incomplete right valve (PMO 94018).

**Locality and horizon.** — Holmenskjæret at Holmen, Nesbru, Oslo-Asker district. Stage 5a, Gastropod Limestone, Ashgillian.

**Description.** — Like the material described by H. & T. Soot-Ryen, the present specimen possesses a small rounded triangular shell, a slightly inflated umbo, a curved antero-dorsal margin, a rounded ventral margin; the posteroventral corner is broadly rounded; the posterodorsal margin is straight to concave with a protruding lower part; surface with broadly spaced concentric lines, mainly after the middle part of the shell.

The holotype is from stage 4bγ, Upper Chasmops Shale, Vestbråten,
Ringerike district. *S. recurva* (Ulrich 1892) and *S. intermedia* (Ulrich 1892) are similar to the present species in the gross overall morphology, but the difference is mainly based on the shape of the posterior side and on hinge characters.

Family MALLETIIDAE Adams & Adams, 1858
Genus *Nuculites* Conrad, 1841
*Type species.* – *Nuculites oblongatus* Conrad, 1841.

*Nuculites aff. planulatus* Conrad, 1841
Fig. 2, D & E

**Material.** – One internal mold with a portion of the shell (PMO 8797).

**Locality and horizon.** – Terneholmen, Nakholmen, Oslo–Asker district. Stage 4ca, Lower Tretaspis Shale, Upper Caradocian.

**Affinities and differences.** – The Norwegian specimen shares the following characteristic features with Conrad's species: Test uniformly and slightly convex; internal septum extends to half way to the ventral margin; postero-umbonal ridge well defined; a compressed area from the ridge to the dorsal margin is easily detected. The present specimen, however, shows a broader and more rounded posterior side and the general outline is shorter than in *N. planulatus*. The Norwegian species is much more similar to the one figured by McCoy (1855). It has, as the British species, a strong oval anterior muscle scar. In addition, six umbonal scars are clearly observed in the present cast. Surface with fine concentric lines. It is 16 mm long and 8 mm high.

The present species differs from *N. neglectus* Hall, 1847 by its broader posterior side and by a more prominent umbonal ridge. *N. planulatus* is originally described from the Lorraine and Utica, New York, by Conrad (1841) as well as from the Schists of Keeper's Lodge, Goldengrove and Llandeilo, U.K., by McCoy (1855).

*Nuculites sp.*
Fig. 2, F

**Material.** – One bivalve external mold (PMO 9760).

**Locality and horizon.** – Frognøya, Ringerike district. Stage 4ca, Lower Tretaspis Shale, Upper Caradocian.

**Description.** – Test elongate to orbicular; umbo nearly central; posterior side obliquely truncate; a rounded ridge extends from the umbo to the posterior angle of the ventral margin; internal septum curved towards the anterior side; surface with fine and not clear concentric striae.
The Norwegian species may be related to *N. cawdori* (Sowerby, 1839). It has the same position of umbo and a similar rounded ridge from the umbo to the posterobasal margin. The present species, however, is higher and has a curved and not oblique internal septum. The Norwegian species is 15 mm long and 12 mm high.

Family **CYRTODONTIDAE** Ulrich, 1894

Genus **Cyrtodontula** Tomlin, 1931

*Type species.* – *Whitella obliquata* Ulrich, 1890.

**Cyrtodontula ventricosa** (Hall, 1847)

Fig. 2, G, H

- *Edmondia ventricosa* Hall 1847: 155, pl. 35, figs. 1a–f
- *Cypricardites ventricosa* Miller 1889: 477
- *Bodmania ventricosa* Miller & Faber 1894: 24
- *Whitella ventricosa* Ulrich 1894: 573, pl. 41, figs. 24–26
- *Whitella ventricosa* Grabau & Shimer 1909: 415, fig. 536, e, f.

*Material.* – One external mold (PMO 55861).


*Description.* – Shape rhomboidal, clearly ventricose; umbo large and prominent; hinge line seems to be short and from its posterior extremity, the shell slopes abruptly towards the ventral margin; surface with fine concen-

---

**Fig. 2.**


tric striae; anterior margin sharply rounded above, making, as stated by Hall (1847: 156), a cordiform profile and is in 'almost a line with the umbo'; umbonal ridge weak.

*C. rugatine* (Ulrich, 1894) and *C. concentrica* (Ulrich, 1894) have a much larger anterior side.

*C. ventricosa* was originally described from the central and higher parts of the Trenton Limestone at Middleville, Herkimer, Trenton Falls and Lowell, New York.

**Cyrtodontula cf. truncata** (Ulrich, 1890)

*Material.* – One external mold of a right valve (PMO 94015).

*Locality and horizon.* – Holmenskjeret at Holmen, Oslo–Asker district. Stage 5a, Gastropod Limestone, Ashgillian.

*Description.* – The Norwegian specimen is more or less identical to Ulrich's species. It has a subrhomboidal, oblique and ventricose shell; umbo prominent, strongly incurved and nearly terminal; umbonal ridge angular and extends to the posterobasal angle; anterior and posterior slopes, slightly convex and abrupt; anterior side very short and narrowly rounded; posterior one truncated; surface with fine concentric lines and stronger irregular ones; distance from umbo to the posterobasal angle is 21 mm and the maximum length is 17 mm.

*C. truncata* differs from *C. scofieldi* (Ulrich, 1892) in being more convex and in having a shorter anterior side and a truncated posterior one.

*C. truncata* has been described from the Galena Shales in Goodhue county, Minnesota.

**Cyrtodontula sp.**

*Material.* – One right valve (PMO 13836).

*Locality and horizon.* – Stavnestangen, Ringerike district. Stage 5a, Gastropod Limestone, Ashgillian.

*Description.* – Shell obliquely ovate and elongate; posterior side nearly straight and narrow, anterior one very small; umbo prominent and incurved; umbonal ridge sharp and extends from the umbo to the posterobasal extremity; anterior slope convex and the posterior is flat to concave. In general, the specimen looks distorted. Surface with fine concentric striae. The internal features are not observed. The maximum height measured from the umbo to
the posterobasal extremity is 35 mm and the maximum length is 19 mm.

The present specimen may be related to *C. sterlingensis* (Meek & Wortthen, 1870). It has the same obliquely elongate shape, but differs by a less angular umbonal ridge and straighter posterior side. The Norwegian species is also smaller in size.

**Genus Cyrtodonta** Billings, 1858

*Type species.* – *Cyrtodonta rugosa* Billings, 1858.

**Cyrtodonta** sp.

*Fig. 2, N*

**Material.** – One mold showing external and internal features (PMO 13193).

**Locality and horizon.** – Herøya in Porsgrunn, Langesund–Skien district. Stage 5a, Gastropod Limestone, Ashgillian.

**Description.** – Test very inequilateral, slightly convex; posterior side higher than anterior one; surface with concentric lines and clearly defined growth lines. A small elongated anterior muscle scar is clearly seen.

**Genus uncertain**

*Fig. 2, O*

**Material.** – Seven molds (PMO 94036, 94025, 94026, 94027, 94028, 94029, 94030). The specimen figured is 94036.

**Locality and horizon.** – Vestre Svartøya, Ringerike district; Holmenskjaeret at Holmen, Oslo–Asker district. Stage 5a, Gastropod Limestone, Ashgillian.

**Description.** – Shell tumid, elongated dorsoventrally; anterior extremity subangular; a part of the recrystallized shell in the specimen figured shows that it was thin. These characters relate the Norwegian specimens to a cyrtodontid. But due to their bad preservation and lack of internal features, generic identification is uncertain.

**Family AMBONICHIIDAE** Miller, 1877

**Genus Ambonychia** Hall, 1847

*Type species.* – *Ambonychia radiata* Hall, 1847.

**Ambonychia radiata** Hall, 1847

*Fig. 3, A, B*

*Ambonychia radiata* Hall 1847: 292, pl. 80, figs. 4a–b

*Byssonychia radiata* Ulrich 1894: 477, fig. 35, VI

*Byssonychia radiata* Pojeta 1962: 201

*Ambonychia radiata* Pojeta 1966: 147, pl. 10

*Ambonychia radiata* Pojeta 1971: pl. 10, figs. 10, 11.

**Material.** – Five right valves (PMO 14312, 16503, 17196, 20715, 20717),
one left valve (PMO 14303), two internal molds (PMO 16385, 20716), two bivalved molds (PMO 13306, 17195) and five incomplete molds (PMO 14306, 14307, 14310, 16404, 17194). The specimens figured are 14303 and 16503.

Locality and horizon. – South beach of Vestre Svartøya, Ringerike district; Holmenskjæret at Holmen, Tangen, Semsvannet, Jongskollen and Slependen in the Oslo–Asker district; Porsgrunn, Langesund–Skien district. Stage 5a, Gastropod Limestone, Ashgillian and stage 5b, Calcareous Sandstone formation, Upper Ashgillian.

Occurrence. – Originally described from the Lorraine Formation of New York. Recorded from the Maysville–Richmond in Quebec, Canada, also in Turin, Italy; and from Ohio, Indiana, Kentucky, Virginia and Tennessee, U.S.A. It is further recorded by Hind (1910) from the Drummuck Group, Scotland.

Remarks. – This well known and widely distributed species is a common form in the Norwegian collection. The specimens at hand show the same characters as Hall's species: Raised and incurved umbo, nearly obsolete anterior margin, obliquely truncate posterior side making an obtuse angle with the hinge line. The Norwegian species, however, seems to be larger than the American one. The specimen in Fig. 3, B has approximately fifty radial plications and is 29 mm long and 35 mm high.

Fig. 3.
Genus *Cleionychia* Ulrich, 1892  
*Type species.*—*Ambonychia lamellosa* Whitfield, 1882.

*Cleionychia corrugata* (Lindström, 1880)  
Fig. 2, P  
☐ *Ambonychia corrugata* Lindström 1880: 17, pl. 15, figs. 1–5  
☐ *Ambonychinia corrugata* Isberg 1934: 55, pl. 4.  

**Material.**—One small right valve (PMO 15667).

**Locality and horizon.**—Stavnestangen, Ringerike district. Stage 5a, Gastro­pod Limestone, Ashgillian.

**Description.**—The present specimen shares the following characters with Isberg's material: Anterior side curved; posterior one winged; umbo small, pointed and somewhat curved; concentric ondulations clear, widely spaced with fine striae in between. The valve figured is 7 mm long and 6 mm high.  
*C. undulata* (Isberg, 1934) (Isberg, pl. 5, fig. 1a–c) is more or less similar in outline to the Norwegian specimen, but the latter has stronger undulations.  
*C. corrugata* was originally described from the Bada Limestone, Dalarna, Sweden.

*Cleionychia pulchella* (Lindström, 1880)  
Fig. 3, C  
☐ *Ambonychia pulchella* Lindström 1880: 17, pl. XIII, figs. 47–50  
☐ *Ambonychinia pulchella* Isberg 1934: 59, pl. 5, figs. 2a–d.  

**Material.**—One external mold (PMO 15654).

**Locality and horizon.**—Stavnestangen, Ringerike district. Stage 5a, Gastro­pod Limestone, Ashgillian.

**Description.**—No significant differences were observed between the Norwegian specimen and the Swedish material: Test convex, hinge line straight and long, umbo terminal and pointed, the part of the ventral margin which is diagonal to the umbo is semi-circular; posterior side slightly winged; surface with concentric lines. The present specimen is 23 mm long and 20 mm high. The particular shape of the ventral margin and the posterior side differentiates *C. pulchella* from any other species of *Cleionychia.*  
The present species is originally described from the Boda Limestone, Dalarna, Sweden.

*Cleionychia* cf. *C. primitiva* (Isberg, 1934)  
Fig. 3, D  
☐ cf. *Ambonychinia primitiva* Isberg 1934: 39, pl. 1, figs. 1a–c.  

**Material.**—Four external molds of left valves (PMO 94035, 10679, 15315,
UPPER ORDOVICIAN BIVALVES FROM OSLO REGION

16386); two external molds of right valves (PMO 15262, 15200). The specimen figured is 94035.

Locality and horizon. – Sælabon, Stavnestangen, south beach of Svartøya and Frognøya, Ringerike district; Holmenskjæret at Holmen in Nesbru, Oslo –Asker district. Stage 4da, Lower Isotelus Shale, Ashgillian.

Affinities and differences. – The following characters are common to both Isberg’s species and the present one: Test convex, hinge line long and straight, anterodorsal margin at right angles to the hinge line, anteroventral margin curved, posterodorsal margin concave to straight, posterior extremity winged, umbo small, terminal and dipping in the hinge area; surface with fine concentric lines. The specimen figured is 13 mm long and 13 mm high.

The Norwegian specimens, however, show stronger concentric lines near the ventral margin. In the specimen figured clear posterior lateral teeth are observed on the posterior extremity of the hinge line.

*C. primitiva* may be related to *C. skalbergensis* Isberg (1934) (Isberg, 1934, pl. I, figs. 2a–c), but this latter has different hinge structure, more curved umbo and more fine ornamentation. *C. primitiva* is described from the Leptaenakalk, Dalarna, Sweden.

Remarks. – The specimen figured is incorrectly oriented. The dorsal margin should be parallel to the horizontal.

*Cleionychia* aff. *C. rhomboidea* (Ulrich, 1892)

Fig. 3, E


Material. – One external mold (PMO 94020).

Locality and horizon. – Holmenskjærret at Holmen in Nesbru, Oslo–Asker district. Stage 5a, Gastropod Limestone, Ashgillian.

Affinities and differences. – The present specimen agrees with Ulrich’s species in the following characters: Test very oblique and rhomboidal; ventral side convex; anterior side nearly straight; posterior side produced and narrowly curved; anterior slope more abrupt than posterior one; greatest convexity nearly in the middle of the shell; surface with concentric lines. Internal features are not observed. However, the Norwegian specimen appears to be more convex and the umbo is more prominent and more strongly incurved. According to Ulrich, the posterior side of *C. rhomboidea* is more produced and more narrowly curved than any other.

*Cleionychia* species

*Cleionychia rhomboidea* was originally described from the Lower Limestone of the Trenton Formation at Minneapolis, Minnesota.
Cleionychia sp. 1
Fig. 3, F

Material. – One right valve (PMO 55865) and an external mold of a right valve (PMO 10497). The specimen figured is 55865.

Locality and horizon. – Nostret, Sælabon and Frognøya, Ringerike district. Stage 4d, Isotelus beds and stage 5a, Gastropod Limestone, Ashgillian.

Description. – Shell convex, mainly on the umbonal region and near the anterior side, where the slope to the edge is abrupt; beak terminal, pointed and incurved; hinge line straight; posterior margin curved; anterior one straight; ventral margin broadly curved; surface with numerous concentric lines. Internal features not observed. The specimen figured is 27 mm long and the distance from umbo to maximum convexity of the ventral margin is 33 mm.

Discussion. – The Norwegian form may be related to C. pulchella (Lindström, 1880) in having a nearly similar outline. However, it has a more curved posterior margin, more sharply bent anterior one and a more broadly curved ventral margin. Comparison is also made with Cleionychia sp. A, described by H. & T. Soot-Ryen (1960: 106, pl. 3, fig. 43). Both species share the same type of ornamentation and the same shape of anterior margin, but the specimens at hand are more convex and have a more widely curved ventral margin.

Cleionychia sp. 2
Fig. 3, G

Material. – One external mold of a left valve (PMO 94019).

Locality and horizon. – Holmenskjæret at Holmen in Nesbru, Oslo–Asker district. Stage 5b, ‘Calcareous Sandstone Formation’, Upper Ashgillian.

Description. – Test very inequilateral; anterior side nearly obsolete and slopes rapidly in a straight line to the ventral margin, which is slightly curved; posterior side alate; hinge line long and straight; umbo terminal and incurved; surface with widely spaced concentric lines with finer intervening ones; a radial impression from the umbo to the posterobasal margin is clearly detected; internal features not observed. The present species is 43 mm long and 20 mm high.

Remarks. – The Norwegian form may be related to Ambonychinia magna Isberg, 1934 (Isberg, 1934, pl. 6, figs. 1a–b). However, it is less convex and less high than Isberg’s species. Also, apart from the umbonal radial impression, the radial striae of the Swedish species are not observed.
Ambonychia sp.
Fig. 3, H

**Material.** – Two deformed bivalved molds (PMO 14311, 14316). The specimen figured is 14316.

**Locality and horizon.** – Vestre Svartøya, Ringerike district. Stage 5a, Gastro-pod Limestone, Ashgillian.

**Description.** – The Norwegian specimens look distorted. Outline triangular, beaks moderate and incurved, posterior side winged, anterior one abrupt, surface with simple ribs.

The general outline of the Norwegian species may relate it to an Opithoptera, but as mentioned by Pojeta (1966), the simple ribs of the specimens at hand differentiates them from Opithoptera, which has bifurcated ribs.

Family PTERINEIDAE Miller, 1877
Genus and sp. uncertain
Fig. 3, I

**Material.** – One external mold of a left valve (PMO 10280).

**Locality and horizon.** – Western point of Frognøya, Ringerike district. Stage 4ca, Lower Tretaspis Shale, Upper Caradocian.

**Remarks.** – The present mold has the general shape of a pterineid. Test convex, umbo anterior, surface with concentric growth rings. But since no internal features are observed, generic identification is uncertain.

Family MODOIMORPHIDAE Miller, 1877
Genus Semicorallidomus Isberg, 1934

*Semicorallidomus whitfieldi* (Isberg, 1934)

Fig. 3, J

*Semicorallidomus whitfieldi* Isberg 1934: 180, pl. 16, figs. 9a–c

**Material.** – One right valve (PMO 15696).

**Locality and horizon.** – Stavnestangen, Ringerike district. Stage 5a, Gastro-pod Limestone, Ashgillian.

**Description.** – The Norwegian specimen is larger than the Swedish one. It also represents the right valve, which was not described by Isberg. Moreover, one can observe the main characters of the original species: Shell slightly convex and thick; inequilateral with a pear-shape lateral outline;
posterior side higher than anterior one; ligamental area long and narrow; anterior side small with an obsolete lunule; surface with sharp concentric lines. The Norwegian species is 18 mm long and 14 mm high.

*S. hians* Isberg, 1934 (Isberg, 1934, pl. 16, figs. 10a–b) has a terminal umbo and more widely spaced concentric lines.

*S. whitfieldi* is originally described from the Leptaenakalk, Dalarna, Sweden.

**Genus Goniophorina Isberg, 1934**

*Type species.* — *Goniophorina volvens* Isberg, 1934

**Goniophorina volvens** (Isberg, 1934)

*Fig. 3, K*

- Goniophorina volvens Isberg 1934: 205, pl. 27, figs. 6a–b and pl. 28, figs. 1a–c
- Goniophorina (Goniophorina) volvens Moore (ed.) 1969: 395, fig. D2, 10.

**Material.** — One incomplete left valve (PMO 17823).

**Locality and horizon.** — Stavnestangen, Ringerike district. Stage 5a, Gastropod Limestone, Ashgillian.

**Description.** — Although not complete, the present specimen shows the characteristic features of Isberg's species. Shell thin, rhomboidal to trapezoidal in shape; strongly convex; posterior basal extremity angular; umbonal carena, from beak to posterobasal angle sharp and compressed; umbo large, anterior, curved inward and forward; surface with fine concentric lines.

*G. (G.) volvens* shows resemblance to *G. (Cosmogoniophorina) carinata* Isberg (Isberg, 1934, pl. 27, figs. 3–5). Both species share a similar outline and umbonal carina. But *G. (C.) carinata* has radial costae.

*G. (G.) volvens* is originally described from the Leptaenakalk, Dalarna, Sweden.

**Genus Modiolopsis Hall, 1847**

*Type species.* — *Pterinea modiolaris* Conrad, 1838.

**Modiolopsis nilssoni** (Hisinger, 1837)

*Fig. 3, L*

- Modiola nilssoni Hisinger, Leth. Svec. 1837: pl. 18, fig. 13
- Modiolopsis nilssoni McCoy 1855: 267, pl. 11, fig. 21
- Modiolopsis nilssoni Kjerulf 1865: 11, fig. 27.

**Material.** — One left valve (PMO 55868), seven external molds (PMO 11044, 11672, 11839, 11840, 11851, 11842, 20468) and seven external casts (PMO 11843). The specimen figured is 55868.

**Locality and horizon.** — Hovedøya, Oslo–Asker district and Nostret, Sælabon, Ringerike district. Stage 5a, Gastropod Limestone, and stage 5b, ‘Calcareous Sandstone Formation’, Ashgillian.
Remarks. – No special difference is detected between the specimens at hand and those figured by McCoy and Kjerulf. The test is narrowed in front and broadened posteriorly; ventral margin is nearly straight with a wide shallow sinus about the middle, from which a slight concavity extends towards the umbo; surface with fine unequal concentric striae. The specimen figured is 18 mm long and 9 mm high.

McCoy mentioned that *M. antiqua* Sowerby, 1839, which is only shorter and not gaping', is a synonym of the present species. *M. nilssoni* with *Ambonychia radiata* Hall are the most common species in the Norwegian collection.

McCoy recorded *M. nilssoni* from the Ludlow shales, Ludlowian, England and Kjerulf recorded it from stage 4, Llanvinian–Ashgillian at Hovedøya, Norway.

*Modiolopsis leptaenarum* (Isberg, 1934)

Fig. 4, A

*Modiolopsis leptaenarum* Isberg 1934: 158, pl. 26, figs. 1a–c.

Material. – Five external molds of right valves (PMO 94032, 14304, 16182, 18132, 94034); two external molds of left valves (PMO 94009, 94034). The specimen figured is 94032.

Locality and horizon. – Ø. Nes badestrand and Holmenskjæret at Holmen in Nesbru, Oslo–Asker district. Stage 5a, Gastropod Limestone, Ashgillian.

Description. – The Norwegian specimens share the following characters with the Swedish species: Shell obliquely elongate, moderately convex; anterior side very small; posterior side larger and higher; umbo prosogyral and incurved; umbonal carena weak; hinge line long; ventral margin nearly straight; surface with clear concentric lines. The specimen figured is 11.5 mm long and 6 mm high.

*M. leptaenarum* is very similar to *M. oweni* Ulrich, 1894 (Ulrich, 1894: 506, pl. 42, figs. 15, 16); it differs only in the following ways: Hinge line longer, anterior side shorter and more convex. Comparison is also made with *M. pygmaea* Isberg, 1934 (Isberg, 1934: 159, pl. 26, figs. 2a–b) from which it differs in being less convex and in having a less high posterior side.

*M. leptaenarum* is originally described from the Leptaenakalk, Dalarna, Sweden.

*Modiolopsis exilis* (Billings, 1874)

Fig. 4, B, C

*Modiolopsis exilis* Billings 1874: 132, pl. 8, figs. 5, 15, 16); it differs only in the following ways: Hinge line longer, anterior side shorter and more convex. Comparison is also made with *M. pygmaea* Isberg, 1934 (Isberg, 1934: 159, pl. 26, figs. 2a–b) from which it differs in being less convex and in having a less high posterior side.

*M. leptaenarum* is originally described from the Leptaenakalk, Dalarna, Sweden.

*Modiolopsis exilis* (Billings, 1874)

Fig. 4, B, C

*Modiolopsis exilis* Billings 1874: 132, pl. 8, figs. 5, 15, 16); it differs only in the following ways: Hinge line longer, anterior side shorter and more convex. Comparison is also made with *M. pygmaea* Isberg, 1934 (Isberg, 1934: 159, pl. 26, figs. 2a–b) from which it differs in being less convex and in having a less high posterior side.

*M. leptaenarum* is originally described from the Leptaenakalk, Dalarna, Sweden.

*Modiolopsis exilis* (Billings, 1874)

Fig. 4, B, C

*Modiolopsis exilis* Billings 1874: 132, pl. 8, figs. 5, 15, 16); it differs only in the following ways: Hinge line longer, anterior side shorter and more convex. Comparison is also made with *M. pygmaea* Isberg, 1934 (Isberg, 1934: 159, pl. 26, figs. 2a–b) from which it differs in being less convex and in having a less high posterior side.

*M. leptaenarum* is originally described from the Leptaenakalk, Dalarna, Sweden.

*Modiolopsis exilis* (Billings, 1874)

Fig. 4, B, C

*Modiolopsis exilis* Billings 1874: 132, pl. 8, figs. 5, 15, 16); it differs only in the following ways: Hinge line longer, anterior side shorter and more convex. Comparison is also made with *M. pygmaea* Isberg, 1934 (Isberg, 1934: 159, pl. 26, figs. 2a–b) from which it differs in being less convex and in having a less high posterior side.

*M. leptaenarum* is originally described from the Leptaenakalk, Dalarna, Sweden.

*Modiolopsis exilis* (Billings, 1874)

Fig. 4, B, C

*Modiolopsis exilis* Billings 1874: 132, pl. 8, figs. 5, 15, 16); it differs only in the following ways: Hinge line longer, anterior side shorter and more convex. Comparison is also made with *M. pygmaea* Isberg, 1934 (Isberg, 1934: 159, pl. 26, figs. 2a–b) from which it differs in being less convex and in having a less high posterior side.

*M. leptaenarum* is originally described from the Leptaenakalk, Dalarna, Sweden.
Fig. 4.


E. *Cuneamya* sp. 2. Lateral view of a right valve. ×2. Stage 5a, Vestre Svartøya, Ringerike district. (PMO 13948). Coll. Münster 1891.


**Locality and horizon.** – Holmenskjæret at Holmen in Nesbru, Oslo–Asker district. Stage 5a, Gastropod Limestone, Ashgillian.

**Description.** – Shell transverse; hinge line nearly straight; ventral margin broadly convex and curved at each extremity; beaks large, prosogyral and incurved; anterior side small, narrowly rounded to subangular above; posterior side broadly rounded to subtruncate; umbonal angulation rounded; surface...
with concentric ridges which are stronger at the anterior end. The bivalved specimen is 18 mm long and 9 mm high.

Discussion. – The previous characters agree more or less with Billings’s description for this species. The Norwegian specimens are shorter, however. But, as mentioned by McLearn (1924), *M. exilis* is very variable. According to McLearn *M. ruda* and *M. exilis* are one and the same species due to the infinite variations which they undergo. *M. solenoides* Sowerby, 1839, differs in having the dorsal and ventral margins more closely parallel. *M. leightoni* Williams 1913, shares with *M. exilis* a great variability, but is always shorter. *M. exilis* was originally described from the Silurian, Arisaig, Nova Scotia.

Family GRAMMYSIIDAE Miller, 1877
Genus Cuneamya Hall & Whitfield, 1875
Type species. – *Cuneamya miamiensis* Hall & Whitfield, 1875

**Cuneamya sp. 1**
Fig. 4, D

**Material.** – One right valve (PMO 13947).

**Locality and horizon.** – Vestre Svartøya, Ringerike district. Stage 5a, Gastropod Limestone, Ashgillian.

**Remarks.** – Badly preserved specimen. The following characters relate it to a *Cuneamya* species: Shell subrhomboidal; strongly incurved beaks; obliquely truncate posterior margin; anterior surface with clear, uniform concentric ornamentation.

**Cuneamya sp. 2**
Fig. 4, E

**Material.** – Two deformed external molds (PMO 13948, 13949). The specimen figured is 13948.

**Locality and horizon.** – Vestre Svartøya, Ringerike district. Stage 5a, Gastropod Limestone, Ashgillian.

**Description.** – Test transversely elongate, oval; dorsal and ventral margins nearly parallel; anterior side very short; lunule clear an oblique sulcus runs from the umbones to nearly the middle of the ventral margin; concentric ridges clear on the anterior side, faint on the posterior.

**Discussion.** – The previous characters relate the Norwegian specimens to *Cuneamya*. However, the oblique sulcus may relate it to a *Grammysia*, and
the elongate shape may relate it to an *Orthonauta*. But, due to the bad preservation and absence of internal features, the present specimens more probably belong to *Cuneamya*.

**Cuneamya sp. 3**  
Fig. 4, F

**Material.** – One articulated specimen (PMO 11065).

**Locality and horizon.** – Nyborg in Asker, Oslo–Asker district. Stage 5a, Gastropod Limestone, Ashgillian.

**Description.** – Shape nearly triangular; umbo strongly incurved forward; anterior side small and slightly projecting; shell ventricose along the umbonal ridge; concentric lines clearer on the anterior side; internal features not observed.

**Discussion.** – The Norwegian specimen may be related to *C. elliptica* Miller (in Foerste 1924: 132, pl. 17, fig. 1) from which it differs in having a much more oblique posterior margin. *C. neglecta* Meek (in Foerste 1924: 131, pl. 17, fig. 2) has a more upright anterior margin. *C. miamiensis* Hall & Whithfield 1875, has nearly a similar posterior margin but a different shape of anterior side.

**Genus and sp. uncertain**  
Fig. 4, G

**Material.** – One external mold of a right valve (PMO 15940).

**Locality and horizon.** – Stavnestangen, Ringerike district. Stage 5a, Gastropod Limestone, Ashgillian.

**Description.** – Shape ovoid, slightly convex; umbo anterior, small and prosogyral; surface with somewhat irregular concentric ridges; internal features not observed. Due to the bad preservation of the present specimen, exact identification is not possible. The general outline may suggest a cyrtodontid.

**Distribution and faunal assemblages**  
Table 1 shows the distribution of the described species in the different horizons and districts. Bivalvia are reported from only three districts: Ringerike, Oslo–Asker and Langesund–Skien. Not a single specimen is recorded from the Hadeland district, which is the fourth district where the Upper Ordovician is present. This may be due to a lack of systematical sampling. On the other hand, a rich fauna has been collected from stage 5a in the Ringerike district. This is in accordance with what has been observed previously (Hen-
ningsmoen 1960), that the Gastropod Limestone (Sa) is typically developed in Ringerike, where it is highly fossiliferous. Twenty-one species are reported from this stage: Similodonta spjeldnaesi, Cyrtodontula cf. truncata, C. sp., a cyrtodontid, gen. & sp. uncertain, Cyrtodontula sp., Ambonychia radiata, Cleionychia corrugata, C. pulchella, C. cf. C. primitiva, C. aff. C. rhomboidea, C. sp. 1, C. sp. 2, Ambonychia sp., Semicorallidomus whitfieldi, Goniophorina volvens, Modiolopsis nilssoni, M. leptearum, M. exilis, Cuneamya sp. 1, C. sp. 2, C. sp. 3, gen. & sp. uncertain, Cyrtodonta sp., Ambonychia sp., Semicorallidomus whitfieldi, Goniophorina volvens, Modiolopsis nilssoni, M. leptearum, M. exilis, Cuneamya sp. 1, C. sp. 2, C. sp. 3, gen. & sp. uncertain. Many forms of this assemblage are described from the Leptaenakalk (Sweden) and the Upper Drummuck Group (Scotland), which are believed to be contemporaneous with stage Sa of Norway. Oslo–Asker district (thirteen species) shares Ringerike district in this rich fauna. Langesund–Skien’s share is only of two species.

Only three species are recorded from the Calcareous Sandstone Formation (5b): Ambonychia radiata, Cleionychia sp. 2 and Modiolopsis nilssoni. Four species are described from the Lower Tretaspis Shale (4ca): Tancrediopsis planodorsata, Nuculites aff. planulatus, Nuculites sp. and a pterineid, gen. uncertain. One species only, Ctenodonta dubia is recorded from the Tretaspis Limestone (4cb) and the Upper Tretaspis Shale (4cy).

In addition to the species reported here, many other fossil bivalves could not be identified, due to their poor preservation. The Upper Ordovician bivalve fauna of the Oslo Region could well have been richer and the species might have a wider geographical and vertical distribution than the present material shows. Unfortunately, the possibilities for finding better material are small, due to the nature of the matrix in which the bivalvia are embedded in this region.

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