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Ceratopea and the correlation of the Wandel Valley Formation, eastern North Greenland

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The presence of heavily calcified, horn-shaped opercula of the gastropod *Ceratopea* Ulrich, 1911 (fig. 7) in the Wandel Valley Formation was first noted by Troelsen (1949) in his description of the Lower Palaeozoic sequence of southern Peary Land, eastern North Greenland. Silicified faunas collected by Troelsen are dominated by gastropods, with rare cephalopods, rare bivalves, and some echinoderm debris. As a result, Troelsen (1949, p. 18) suggested a Late or possibly Middle Canadian (Early Ordovician) age for the formation on the basis of the occurrence of *Ceratopea*. The specimens have not been further described although Peel *et al.* (1974) commented on the occurrence.

Since the time of the original collection by Troelsen, the importance of *Ceratopea* as a stratigraphic guide fossil within the Late Canadian (late Early Ordovician) has been increasingly recognised (Yochelson & Bridge, 1958; Yochelson, 1973; Yochelson & Copeland, 1974). Consequently, it is now possible to determine the Peary Land specimens at the specific level and to suggest a more precise correlation for the Wandel Valley Formation.

All the material discussed here was collected by J. C. Troelsen in 1947 during the Danish Peary Land Expedition. Additional, as yet unprepared, material collected by Peel & Christie (this report) has not been examined and is not described. The greater part of the Troelsen collections comprises material etched from the matrix by Troelsen but some untreated blocks of dolomite from collections 11 and 15 have subsequently been digested in acid (J.S.P.). The material was collected from four localities within the Wandel Valley Formation, the positions of which are indicated

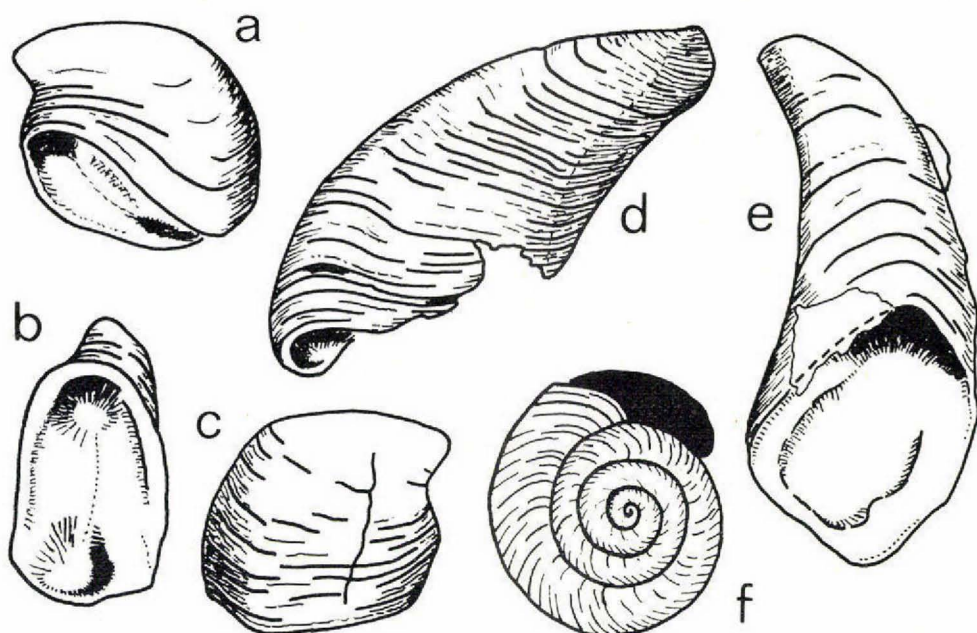


Fig. 7. a-c: *Ceratopea ankylosa*, MMH 13367 from Troelsen collection 13a, $\times 2.8$; a, c, lateral views; b, view of muscle attachment surface showing the characteristic two depressions. d, e: *Ceratopea unguis*, MMH 13368 from Troelsen collection 11, $\times 2.8$; d, lateral view; e, view of muscle attachment surface. f: restoration of *Ceratopea* showing the position of the operculum (black) in the shell (Yochelson & Barnett, 1972).

in fig. 5 (Peel & Christie, this report). Two collections (13a, 14a) are from the lower member, consisting of pale grey, thinly bedded dolomite with intercalated thin, dark dolomite horizons rich in silicified fossils. Three collections (11, 13b, 14b) are from dark weathering dolomite of the middle member of the Wandel Valley Formation (Troelsen, 1949; Peel & Christie, this report). A sixth collection (15) consists of several loose blocks. Unfortunately, more precise location of individual collections within the lower and middle members of the formation (or even the sequence of collections from the same member) is not possible.

Collections 13a, 13b, 14a, and 14b contain numerous specimens of *Ceratopea ankylosa* Cullison, 1944 (fig. 7). This species was first described from the Cotter Formation of the Ozark area and is particularly common in north-east Arkansas. A shell has not been conclusively associated with this operculum in Missouri and Arkansas, but the Peary Land collections contain a shell of *Ceratopea*, which Troelsen (1949, p. 18) assigned to *Raphistomina* Ulrich & Scofield, 1897. This lenticular shell has a strong circumbilical cord in early growth stages similar to that reported in shells associated with the operculum of *Ceratopea hami* Yochelson & Bridge, 1958, from slightly younger rocks of the West Spring Creek Formation of Oklahoma and the El Paso Formation of West Texas. That species may be closely related to *C. ankylosa*. A similar feature, though not so prominent, is seen in *Ceratopea canadensis* (Billings,

1865) of Yochelson & Copeland (1974, Pl. 1, fig. 2) from the Oxford Formation of Ontario, but the shell of that species apparently has a wider umbilicus.

Other gastropods in collections 13 and 14 include a common, small, *Trochonema*-like form which is also known from the upper part of the El Paso Formation. This is associated with a generally similar gastropod having a smaller umbilicus and spiral lirae on the base which also occurs in the Smithville Formation of northern Arkansas, though it may be present in older units. Fragments of bivalves (*?Euchasma*) and cephalopod siphuncles also occur.

The fauna suggests a Late Canadian age for the enclosing strata of the lower and middle members of the Wandel Valley Formation, but it is unlikely that these rocks are latest Canadian.

Collection 11 is somewhat more diverse than collections 13 and 14 in that a large amount of echinoderm debris is present in the form of isolated ossicles and plates. Small high-spired gastropods also occur. *Ceratopea unguis* Yochelson & Bridge, 1958, is by far the most common fossil, being represented by more than 50 opercula (fig. 7). No shells are closely associated with the opercula but fragments of shells in the same collection show the circumbilical cord noted above. This species occurs abundantly in the Smithville Formation of Arkansas (Yochelson & Wise, 1972) and the upper part of the West Spring Creek Formation of Oklahoma (Yochelson, 1973). It is also reported from eastern New York State (Yochelson & Barnett, 1972).

In the same collection a large, flat macluritid operculum and a few fragments of macluritid shell are also present. This operculum is the same as one figured by Billings (1865, p. 243) from Early Ordovician rocks at Cape Norman, Newfoundland, but it has not been formally named. It also occurs in Ellesmere Island and in the Durness Limestone of Skye, Scotland.

Collection 11 is again of Late Canadian age. *Ceratopea unguis* occurs in younger strata than *Ceratopea ankylosa* in the southern and eastern United States (Yochelson & Bridge, 1958). However, it is not possible to determine whether collection 11 is from the same stratigraphic level as collections 13 and 14 or whether younger strata are represented.

Collection 15, from a loose block, contains a somewhat different fauna than collections 13 and 14, although *Ceratopea ankylosa* is again the stratigraphically determinative element. Only a few specimens of the operculum are present but these attain a larger size than those present in collections 13 and 14. Several *Ceratopea* shells also occur as well as one specimen tentatively identified as *Bridgeina* Flower, 1968. At least three genera of high-spired gastropods are present, together with a few cephalopod fragments. Preservation is not as good as in collections 13 and 14. The colour of the silicified residues is more comparable to than seen in collection 11. As with collections 13 and 14, a correlation with Late Canadian Cotter Formation equivalents is indicated.

Conclusions

The presence of *Ceratopea ankylosa* in collections 13–15, from the lower and middle members of the Wandel Valley Formation, indicates a correlation with the Cotter Formation of the Ozark area and equivalent Late Canadian (late Early Ordo-

vician) strata. The occurrence of *Ceratopea unguis* in collection 11 may suggest a correlation of part of the middle member of the Wandel Valley Formation with the Smithville Formation of Arkansas and other Late Canadian equivalents of slightly younger age than the Cotter Formation. However, the position of collection 11 relative to other collections from the middle member of the Wandel Valley Formation is not known.

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Beatricea from the Ordovician of Hall Land, North Greenland

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Large, somewhat irregular cylinders of the supposed stromatoporoid genus *Beatricea* Billings, 1857, have frequently been reported from Ordovician strata. Sokolov (1962) noted the occurrence of 14 species from the Urals, Siberia, Novaya Zemlya and North America, in addition to representatives of the closely related genera *Aulacera* Plummer, 1843 and *Cryptophragmus* Raymond, 1914. Although diverse Ordovician faunas were described from Greenland by Troedsson (1928), Poulsen (1927) and Teichert (1937), no record has previously been made of these genera in Greenland. It is therefore of some interest that specimens of *Beatricea* have now been identified in collections made by J. H. Allaart and P. R. Dawes in 1965 during 'Operation Grant Land' from Kap Ammen, on the northern coast of Hall Land, North Greenland.

The Hall Land specimens are referred to *Beatricea regularis* Stearn, 1956, originally described from the Upper Ordovician Stonewall Formation of southern Manitoba.