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A New Genus of Cardioceratids (Ammonoidea) from the Upper Callovian–Lower Oxfordian of Northern Siberia

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Abstract—A new genus, *Anabariceras*, and two new species, *A. meledinae* and *A. aspectabile*, are described from the Upper Callovian–Lower Oxfordian boundary beds from the Anabar River basin. Based on analysis of the ontogenetic development of major characters (suture, shell shape, and ornamentation), the affinity of this genus to the subfamily Quenstedtoceratinae is substantiated.

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Key words: Cardioceratidae, Ammonoidea, Upper Callovian, Lower Oxfordian, Siberia, Russia.

INTRODUCTION

The study of ammonites collected from the Callovian–Oxfordian boundary beds in the steep river banks of the Anabar River revealed the presence of specimens different from all known Cardioceratids in their shell ontogeny, terminal suture outlines, and other morphological characters. They were described as a new genus *Anabariceras* in the family Cardioceratidae. At present many foreign and Russian workers recognize three subfamilies within the Cardioceratidae (Arctocephalitinae Meledina, 1968, Cadoceratinae Hyatt, 1900, and Cardioceratinae Siemiradzki, 1891) (*Treatise*…, 1957; Knyazev, 1975; Imlay, 1982; Lominadze, 1982; Callomon, 1985; Callomon and Wright, 1989; Kiselev, 2001, etc.). Meledina (1977) proposed that some (mostly Late Callovian) genera of Cardioceratidae be assigned to the subfamily Quenstedtoceratinae, which is characterized by lens-shaped whorls at intermediate growth stages, sickle-shaped ribs, and the suture with the lobes $U_1^3U_1^4 : U_1^4U_1^3$. This family structure is accepted by Repin and Rashvan (1996), Repin (2002), and myself. However, the generic composition of the subfamilies is interpreted differently by different workers.

Meledina (1994) has included the genera *Rondiceras* Troizkaya, 1955, *Quenstedtoceras* (with the subgenera *Quenstedtoceras* Hyatt, 1877 and *Soaniceras* Meledina, 1977), *Stenocadoceras* Imlay, 1953, *Eboraciceras* Buckman, 1918, and *Longaeviceras* Buckman, 1918 and, tentatively, *Pavloviceras* Buckman, 1920 and Goliathiceras Buckman, 1918 in the subfamily Quenstedtoceratinae. The latter genus has been assigned to the subfamily Cardioceratinae (Knyazev, 1975) based on its suture.

The presence of the lens-shaped intermediate stage in the ontogeny of the new genus, its sutural ontogeny, and its ornamentation allow the assignment of the new genus to the subfamily Quenstedtoceratinae.

MATERIALS AND METHODS

This study is based on the ammonoids collected by myself together with V.G. Knyazev from the Callovian–Oxfordian sections in the Anabar River basin in 2000

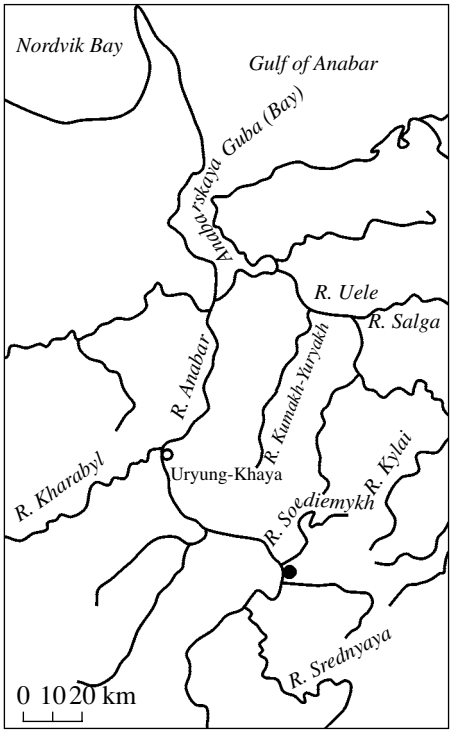


Fig. 1. Locality with *Anabariceras* (marked by black circle).

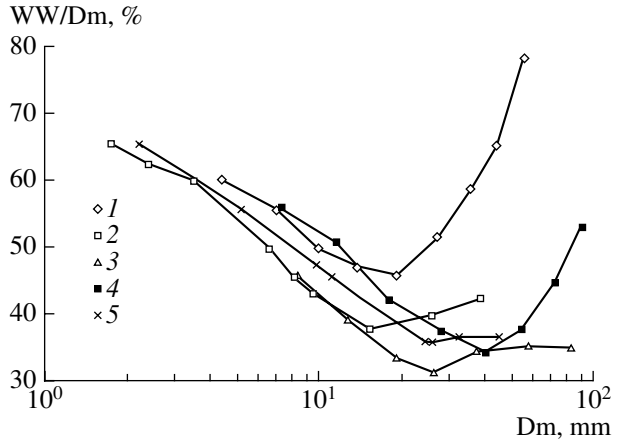


Fig. 2. Whorl width/shell diameter ratio in the genera of Quenstedtoceratinae: (*1*) *Pavloviceras minnekahtense* Imlay, specimen GM IGABM, no. 181/290; Anabar River, Lower Oxfordian; (*2*) *Vertumniceras nikitinianum* Lahusen, specimen GM IGABM, no. 181/81; Anabar River, Lower Oxfordian; (*3*) *Anabariceras meledinae*, sp. nov., specimen GM IGABM, no. 181/1; Anabar River, Upper Callovian; (*4*) *Longaeviceras stenolobum* (Sokolov), specimen GM IGABM, no. 181/377; Anabar River, Upper Callovian; (*5*) *Eboraciceras subordinarium* Buckman, specimen GM IGABM, no. 181/50; Anabar River, Upper Callovian.

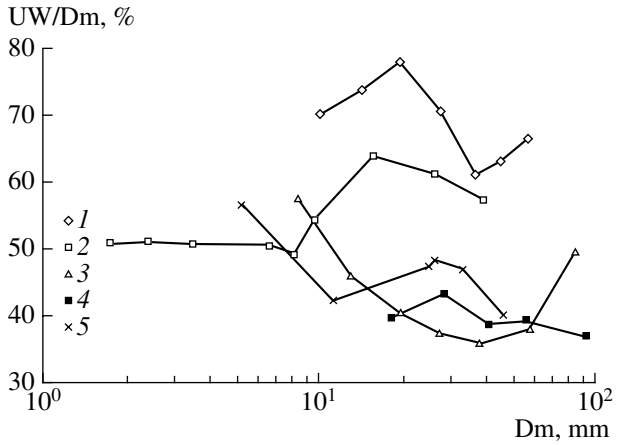


Fig. 3. Umbonal/shell diameter ratio in some genera of Quenstedtoceratinae: (*1*) *Pavloviceras minnekahtense* Imlay, specimen GM IGABM, no. 181/290; (*2*) *Vertumniceras nikitinianum* Lahusen, specimen GM IGABM, no. 181/81; (*3*) *Anabariceras meledinae* sp. nov., specimen GM IGABM, no. 181/1; (*4*) *Longaeviceras stenolobum* (Sokolov), specimen GM IGABM, no. 181/377; (*5*) *Eboraciceras subordinarium* Buckman, specimen GM IGABM, no. 181/50.

supplemented by material collected earlier from the same locality (Fig. 1). The collection studied is housed in the Museum of the Institute of Diamond and Precious Metal Geology, Siberian Division, Russian Academy of Sciences (GM IGABM) in Yakutsk, collection no. 181.

In order to study the generic differences WW/Dm and UW/Dm were plotted against the shell diameters of the Quenstedtoceratinae studied. Abbreviations: (Dm) shell diameter, (WW) whorl width, (Wh) whorl height, (MWH) median whorl height, and (UW) umbilical width.

SYSTEMATIC PALEONTOLOGY

Family Cardioceratidae Siemiradzki, 1891

Subfamily Quenstedtoceratinae Meledina, 1977

Genus *Anabariceras* Stolyarova, gen. nov.

Etymology. From the Anabar River.

Type species. *A. meledinae* sp. nov.

Diagnosis. Shell large and moderately narrow (WW/Dm from 30 to 45%), with narrow umbilicus (UW/Dm from 15 to 23%). Ornamentation of many thin secondary ribs (from four to five) between the pairs of primary ribs.

Species composition. Two species: *A. meledinae* sp. nov. and *A. aspectabile* sp. nov.

Comparison. The genus *Anabariceras* is distinguished from *Longaeviceras* Buckman, 1918 by thinner, more frequently spaced secondary ribs, which are less strongly curved on the flanks, and by the flattened shells in the external whorls (Fig. 2). The differences from the genus *Pavloviceras* Buckman, 1920 are observed as early as at Dm = 10 mm (Fig. 2) and include a compressed shell, high oval cross section, and the absence of a keel in inner whorls in the new genus. *Anabariceras* differs from *Eboraciceras* Buckman, 1918 (Fig. 2) and *Rondiceras* Troizkaya, 1956 at Dm > 40 mm in the absence of the inflated stage and in the high oval cross section. The new genus is distinguished from *Vertumniceras* Buckman, 1918 and *Quenstedtoceras* Hyatt, 1877 by the large shell, narrower umbilicus (Fig. 3), thinner and more closely spaced secondary ribs. It differs from *Stenocadoceras* Imlay, 1953 in the more flattened flanks of the last whorl, wider umbilicus, and in the ribs being thinner and less pronounced in the inner whorls and more strongly curved toward the aperture on the venter.

Anabariceras meledinae Stolyarova, sp. nov.

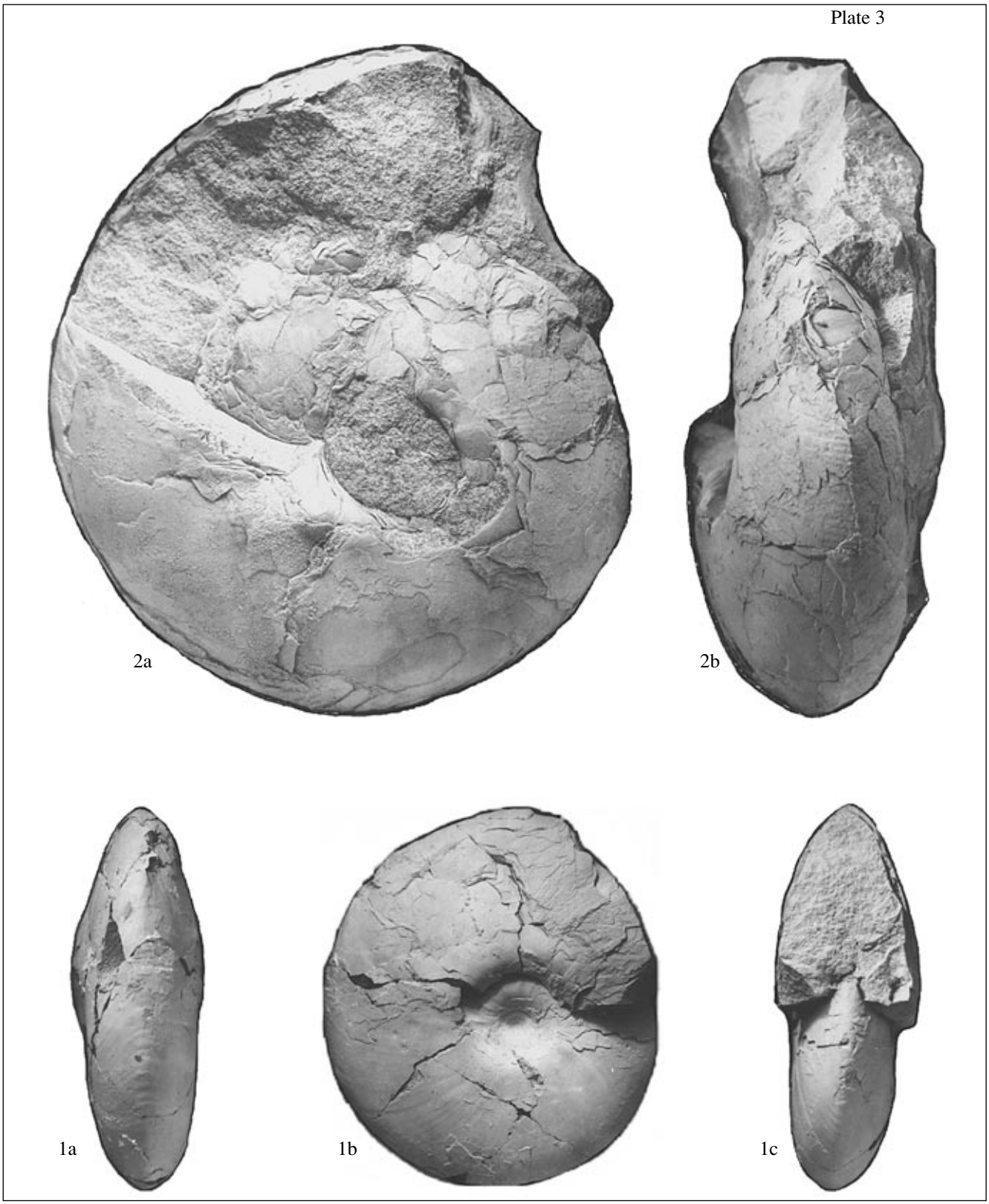
Plate 3, fig. 1; Plate 4, figs. 1–6

Etymology. In honor of S.V. Meledina.

Holotype. GM IGABM, no. 181/390; right bank of the Anabar River, 4 km upstream of the Soediemykh River mouth; Upper Callovian, *subordinarium* Zone.

Shell shape. The shell is large, discoid, and compressed (WW/Dm = 30–35%). The cross section is high oval, with its maximum width in the lower part of the whorl. The venter is narrow and rounded. The umbilicus ranges from narrow in the inner whorls (UW/Dm from 14 to 17%) to moderately narrow in the outer whorl (UW/Dm from 19 to 22%). In the last whorls the umbilicus is stepped, with a gently rounded umbil-

Plate 3

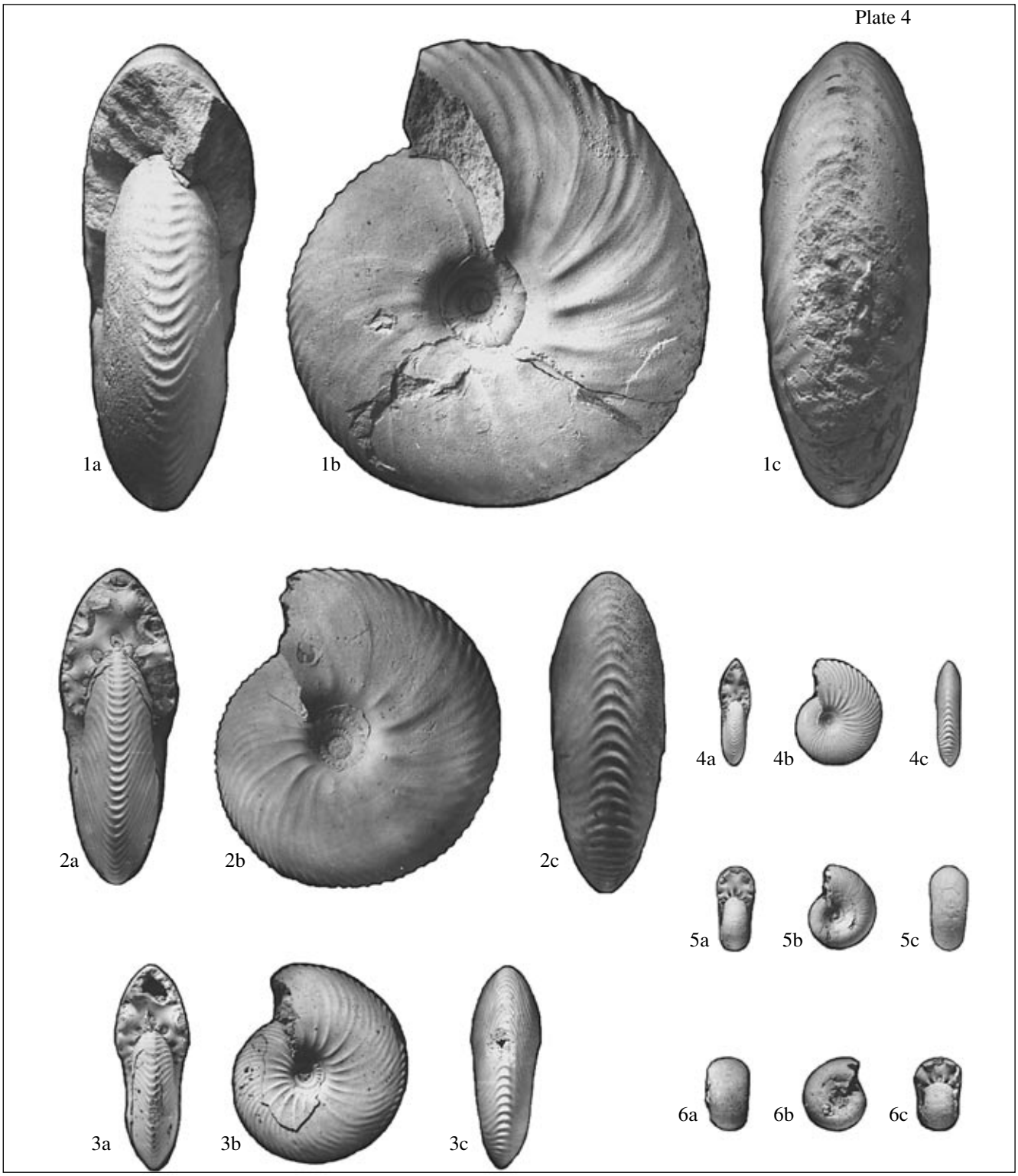


Explanation of Plate 3

All sizes are natural.

Fig. 1. *Anabariceras meledinae* sp. nov.; holotype GM IGABM, no. 181/390: (1a) ventral, (1b) lateral, and (1c) apertural views; Anabar River; Upper Callovian, *subordinarium* Zone.

Fig. 2. *Anabariceras aspectabile* sp. nov.; holotype GM IGABM, no. 181/279: (2a) lateral and (2b) ventral views; Anabar River; Lower Oxfordian, *obliteratum* Zone.



Explanation of Plate 4

All specimens are in natural size, except for especially marked cases.

Figs. 1–6. *Anabariceras meledinae* sp. nov., specimen GM IGABM, no. 181/1: (1a) apertural, (1b) lateral, and (1c) ventral views (Dm = 83.2 mm); (2a) apertural, (2b) lateral, and (2c) ventral views (Dm = 58.0 mm); (3a) apertural, (3b) lateral, and (3c) ventral views (Dm = 37.6 mm); (4a) apertural, (4b) lateral, and (4c) ventral views (Dm = 19.5 mm); (5a) apertural, (5b) lateral, and (5c) ventral views (×1.9; Dm = 8.3 mm); (6a) ventral, (6b) lateral, and (6c) apertural views (×7.5; Dm = 1.85 mm).

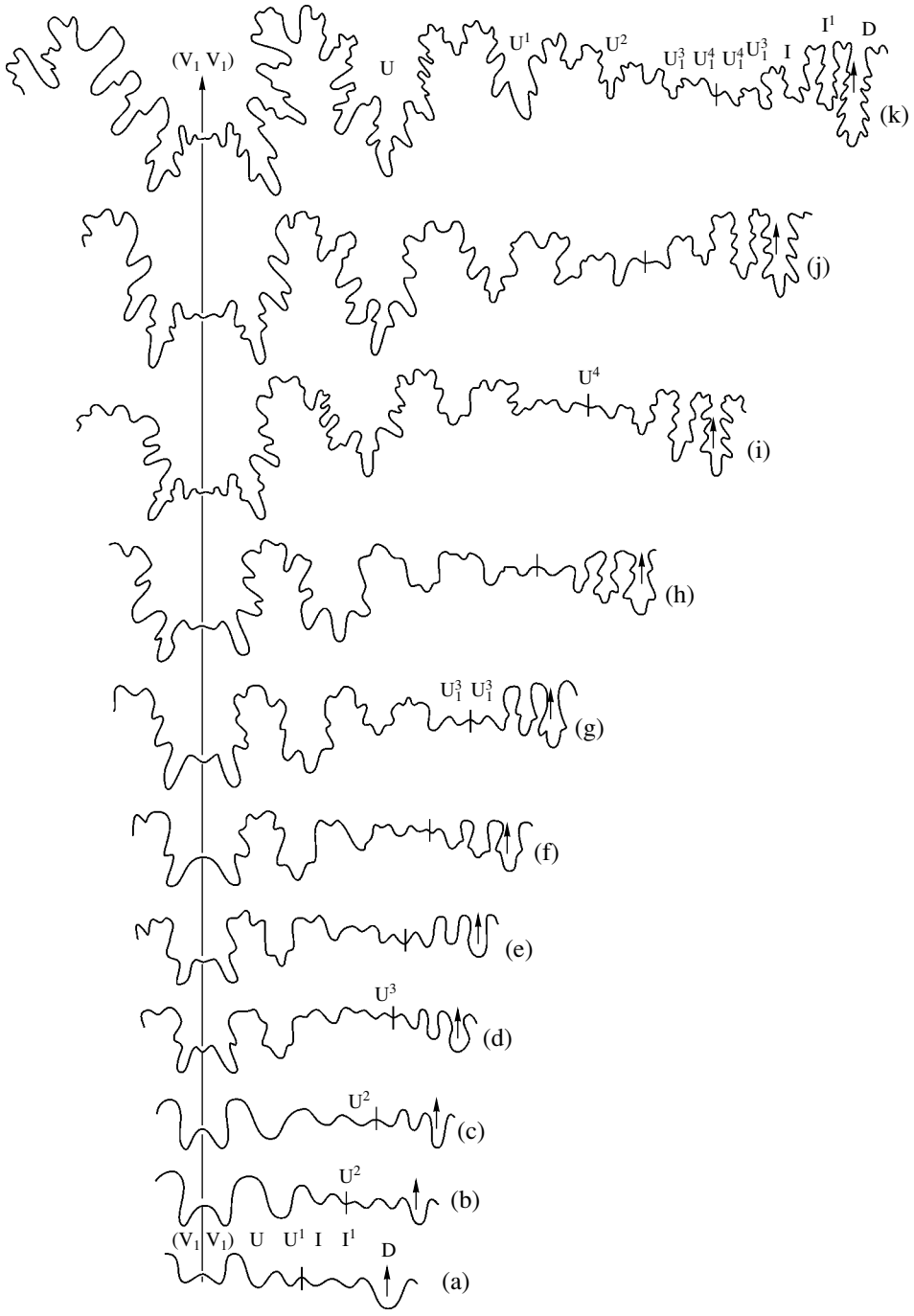


Fig. 4. Sutural ontogeny of *Anabariceras meledinae* sp. nov. (specimen GM IGABM, no. 181/1) at (a) Dm = 1.2 mm, (b) Dm = 1.9 mm, (c) Dm = 2.5 mm and WW = 1.4 mm, (d) WW = 1.9 mm, (e) WW = 2.1 mm, (f) WW = 2.6 mm and Wh = 2.1 mm, (g) Dm = 6.8 mm, (h) Dm = 8.0 mm, (i) Dm = 13.0 mm, (j) Dm = 15.4 mm, and (k) Dm = 26.7 mm.

ical edge. The body chamber is about one whorl in length. The initial whorls (at Dm up to 2 mm) are oval in cross section, with a wide venter. At Dm about 8 mm, the cross section is circular, and its width and height are equal. In the inner whorls (Dm up to 20 mm) the shell is involute; the flanks are convex, with their maximum width in the mid-flank. In the intermediate whorls (Dm from 20 to 40 mm) the shell is discoid, moderately narrow (WW/Dm = 33–35%), the flanks are compressed, whereas the maximum width is observed at the umbilical shoulder. The cross section is lens-shaped. The umbilicus is narrow (UW/Dm = 14–15%). The umbilical shoulder is broadly rounded.

Dimensions in mm and ratios in %:

Specimen GM IGABM, no.	Dm	Wh	WW	MWH	UW	Wh/Dm	WW/Dm	UW/Dm	Wh/WW
181/275	58.4*	–	–	–	–	–	–	–	–
–	53.4*	–	26.6	–	9.0	–	49.8	16.8	–
181/322	69.2	19.2*	31.8	–	13.0	27.7	45.9	18.8	60.4
181/383	97.5*	26.6*	–	–	–	27.3	–	–	–
Holotype									
181/390	72.4	–	33.5	19.5	14.0	–	46.3	19.3	65.4
–	58.4	20.2	26.5	–	10.0	34.6	45.4	17.1	76.2
–	51.8	19.1	25.2	14.5	8.2	36.9	48.6	15.8	75.8
–	38.5	14.2	20.0	–	6.5	36.9	51.9	16.9	71.0
181/1	83.0	29.1	38.2	18.6	18.6	35.1	46.0	22.4	76.2
–	58.0	20.5	26.6	13.1	10.5	35.3	45.9	18.1	77.1
–	37.6	12.9	18.0	10.2	6.5	34.3	47.9	17.3	71.7
–	26.9	8.4	13.4	8.8	4.8	31.2	49.8	17.8	62.7
–	19.5	6.5	9.8	6.8	3.7	33.3	50.3	19.0	66.3
–	12.8	5.0	6.2	4.6	2.7	39.1	48.4	21.1	80.6
–	8.3	3.8	4.0	3.0	2.1	45.8	48.2	25.3	95.0
181/297	85.2	–	38.2	–	17.3	–	44.8	20.3	–

* Denotes approximate values (distorted shells).

Ornamentation. The ornamentation of the last whorl (Dm > 60 mm) is represented by thick, widely spaced primary ribs, arched forward and inclined backward. The primary ribs are prominent, crested, extending up to the mid-height. The secondary and intercalate ribs on the flanks are very thin, weakly protruding, and in places are not observed, although clearly visible on the venter. Four to five secondary and intercalating ribs are present between a pair of primary ribs. Smoothening of the ornamentation on the flanks begins at Dm > 40 mm. At Dm from 40 to 60 mm the ribs are most prominent in the lower third of the whorl and on the venter. There are three, less frequently four, intercalating ribs. Some ribs branch at the ventrolateral shoulder (Pl. 4, fig. 2). In the intermediate whorls (Dm from 20 to 40 mm), the ornamentation is represented by the alternation of arched primary ribs, bifurcating at mid-flank, and intercalating ribs (1–2). The ribs are slender and prorsiradiate. The primary ribs are more prominent. Above the point of bifurcation, the ribs become smoother, gently curved toward the aperture, and form projections on the venter (Pl. 4, fig. 3). In the inner whorls (Dm up to 20 mm), the ornamentation consists of primary ribs that are weakly inclined orad and become thicker ventrally and uncommon intercalating ribs. At Dm of about 8 mm the shell is covered by thin radial ribbing (Pl. 4, figs. 4–6).

Suture. The sutural ontogeny is typical of Quenstedtoceratinae (Fig. 4): the early development of the subdivided lobes U^3 and U^4 at diameters of about 7 and 26 mm, respectively. The ultimate sutural formula is $(V_1V_1)UU^1U^2U_1^3U_1^4:U_1^4U_1^3\,II^1D$. Figure 4 shows a drawing of the sutural ontogeny of a specimen of *Anabariceras* that was previously identified as *Longaeviceras* sp. (Stolyarova, 2002).

Occurrence. Upper Callovian, *Eboraciceras subordinarium* Zone; Lower Oxfordian, *Scarburgiceras obliteratum* Zone; northern Siberia.

Material. Seven reasonably well-preserved shells: three from the *subordinarium* Zone, three from the *obliteratum* Zone; and one from talus.

Anabariceras aspectabile Stolyarova, sp. nov.

Plate 3, fig. 2

Etymology. From the Latin *aspectabilis* (interesting, curious).

Holotype. GM IGABM, no. 181/279; right bank of the Anabar River, 4 km upstream of the Soediemykh River mouth; Lower Oxfordian, *obliteratum* Zone.

Shell shape. The shell is large, involute, moderately compressed (WW/Dm up to 45%), with weakly convex flanks. The whorl cross section is high oval. The umbilicus is narrow and funnel-shaped. The body chamber is approximately one whorl.

Dimensions in mm and ratios in %:

Specimen GM IGABM, no.	Dm	Wh	WW	MWH	UW	Wh/Dm	WW/Dm	UW/Dm	Wh/WW
Holotype									
181/279	119.8	–	–	–	–	–	–	–	–
–	106.0	34.4*	49.5	25.5	21.3*	32.4	46.7	20.1	69.5
181/287	69.2	19.2	31.8	–	13.0	27.7	45.9	18.8	60.4
181/385	120.0	–	–	27.8	–	–	–	–	–
–	92.8	42.0*	–	–	–	45.3	–	–	–

* Denotes approximate values (deformed shells).

Ornamentation. The ornamentation of the external whorl consists of wide nodes along the umbilical shoulder, 1 cm apart, and by dense, thin, almost straight ribs on the flanks. The ribs on the venter are thickened, rounded, and ledge-shaped. The ornamentation of inner whorls is unknown.

Comparison. This species is distinguished from *A. meledinae* by the more convex flanks, shallower umbilicus, less strongly curved and weaker ribs.

Material. Three slightly distorted molds with complete living chambers from the type locality.

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