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PALEONTOLOGY

HETEROPOLAR DIVISION OF THE SUTURE LINE IN SOME OF THE LOWER TRIASSIC AMMONITES

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According to the mode of division of lobes and saddles in ammonites, Wedekind [1] distinguished two types of division of the suture line: unipolar and bipolar. The division of the suture line Wedekind conceived as a process, and therefore the types of division (unipolar and bipolar) were treated

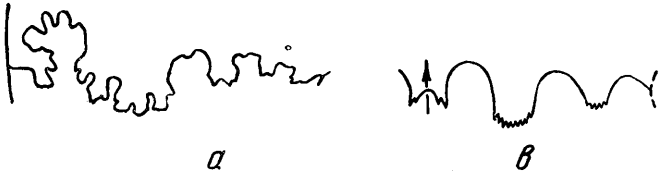

Fig. 1. *a*—Suture line in *Glyptophiceras nielseni* Spath., as an example of unipolar division (sagittal-unipolar); *b*—suture line in *Hoplitoides ingens* Koenen, as an instance of bipolar division (sagittal-bipolar).

by him not in the sense of formal logic, but in the natural history aspect. Consequently, Wedekind makes sharp distinction between the sutural elements and indentations and notches (Inzisionen) in them. He stresses the point that lobes and saddles are «the primary curves of the suture line», whereas Inzisionen—«notches in the lobes and saddles, the notching appearing first in those sutural elements which lie nearest to the plane of symmetry of the shell» ([1], S. 192), i. e. division begins always from the external (E) and internal (I) lobe.

And whereas the formation of lobes and saddles is subject to special laws (Lobengesetz), the principles underlying the formation of notches and indentations are entirely different, i. e. those of unipolar and bipolar division. In both cases those elements are the first to undergo division which lie nearest to the plane of symmetry of the shell, other elements following in consecutive order umbilically.

Fig. 1, *a* and *b* are an excellent illustration of Wedekind's conception. In this sense both types of division could be termed sagittal-polar types of division, because of the initial poles of division being arranged near the sagittal plane, or the plane of symmetry of the shell.

However, the unipolar and bipolar types of division of the suture do not cover all modes of division which may eventually develop, as indicated by Diener ([2], [3]). As far as division is concerned, Diener pointed out the suture in *Hedenstroemia muthiana* Krafft ([4], pl. IX, Fig. 7c), not fitting in the system of Wedekind's classification ([2], S. 378), and made the assumption that «the establishment of unipolar and bipolar division does not yet cover the full range of variation of notches in the ammonite sutures» ([3], S. 592). However, the material which was in Diener's possession was inadequate and did not carry sufficient weight.

In 1939 the author described *Anahedenstroemia tscherskii* Popow ([5], p. 77, table 1, fig. 4) from the Lower Triassic deposits of the Okhotsk-Kolyma divide. The suture of this species is shown in Fig. 2.

Fig. 2. Suture line in *Anahedenstroemia tscherskii* Popow, as an instance of heteropolar division (sagittal-unipolar and umbilical-bipolar).

The division of the external and two lateral lobes and their corresponding saddles is of the unipolar type, i. e. only the bases of the lobes are serrated, the summits of the saddles are entire. But beginning from the first auxiliary lobe, all the lobes and saddles of the auxiliary row display already bipolar division. The character of division is entirely different from the one in the main specimens. Thus, the suture line of this species from the fam. *Hedenstroemiidae* Waagen combines both the unipolar and bipolar mode of division. Consequently, such division is to be regarded as heteropolar.

The initial poles of the secondary division of the auxiliary elements are situated in the base of the first auxiliary lobe and in the summit of the first auxiliary saddle on each side of the shell, i. e. the division of auxiliary elements in *A. tscherskii* begins not near the sagittal plane, but much more distally. One may say that the auxiliary poles of division lie near the projection of the external margin of the inner volution of the shell on the flank of the outer whorl. For this reason the auxiliary poles of dissection could be called «projection poles».

As a matter of fact, however, the secondary division begins from the umbilical suture. This is proved by the division of the suture in the Olenek specimen of *Hedenstroemia mojsisovicsi* Diener, figured by E. Mojsisovics ([6], pl. III, fig. 13). The suture line in this species, too, undergoes the heteropolar type of division. Besides, both the structure and division of all the elements of the auxiliary line and the inner portion of the suture line show remarkable symmetry, except the inner lobe and the saddles. The axis of symmetry lies on the umbilical suture.

In this case it may be assumed that the secondary division of auxiliary and internal elements of the suture line begins from the umbilical suture on both flanks of the shell, and the poles of division lie in the plane passing through the points of the umbilical constriction on both flanks of the shell. The secondary division of the internal and auxiliary elements in this case may be termed the umbilical-polar type of division.

The above instances of heteropolar division of the suture lines in representatives of the fam. *Hedenstroemiidae* Waagen from the Lower Triassic of north-eastern Asia bear evidence, that the heteropolar division is not a casual occurrence or ill-stated fact, as was believed by Wedekind (S. 536), but is peculiar to many species of the Boreal region of the Lower Triassic.

In the controversy between Diener and Wedekind ([1], [2], [3], [8]) it was Diener who was right. The types of division of the suture in ammonites can be schematized as follows:

A. Sagittal-polar division: a) unipolar division, e. g. *Ophiceras*, *Glyptophiceras*, *Ceratites* and others; b) bipolar division, e. g. *Stephanoceras*, *Hoplitoides*, etc.

B. Umbilical-polar division: a) unipolar division; b) bipolar division.

C. Heteropolar division or combined division (sagittal-umbilical-polar): a) sagittal-polar (unipolar) and umbilical-polar (bipolar) is observed in *Anahedenstroemia tscherskii* Popow and *Hedenstroemia mojsisovicsi* Diener (Olenek specimen).

The B type division in a pure state has not been observed yet and is hardly possible; but there are other types of heteropolar division likely to occur (C).

Besides representatives from the fam. *Hedenstroemidae*, the tendency to heteropolar division is expressed also in *Pseudosagoceras multilobatum* Noetling ([7], pl. XIX—XXVII).

The umbilical seam assumes great importance as the site of formation of new elements of the suture line, as well as new indentations and notches upon them. But if the umbilical suture and the so-called «Umschlag» are the area, where not only new elements, but also indentations in them are forming, the difference between the lobes and notches, established by Wedekind as a matter of principle and strongly disputed by Diener, is obliterated. Every notch with gradual increase in dimensions is transformed into a lobe, and vice versa.

There still remains unclear in what relation to heteropolar division stands the frequently observed asymmetrical structure of the auxiliary elements of the suture line on one and the same suture on different sides of the shell, as observed in *Anahedenostroemia himalayica* Spath., in *Hedenstroemia borealis* sp. nov. and in *Pseudosagoceras multilobatum* Noetl.

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