Notes – *Notiser*

The oral area of *Echinoencrinites* von Meyer 1826

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Specimens of different species of *Echinoencrinites* show a basic pattern of seven oral plates and a variable number of additional orals developed during ontogeny. The pattern of plate distribution in the oral area corresponds to that of the Glyptocystitida. The ontogenetically introduced oral plates are intercalated in the same style as seen in such other blastozoan groups as the Eocrinoidea, Diploporita and Rhombifera. This pattern of growth may indicate close relationship between these groups.

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The plate configuration of the theca and distribution of the pore rhombs of *Echinoencrinites* are well known (Fig. 1, A. B); however, the oral area is poorly understood. The general view has been that five oral plates are present in the various species (Fig. 1, C). Jaekel (1899, pl. 13), however, figured specimens of *Echinoencrinites* showing a suture crossing the hydropore and gonopore. This has been overlooked by subsequent authors to some extent.

Paul (1967) described British Silurian echinoencrinitids with six oral plates surrounding the mouth and an odd oral (O7) from all genera and species of the subfamily Scoliocystinae. This pattern is the same as seen in other representatives of the Glyptocystitida. *Echinoencrinites* itself thus appears to differ from most of the other glyptocystitids.

Specimens of *Echinoencrinites* from Russia located in Paleontologisk museum, Oslo (PMO) are well preserved and show the oral area sufficiently well to be used in this study.

According to museum labels, the material consists of *Echinoencrinites senckenbergi, E. Angulosa*, and *E.* cf. *reticulatus* ranging from the Volkhov Formation (B_2) to the Kunda Formation (B_3), thus corresponding to the Arenig and lower Llanvirn. There are no modern studies made on the various species and subspecies of *Echinoencrinites* from Russia and Estonia. This must be kept in mind when considering the information given below.

Primary and secondary plates

All specimens of the different species have a basic pattern of seven oral plates (Figs. 2 and 4); six of them surround the mouth and O7 is located in the lower part of the oral area, not in contact with the mouth. There is a tri-partition (O6:O7:O1) of the plate generally defined as O1 by some authors (Figs. 1 C and 4). The other primary plates are large, pentagonal or hexagonal, (O2, O3, O4, O5). Some specimens of different species have only this basic pattern (Fig. 2, A).

Other specimens, both of *E. reticulatus* and *E. striatus*, have additional oral plates (Figs. 2, B, C, 3 and 4). These secondary plates are intercalated between O1, O2, between O2, O3, between O3, O4, and between O5, O6 (Fig. 2, B, C). No secondary plates have yet been found between O4, O5. The secondary plates are smaller than the primary ones, and are triangular in shape when recently formed (Fig. 2, B); they are thus easily distinguished from the primary plates.

Specimens with secondary plates have more brachiole facets than specimens with only primary plates.

Ontogeny

The number of secondary oral plates plotted against thecal height (Fig. 3) appears to be related to the size of the animals. The smaller

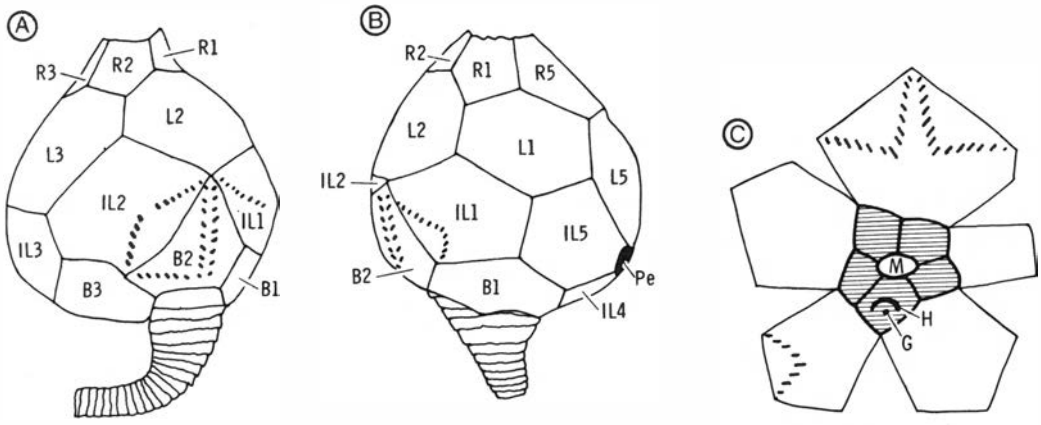

Fig. 1. Plate distribution in *Echinoencrinites senckenbergi acutangulus* Regnéll (A, B) and in the oral area of *E. lahuseni* Jaekel (C) modified from Kesling 1967, figs. 89, 2c and 90, 3a, b. B1–4: basal plates, G: gonopore, H: hydropore, IL1–5: infra lateral plates, L: lateral plates, M: mouth, Pe: periproct, R1–4: radial plates. Note that only five plates were considered to be present in the oral circlet (horizontally ruled in C).

specimens have the basic pattern only, whereas the somewhat larger specimens have more of the secondary orals. Even though the number of specimens for study is small the tendency seems clear.

In Fig. 4 a series of three ontogenetic stages are shown. The first stage contains specimens with only the basic pattern of seven orals (Fig. 4, A). The second stage includes specimens with four additional plates (Fig. 4, B) added between O1–O2, O2–O3, O3–O4, O5–O6. Two specimens have this type of plate construction (Fig. 3). The next stage (Fig. 4, C) includes specimens with more additional plates. These later secondary plates are added in a clockwise manner, as described from other blastozoans (Bockelie 1978, 1981a, b).

Corresponding with the increase of secondary plates is the addition of brachiole facets. As many as 14 brachiole facets may have been

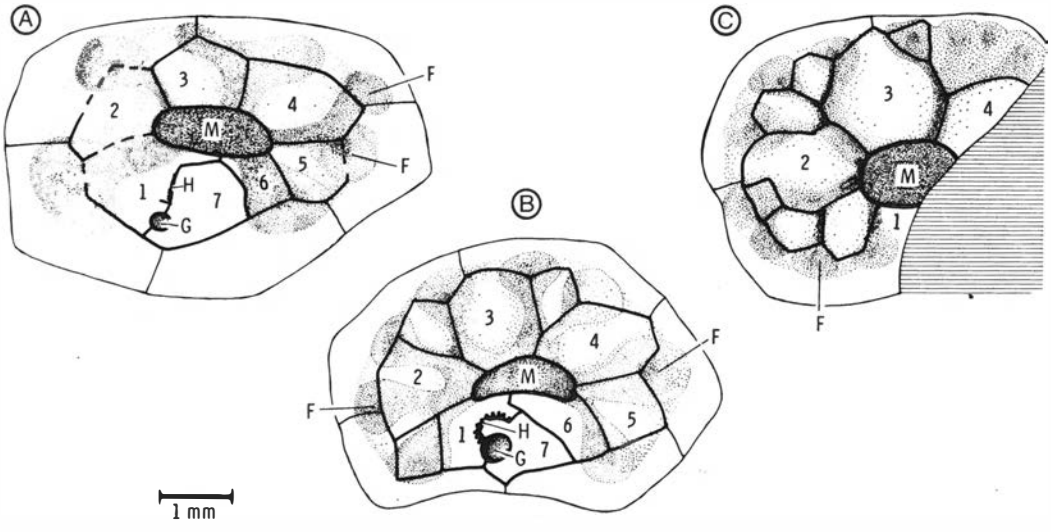

Fig. 2. Primary (1–7) and secondary (unnumbered) oral plates of three specimens of *Echinoencrinites striatus* Jaekel. The number of additional oral plates are related to the number of brachiole facets (F). A: PMO A7836, B: PMO A7817, C: PMO A332. All specimens from Glauconite Limestone (?), Isvos, Leningrad District, USSR. Terminology as in Fig. 1.

present in PMO 332 (Fig. 2, C), whereas in the smaller specimens five or six brachiole facets are commonly preserved.

Discussion

An interesting feature with *Echinoencrinites* is the absence of secondary orals between O4 and O5. Most blastozoans have a duct leading from the hydropore and gonopore just under O7–O6–O5 and close to the border of the mouth. The duct then passes to the right side of the theca and is located below the O4:O5 suture before entering into the thecal interior. There is reason to believe that *Echinoencrinites* had the duct located in the same manner. Similar patterns have been demonstrated for the duct in various species of *Hallicystis* (Callocystitidae) by Paul (1976b), and for the diploporite *Haplosphaeronis* by Bockelie (1981a). Furthermore, the anal opening of *Echinoencrinites* is located just below the two orals O4 and O5. These morphological features are probably the reason for the lack of secondary plates at the O4:O5 suture.

The distribution of the primary oral plates as described above is typical for the Glyptocystitida. A similar pattern of distribution has also been observed in the classes Diploporita and Eocrinoidea (Bockelie 1981a, b) as well as in the Rhombifera. It may also be present in some of the other blastozoan classes: there are probably only a limited number of possible arrangements of the thecal plates around the mouth, as both the gonopore and the hydropore are located in this area.

The Echinoencrinitidae belong to the earliest representatives of the superfamily Glyptocystitida, and range back to the early Ordovician. Phylogenetically the Echinoencrinitidae are closely related to the Cheirocrinidae (Paul 1972, Fig. 1). This was already assumed by Jaekel (1899:241). The reduction of pore-rhombs seems to be the most important feature in the evaluation of possible phylogenetic lineages of the Glyptocystitida. This was demonstrated by Paul (1972) for the Cheirocrinidae, and the same features also apply to the Echinoencrinitidae. The Ordovician

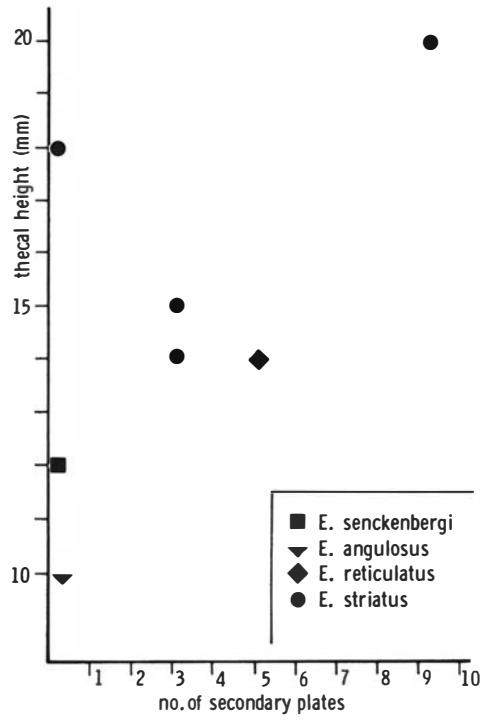

Fig. 3. Relationship between number of additional orals (secondary plates) and thecal size in material available. There is a tendency towards an increase in the number of additional plates with increased thecal size.

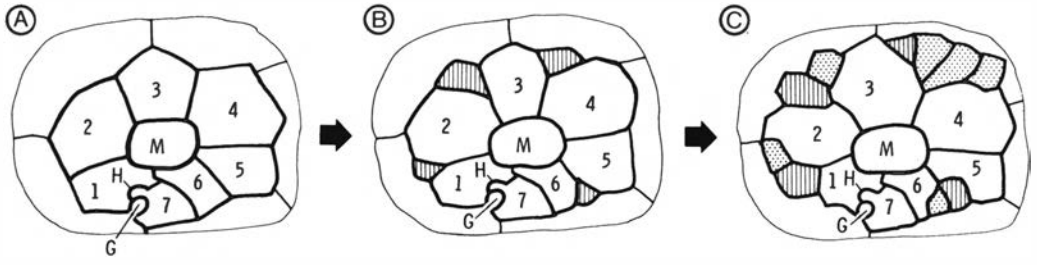

Fig. 4. Suggested ontogenic series of *Echinoencrinites* (A–C). The youngest individuals have seven orals (A). Additional orals (vertically ruled) are added between the primary ones (B). At later stages a new set of additional orals (dotted) are added in a clockwise manner, typical of several blastozoan classes. Terminology as in Fig. 1.

genera of this latter family have 7–3 rhombs and the Silurian genera have 3–2 rhombs. If half rhombs are included as one rhomb, *Echinoencrinites lahuseni* (the oldest species) has seven rhombs, *E. reticulatus* has five or six, and the latest, *E. senckenbergi*, has three rhombs. This pattern of pore-rhomb reduction (Jaekel, 1899:247, diagram) still seems to hold for this genus.

The observations made above show clearly the importance of studying changes in ontogeny. The young individuals of *Echinoencrinits* have as shown a pattern of seven primary oral plates. As far as is known, all Silurian echinoencrinitid genera have only this type of plate arrangement, irrespective of stages in ontogeny.

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