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The ontogeny of the kossmaticeratid ammonite *Yokoyamaoceras jimboi* MATSUMOTO from the Upper Cretaceous of Far East Russia

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With 2 figures in the text

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Abstract: The suture ontogeny of the poorly studied ammonite *Yokoyamaoceras jimboi* MATSUMOTO from the Santonian/Campanian boundary of the Kamchatka Peninsula is examined. Well preserved specimens allow to recognize an originally fivelobate primary suture ELU_2U_1I, an early subdivision of $U_1 \rightarrow U_{1v}U_{1d}$ in the third suture line, and the formation of a deeply suspending sutural lobe S by amalgamation of the metalobes $U1_{vv}$, U_{1vdv} and U_{1vdd}.

Zusammenfassung: Die Loben-Ontogenie von *Yokoyamaoceras jimboi* MATSUMOTO wird anhand von gut erhaltenen Exemplaren der Santon/Campan-Grenze der Halbinsel Kamchatka untersucht. Als Ergebnis wird folgende Entwicklung beschrieben: Fünflobige Primärsutur ELU_2U_1I, frühe Zerschlitzung von $U_1 \rightarrow U_{1v}U_{1d}$ ab 3. Lobenlinie, später Bildung eines tief suspensiven Suturallobus S durch Verschmelzung von U_{1vv}, U_{1vdv} und U_{1vdd}.

1. Introduction

Suture ontogenies of members of the order Ammonitida are actually well known. Exceptions are endemic groups of Pacific and Austral ammonites, including some of the kossmaticeratids which are used as index for Upper Cretaceous strata of these realms. Among these are the Indo-Pacific genera *Yokoyamaoceras* WRIGHT & MATSUMOTO, 1954, and *Marshallites* MATSUMOTO, 1955.

The suture ontogeny of *Marshallites compressus* MATSUMOTO from the Upper Albian/Lower Cenomanian of Hokkaido was first described by MATSUMOTO (1955, p. 126, text-figs. 1, 2), who depicted five lobes at the end of the first whorl, seven lobes for the second whorl, nine lobes for the third whorl, and ten lobes for the fourth whorl with $U_{1v} = S$ and individualized U_{1d}.

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O. H. SCHINDEWOLF (1966, p. 627, text-fig. 389) studied the suture ontogeny of the Indo-Pacific ammonite *Kossmaticeras* cf. *K. sakondryense* COLLIGNON from the Coniacian of Madagascar. Accordingly, the first subdivision of the $U_1 \rightarrow U_{1v}U_{1d}$ occurs very early, while lobe U_2 was situated at the seam, and the forthcoming new lobe U_{1vv} is not included in the sutural lobe $S = U_{1vdv}$.

Recently, one of the authors studied the suture ontogeny of *Marshallites cumshewaensis* (WHITEAVES) from the Lower Cenomanian of Kamchatka Peninsula and recognized a fivelobate primary suture ELU_2U_1I, an early subdivision of the lobe $U_1 \rightarrow U_{1v}U_{1d}$ in the third suture line, a deeply suspending sutural lobe $S = U_{1v}$ and an individual lobe U_{1d} in the adult growth stage (ALABUSHEV, 1989, p. 53, text-fig. 8).

These data concerning the suture ontogeny of kossmaticeratids are quite contradictory. In order to solve the problem, the suture and shell morphogeny of well-preserved specimens of *Yokoyamaoceras jimboi* MATSUMOTO are investigated. Eight successive subdivisions of the suture line are observed during ontogeny. Additionally, some features of the shell structure, which are connected with the formation of constrictions and the disappearance of the outer prismatic and nacreous layers on the dorsal side, are described.

2. Description

This study of suture and shell morphogeny is based on 46 specimens of *Yokoyamaoceras jimboi* MATSUMOTO from the Santonian/Campanian boundary of northwestern Kamchatka. All material was collected from limestone concretions of a single locality in the Talovka Valley near Penzhina Bay, and is deposited in the Geologisch-Paläontologisches Institut Tübingen (GPIT).

2.1 Suture ontogeny

The suture line is characterized by a threelobate prosuture LU_2U_1 (Fig. 1 A) and a fivelobate primary suture ELU_2U_1I (Fig. 1 B). The first subdivision of the lobe $U_1 \rightarrow U_{1v}U_{1d}$ occurs in the third line (Fig. 1 C). The second subdivision of the new lobe $U_{1v} \rightarrow U_{1vv}U_{1vd}$ is recognized in the

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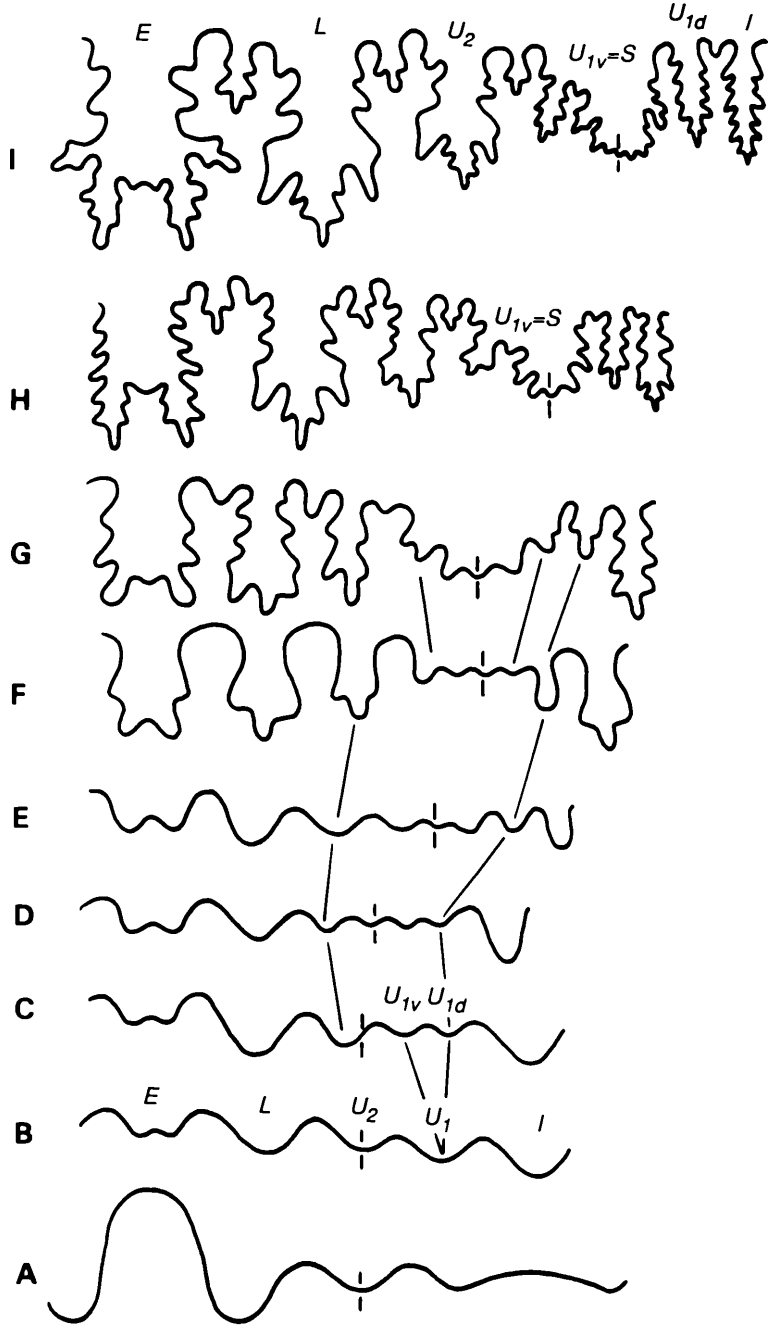
Fig. 1. Suture-line ontogeny of *Yokoyamaoceras jimboi* MATSUMOTO, specimen GPIT 1732/1. Santonian/Campanian boundary, Talovka River, northwestern Kamchatka. A – prosuture, × 65; B – primary suture, ×65; C – 3rd suture line, ×65; D–E – 10th (primary constriction) and 17th (1,5 whorls) suture lines, × 65; F–G – 24th (2,0 whorls) and 33rd (2,6 whorls) suture lines, ×40; H – 40th (3,0 whorls) suture line, ×35; I – 55th (4,0 whorls) suture line, ×14.


I
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tenth line (Figs. 1 D, 2 B). The third subdivision of $U_{1vd} \rightarrow U_{1vdv}U_{1vdd}$ occurs in the seventeenth line (Fig. 1 E). The fourth, fith and sixth subdivisions are found accordingly in the 24th, 33rd and 40th lines (Figs. 1 F–H). All metalobes from the original U_{1v} form a deeply suspending sutural lobe *S* beginning in the 30th line (Fig. 1 G–I).

The investigated *Y. jimboi* differs from the earlier studied *Marshallites cumshewaensis* (WHIT.) only in its more rapid addition of the new suture elements. In the younger *Y. jimboi*, all subdivisions of lobes, beginning from the second one ($U_{1v} \rightarrow U_{1vv}U_{1vd}$), occur at about half a whorl earlier than in the older *M. cumshewaensis* (ALABUSHEV, 1989, text-fig. 8). Moreover, the lobe U_2 of *Yokoyamaoceras* is trifid, while U_2 of *Marshallites* is bifid.

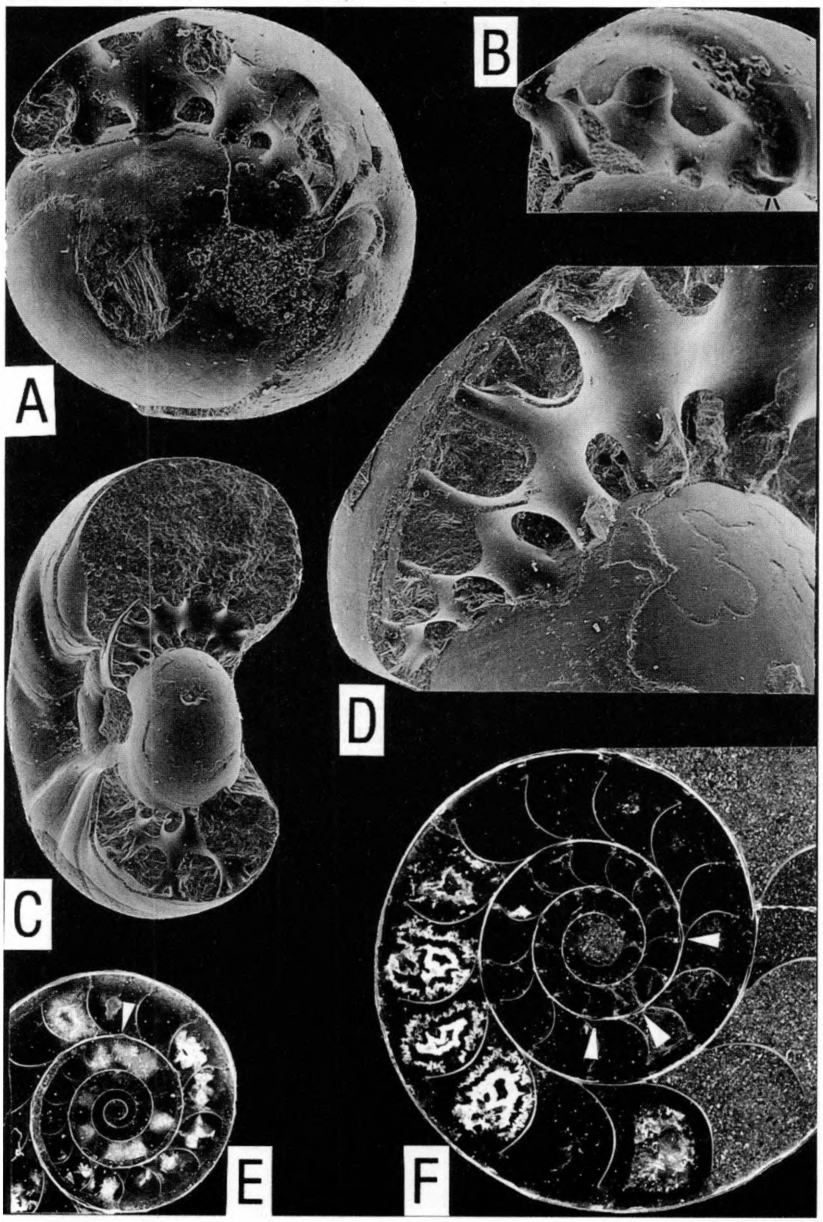
2.2 Shell morphogeny

All features of the shell morphogeny of *Yokoyamaoceras jimboi* are depicted in Fig. 2. The suture line is sixlobate from the third line up to the primary constriction (Fig. 2 A), where the seventh lobe appears (Fig. 2 B). All lobes are well reflected by the configuration of the septal surface. The existence of a deeply suspending sutural lobe $S = U_{1v}$ is indicated by the outline of ventral and dorsal parts of the septa (Fig. 2 C, D) beginning with the middle of the third whorl.

The protoconch is small and round in cross section. It has a diameter of 0,42 mm, and a width of 0,70 mm (Fig. 2 A). The primary constriction is well developed (Fig. 2 B) and situated at 320° from the proseptum. The shell sculpture is represented by fine ribs and deep constrictions. Only fine striae and projected constrictions are present between the third and fifth whorl (Fig. 2 C), when fine primary ribs appear.

The appearance of periodic constrictions, 4–7 per whorl, is related to the bulges of the inner nacreous layer (Figs. 2 E, F). The wedging out of the outer prismatic and, later on, the nacreous layer along the umbilical seam is reflected in cross section. In median section we observe a central position of the siphon up to the primary constriction. A ventral position of the siphon begins with the middle part of the second whorl.

Fig. 2. Shell morphogeny of *Yokoyamaoceras jimboi* MATSUMOTO. A–B – specimen GPIT 1732/2: A – protoconch and seven chambers, ×80; B – 10th septa (primary constriction), × 80. C–D – specimen GPIT 1732/3: C – general view of shell (4,0 whorls), × 10; D – general view of septa (part, 3,0 whorls), ×50. E – median section, ×5, specimen GPIT 1732/4. F – median section, ×5, specimen GPIT 1732/5. Appearence of new sutural elements is indicated by black lines (A, B), bulges of the inner nacreous layer by white arrows (E, F). All specimens are from the Santonian/Campanian boundary, Talovka River, northwestern Kamchatka.


A
B
C
D
E
F

3. Conclusions

The studied specimens of *Y. jimboi* indicate that the main suture features of kossmaticeratids are the early subdivision of the lobe U_1 in the third suture line, and the deeply suspending sutural lobe $S = U_{1v}$ from the middle of the third whorl. The stratigraphically younger genus *Yokoyamaoceras* differs from the genus *Marshallites* in a more rapid subdivisions of metalobes, beginning with the U_{1v} in the 10th suture line. The different configurations of the lobe U_2 have no major systematic value. This is in good accordance with similar observations in other ammonite groups (Wiedmann et al. 1990).

In comparison with the observations of Schindewolf (1966) on the suture ontogeny of *Kossmaticeras* cf. *K. sakondryense* Collignon, it can be shown that the metalobes U_{1vv}, U_{1vdv} and U_{1vdd} are included into the deeply suspending sutural lobe *S*.

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