

Paratumaroceras, a New Paragastrioceratid Genus (Ammonoidea) from the Lower Permian of the Western Verkhoyansk Region

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Abstract—Based on the ontogeny of the genus *Tumaroceras*, a new genus *Paratumaroceras*, with the type species *P. ruzhencevi* sp. nov., is proposed. New taxa are described.

Key words: Ammonoidea, Paragastrioceratidae, new taxa, Lower Permian, northeastern Russia.

INTRODUCTION

The family Paragastrioceratidae is the most representative among Permian ammonoids of the Verkhoyansk Region. In the Verkhoyansk Basin it reached its greatest taxonomic diversity in the Sakmarian and Artinskian. During that time more than ten species belonging to the genera *Uraloceras*, *Paragastrioceras*, and *Eotumaroceras* developed in this basin. In the Kungurian, the species and generic composition of the paragastrioceratid assemblage was completely renewed. The family was represented mostly by the genus *Tumaroceras*, which was dominant among Kungurian ammonoids of the Verkhoyansk Basin. The genus *Baraioceras* was subdominant at that time.

The suture of the genus *Tumaroceras* (type species *T. yakutorum* Ruzh.), established by Ruzhencev (1961), is intermediate between *Paragastrioceras* and *Uraloceras* (the ventral prongs are broader than in *Paragastrioceras* but narrower than in *Uraloceras*). A wide but small shell is an important diagnostic character. This genus was studied in the greatest detail by Andrianov (1985), who established another three *Tumaroceras* species from the Kungurian of the Verkhoyansk Basin (*T. bogoslovskayae*, *T. volkodavi*, and *T. ? kashirzevi*). Of these, *T. bogoslovskayae* is most easily distinguishable from *T. yakutorum* by the form of adult shells and is, thus, accepted by all specialists. Andrianov did not study the ontogeny of the shells of *Tumaroceras*. The ontogeny of all presently known *Tumaroceras* species was studied by Kutugin (1999b). It was shown that the morphology of the small specimen no. 55/605, proposed as the holotype of *T. bogoslovskayae* (Andrianov, 1985, pi. 12, fig. 1), falls within the variability range of juveniles of *T. yakutorum*. This suggests that *T. bogoslovskayae* is a junior synonym of *T. yakutorum*. The other two specimens, a large shell and a fragment of a whorl, are very similar to one another but have some morphological differences from all other representa-

tives of *Tumaroceras*. The ontogenetic study of the large specimen no. 55/563 has showed that at all ontogenetic stages the shell studied is clearly distinguishable from all known representatives of *Tumaroceras*, including the holotype of *T. bogoslovskayae*, by the considerably wider whorls (Figs. 1, 2). The differences include the shape of the transverse ornamentation (the ventral projection is very low and flattened instead of high and rounded) and the sutural outline (narrower ventral prongs and wide lateral lobe). Morphological features of the specimens studied distinguish them not only from all known *Tumaroceras* species but also from other Early Permian paragastrioceratids (*Svetlanoceras*, *Uraloceras*, *Paragastrioceras*, *Baraioceras*, etc.). Therefore, these two shells are here assigned to the new genus *Paratumaroceras* (and the new species *P. ruzhencevi*). The genus *Paratumaroceras* most likely evolved from *Paragastrioceras tuberculatum* (Popov) by smoothening of the ventral projection, disappearance of the nodes on the flanks of adult shells, and widening of the whorls.

MATERIAL

The material is housed at the Geological Museum of the Institute of Geology of Diamonds and Precious Metals of the Russian Academy of Sciences (GM IGABM).

SYSTEMATIC PALEONTOLOGY

Order Goniatitida Hyatt, 1884

Suborder Goniatitina Hyatt, 1884

Superfamily Neococerataceae Hyatt, 1900

Family Paragastrioceratidae Ruzhencev, 1951

Genus *Paratumaroceras* Kutugin, gen. nov.

Type species. *P. ruzhencevi* sp. nov.; Kungurian of the Verkhoyansk Region.

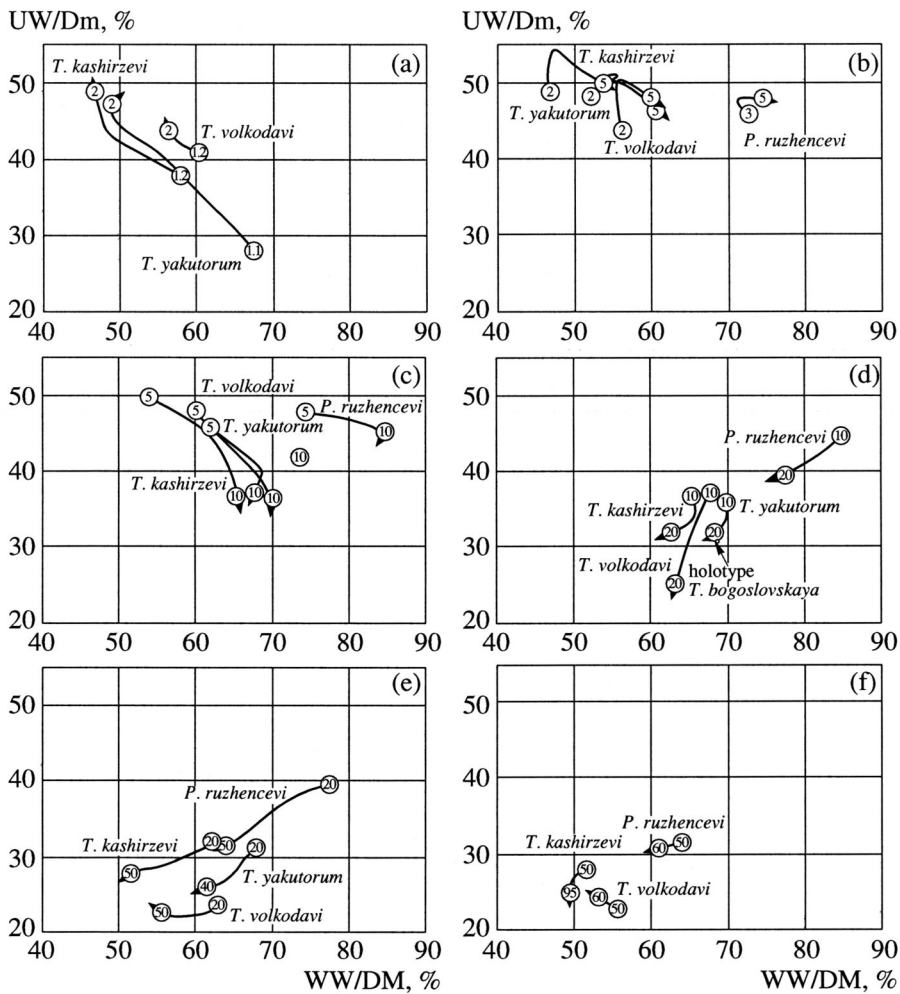


Fig. 1. Diagram showing the ontogenetic changes of the shells of *Tumaroceras* and *Paratumaroceras* at different growth stages: (a) extremely tiny size (less than 2 mm), (b) tiny size (2-5 mm), (c) very small size (5-10 mm), (d) small size (10-20 mm), (e) medium size (20-50 mm), and (f) large size (over 50 mm). The arrows show the direction of the ontogeny and the encircled numbers indicate the initial and final diameters of the shells at the ontogenetic stages (in mm).

Diagnosis. Large paragigonic shells (morphological classification after Kutugin [1998]), with very wide venter, gradually merging into flanks and moderately wide, slightly concave umbilical walls. Ornamentation reticulate. Ribs with very broad, flattened ventral projection. Suture composed of moderately broad ventral prongs, separated by high and wide median saddle; wide helmetlike lateral lobe; funnel-shaped umbilical lobe; caniniform inner lateral lobe; and fusiform dorsal lobe.

Composition. Type species.

Comparison. This genus is distinguished from all paragastrioceratids (except *Baraioceras*) by the wider shell (subanucone and subcadicone) at the early and intermediate stages. It is distinguished from *Baraioceras* by the narrower shell, and by the moderately large and deep, rather than very narrow and shallow, ventral prongs. The level of sutural development suggests that the new genus is intermediate between *Paragastrioceras* and *Tumaroceras*. It differs from *Paragastrioceras* in the narrower ventral prongs and is

distinguished from *Tumaroceras* by wider ventral prongs. In addition, it is distinguished from the genera *Paragastrioceras*, *Uraloceras*, and *Tumaroceras*, which are the most similar to it in shell shape and sutural outline, by the low and flattened ventral projection instead of a high and rounded projection. It differs from the Late Permian paragastrioceratids (*Pseudogastrioceras*, *Altudoceras*, *Daubichites*, etc.) in the absence of the ventral sinus in the adult shell.

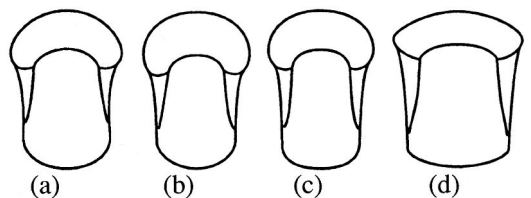


Fig. 2. Reconstructions of the juvenile shells of *Tumaroceras* and *Paratumaroceras*, x2: (a) *T. yakutorum*, specimen GM IGABM, no. 55/277, (b) *T. volkodavi*, holotype no. 55/192, (c) *T. kashirzevi*, specimen no. 55/273, and (d) *P. ruzhencevi*, holotype GM IGABM, no. 55/563.

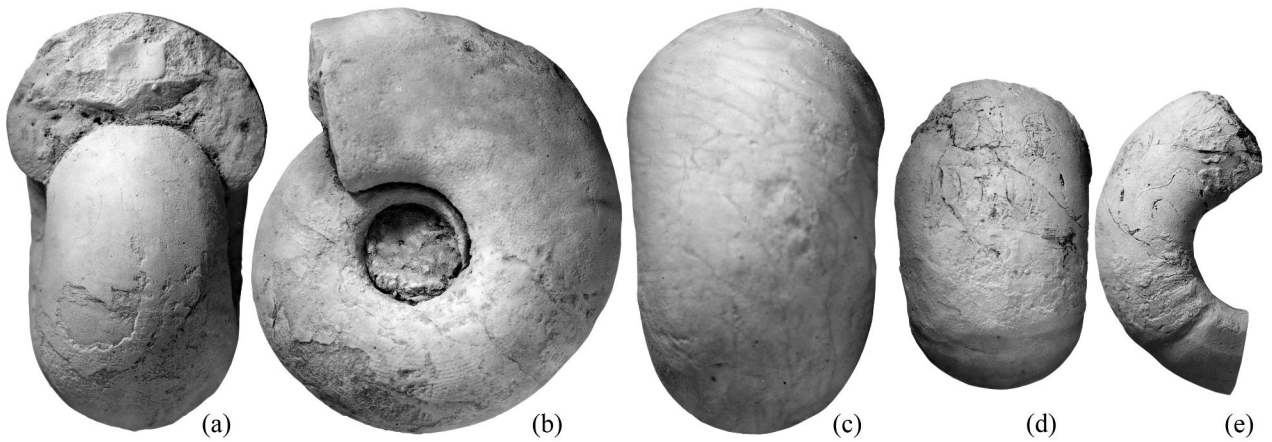


Fig. 3. Representatives of *Paratumaroceras ruzhencevi*, x1; (a)-(c) holotype GM IGABM, no. 55/563: (a) apertural view; (b) lateral view, (c) ventral view; D'elendzha River, right bank, about 16.5 km from the mouth; Kungurian, lower part of the Orol Formation; (d) and (e) specimen GM IGABM, no. 55/283: (d) ventral view, (e) lateral view; D'elendzha River, upstream of the mouth of Sorokokyt Creek; the same stratigraphic level.

Paratumaroceras ruzhencevi Kutugin, sp. nov.

Tumaroceras bogoslovskayae: Andrianov, 1985, p. 147 (pars), pl. 12, fig. 5, non fig. 1; pi. 13, fig. 3.

Etymology. In honor of V.E. Ruzhencev.

Holotype. Geological Museum of the Institute of Geology of Diamonds and Precious Metals, Russian Academy of Sciences (GM IGABM), no. 55/563; western Verkhoyansk Region, basin of the Tumara River, D'elendzha River, right bank, about 16.5 km from the mouth; Kungurian, Tumara Horizon, lower part of the Orol Formation.

Shell shape (Figs. 3, 4a). The shell is large, paragonic, slightly tumariconic, with quite a wide venter, gradually merging into moderately narrow, weakly convex flanks and gently sloping umbilical walls. The umbilicus is medium-sized and funnel-shaped. The shell ontogeny is shown in Figs. 1 and 5. At the earliest stages (so-called tiny stage), the subanu-

conic shell does not significantly change. Subsequently (so-called very small stage), the umbilicus is slightly narrower (by less than 5%), while the shell widens considerably (by more than 10%), although remaining subanuconic. Its characteristic features include the flattened venter and umbilical walls, and the absence of flanks. At the so-called small shell stage, the relative width of the whorl is reduced by 8%, while the umbilicus width is reduced by 6-7%. Therefore, the shell becomes intermediate between subcadicone and subanuconic (subcadiconic-subanuconic). The umbilical walls and the venter become convex. Narrow, moderately convex flanks are formed. At the stage of medium-sized and large shells, the morphogenetic process is directed similar to that at the stage of the small shell. The shell becomes paragonic and slightly tumariconic.

Measurements in mm and ratios in%:

Specimen no.	Whorl	Dm	WH	WW	UW	WW/DM	WH/Dm	UW/Dm	WW/WH
Holotype	9	58.7	23.02	35.8	18.0	61.0	39.2	30.7	155.5
55/563	"	50.0	19.92	31.86	15.68	63.7	39.8	31.4	159.9
"	"	43.7	17.68	29.0	14.0	66.4	40.5	32.0	164.0
"	8	32.4	12.02	23.0	11.8	71.0	37.1	36.4	191.3
"	"	24.3	8.58	17.8	9.3	73.3	35.3	38.3	207.5
"	7	18.17	6.42	14.5	7.3	79.8	35.3	40.2	225.9
"	"	13.72	4.45	11.5	5.97	83.8	32.4	43.5	258.4
"	6	10.6	3.3	9.0	4.75	84.9	31.1	44.8	272.7
"	"	8.32	2.55	7.0	3.77	84.1	30.6	45.3	274.5
"	5	6.57	2.0	5.3	3.05	80.7	30.4	46.4	265.0
"	"	5.15	1.52	3.85	2.46	74.8	29.5	47.8	253.3
"	4	4.0	1.17	2.85	1.91	71.3	29.3	47.8	243.6
"	"	3.1	0.92	2.25	1.43	72.6	29.7	46.1	244.6
"	3	2.37	0.75	1.9		80.2	31.6		253.3
55/283	9	41.0	15.8	28.0	14.6	68.3	38.5	35.6	177.2
"	8	30.1	13.1	22.7		75.4	43.5		173.3

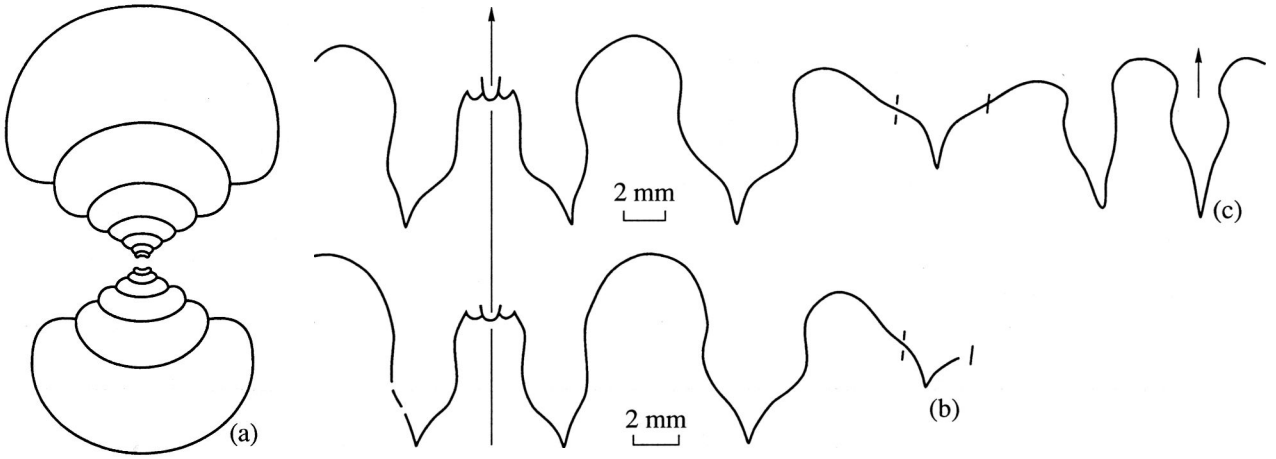


Fig. 4. Cross section and sutures of *Paratumaroceras ruzhnecevi*: (a) and (b) holotype GMIGABM, no. 55/563: (a) at Dm = 58.7 mm; (b) at Dm = 35 mm, WW = 24 mm, WH = 14 mm; and (c) specimen GM IGABM, no. 55/283 at Dm = 36 mm, WW = 25 mm, WH = 16.5 mm.

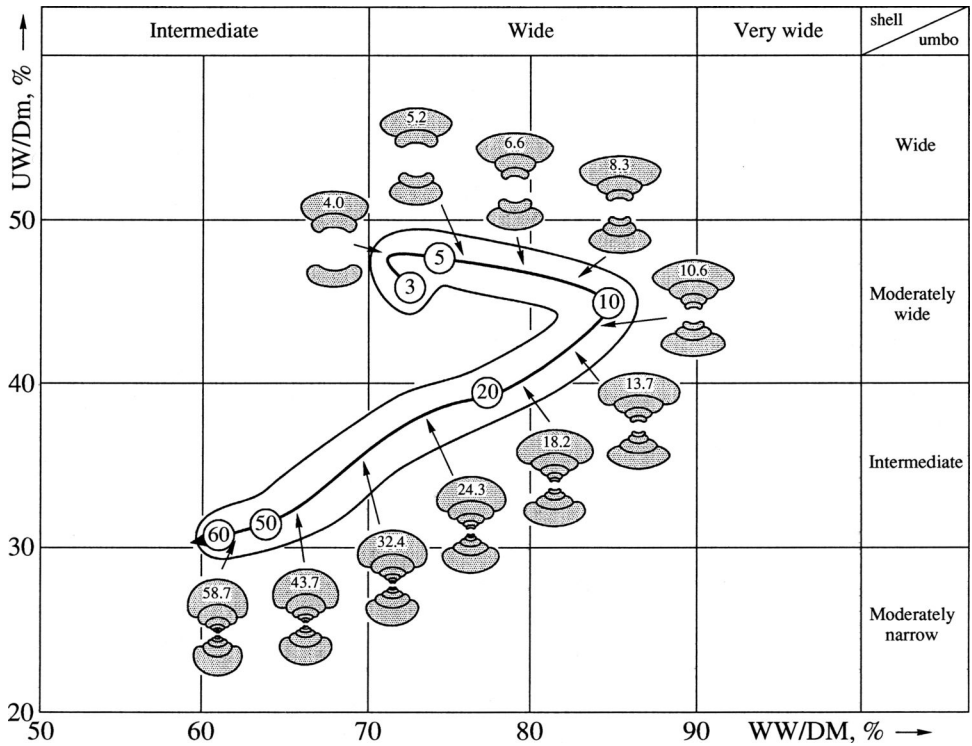


Fig. 5. Ontogenetic changes of the shell of *Paratumaroceras ruzhnecevi*. The arrows show the direction of the ontogeny, the encircled numbers indicate the intermediate diameters of the shells in the ontogeny (in mm), and the numbers on the cross sections show the diameters of the shells (in mm).

Ornamentation. The ornamentation is represented by distinct spirals and threadlike ribs. At Dm = 60 mm, about seven spirals and 25-30 ribs occur on the space of 5 cm. The ribs form a broad and shallow umbilical sinus and low, very broad, flattened umbilical projection. The shell possesses wide but shallow constrictions following the ribs.

Suture. The suture is shown in Figs. 4a and 4b.

Remarks. Andrianov (1985) assigned both shells to the new species *Tumaroceras bogoslovskayae*, which differed from other representatives of *Tumaroceras* in the "considerably wider shell" (Andrianov, 1985, p. 147). This feature is very clearly developed in the two above specimens. Study of the species has

shows that the holotype of *T. bogoslovskayae*, represented by a small shell (Andrianov, 1985, pi. 12, fig. 1), cannot be distinguished from the most strongly ornamented shells of *Tumaroceras yakutorum* of similar size. The study of the early whorls of the large shell of *T. bogoslovskayae* (Andrianov, 1985, pi. 13, fig. 3) has showed that this shell belongs to a species entirely different from the holotype of *T. bogoslovskayae*. Hence, the holotype of *T. bogoslovskayae* and two other (larger) shells of this species represent at least two different species. There is no evidence allowing separation of the holotype of *T. bogoslovskayae* from *T. yakutorum*. The two remaining shells are assigned to a new species, *Paratumaroceras ruzhencevi*.

Occurrence. Kungurian, Tumara Horizon, lower part of the Orol Formation, *yakutorum* Zone (after Kutugin, 1999a); western Verkhoyansk Region.

Material. Two specimens. Apart from the holotype (collected by V.N. Andrianov and others in 1961—1965, sample 17), specimen GM IGABM, no. 55/283 from the lower part of the Orol Formation, D'lelendzha River, upstream of the mouth of Sorokokyt Creek (collected by V.N. Andrianov and others in 1967, sample 15/1).

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