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Phylloceratids (Ammonoidea) from the Lower Jurassic of Northeastern Asia

Yu. S. Repin*, S. V. Meledina, and S. N. Alexeev****

* *All-Russia Oil Geological Exploration Research Institute, Liteinyi pr. 39, St. Petersburg, 192104 Russia.*

** *Joint Institute of Geology, Geophysics, and Mineralogy, Siberian Division, Russian Academy of Sciences, Universitetskii pr. 3, Novosibirsk, 630099 Russia.*

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Abstract—A new phylloceratid superfamily Boreophylloceratacеae including a new monotypic family Boreophylloceratidae and a new family Yukagiritidae (including two new genera *Yukagirites* and *Kolymophylloceras*) are erected based on the structure of the inner whorls. The family Phylloceratadiae includes the genus *Phylloceras* (with two species, one of which is new), a new genus *Platyphylloceras* (with two species), and the genus *Calliphylloceras*. In the family Holcophylloceratidae a new species of the type genera is erected. In total, the Lower Jurassic assemblage in northeastern Asia includes two superfamilies, three families, seven genera, and ten species. The new taxa are described, and the zonal distribution of the phylloceratid taxa is presented.

INTRODUCTION

Among the Mesozoic ammonoids, phylloceratids represent the most conservative and slowly evolving group. In northeastern Russia, phylloceratids are always present in the ammonoid assemblages. They are recognized in all the stages of the Lower Jurassic and occur in many stratigraphic levels. However, phylloceratids do not occur in mass accumulations and are usually found as isolated specimens. The genera and species of the Phylloceratida are diagnosed based on the internal structure of the shell, including the sutural ontogeny and structure of the siphuncle, the characters that are not always identifiable because of the paucity and poor preservation of these ammonoids. Phylloceratids are not extensively used in the Boreal Jurassic zonal stratigraphy, and this group is almost ignored in biostratigraphy.

In the present paper we discuss the morphology, systematics, and phylogeny of Siberian phylloceratids and provide new data on their geographic and stratigraphic distribution in the Lower Jurassic rocks in northeastern Asia.

The material used is based on our own collection and on that collected by T.I. Kirina and I.V. Polubotko. The collection is unique in its stratigraphic and geographic range and taxonomic diversity. New data is obtained on the whorl structure and sutural ontogeny in the Hettangian–Sinemurian and Pliensbachian–Toarcian phylloceratids.

The ammonoids are described using the terminology and techniques commonly accepted in Russia (Krymholz, 1960). The sutural terminology was used in accordance with that proposed by Akexeev and Vavilov (1983). The siphuncular elements are termed according to Zakharov (1978), and Druzczic and Doguzhaeva (1981).

The material is housed in the Museum of the All-Russia Oil Geological Exploration Research Institute, St. Petersburg (VNIGRI), collection no. 837 and in the monographic collection department of the Central Siberian Geological Museum (TsSGM), Novosibirsk, collection no. 580.

SYSTEMATICS OF BOREAL PHYLLOCERATIDS

Before the systematic position of new Early Jurassic genera and species in the order Phylloceratida is established, the general systematics of phylloceratids is to be discussed.

Druzczic and Doguzhaeva (1974) indicated that the members of the order Phylloceratida have a large central siphuncle in the first two whorls, which moves ventrad at the end of the second-third whorls, and sometimes even at the end of the third whorl. However, it never closely contacts the venter. The septal necks in the first whorl are retrochoanitic, and from the second whorl they are short and prochoanitic and remain short throughout growth.

Later Druzczic and Knorina (1980) studied several specimens of «Phyllopachyceras» from the rocks assigned to the Valanginian (Voronez, 1962) in the basin of the Anabar River and discovered that these specimens possess characters that contrast with those of the previously proposed diagnosis of the order Phylloceratida. The boreal phylloceratids show an unusually large protoconch, caecum, and siphuncle, and prochoanitic septal necks from the beginning of the phragmocone.

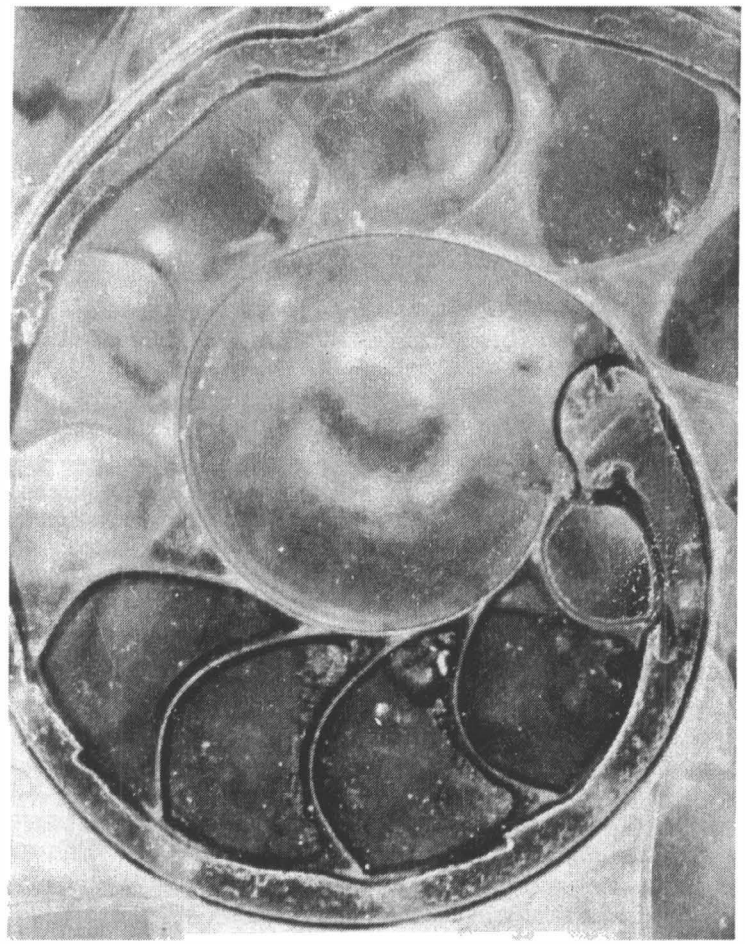


Fig. 1. *Boreophylloceras praeinfundibulum* (Vor.); specimen no. 837/81, protoconch and first whorl, ×50; Anabar River, Berriasian, *mesezhnikowi* Zone.

In the present paper, Yu.S. Repin and A.S. Alexeev also studied the specimens assigned to *"Phyllopachyceras" praeinfundibulum* Voronez, 1962 and *"Ph." lenaense* Voronez, 1962 from the sediments of the same age (Berriasian, *mesezhnikowi* Zone) of the Anabar Region. Their observations fully supported the data on the internal whorls of Boreal "*Phyllopachyceras*" indicated by Druzczic and Knorina (1980) (Fig. 1).

The sutural ontogeny was studied in two specimens of *"Ph." praeinfundibulum* (Fig. 2). The sutural ontogeny was so different from the ontogeny of all previously studied phylloceratids that the diagnosis of the order had to be emended.

In *"Ph." praeinfundibulum* the prosuture is two-lobed, the primary suture is five-lobed and is connected to the prosuture near the seam (Fig. 2a). The third suture (Fig. 2b) is composed of eight lobes (not counting the rudimentary complexity of the internal lateral lobe) and has digitized lobes and phylloid saddles. A shift from the five-lobed to the eight-lobed suture without any intermediate stages was observed. The modes of the emergence of new sutural elements remain unclear (whether they formed by the division of the saddle or of the primary lobes. Hence their terminology is unclear. We therefore indicated the changes in the third suture by the indices F, G, and H. Further increase in sutural complexity occurs by the secondary division of the internal lateral lobe and by the separation of new umbilical lobes (Figs. 2c–2j).

The abrupt transition from the five-lobed to the eight-lobed suture may certainly be interpreted as acceleration. This is supported by the missing stages of retrochoanitic septal necks: the third suture and all the succeding have prochoanitic septal necks.

Generally, the boreal phylloceratid species have a very large protoconch, caecum, and ammonitella, ventral siphuncle and prochoanitic septal necks from the beginning of the phragmocone, and an eight-lobed suture.

These characters exclude the assignment of the species *praeinfundibulum* and *lenaense* to the genus *Phyllopachyceras* as well as to any other phylloceratid genus with known early ontogenetic stages and sutural ontogeny. The rank of differences in these species is clearly higher than generic. The new genus *Boreophylloceras* including the species *B. praeinfundibulum*

(Vor.) and *B. lenaense* (Vor.) is established. This genus is considered as an apparently terminal member of the family Boreophylloceratidae and superfamily Boreophylloceratacеae in the suborder Phylloceratina.

The superfamily Boreophylloceratacеae also includes several Early Jurassic genera that as in the genus *Boreophylloceras* have a marginal ventral siphuncle and prochoanitic septal necks already by the end of the first whorl. These species represent the separate family Yukagiritidae fam. nov.

Thus, the order Phylloceratida is composed of two superfamilies: Phylloceratacеae Zittel, 1884 and Boreophylloceratacеae superfam. nov. All phylloceratid genera from the Boreal Lower Jurassic are assigned to either of these superfamilies. The former superfamily includes the families Phylloceratidae Zittel, 1884 and Holcophylloceratidae Druzczic, 1956, while the second is represented by the new family Yukagiritidae.

DISTRIBUTION OF THE LOWER JURASSIC PHYLLOCERATIDS IN NORTHEASTERN ASIA

A new phylloceratid assemblage was discovered that includes the members of the three families: Yukagiritidae, Phylloceratidae and Holcophylloceratidae.

The earliest Jurassic phylloceratids are of Hettangian and Sinemurian age and are recognized only in northeastern Russia (Fig. 3). The basins of the Viliga and Gizhiga rivers (Malaya Turomcha River) of Hettangian rocks contain small peculiar shells that we assigned to the genera *Kolymophylloceras* (Yukagiritidae) and *Platyphylloceras* (Phylloceratidae). The former genus is represented by the species *K. turomchense*, the latter by the species *P. okhoticum* Repin sp. nov. Another species, *Platyphylloceras kedonicum* sp. nov. was found in the Lower Toarcian *propincuum* Zone in the Levyi Kedon River. The Upper Sinemurian *kolymicus* Zone shows the emergence of the species *Yukagarites kinasovi* sp. nov. found at the Talaya River (in the basin of the Buyundy River). The Upper Pliensbachian *viligaensis* Zone (Molodo River) contains *Y. molodoensis* sp. nov.

The earliest species of the genus *Phylloceras* (*Ph. omkuchanicum* sp. nov.) was found in the Omolon River Basin (Okuumchan River). In the Toarcian, this genus became widespread in the entire northeastern Asia. The occurrences of the species *Ph. heterophyllum* (Sow.) are known from the *elegantulum* Zone on the Markha River, from the *commune* Zone, in the eastern bank of Anabar Bay, on the Tyung River, and the Levyi Kedon River, from the *braunianus* Zone on the Tokur-Yuryakh River, and from the *rosenkrantzi* and *danilovi* zones, in the basin of the Kolyma River (Berezovka River) (Pl. 4, figs. 1, 5, and 10; pl. 5, figs. 1 and 7).

The Lower Toarcian *elegantulum* Zone on the Markha River contains indeterminable species of the genus *Calliphylloceras* (Pl. 5, fig. 2). The Lower

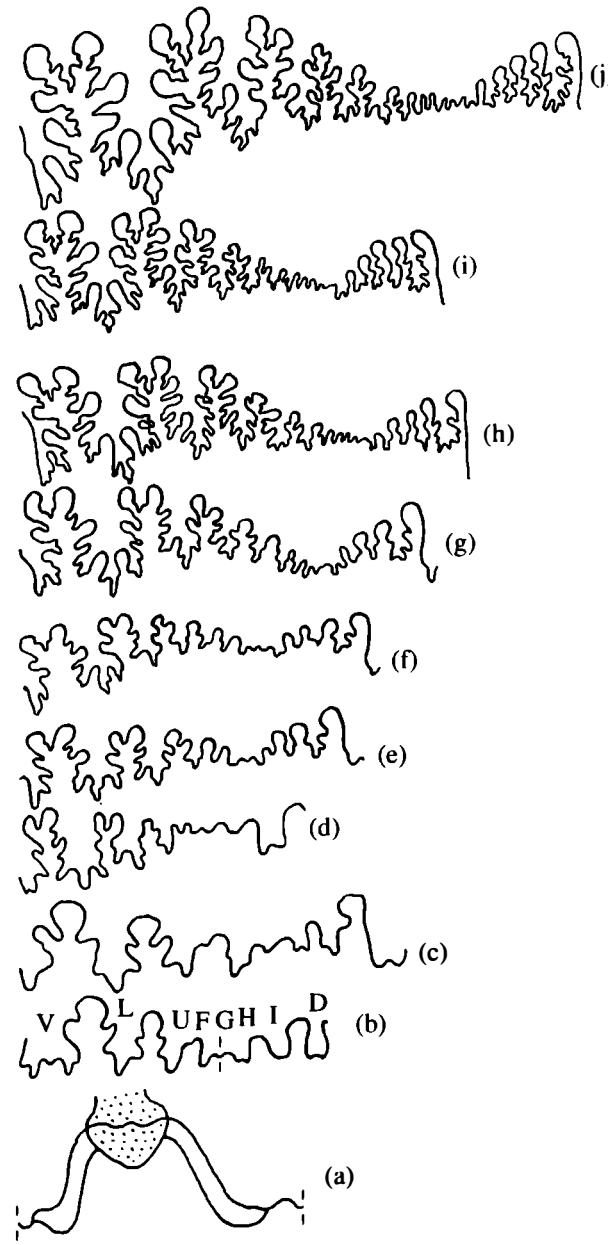


Fig. 2. Sutural ontogeny of *Boreophylloceras praeinfundibulum* (Vor.); specimen no 837/81; (a) sutures 1 and 2 (×45); (b–d) sutures 3, 4, and 9 (whorl 0.7, the place of the nepionic constriction), ×30; (e) whorl 1, ×22.5; (f and g) whorls 1.3 and 1.6, ×18; (h) whorl 2.2, ×8.2, (i) whorl 2.7, ×5.3; (j) whorl 3.2, ×4.5; Anabar River; Berriasian, *mesezhnikowi* Zone.

Pliensbachian *talrosei* Zone on the Anabar, Kelimyar, and Motorchuna rivers contain the phylloceratid *Zetoceras zetes* (Orb.) (Pl. 5, figs. 4 and 5). The same zone on the Motorchuna River contains the earliest member of the family Holcophylloceratidae, *Holcophylloceras? tyungense* sp. nov. This species is found in the Lower Toarcian *commune* Zone, Tyung River. *Holcophylloceras* sp. was found in the uppermost Toarcian, of the Anadyr River.

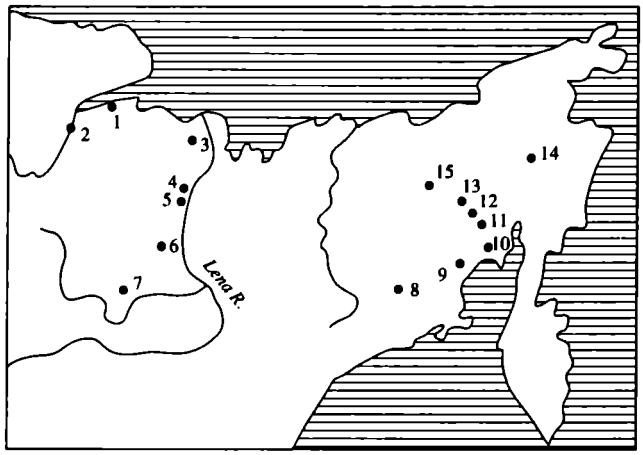


Fig. 3. Phylloceratid occurrences in Northeastern Asia; (1) eastern coast of Anabar Bay; *Phylloceras heterophyllum* Sow., Toarcian, *commune* Zone; (2) Anabar River, *Zetoceras zetes* (Orb.), Pliensbachian, *talrosei* Zone; (3) Kelimyar River, *Zetoceras zetes* (Orb.), Pliensbachian, *talrosei* Zone; (4) Motorchuna River, *Z. zetes* (Orb.), *Holcophylloceras tyungense* sp. nov., Pliensbachian, *talrosei* Zone; (5) Molodo River, *Yukagirites molodoensis* sp. nov., Pliensbachian, *viligaensis* Zone; (6) Tyung River, *Phylloceras heterophyllum* Sow., *Holcophylloceras tyungense*, sp. nov., Toarcian, *commune* Zone; (7) Markha River, *Ph. heterophyllum* Sow., *Calliphylloceras* sp., Toarcian, *elegantulum* Zone; (8) Talaya River, *Yukagirites kinasovi* sp. nov., Sinemurian, *kolymicum* Zone; (9) Viliga River, *Platyphylloceras okhoticum* sp. nov., Hettansian, *viligense* Zone, (10) Malaya Turomcha River, *Kolymophylloceras turomchense* sp. nov.; Hettangian, *viligense* Zone; (11) Levyi Kedon River, *Platyphylloceras kedonicum* sp. nov., Toarcian, *propinquum* Zone, *Ph. heterophyllum* Sow., Toarcian *commune* Zone; (12) Okumchan River, *Phylloceras omkuchanicum* sp. nov., Sinemurian, *libratus* Zone; (13) Tokur-Yuryakh River, *Ph. heterophyllum* Sow., Toarcian, *braunianus* Zone; (14) Anadyr River, *Holcophylloceras* sp., Toarcian, *paracompactile* Zone; (15) Berezovka River, *Ph. heterophyllum* Sow., Toarcian, *rosenkratzi* and *danilovi* zones.

The stratigraphic ranges of the phylloceratids are shown in the table.

SYSTEMATIC PALEONTOLOGY

Superfamily Boreophylloceratacea Alexeev et Repin, superfam. nov.

Diagnosis. Shell ophioconic, involute, with narrow umbilicus. Whorls rounded-oval and high. Ornament ranges from finest striae to ribs in ventral parts of the whorls. Prosuture two-lobed, primary suture five-lobed. Siphuncle becomes ventral and septal necks become prochoanitic in the first whorl.

Composition. Families Boreophylloceratidae and ? Yukagiritidae from northeastern Asia.

Comparison. This superfamily differs from the superfamily Phylloceratacea in that the siphuncle becomes ventral during the first whorl, and at the same time the septal necks become prochoanitic, and in the accelerated transition in sutural ontogeny in the early members (genus *Boreophylloceras*) that have an eight-lobed suture.

Family Boreophylloceratidae Alexeev et Repin, fam. nov.

Diagnosis. Shell ophioconic and involute. Whorls rounded-oval and compressed. Ornament of internal whorls (diameter up to 25–30 mm) consists of striae, later in ontogeny, ventral part of whorls possesses short and rounded ribs. Protoconch, caecum, and ammonitella very large. Siphuncle from the very beginning ventral, septal necks prochoanitic from the third suture. Third suture phylloid and contains eight lobes (VLUF:G:HID).

Composition. Genus *Boreophylloceras* from the Berriasian of Siberia.

Comparison. The very large initial elements of the shell (Fig. 1), the ventral-marginal siphuncle from the beginning of coiling, prochoanitic septal tubes from the stage of the third suture, and a well developed phylloid third suture composed of eight lobes are the characters distinguishing the new family from all other families of the order Phylloceratida.

Genus *Boreophylloceras* Alexeev et Repin, gen. nov.

Etymology. From Latin *boreus* (northern) and the genus *Phylloceras*.

Type species. *Phyllopachyceras praeinfundibulum* Voronez, 1962; Berriasian, *mesezhnikowi* Zone; Siberia.

Diagnosis. Shell medium-sized, with narrow umbilicus (Fig. 4). Venter rounded and moderately wide. Early whorls (diameter up to 25–30 mm) possess ornament of fine striae. Later short rounded ribs appear in the ventral part of whorl running across venter. Protoconch (D^1 = 1.54 mm, D^2 = 1.47 mm) and ammonitella Damm (2.90 mm, α = 290°) large. Sutural complexity increases by division of internal lateral lobe I and by separation of umbilical lobes U^n (Fig. 2).

Composition. Apart from the type species, the genus includes *B. lenaense* (Voronez, 1962) from the Berriasian of Siberia.

Family Yukagiritidae Repin, fam. nov.

Diagnosis. Shells small, involute, with rounded venter and moderately convex flanks. Ornament ranges from fine striae to thin but distinct ribs. Protoconch large, rounded-oval. At the end of first whorl, siphuncle becomes ventral, septal necks become prochoanitic. Sutural complexity increases by the gradual division of internal lateral lobe (I) and by simultaneous separation of new umbilical lobes (U^n).

Composition. Two genera: *Yukagirites* and *Kolymophylloceras* from the Hettangian–Pliensbachian of Northeastern Asia.

Comparison. This family is distinguished from the family Boreophylloceratidae by smaller sizes of the

protoconch and ammonitella, by the siphuncle contacting the venter later in ontogeny, later ontogenetic change from retrochoanitic septal necks to prochoanitic, and by gradual transition from the five-lobed suture to the eight-lobed.

Genus *Kolymophylloceras* Repin, gen. nov.

Etymology. From the Kolyma River and the genus *Phylloceras*.

Type species. *K. turomchense* sp. nov.; Hettangian, *viligense* Zone of the Omolon Massif.

Diagnosis. Shell small, flattened-oval, involute, with very narrow umbilicus. Flanks moderately convex, gradually transiting to rounded venter. Protoconch rounded and large. Siphuncle ventral from the end of the first whorl. Third and all succeeding septal necks prochoanitic and short.

Composition. Type species.

Kolymophylloceras turomchense Repin, sp. nov.

Plate 4, figs. 3 and 6

Etymology. From the Turomcha River.

Holotype. VNIGRI Museum, no. 837/71, small mold with living chamber, Basin of the Gizhiga River (Malaya Turomcha River); Hettangian, *viligense* Zone, Svyazuyushchinskaya Formation.

Shell form. The shell is small, flattened-oval, and involute. The flanks are moderately convex. The whorl cross section is compressed, with maximum width in the middle part of the flanks. The umbilicus is very narrow, with rounded and steep walls.

Ornament. At diameter of 15 mm the flanks possess thin subradial striae that are not preserved in the internal mold.

Phragmocone. The specimen studied (Pl. 4, fig. 3) has 2.7 whorls and a living chamber of 0.8 of the whorl. The first whorl contains 13 septa, the second 14 septa, and the incomplete third whorl contains 9 septa. The protoconch is large, oval-spherical (D^1 = 0.64 mm), and the prosiphon is short (0.1 mm). The caecum is oval-elongated and slightly larger than the siphuncle. The third and the next septa are prochoanitic, with short septal necks. The nepionic constriction is weakly developed. The diameter of the ammonitella is 1.4 mm, $\alpha = 320°$.

Suture (Fig. 5). The prosuture is two-lobed, the primary suture is five-lobed (Figs. 5a–5c). Lobe I in the ninth suture is about to subdivide: its base is flattened, it is slightly extended (Fig. 5e). Lobe I in the tenth suture is subdivided by the median saddle into I_v and I_d (Fig. 5f). At the end of the first lobe, saddle U/I_v lying on the seam is subdivided by the small lobe U^1 (Fig. 5g) that has shifted by the beginning of the second whorl ventrad of the seam. At the stage of whorl 1.2, lobe U^2 starts forming on the seam (Fig. 5i). At the stage of whorl 1.6, lobe U^3 is formed on the saddle U^2/J_v. At the same time, lobe I_v divides into lobes I_{vv} and I_{vd} (Fig. 5j).

Stratigraphic distribution of phylloceratid in the Lower Jurassic of Northeastern Asia

	21	*Holcophylloceras* sp.
	20	
	19	*Phylloceras heterophyllum*
	18	
Toarcian	17	*Phylloceras heterophyllum*
	16	*Phylloceras heterophyllum, Holcophylloceras tyungense*
	15	
	14	*Phylloceras heterophyllum, Calliphylloceras* sp.
	13	*Platyphylloceras kedonicum*
	12	
	11	*Yukagirites molodoensis*
Pliensbachian	10	*Zetoceras zetes, Holcophylloceras tyungense*
	9	
	8	
Sinemurian	7	*Yukagirites kinasovi*
	6	
	5	*Phylloceras omkuchanicum*
	4	
	3	
Hettangian	2	*Platyphylloceras okhoticum* *Kolymophylloceras turomchense*
	1	

Zones: 1—*primulum*, 2—*viligense*, 3—*liasicus*, 4—*angulata*, 5—*libratus*, 6—*siverti*, 7—*kolymicum*, 8—Lower Pliensbachian, 9—*stokesi*, 10—*talrosei*, 11—*viligaensis*, 12—*extremus*, 13—*propinquu*, 14—*elegantulum*, 15—*falciferum*, 16—*commune*, 17—*braunianus*, 18—*spinatum*, 19—*rosenkrantzi*, 20—*danilovi*, 21—*paracompactile* (Repin and Polubotko, 1996).

At the stage of whorl 1.8, lobes I_{vv} and I_{vd} are formed, and lobe U^4 is formed on the saddle U^3/I_{vv} (Figs. 5k–5l). Later, by the beginning of the first whorl, lobe U^4 is shifted ventrad of the seam, at the same time as the formation of lobe U^5 on the saddle U^4/I_{vv} (Fig. 5m). Thus, by the beginning of the third whorl the suture has the following structure: $VLUU^1U^2U^3U^4{:}U^5{:}I_{vv}I_{vd}I_dD$.

Material. Eight small molds from the basin of the Malaya Turomcha River.

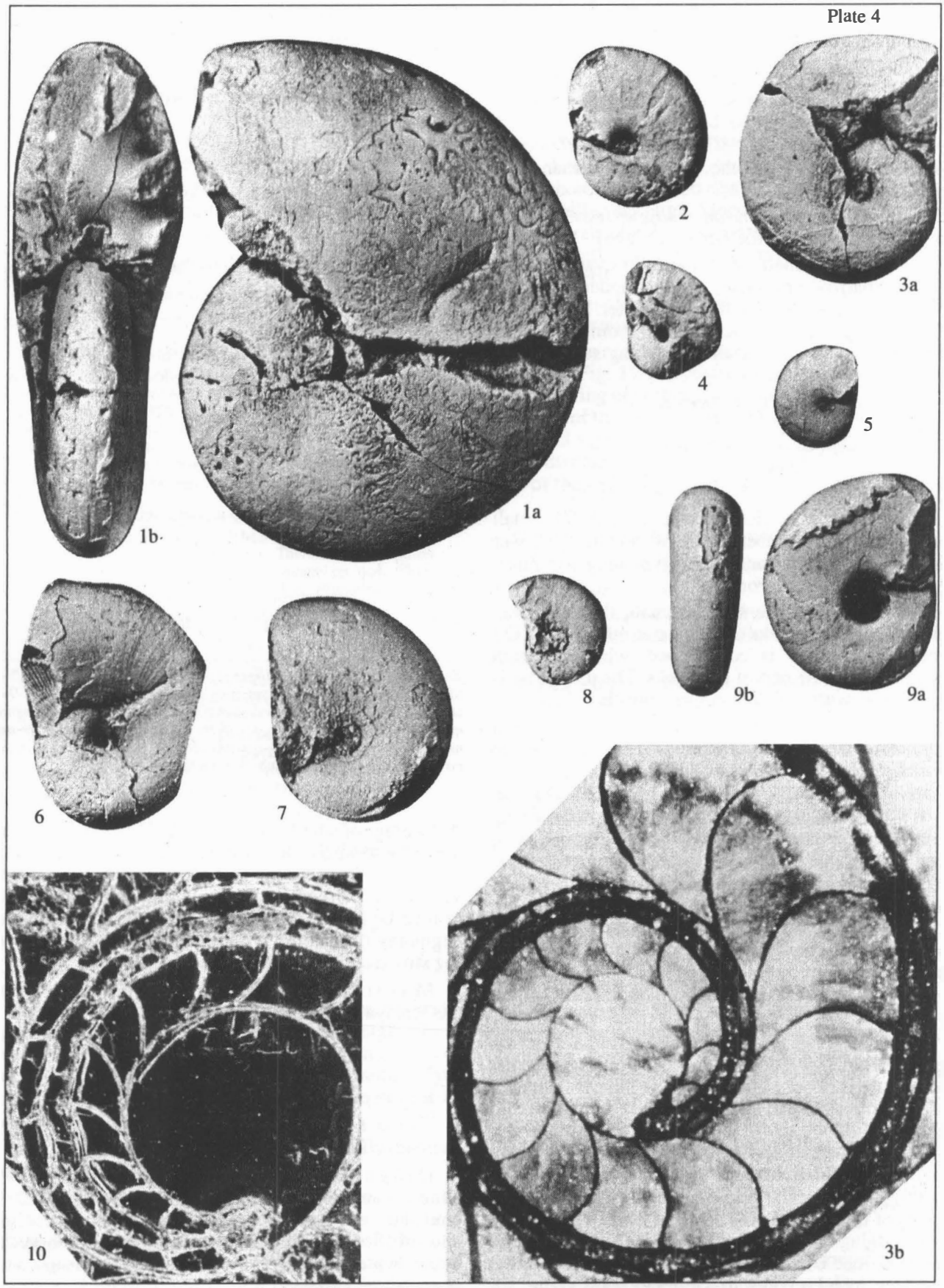
Genus *Yukagirites* Repin, sp. nov.

Etymology. From the Yukagirian tribe.

Type species. *Yu. molodoensis* sp. nov.; Pliensbachian, *viligaensis* Zone, Western Yakutia.

Diagnosis. Shell small, involute, with weakly convex flanks and rounded narrow venter. Flanks covered with numerous striated riblets. Siphuncle at the end of first whorl becomes ventral. Septal necks become prochoanitic from the ninth–tenth septa and possess long pillars.

Plate 4



Composition. Two species *Yu. molodoensis* and *Yu. kinasovi* from the Sinemurian and Pliensbachian of northeastern Siberia.

Comparison. This genus differs from the genus *Kolymophylloceras* in the shallower and less inflated shell, long prochoanitic necks and their later appearance in ontogeny.

Remarks. This genus is similar to the genus *Fergusonites* from the Hettangian of Nevada (Guex, 1980) differing in the narrower umbilicus and more convex flanks, and also in the absence of a narrow apertural constriction.

***Yukagirites kinasovi* Repin, sp. nov.**

Plate 4, fig. 8

Etymology. After the geologist V.P. Kinasov.

Holotype. Museum VNIGRI, no. 837/73, small mold; basin of the Buyundy River (Talaya River); Upper Sinemurian, *kolymicum* Zone.

Shell shape. The shell is small and involute. Weakly convex flanks gradually transit to the rounded venter and more steeply with the wall of the narrow umbilicus.

Dimensions in mm and ratios (%):

Specimen no.	D	WH	WW	UW	WH/D	WW/D	UW/D
Holotype 837/73	21.0	11.0	6.5	2.4	52.0	31.0	10.0

Ornamentation. The shell possesses thin rounded ribs forming an apertural projection from the mid-flank where they are most distinct.

Phragmocone. The studied specimen is somewhat distorted, hence the data on the inner whorls are provisional and incomplete. The specimen is composed of the phragmocone (3.8 whorls) and body chamber of 0.5 whorls. The first and second whorls apparently have 12 septa, the third 13, and the fourth 9. The protoconch is rounded and medium sized (D^1 = 0.6 mm). The siphuncle becomes marginal–ventral at the end of the first whorl.

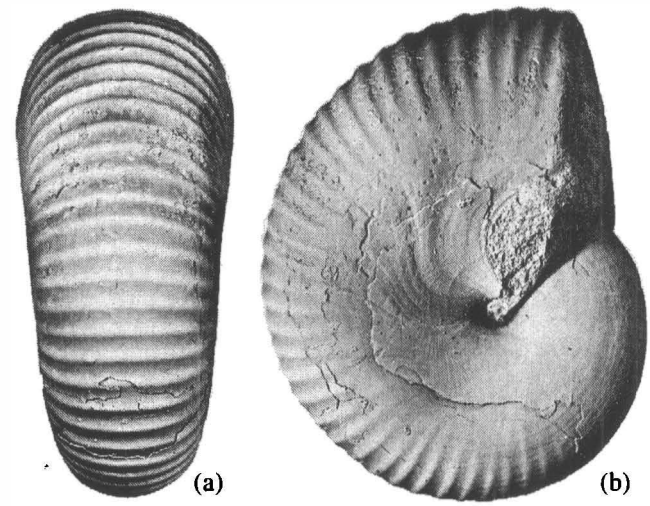


Fig. 4. *Boreophylloceras praeinfundibulum* (Vor.); specimen no. 837/101, ×1: (a) ventral view, (b) lateral view; Anabar River; Berriasian, *mesezhnikowi* Zone.

Material. Holotype.

***Yukagirites molodoensis* Repin, sp. nov.**

Plate 4, fig. 4; Plate 5, fig. 8

Etymology. From the Molodo River.

Holotype. Museum VNIGRI, no. 837/72, small phragmocone, Western Yakutia, basin of the Molodo River, Upper Pliensbachian, *talrosei* Zone.

Shell shape. The shell is small and involute. Flanks are weakly convex, gradually transit into the rounded venter and steeply fuse with the wall of the very narrow umbilicus.

Explanation of Plate 4

Figs. 1, 5, and 10. *Phylloceras heterophyllum* (Sow.); (1) specimen no. 837/77, ×1: (1a) lateral view, (1b) apertural view; Sart Creek in the basin of the Levyi Kedon River; Lower Toarcian, *commune* Zone; (5) specimen no. 837/78, lateral view, ×1; Tokur-Yuryakh River; Lower Toarcian, *braunianus* Zone; (10) specimen no. 837/80, protoconch and first whorl, ×88; Tokur-Yuryakh River; Lower Toarcian.

Fig. 2. *Platyphylloceras kedonicum* sp. nov.; holotype no. 835/74, lateral view, ×1; Golovnoi Creek in the basin of the Levyi Kedon River; Lower Toarcian, *propinquum* Zone.

Figs. 3 and 6. *Kolymophylloceras turomchemse* sp. nov.; (3) holotype no. 837/71; (3a) lateral view, ×3; (3b) protoconch and the beginning of the first whorl, ×50; Malaya Turomcha River, Lower Hettangian, *viligense* Zone; (6) specimen no. 837/79b, lateral view, ×3; Malaya Turomcha River, Lower Hettangian, *viligense* Zone.

Fig. 4. *Yukagirites molodoensis* sp. nov.; holotype no. 837/72, lateral view, ×1; Molodo River; Upper Pliensbachian, *viligaensis* Zone.

Fig. 7. *Phylloceras omkuchanicum* sp. nov.; holotype no. 837/76, lateral view, ×2; Okumchan River; Lower Sinemurian, *libratus* Zone.

Fig. 8. *Yukagirites kinasovi* sp. nov.; holotype no. 837/73, lateral view, ×1; Talaya River; Upper Sinemurian, *kolymicum* Zone.

Fig. 9. *Platyphylloceras okhoticum* sp. nov.; holotype no. 837/75, ×4; (9a) lateral view, (9b) ventral view; Viliga River; Lower Hettangian, *viligense* Zone.

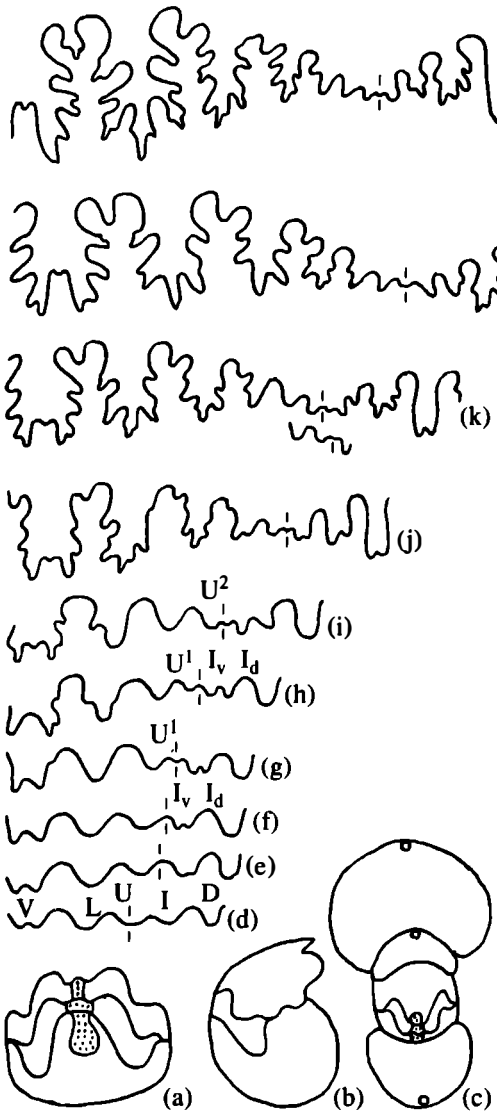


Fig. 5. Sutural ontogeny of *Kolymophylloceras turomchense* sp. nov.; holotype, no. 837/71: (a–c) protoconch and first whorl, ×40; (d–i) sutures 3 and 9 (whorl 0.6), 10 (whorl 0.65), whorl 0.8, whorl 1.0, whorl 1.2, ×40; (j–l) whorl 1.6, whorl 2.2, ×26.5; (m) whorl 2.4, ×20; Malaya Turomcha River; Lower Hettangian, *viligense* Zone.

Dimensions in mm and ratios (%):

Specimen no.	D	WH	WW	UW	WH/D	WW/D	UW/D
Holotype 837/72	22.0	12.8	6.7	12.2	58.2	30.5	10.0

Ornamentation. The shell possesses thin ribs forming a mid-flank orad projection. Ribs differ in height and the interrib spaces have an irregular width.

Phragmocone (Pl. 5, fig. 8). The phragmocone studied is composed of 3.6 whorls. The first whorl has 13 septa, the second and third have 12 septa each, the incomplete fourth whorl has 7 septa. The protoconch is rounded-oval and large (D^1 = 1.34 mm). The prosiphuncle is medium-long (0.16 mm). The ammonitella is large (D_{am} = 1.34 mm) and short (α = 275°). The nepionic rib is distinct, 0.28 mm long and 0.08 mm thick. The nepionic constriction is indistinct. The siphuncle first lies close to the venter, and then becomes marginal-ventral. The septal necks from the 9–10th septa (at the end of the ammonitella) become prochoanitic and possess long pillars.

Suture (Fig. 6). The primary suture is five-lobed; lobe U lies on the seam. At the end of the first half of the whorl, lobe U gradually shifts to the venter (Fig. 6b–6c), whereas lobe I becomes extended and slightly flattened. The division of lobe I occurs at the seventh suture (Fig. 6c). At whorl 0.6 (ninth suture), lobe U^1 is formed on saddle U/I_v lying on the seam (Fig. 6d). By the beginning of the second whorl, the sutural formula becomes $VLUU^1U^2:I_{vv}I_{vd}I_dD$ (Fig. 6e). In whorl 1.6, lobe U^3 is formed and lobes I_{vv} and I_{vv} are clearly separated (Fig. 6f). The emergence of lobe U^4 and the third division of lobe I occurs at the stage of whorl 2.2 (Fig. 6h). By whorl 3.3, five divisions of lobe I have already occurred, and the new lobe U^5 lies on the seam, i.e. the ontogeny shows the same number of divisions and new elements (Fig. 6i). By the end of the third whorl, the sutural formula becomes

$$VLUU^1U^2U^3U^4U^5U^6:I_{vvvvv}I_{vvvvd}I_{vvvd}I_{vvd}I_{vd}I_dD.$$

Comparison. This species is very similar to *Y. kinasovi* in the shell morphology from which it differs in the narrower umbilicus and less prominent ribs.

Material. Holotype.

Superfamily Phylloceratacеae Zittel, 1884

Family Phylloceratidae Zittel, 1884

Genus *Phylloceras* Suess, 1865

***Phylloceras omkuchanicum* Repin, sp. nov.**

Plate 4, fig. 7

Etymology. After the Omkuchan River.

Holotype. Museum VNIGRI, no. 837/76, small mold with the beginning of the body chamber; Omkuchan River in the basin of the Omolon River; Sinemurian *libratus* zone, Tokchikinskaya Formation.

Shell shape. Shell is small, oval-rounded, and involute. Flanks are moderately convex, gradually fused with the rounded venter and steeply fused with the wall of the narrow umbilicus. The umbilical shoulder is rounded. The maximum width of the whorl is in the mid-flank.

Dimensions in mm and ratios (%):

Specimen no.	D	WH	WW	UW	WH/D	WW/D	UW/D
Holotype 837/76	14.3	8.3	5.0	1.4	58.0	16.7	9.8

Ornamentation. The shell possesses very thin ribs that are distinct in the ventral part of the flanks and

in the venter. The ribs are subradiate and become distinct at D = 10 mm.

Phragmocone (Fig. 7). The specimen studied is composed of three complete whorls, the beginning of the fourth whorl (three chambers), and the beginning of the living chamber. The first and the second whorls have 17 septa each, the third has 14? septa, the length of the preserved part of the body chamber is 1/6 of the whorl. The protoconch is rounded, large (D^1 = 0.76 mm, D^2 = 0.63 mm). The caecum is rounded-drop-like, large (C_1 = 0.18 mm, C_2 = 0.16 mm), and terminates in the second chamber. The nepionic constriction and rib are weakly developed. The ammonitella is large (D_{am} = 1.08 mm) and long (α = 350°). In the second whorl (after the nepionic rib), five well developed inner ribs were observed. They are 0.5–0.6 mm long and 0.1–0.2 mm thick, which is 5–10 times thicker than the shell wall.

Comparison. This species differs from *Ph. heterophyllum* in the more convex flanks and in the presence of the inner ribs.

Material. Two small shells.

Genus *Platypachyceras* Repin gen. nov.

Etymology. From Greek *platys* (flat) and the genus *Phylloceras*.

Type species. *P. kedonicum* sp. nov. Toarcian, *propinquum* Zone; basin of the Kedon River.

Diagnosis. Shell small and medium-sized, involute, and oval-flattened. The suture complexity increases through the separation of new umbilical lobes U_n.

Composition. Two species: *P. ochoticum* and *P. kedonicum* from the Hettangian and Toarcian of Northeastern Russia.

Comparison. This genus differs from the genus *Phylloceras* in the flattened subparallel flanks and slightly wider umbilicus with steep walls. These characters and the absence of real inner ribs distinguish this genus from *Calliphylloceras*. *Platyphylloceras* differs from *Fergusonites* from the Hettangian of North America in the flattened subparallel flanks and the absence of the apertural constriction.

Platyphylloceras okhoticum Repin, sp. nov.

Plate 4, fig. 9

Etymology. From the sea of Okhotsk.

Holotype. Museum VNIGRI, no. 837/75, small phragmocone; Viliga River; Hettangian, *viligense* Zone, Kalyan Formation.

Shell shape. The shell is small, involute, oval-depressed, with a rounded and wide venter and narrow umbilicus with a steep wall.

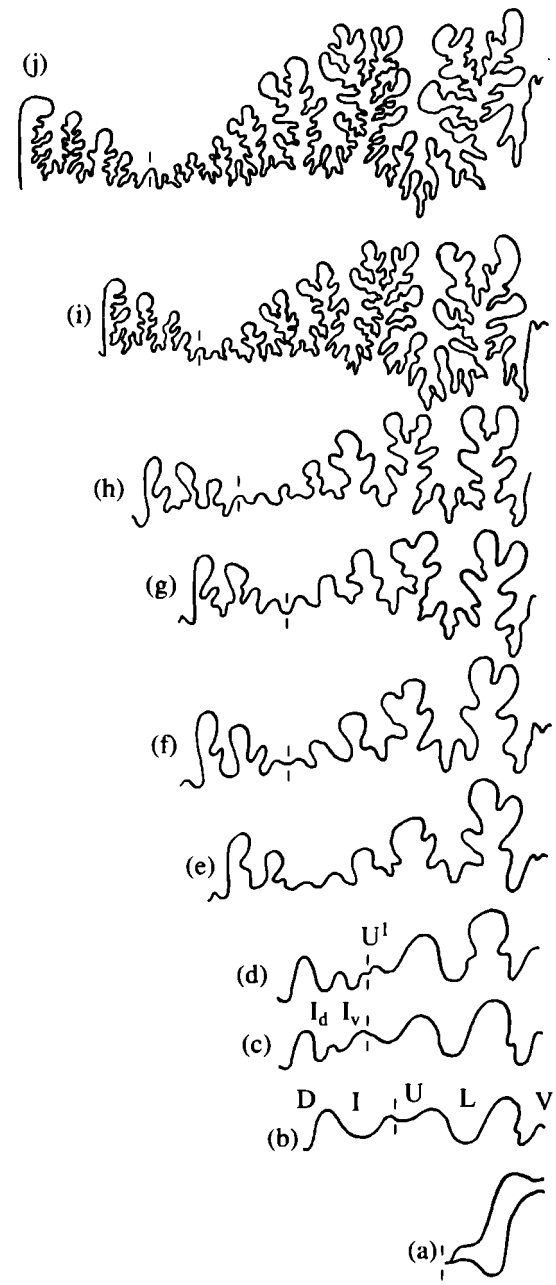


Fig. 6. Sutural ontogeny of *Yukagirites molodoensis* sp. nov., holotype no. 837/72; (*a*) sutures 1 and 2, ×40; (b and d) sutures 6, 7, and 9 (whorl 0.6), ×40; (e, f) whorls 1.2 and 1.6, ×32; (g) whorl 2.0, ×20; (h) whorl 2.2, ×17; (i) whorl 3.3, ×7; (j) whorl 4.0, ×4.5; Molodo River; Upper Pliensbachian, *viligaensis* Zone.

Dimensions in mm and ratios (%):

Specimen no.	D	WH	WW	UW	WH/D	WW/D	UW/D
Holotype 837/75	10.6	5.0	3.0	2.5	47.0	14.8	23.6

Ornamentation. The shell possesses striae that are slightly orad inclined. In the ventral part of the

Plate 5

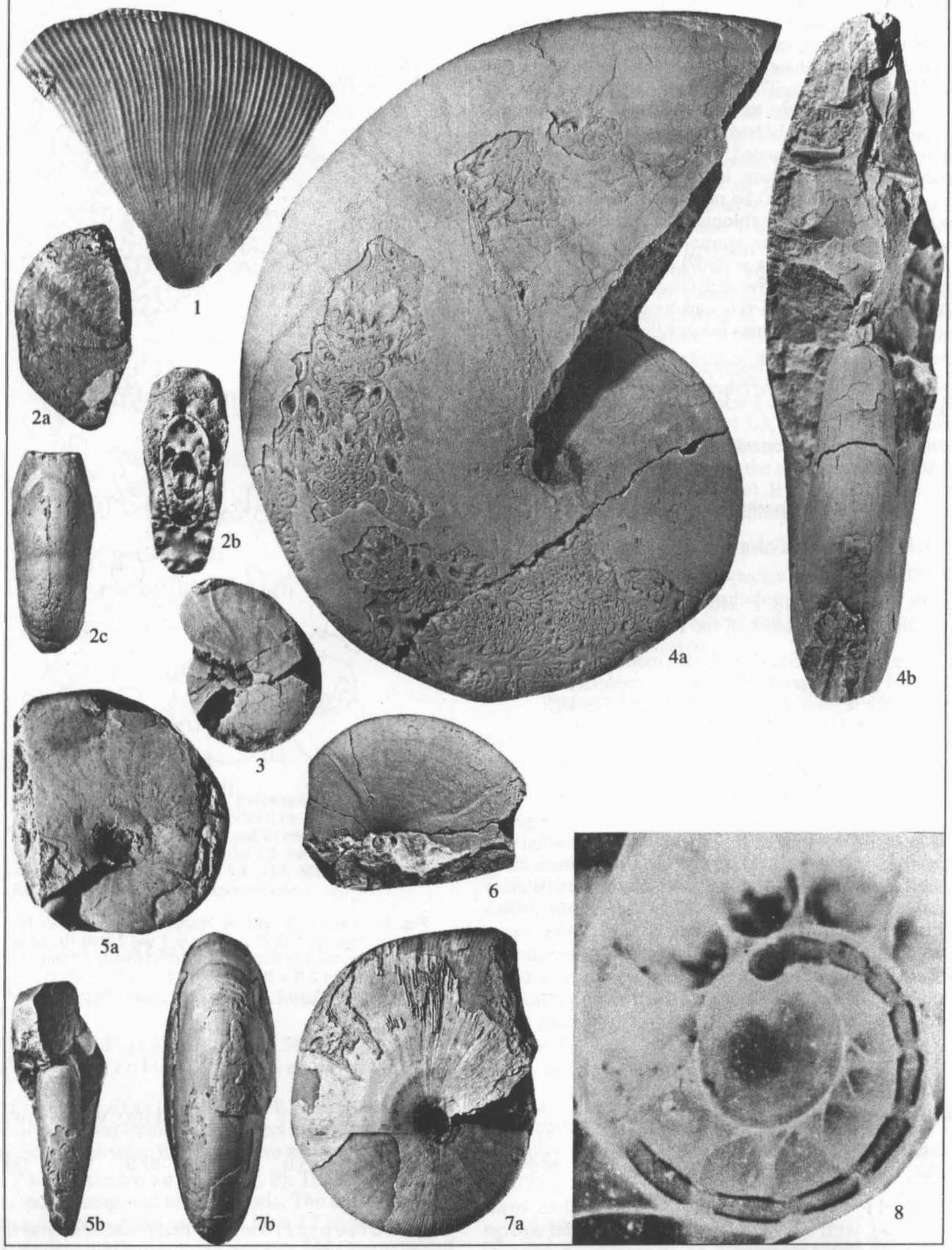


Fig. 7. *Phylloceras omkuchanicum* sp. nov., holotype no. 837/76, protoconch and first whorl, ×50; Omkuchan River; Lower Sinemurian, *libratus* Zone.

flanks, striae are weakly inclined posetriorly and run across the venter.

Material. Two small shells from the basin of the Viliga River.

***Platyphylloceras kedonicum* Repin, sp. nov.**

Plate 4, fig. 2

Etymology. From the Kedon River.

Holotype. Museum VNIGRI, no. 837/74; medium-sized shell, basin of the Kedon River; Toarcian, *propinquum* Zone.

Shell shape. The shell is medium-sized, involute, and compressed. Flanks gradually fuse with a relatively narrowly rounded venter. The umbilicus is narrow, with steep wall. The umbilical shoulder is rounded.

Dimensions in mm and ratios (%):

Specimen no.	D	WH	WW	UW	WH/D	WW/D	UW/D
Holotype 837/74	33.0	18.0	4.8	3.8	54.5	14.5	11.5

Explanation of Plate 5

In all cases, except for Fig. 8, sizes are natural.

Figs. 1 and 7. *Phylloceras heterophyllum* (Sow.); (1) specimen no. 580/42; lateral view; Anabar Bay; Lower Toarcian, *commune* Zone; (7) specimen no. 580/5: (7a) lateral view, (7b) ventral view; Markha River; Lower Toarcian. *elegantulum* Zone.

Fig. 2. *Calliphyloceras* sp., specimen no. 580/50: (2a) lateral view; (2b) apertural view, (2c) ventral view; Markha River; Lower Toarcian, *elegantulum* Zone.

Figs. 3 and 6. *Holcophylloceras ? tyungense* sp. nov.; (3) holotype no. 580/49; Tyung River; Lower Toarcian *commune* Zone; (6) specimen no. 590/9; Motorchuna River; Upper Pliensbachian, *talrosei* Zone.

Figs. 4 and 5. *Zetoceras zetes* (Orb.), (4) specimen no. 580/7: (4a) lateral view; (4b) apertural view; Motorchuna River; Upper Pliensbachian, *talrosei* Zone; (5) specimen no. 580/8, with an incomplete terminal whorl: (5a) lateral view, (5b) apertural view; Anabar River; Motorchuna River; Upper Pliensbachian, *talrosei* Zone.

Fig. 8. *Yukagirites molodoensis* sp. nov.; holotype no. 837/72, protoconch and first whorl, ×50; Molodo River; Upper Pliensbachian, *viligaensis* Zone.

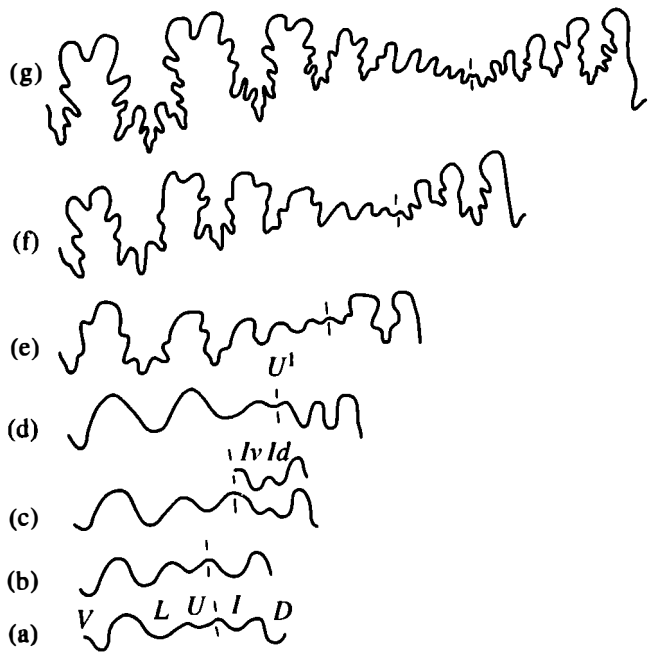


Fig. 8. Sutural ontogeny of *Platyphylloceras kedonicum* sp. nov.; holotype no. 837/74; (a) suture 5 (whorl 0.3), ×40; (b-d) whorl 0.8 (nepionic constriction), whorl 0.9, whorl 1.1, ×27; (e) whorl 1.5, ×27; (f, g) whorl 3.0, whorl 4.2 (×16); Kedon River; Toarcian, *propinquum* Zone.

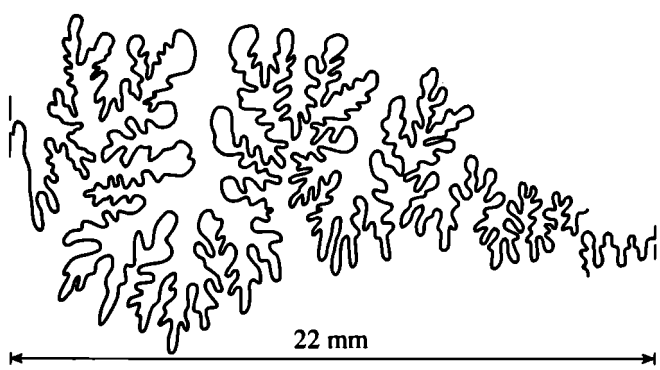


Fig. 9. Suture of *Holcophylloceras ? tyungense* sp. nov.; specimen no. 580/9; Motorchuna River; Upper Pliensbachian, *talrosei* Zone.

Ornamentation. The flanks possess very thin striae forming a very gently aperturally inclined arch at the mid-flank. In addition, the shell possesses thin rounded ribs following the striae (especially distinctly in the body chamber).

Phragmocone. The studied specimen is distorted and is composed of black calcite precluding study of the inner whorls. The shell consists of the phragmocone (4.4 whorls) and body chamber (0.4 whorls).

Suture (Fig. 8). The primary suture is unstudied. At the stage of whorl 0.3, lobe U is shifted to the outer part of the whorl (Fig. 8a). At the stage of whorl 0.9, the first division of the internal lateral lobe occurs (Fig. 8c). The separation of lobe U^1 occurs at the beginning of the second whorl (Fig. 8d). This is followed by the separation of the new umbilical lobes and further subdivision of lobe I. At the stage of whorl 4.2 the sutural formula becomes:

$$VLUU^1U^2U^3U^4U^5U^6U^7:U^8:I_{vvvvv}I_{vvvvd}I_{vvvd}I_{vvd}I_{vd}I_dD.$$

Material. Holotype.

Comparison. This species differs from *P. okhoticum* in the compressed and subparallel flanks and in the narrower umbilicus.

Family Holcophylloceratidae Druzczic, 1956

Genus *Holcophylloceras* Spath, 1927

Holcophylloceras ? tyungense Meledina, sp. nov.

Plate 5, figs. 3 and 6

Etymology. From the Tyung River.

Holotype. TGSM, no. 580/49, phragmocone; Tyung River in the basin of the Vilyui River; Toarcian, *commune* Zone.

Shell shape. The shell is medium-sized, involute, with flattened flanks and a narrow rounded venter. The ventrolateral shoulder is subquadrate-rounded. The whorl cross section is oval-angular. The umbilicus is narrow, with a steep wall.

Dimensions in mm and ratios (%):

Specimen no.	D	WH	WW	UW	WH/D	WW/D	UW/D
Holotype 580/49	32.0	18.0	–	2.0	56.2	–	6.0
"	27.0	16.0	13.0	1.7	59.0	48.1	6.2
580/9	42.0	24.0	12.0	–	54.7	28.5	–

Ornamentation. At the stages smaller than D = 17 mm, the shell possesses thin radial striae. At larger sizes, the mold and shell possess rare (3–4 per whorl) weakly developed constrictions and ribs located before the constrictions. The ribs are crescentic and inclined orad in the ventral part of the flanks. The holotype shows irregular weak ribs reaching the mid-flank. Specimen no. 580/9 shows weak spiral furrows in the ventral part of the flanks.

Phragmocone. The holotype is represented by the phragmocone. The last half-whorl is distorted. The internal structure of the molds consisting of a compact carbonate matrix is unstudied.

Suture. The suture is drawn only from the external part of the whorl (Fig. 9). The lateral and umbilical lobes are narrow, strongly incised, and tripartite. Saddle V/L and L/U are high, possessing four digits because of the subdivision of the saddles by the adventive lobes.

Comparison. This species resembles *H. submontanum* Besn. from the Aalenian of the Caucasus (Besnossov, 1958), from which it differs in the rare, irregular, and straighter constrictions, and in the less prominent ribs.

Remarks. The constrictions and ribs that are weakly developed in the mold allow the assignment of the Siberian specimens to the genus *Calliphylloceras*. However, this assignment contradicts the presence of the ribs both in the inner and the outer shell surfaces that is observed in the genus *Holcophylloceras*. Two specimens assigned to the same species show a difference of the whorl width of about 20%. Hence, the assignment of both these specimens to the same species is provisional, not least because they occur in different stratigraphic levels.

Occurrence. Pliensbachian and Toarcian; basin of the Vilyui River.

Material. 2 specimens: from the Upper Pliensbachian *talrosei* Zone, Motorchuna River and from the Lower Toarcian *commune* Zone of the Tyung River.

ACKNOWLEDGMENTS

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