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The First Discovery of Apartidae (Ammonoidea) in the Carnian of Northeastern Asia

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Abstract—A new genus *Siberioklipsteinia* (with the type species *S. dagysi* sp. nov.) and a new species *Arctoarpadites nelgesensis* are described from the Carnian of the Kharaulakh Range and Yana Upland (eastern Yakutia). The new data allow refinement of the taxonomy of Carnian ammonoids of northeastern Asia and emendation of some details of their geographical differentiation. The new ammonoid taxa belong to the family Arpaditidae, which was not previously recorded from the eastern Boreal Realm.

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Key words: Ammonoidea, Arpaditidae, Carnian, northeastern Asia.

INTRODUCTION

The 70-year-long study of the Carnian ammonoids of northeastern Asia has revealed the taxonomic composition, stratigraphic distribution, and main features of their geographic differentiation. In the Carnian, the ammonoid fauna of this area, which in the Triassic belonged to the Siberian Province of the Boreal Realm, was impoverished compared to the synchronous faunas of southern regions. Their role in the marine invertebrate communities of Boreal paleoseas decreased significantly from the end of the Middle Triassic (Dagys et al., 1979). The Carnian ammonoid assemblages of northeastern Asia were clearly dominated by two families, Sirenitidae (*Seimkanites, Neosirenites, Yakutosirenites, Yanosirenites, Sirenites*, and *Striatosirenites*) and Trachyceratidae (*"Protrachyceras"* and *Neoprotrachyceras*). Ussuritids (*Arctophyllites*) and arcestids (*Proarcestes*) are not uncommon, but less frequent. Only in one locality in the upper reaches of the Zyryanka River (middle reaches of the Kolyma River) shells of *Obruchevites* tentatively assigned to the family Clionitidae have been found (Vavilov, 1977).

In the last two decades, in the course of the study of standard sections and the refinement of the Upper Triassic biostratigraphy of northeastern Asia, Konstantinov and Sobolev (1999a, 1999b) discovered peculiar ceratitids in the Carnian of the northern Verkhoyansk Region and Yana Upland. These ceratitids have characters (ornamentation of radial smooth ribs or plications on the flanks, median groove on the venter, and subammonitic suture with pleated saddles) are strikingly different from all ammonoids known in this area. They are described in this paper as *Siberioklipsteinia dagysi* gen. et sp. nov. and *Arctoarpadites nelgesensis* sp. nov.

The data obtained allow significant emendation of the taxonomic composition of the Carnian ammonoids of northeastern Asia and of some details of their geographic differentiation.

The new taxa belong to the family Apaditidae, which is mainly found in the Ladinian and Carnian of the Tethyan Realm and were not previously recorded from northeastern Asia. In the Boreal Realm, arpaditids were previously only known from the Upper Carnian of Axel Heiberg Island (Arctic Canada). These include *Sirenites costatus* (Tozer, 1961), later designated the type species of the genus *Arctoarpadites* (Tozer, 1994). In modern classifications of Triassic ammonoids, the family Arpaditidae includes the subfamilies Arpaditinae, Sirenitinae, and Protrachyceratinae (Tozer, 1971, 1981). However, some taxonomists consider the first two groups as families, while assigning the Protrachyceratinae to the family Trachyceratidae (Shevyrev, 1986), the view accepted in this paper.

The ammonoids studied have a narrow stratigraphic distribution, being confined to one zone. They come from a few localities (Fig. 1) and undoubtedly represent a rare (exotic) form for the fauna of Carnian ammonoids of northeastern Asia. In this large area no ammonoids with a similar morphology have been found that could be possible ancestors or descendants of the species described. Therefore, it is reasonable to suggest that they are of southern origin, while their occurrence in the Boreal fauna may be explained by short-termed invasions from more southerly regions during eustatic rises.

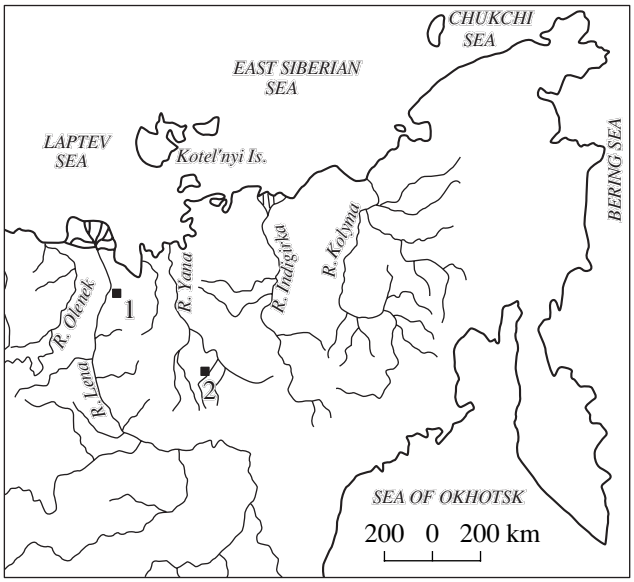

Fig. 1. Localities of arpaditids in northeastern Asia. (1) northern Verkhoyansk Region, Kharaulakh Range, Darky River; (2) Yana Upland, Nel'gese River, close to the mouth of Ementek Creek.

MATERIAL AND LOCALITY

This study is based on a collection of about 15 specimens collected by myself in 1990 while studying Triassic beds in the basin of the Darky River (Kharaulakh Range). Shells of *Sibericlipsteinia dagysi* were found in the clayey-carbonate nodules of the Ebitiem Formation, 2.5 m above the base of the arenaceous, greenish gray siltstones 7 m thick (Konstantinov and Sobolev, 1999a). The accompanying faunal assemblage, including the ammonoids *Neosirenites* ex gr. *armiger* (Vozin), *Sirenites* sp., and *Arctophyllites okhotensis* Konst.; the nautiloids *Cosmonautilus polaris* Sobolev, *Proclydonautilus goniatites* (Hauer), and *Germanonautilus* sp. nov.; and the bivalves *Zittelihalobia ornatissima* (Smith), allows referring the host rock to the Lower Carnian *Neosirenites armiger–Yakutosirenites ochotensis* Zone. The specimen identified as *Arctoarpadites nelgesensis* I received from the geologists of the State Unitarian Scientific Industrial Enterprise (FSUSIE) Aerogeologiya A.Yu. Egorov, Yu.A. Bogomolov, and M.K. Maksimov. It was collected in 1988 in the Adycha River basin. The specimens come from a member of dark greenish gray siltstones (visible thickness 38 m), which, based on the ammonoid assemblage (*Sirenites yakutensis* Kipar., *Striatosirenites* sp., and *Proarcestes verchojanicus* Kipar.), is dated as the Upper Carnian *Sirenites yakutensis* Zone.

The collection is housed in the Department of Monographic Collections of the Central Siberian Geological Museum (TsSGM) in the Joint Institute of Geology, Geophysics, and Mineralogy, Siberian Division, Russian Academy of Sciences, Novosibirsk, Russia, coll. no. 995.

SYSTEMATIC PALEONTOLOGY

Order Ceratitida

Superfamily Trachyceratataceae Haug, 1894

Family Arpaditidae Hyatt, 1900

Genus *Siberioklipsteinia* Konstantinov, gen. nov.

Etymology. From Siberia and the genus *Klipsteinia*.

Type species. *S. dagysi* sp. nov.

Diagnosis. Shells in juveniles inflated, semi-involute, with whorls transversely oval or rounded in cross section; adult whorls platyconic, involute, rapidly expanding, strongly overlapping, elongated oval in cross section. Maximum whorl width in upper third. Venter narrow, with smooth, shallow median groove. Flanks weakly convex or flattened, gently sloping to umbilicus, with densely and irregularly spaced, weak, sigmoidal folds and striae, somewhat thicker in mid-flank. Umbilical shoulder rounded. Umbilical wall low and sloping. Umbilicus moderately narrow, calyx-shaped, and rounded. Suture subammonitic, with serrated lobes and pleated saddles.

Species composition. Type species.

Comparison. This genus is distinguished from the genus *Klipsteinia* Mojsisovics, 1882 by the narrower umbilicus, subammonitic suture with pleated saddles, shape and arrangement of its elements of the umbilical region of the suture: in the genus *Klipsteinia*, the first umbilical lobe is wide and is adjacent to the umbilical seam, while in the new genus it is narrow and located on the flank. The new genus differs from the genus *Silenticeras* McLearn, 1930, which also has an involute, flattened shell, similar ornamentation, and weakly pleated tops of the saddles, in the shallow median groove, in the absence of true keels on the sides of the groove, and in the narrow siphonal saddle.

***Siberioklipsteinia dagysi* Konstantinov, sp. nov.**

Etymology. In honor of A.S. Dagis, outstanding expert in the Triassic paleontology and stratigraphy.

Holotype. TsSGM, no. 5/995; northern Verkhoyansk Region, Kharaulakh Range, Darky River, Lower Carnian, *Neosirenites armiger–Yakutosirenites ochotensis* Zone.

Shape (Figs. 2, 3a–3g). The shell in the first 2.5 whorls is ophioconic, strongly inflated, semi-involute. The whorls are weakly and moderately overlapping, moderately expanding, transversely oval in cross section. The umbilicus is moderately narrow. As the shell size increases, at the stage of 3–3.5 whorls, the relative whorl height and whorl overlap degree increase, while the relative width decreases. The cross section at the end of the third whorl is rounded; in the middle of the fourth whorl, elongated oval. At the middle and late growth stages (4–6.5 whorls) the shell is platyconic, moderately wide, and involute. The venter at the stage of 3–3.5 whorls is convex, with a weakly developed

central narrow band, which is replaced by the end of the fourth whorl by a narrow, smooth, semi-rounded groove. The groove is rimmed by narrowly rounded ridges, which do not have appearance of true keels. The venter is gradually fused with weakly convex flanks, which weakly decrease in height in the lower third of the whorl. At the end of the fourth whorl, the umbilical wall is formed, which is separated from the flanks by a rounded umbilical shoulder. The umbilicus is moderately narrow, calyx-shaped, and relatively deep. The body chamber is short (slightly longer than 0.5 of the whorl). The aperture is not preserved.

Dimensions in mm and ratios:

Specimen no.	Number of whorls	Dm	WH	UW	WW	WH/Dm	UW/Dm	WW/Dm
1/995	4	5.9	2.9	2.4	1.0	0.50	0.41	0.17
2/995	5	9.3	5.9	3.7	1.9	0.63	0.40	0.21
3/995	0.5	0.4	0.3	0.5	0	0.70	1.25	0
	1	0.6	0.2	0.5	1.0	0.40	0.80	0.12
	1.5	0.9	0.4	0.7	0.2	0.41	0.73	0.23
	2	1.3	0.7	1.0	0.2	0.52	0.75	0.19
	2.5	1.9	0.8	1.1	0.4	0.42	0.58	0.23
	3	2.6	1.0	1.5	0.8	0.40	0.55	0.30
	3.5	4.0	1.8	2.0	1.1	0.44	0.50	0.28
	4	5.8	2.6	2.7	1.4	0.46	0.47	0.24
	4.5	8.1	3.8	3.2	1.7	0.47	0.40	0.21
	5	11.4	5.4	4.2	2.2	0.47	0.37	0.19
	5.5	14.6	7.0	4.6	2.9	0.48	0.32	0.20
	6	20.0	9.3	6.5	4.1	0.47	0.32	0.20
4/995		24.8	11.4	6.3	5.6	0.46	0.25	0.23
Holotype								
5/995	6.25	26.5	12.8	7.2	5.3	0.48	0.27	0.20
	6.75	33.0	15.6	8	6.7	0.47	0.24	0.20

Ornamentation. In the first 2.5 whorls the shell is smooth. In the last half of the third whorl in specimen no. 1/995, there are three constrictions, weakly sigmoidal and irregularly spaced. In the fourth whorl, the flanks possess weak, densely spaced, sigmoidally curved low folds. They begin as striae near the seam, somewhat bending backwards in the lower third of the whorl. In the mid-flank they form a weak projection and at the same time become slightly inflated. As they approach the venter, the folds become weaker and are bent posteriorly, then are sharply bent anteriorly to form a rounded ventral projection. The flanks of the adults (5–6.5 whorls) possess thin, sigmoidal, closely spaced ribs and striae, simple and sometimes forming indistinct bunches of two, less commonly three ribs, or striae. They begin from the umbilical shoulder, where they are slightly inflated, become weaker in the lower third of the whorl, and increase in the middle. Where crossed by ribs and plications of the umbilical shoulder, they possess weak rounded ridges occurring obliquely, at an acute angle, with a top directed toward the aperture.

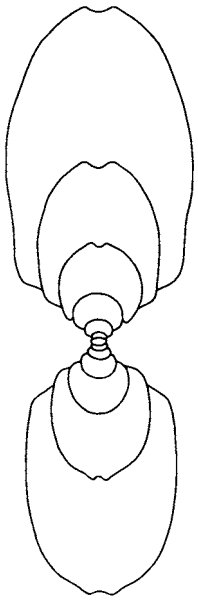

Fig. 2. Cross section of the shell of *Siberioklipsteinia dagysi* sp. nov.; specimen no. 3/995, ×4; Kharaulakh Range, Darky River; Lower Carnian, *Neosirenites armiger–Yakutosirenites ochotensis* Zone.

Suture (Figs. 4a, 4b). The ventral lobe is relatively wide, strongly narrowing toward the base from the tops of the first external saddles. It is separated by a low, rounded siphonal saddle into two narrow prongs. A wedge-shaped acute tooth is observed at the base of each prong. The first umbilical lobe is approximately half as narrow and shallow as the lateral lobe. In the umbilical part of the whorl there are several denticles still undeveloped into lobes. The lateral and the first umbilical lobes are serrated at their bases. The saddles are weakly pleated. The incisions are best developed on the external slope of the saddle V/L.

Remarks. Johnston (1941, p. 458, pl. 60, figs. 1, 2, text-fig. 1f) described the species *Arpadites schenki* from the *Joannites* Zone from the New Pass in Nevada, which is equivalent to the Lower Carnian *aon* and *aonoides* of the Alps. This species is distinguished from all *Arpadites* s.s. by the involute shell. *A. schenki* is similar to *S. dagysi* in the general shape of the shell, relative width of the umbilicus, presence of thin lines and folds on the flanks, and of the medial groove on the venter. However, it cannot be assigned to the genus described being different in having the ceratitid suture with undifferentiated saddles, relatively lower and wider whorls, and a vertical umbilical wall.

Material. Ten specimens from the Darky River.

Genus *Arctoarpadites* Tozer, 1994

Arctoarpadites nelgesensis Konstantinov, sp. nov.

Etymology. After the Nel'gese River, left tributary of the Adycha River in eastern Yakutia.

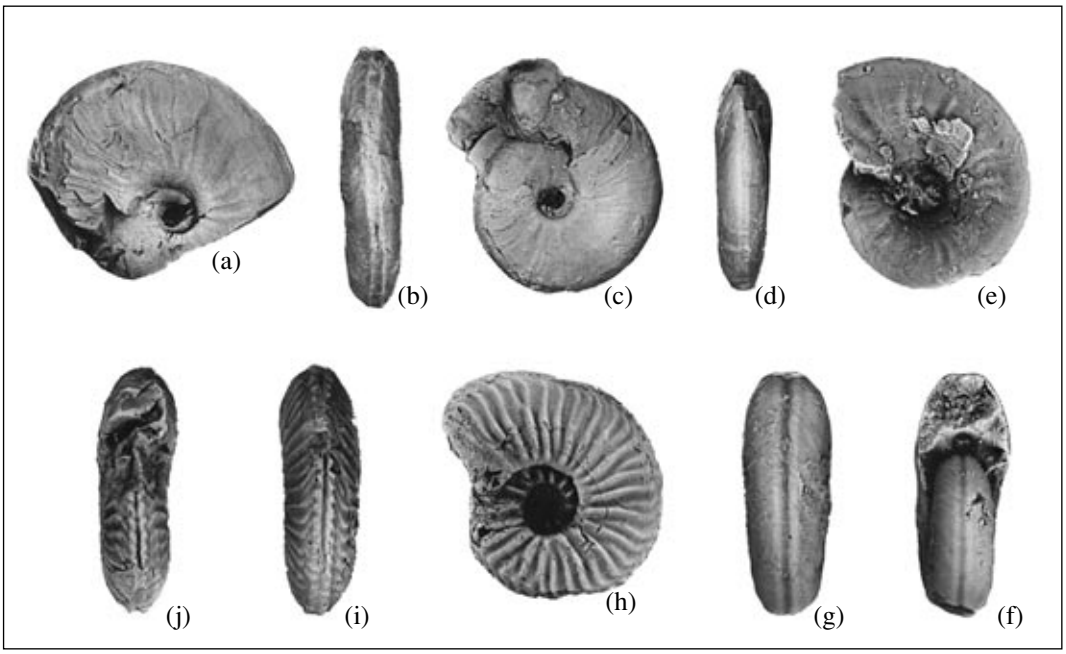

Fig. 3. Shells of new arpaditids: (a–g) *Siberioklipsteinia dagysi* sp. nov.; (a, b) holotype no. 5/995, ×1: (a) lateral view, (b) ventral view, (c, d) specimen no. 4/995, ×1: (c) lateral view, (d) ventral view; (e–f) specimen no. 2/995, x 3.3: (e) lateral view, (f) apertural view, (g) ventral view; Kharaulakh Range, Darky River; Lower Carnian; *Neosirenites armiger–Yakutosirenites ochotensis* Zone; (h–j) *Arctoarpadites nelgesensis* sp. nov.; holotype no. 7/995, ×1: (h) lateral view, (i) ventral view, (j) apertural view; Yana Upland, Nel'gese River, near the mouth of Ementek Creek; Upper Carnian, *Sirenites yakutensis* Zone.

H o l o t y p e. TsSGM, no. 7/995; Yana Upland, middle reaches of the Nel'gese River, near the mouth of Ementek Creek; Upper Carnian, *Sirenites yakutensis* Zone.

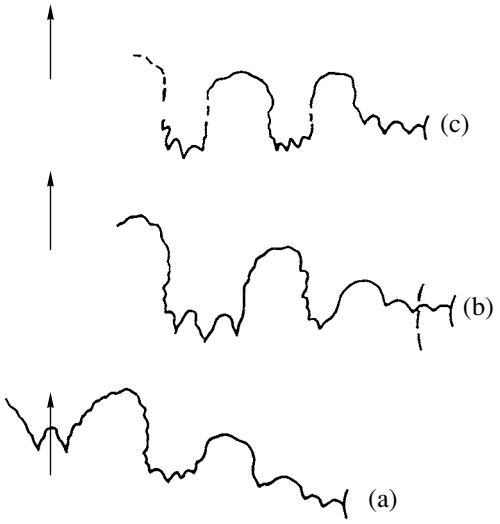

Fig. 4. Sutures of new arpaditids; (a, b) *Siberioklipsteinia dagysi* sp. nov.: (a) specimen no. 2/995, at WH = 4.7 mm, WW = 3.7 mm (end of the fourth whorl); Kharaulakh Range, Darky River; Lower Carnian; *Neosirenites armiger–Yakutosirenites ochotensis* Zone; (b) specimen no. 6/995, at WH = 6.1 mm; the same age and locality; (c) *Arctoarpadites nelgesensis* sp. nov.; holotype no. 7/995, at WH = 7 mm, WW = 6.7 mm; Yana Upland, Nel'gese River, near mouth of Ementek Creek; Upper Carnian; *Sirenites yakutensis* Zone.

S h a p e (Figs. 3h–3j). The shell is small, semiinvolute, medium-thick. The whorls gradually expand, are strongly overlapped, elongated oval in cross section. The maximum whorl width is in the umbilical region. The venter is narrow, rounded, with a smooth median groove. The flanks are convex. The umbilical shoulder is distinct and rounded. The umbilical wall is relatively high and convex. The umbilicus is moderately wide and relatively deep. The body chamber is slightly shorter than one whorl. The aperture is not preserved.

D i m e n s i o n s i n m m a n d r a t i o s:

Specimen no.	Dm	WH	UW	WW	WH/Dm	UW/Dm	WW/Dm
Holotype 7/995	29.2	12.8	9.8	8.9	0.44	0.34	0.30

O r n a m e n t a t i o n. The flanks possess closely spaced (17 per half whorl), weakly sigmoidally bent ribs, primary and auxiliary. The intercostal spaces are somewhat wider than ribs. Primary ribs begin from the umbilical shoulder, where they form elongated, radial, ridgelike inflations reaching the mid-height, then run, weakly bending, almost radially. As the ribs reach the venter, they bend forward, somewhat expand on the bend, and terminate in small nodes on the keels rimming the median groove. Each rib terminates in one node. There are 10 ribs per half whorl near the umbilical shoulder and 17 ribs near the venter. They correspond to the 22 nodes on the ventral spiral. Auxiliary

ribs usually begin from the mid-whorl or somewhat lower. Short auxiliary ribs that begin near the venter are less common. Sometimes the beginnings of the auxiliary ribs approximate the primary ribs, but no branching of ribs is observed.

S u t u r e is poorly preserved (Fig. 4c). On the external part of the whorl it is composed of the ventral, lateral, and fist umbilical lobes. In the umbilical part of the whorl, a row of teeth, which are not developed into lobes, is present. The lobes are denticulated, the saddles are pleated.

C o m p a r i s o n. This species is distinguished from the type species *A. costatus* (Tozer, 1961) by the absence of branched ribs on the flanks and by the smaller ratio of the number of nodes on the ventral spirals to the number of ribs approaching the venter: in *A. costatus* this ratio is 2 : 1, while in the new species the number of nodes is only slightly larger than the number of ribs.

R e m a r k s. Although the species described is significantly different from the type species, such characters as densely spaced, weakly sigmoidal smooth ribs on the flanks, their sharp bend as they reach the ventral spirals of the nodes, and the subammonitic suture allow positive assignment of this species to the genus *Arctoarpadites*.

M a t e r i a l. Holotype.

ACKNOWLEDGMENTS

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