

Aptychi from the Volgian Stage of the Russian Platform

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Abstract—Volgian aptychi from the Russian Platform are described and figured for the first time. The Lower Volgian *klimovi* Zone and the uppermost Kimmeridgian beds contain *Lamellaptychus submortilleti* Trauth, 1938. The *pseudoscythica* Zone (Faunal Horizon *neoburgense*) contains *Laevaptychus latobliquus* Trauth, 1931, belonging to *Anaspidoceras neoburgense* (Oppel, 1863), and a small unidentifiable *Lamellaptychus* sp. A new species *Praestriaptychus volgensis* was found in the *panderi* Zone (Middle Volgian). Probably, these aptychi belong to the Boreal-Subboreal Virgatitinae or Dorsoplanitinae, because they are accompanied by numerous *Pavlovia* and *Zaraiskites*. The occurrence of *P. volgensis* is the youngest find of *Praestriaptychus* in the Jurassic.

Key words: Volgian Stage, aptychi, Russian Platform, new species.

INTRODUCTION

Aptychi are rarely found in the Panboreal Superrealm. The Late Kimmeridgian *Laevaptychus* known from England (Arkell, 1956; Callomon and Cope, 1971; Birkelund *et al.*, 1983; Oastes, 1991) and from the Russian Platform (Vischniakoff, 1875; Hantzpergue *et al.*, 1998; Rogov, 2002a) are the only exceptions, although these aptychi are still poorly studied. Volgian aptychi from the Russian Platform have only been mentioned once in the literature, and they were never described or figured. Sokolov (1901, p. 69), in the first paper in a series of studies on the Vetlyanskii Horizon, briefly indicated the presence of aptychi in the Upper Volgian beds. However, the Upper Volgian aptychi were never mentioned by any subsequent researchers. Moreover, the presence of the Upper Volgian beds in the Orenburg Region was questioned by Yanshin (1964).

At present, Volgian aptychi are recorded from several sections in the Middle Povolzhye (middle reaches of the Volga River). The most numerous occurrences were recorded in the lectostratotype of the Volgian Stage near the village of Gorodishche (Ulyanovsk Region) (Fig. 1a). This section was described several times (Rogov, 2002b). Therefore, in this paper only the part of this section containing Volgian aptychi is figured. Kimmeridgian aptychi have been previously recorded from Gorodishche (Vischniakoff, 1875; Hantzpergue *et al.*, 1998). Vischniakoff (1875) did not indicate the precise location of the occurrence of aptychi, he only mentioned that aptychi were found in clay and marly beds and that they were pyritized. However, this type of preservation suggests that he referred to Kimmeridgian rather than Volgian aptychi, because Volgian aptychi from Gorodishche, in contrast to most Kimmeridgian, are not pyritized.

In addition, Early Volgian aptychi were recently found in the sections near the village of Murzitsy

(Sechenovskii District of the Nizhni Novgorod Region) and near the village of Polevye-Bikshiki (Batyrevskii District of Chuvashiya) (Figs. 1b, 1c). The latter section was described by Mitta (1986). However, finds of aptychi were not mentioned.

The lower part of the *klimovi* Zone (Beds with *Neochetoceras steraspis* and *Lingulaticeras solenoides* in all the sections studied contained heavily ornamented *Lamellaptychus*, similar to *L. submortilleti* Trauth, which also occurs in the Upper Kimmeridgian *autissiodorensis* Zone.

The species *Laevaptychus latobliquus* Trauth occurs in the *neoburgense* Faunal Horizon where these aptychi are found in association with numerous *Anaspidoceras neoburgense* (Oppel). In the section at Gorodishche, a small *Lamellaptychus* was found together with the above species. Upward in the section, rare *Praestriaptychus volgensis* sp. nov. are found in the lower part of the *panderi* Zone in Gorodishche.

Terminology by Khalilov (1978) and Kozlova (1999) is used in descriptions of aptychi. Standard measurements are shown in Fig. 2.

MATERIAL

The material described is housed in the Paleontological Institute of the Russian Academy of Sciences (PIN), coll. no. 4986.

SYSTEMATIC PALEONTOLOGY

Genus *Praestriaptychus* Trauth, 1927

Praestriaptychus volgensis Rogov, sp. nov.

Etymology. From the geographic and stratigraphic distribution of the species (Volgian Stage of the Volga River basin).

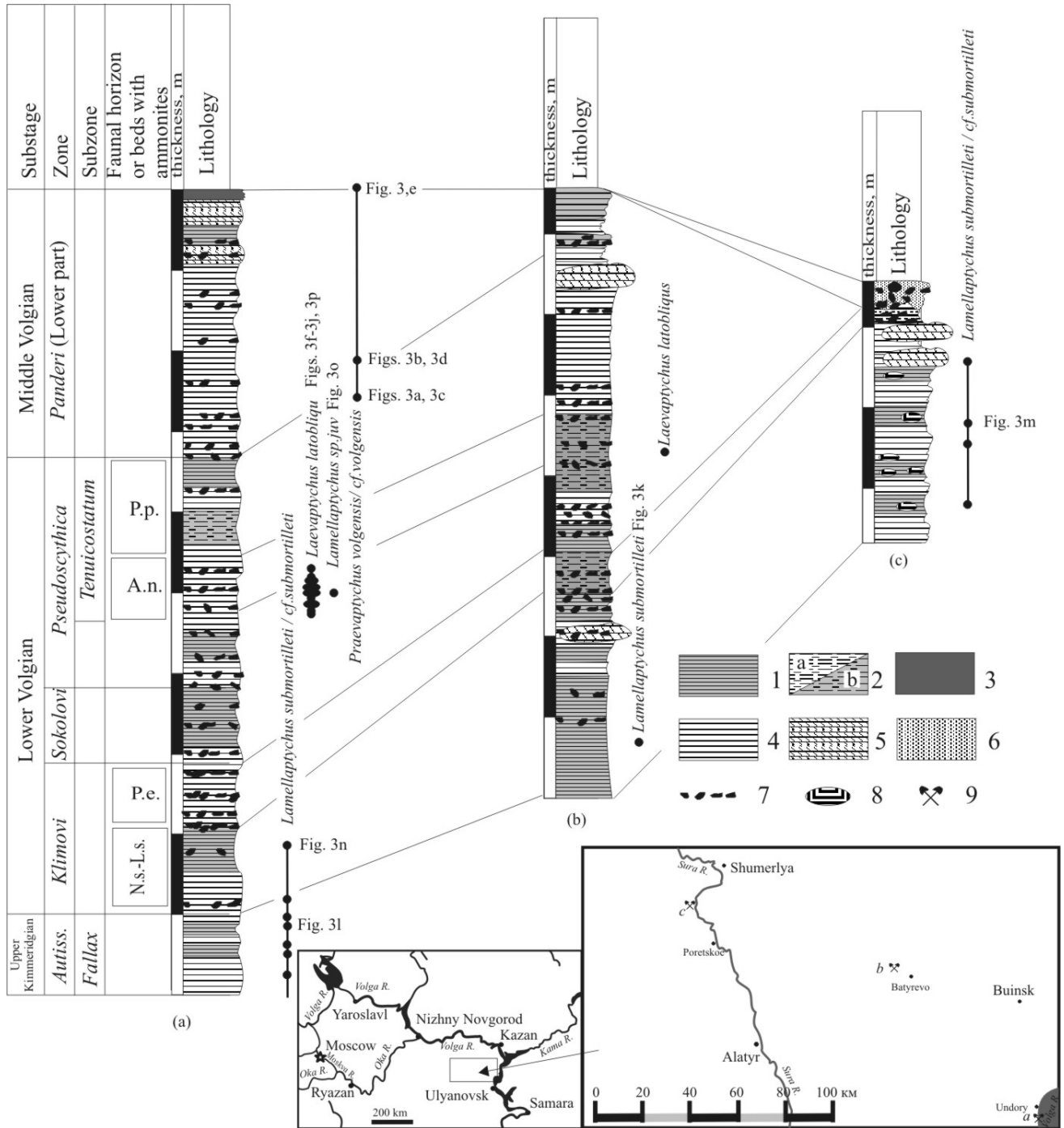


Fig. 1. Stratigraphic distribution of Volgian aptychi in Povolzhye and location of sections studies. Figures show sections: (a) Gor-odishche, (b) Polevye-Bikshiki, (c) Murzitsy. Figures near the dots indicate the occurrences of aptychi in the sections corresponding to the number of the figure showing these specimens; lithology and outcrops: (1) solid dark clay, (2a) light-colored siltstone, (2b) dark colored siltstone, (3) bituminous shale, (4) light gray bioturbidite clay, (5) marl, (6) sand, (7) phosphorite nodules, (8) ferruginous nodules, (9) indications of sections on the scheme, stratigraphic subdivisions: *N. s.-L. s.*-Beds with *Neochetoceras steraspis* and *Lingulaticeras solenoides*; *P. e.* Faunal Horizon *Paralingulaticeras efimovi*; *A. n.* Faunal Horizon *Anaspidoceras neoburgense*; *P. p.* Faunal Horizon *Pseudovirgatites puschi*; U. Kim.—Upper Kimmeridgian; *Autiss.*—*Autissiodorensis*.

H o l o t y p e. PIN, 4986/8; right bank of the Volga River, near the village of Gorodishche; Middle Vol-gian, *panderi* Zone; 2.5 m below the base of the bituminous shale.

Description (Figs. 3a-3e). The valves are narrow and small, almost oval in outline, composed of cal-cite and usually a thicker organic layer. The lateral margin of the valve is subparallel to the harmonic margin almost along its entire length. A shallow furrow is sometimes present along the harmonic margin. The harmonic margin forms an angle of about 90° with the frontal and lateral margins. The valves' surface is smooth. The inner surface possesses thin and closely spaced growth lines.

Dimensions in mm, ratios in and angles in degrees:

Specimen no.	L	L_t	W	L_t/L	W/L	A	T
Holotype 4986/8	10.95	11.1	4.05	1.01	0.37	93	89

Variability. The collection studied includes narrower (Figs. 3a, 3c) and wider (Figs. 3b, 3d) aptychi. In the narrower aptychi, the lateral margin is more parallel to the symphysis (harmonic margin). The strength of the growth lines is also variable. An aptychus very similar to *P. volgensis* sp. nov. was found by A.V. Guzhov in the overlying part of the *panderi* Zone, in a loose block of clay and shale (Fig. 3e).

Comparison. Most Late Jurassic *Praestriptychus* are distinguished from the species under description by having wider valves. The aptychus from the Upper Kimmeridgian figured by Schweigert and Dietl (1999, pi. 2, fig. 4) is the most closely similar to the holotype. However, the growth lines in *P. volgensis* are more closely spaced, while the valves are shorter. In addition, the new species is distinguished by its very small size. Growth lines in *P. volgensis* resemble those in some other Late Kimmeridgian species from South Germany (Schweigert, 1998, pi. 10, fig. 1; Schweigert and Dietl, 1999, pi. 2, fig. 5) and the aptychus from the Kimmeridgian of the Northern Caucasus (Khudyayev, 1932, pi. 3, fig. 7).

Remarks. Unfortunately, all specimens of *P. volgensis* were found separately from ammonites. Therefore, their assignments may only be speculated. Because the narrow-valved *Praestriptychus* are associated only with the members of the family Perisphinctaceae, the aptychi described most likely belong to *Zaraiskites* or *Pavlovia*, together with which they are often found. Mesezhnikov *et al.* (1977) and Blom *et al.* (1984) recorded *Haploceras* and *Sutneria* from the same beds. However these ammonites typically had different aptychi (*Punctaptychus-Lamellaptychus* and ? *Laevaptychus*, respectively). This is the first find of aptychi in Volgian Boreal or Subboreal ammonites. Apparently, the species *P. volgensis* is the stratigraphically youngest member of its genus, which has a typical

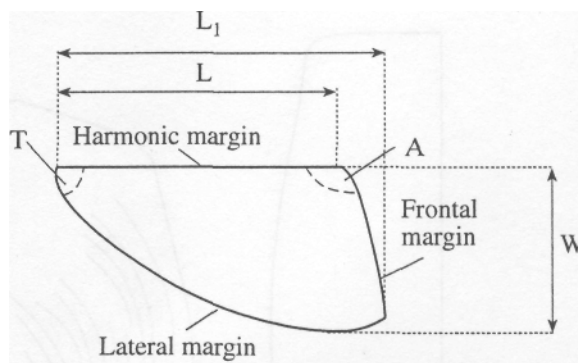


Fig. 2. Measurements of aptychi used in the paper. (A) apical angle, (T) terminal angle, (W) width, (L) length of the harmonic margin, (L_1) length of the aptychus.

Jurassic morphotype. Early Cretaceous *Praestriptychus* are also known (Trauth, 1937), but they differ from the Jurassic aptychi in the presence of the variously developed radial ornamentation and the somewhat different shape of the valves. It is possible that the Cretaceous *Praestriptychus* should be assigned to a new genus.

Occurrence. Middle Volgian, *panderi* Zone, Ulyanovsk Povolzhye (middle reaches of the Volga in the region of Ulyanovsk).

Material. Three specimens: a complete, slightly deformed bivalved aptychus with a well preserved organic layer and a poorly preserved calcite layer (holotype 4986/8) and two incomplete valves (4986/9, 4986/10); from the section near the village of Gorodishche.

Genus *Laevaptychus* Trauth, 1927

Laevaptychus latobliquus Trauth, 1931

Aptychus cf. *obliquus*: Quenstedt, 1849, p. 312, pi. 22, figs. 14a, 14 b.

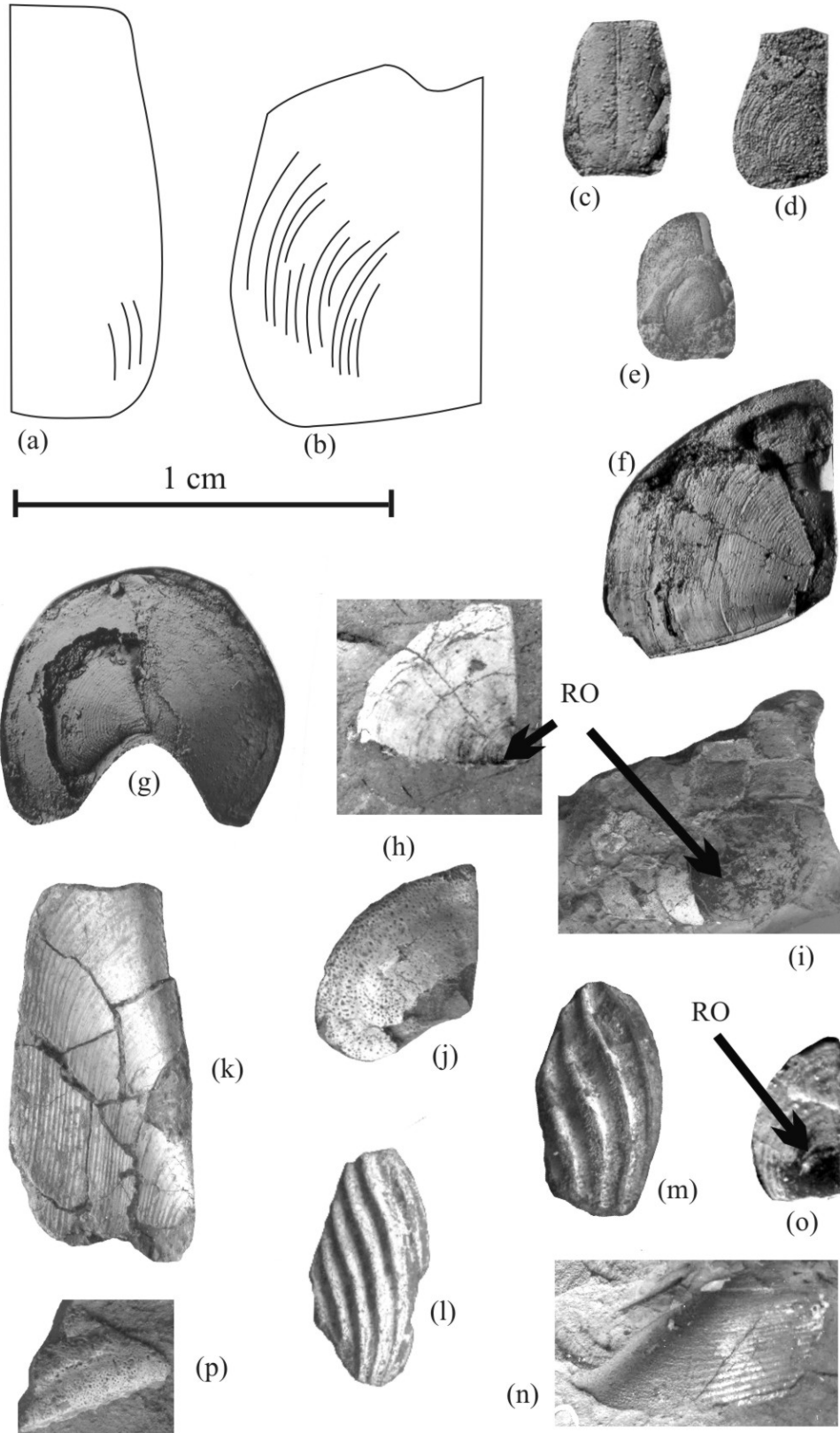
Laevaptychus latobliquus: Trauth, 1931, p. 59, fig. B17.

Laevaptychus obliquus: Răileanu, Năstăseanu, 1960, p. 25, pl. 8, fig. 27.

? *Laevaptychus (Obliquuslaevaptychus) latobliquus* van 1: Gasirowski, 1962, pl. 5, fig. 28.

Holotype. A holotype was not designated.

Description (Figs. 3f-3j, 3p). The valves are medium-sized, more rarely small, thick, and subtriangular in outline. The harmonic and frontal margins are straight and almost equal in length and form an obtuse angle. The outer layer is calcite, thick (at the aptychus's length, about 3 cm, it is up to 3-4 mm thick). The inner layer is organic, thinner than the outer layer, and is discernible only in some specimens. The valves' internal surface is uniformly covered with pores. The inner surface possesses numerous thin growth lines.



Dimensions in mm, ratios in %, and angles in degrees:

Specimen no.	L	L ₁	W	L ₁ /L	W/L	A	T
4986/14	12.6	19.3	11.0	1.53	0.88	133	65
4986/12	9.2	12.2	9.2	1.33	0.99	-	-
4986/13	12.1	15.3	12.3	1.26	1.01	119	60
4986/16	11.9	15.3	12.0	1.28	1.01	124	55
4986/11	32.6	≈42.7	34.9	1.31	1.07	115	70

Comparison. *L. obliquus* (Quenstedt, 1845-1849, p. 312, pi. 22, fig. 15; Ooster, 1857-1863, p. 25, pi. 6, figs. 11-13; Trauth, 1931, p. 101, fig. B16) is the most similar species. The latter differs in the somewhat narrower valves and curved frontal margin. The specimen figured by Gasirowski (1962, pi. 5, fig. 28) as *L. latobliquus*, has a width of the valves similar to *L. latobliquus*, but its curved frontal margin is similar to that of *L. obliquus*. Hence, it is included in the synonymy only provisionally. Aptychi similar to the species described are known from the Tithonian of Tunisia (Pervinquiere, 1907, p. 34, pi. 2, figs. 4-7). Although they do not have a straight frontal margin, the valves in these aptychi are considerably narrower. Aptychi with a straight frontal margin similar to the species under description were described from the Kimmeridgian-Tithonian of Somalia (Valduga, 1954, pi. 8, fig. 6). However, *L. latobliquus* has somewhat wider valves. The Kimmeridgian *Laevaptychus* of Central Russia (Rogov, 2002a, pi. 1, figs. 1-4), usually have a smaller apical angle and narrower valves.

Remarks. The species *L. latobliquus* Trauth, 1931 is a typical parataxon, because, while having a wide interval of distribution, it is associated with representatives of different aspidoceratid species and genera. Nevertheless, in the section at Gorodishche, these aptychi certainly belong to *Anaspidoceras neoburgense* (Oppel). Structures considered to be upper jaws of aspidoceratids were recently described from the Upper Kimmeridgian of South Germany, where they were found in association with *Laevaptychus* (Schweigert, 1998; Schweigert and Dietl, 1999, 2001). No similar finds are known as yet from tHfc Volgian.

In aptychi from the clayey Lower Volgian facies in the section of Gorodishche, the inner organic layer is preserved to a varying extent (Figs. 3h, 3i, 3o). In the carbonate facies of South Germany aptychi are more abundant, but traces of the organic layer that was once present on the concave surface of the valves are extremely rare (Schweigert and Dietl, 2001, pi. 2, fig. 3).

Most valves found are small in size. Two size classes separated by a gap can be recognized (Fig. 4). This accurately corresponds to the data on the size-frequency distribution of the shells of *A. neoburgense* in the Gorodishche Section. They are represented either by small shells (usually 3-5 cm in diameter), or, more rarely, by larger shells (over 10 cm in diameter), whereas ammonites 5-10 cm in size are absent. The presence of two size classes can most likely be explained by polymorphism sensu Matyja (Matyja, 1986, 1994; Matyja and Wierzbowski, 2001) rather than sexual dimorphism because *Anaspidoceras* is found in association with *Sutneria*. Representatives of the latter genus are presently considered to be antidi-morphs of *Physodoceras* s. 1. (Schweigert, 1997, 1998).

One of the specimens (Fig. 3p) shows a distinct, elongated elevation in the shape of a wide ridge on the convey surface of the valve. The cause of the appearance of this elevation is uncertain. Schweigert and Dietl (2001, p. 136, pi. 2, fig. 1) suggested that similar structures on the inner surface of *Laevaptychus* were produced by parasites. Apparently, a similar cause may be suggested in the above case. Gasirowski (1962, p. 58) indicated that most *Laevaptychus* from the lower part of the aptychus horizon VI in the Western Carpathians (Upper Kimmeridgian-Middle Tithonian) possessed radial plications on their inner surface.

Occurrence. Kimmeridgian of Germany, Kimmeridgian-Middle Tithonian of Western Carpathians and Romania; Lower Volgian, *pseudoscythica* Zone, Faunal Horizon *neoburgense* of the Russian Plate.

Material. Twelve specimens (4986/11^986/22); complete valves and their fragments and one specimen with two valves; from the section near the village of Gorodishche.

Fig. 3. Aptychi. Enlarged two times, except figs. 3f and 3i. The scale is shown for figs. 3a and 3b. (RO) remains of organic layer. All aptychi (except 3e) collected by the author, (a)-(e) *Praestriaptychus volgensis* sp. nov.; Gorodishche, Middle Volgian, *panderi* Zone; (a) and (c) holotype no. 4986/8; (a) scheme showing the shape of the aptychus and the course of the growth lines on the inner organic layer; (b) and (d) specimen no. 4986/9; (b) scheme showing the shape of the aptychus and the course of the growth lines on the inner organic layer; (e) specimen 4986/10 (coll. by A.V. Guzhov); (f)-(j) and (p) *Laevaptychus latobliquus* Trauth, 1931, Gorodishche, Lower Volgian, *pseudoscythica* Zone, Faunal Horizon *neoburgense*; (f) specimen no. 4986/11, internal view, x1, (g) specimen no. 4986/14, external view in place where the valve is partly damaged, showing the growth lines; (h) specimen no. 4986/13, internal view, (i) specimen no. 4986/22, external view in place where the valve is broken, clearly showing the remaining organic layer, x1; (j) specimen no. 4986/16, external view; (p) specimen no. 4986/15, fragment of the valve, external view; (k)-(n) *Lamellaptychus submortilleti* Trauth, 1938; (k) specimen no. 4986/23, internal view; Polevye-Bikshiki; Lower Volgian, *klimovi* Zone; Beds with *Neochetoceras steraspis* and *Lingulaticeras solenoides*; (l) specimen no. 4986/25, external view; Gorodishche; Upper Kimmeridgian, *autissiodorensis* Zone, *fallax* Subzone; (m) specimen no. 4986/27, external view; Murzitsy, Lower Volgian, *klimovi* Zone, Beds with *Neochetoceras steraspis* and *Lingulaticeras solenoides*; (n) specimen no. 4986/26, imprint of the inner side of the aptychus; Gorodishche, Lower Volgian, *klimovi* Zone, Beds with *Neochetoceras steraspis* and *Lingulaticeras solenoides*; (o) *Lamellaptychus* sp. juv., 4986/23; Gorodishche, Lower Volgian, *pseudoscythica* Zone, Faunal Horizon *neoburgense*.

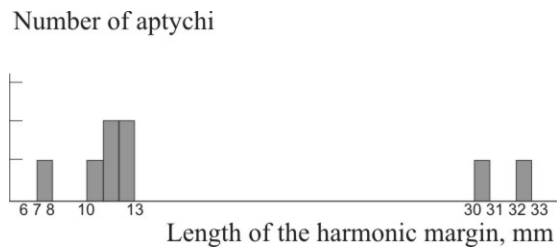


Fig. 4. Size-frequency distribution of *Laevaptychus latobliquus* Trauth, 1931 in the section Gorodishche. One digit on the vertical axis equals one specimen.

Genus *Lamellaptychus* Trauth, 1927

Lamellaptychus submortilleti Trauth, 1938

Lamellaptychus submortilleti n. n. f. typ.: Trauth, 1938, p. 143, pl. 10, figs. 23-25, 27.

Lamellaptychus submortilleti n. n. var. *longa*: Trauth, 1938, p. 144, pl. 10, fig. 26.

Neochetoceras subnudatum (Fontannes) mit *Lamellaptychus*: Schweigert, 1998, pl. 2, fig. 1; Schweigert and Dietl, 1999, pl. 6, fig. 1.

cf. *Lamellaptychus submortilleti longa*: Khalilov, 1978, p. 51, pl. 1, figs. 5 and 6.

non *Lamellaptychus submortilleti submortilleti*: Michalik *et al.*, 1990, p. 88, pi. 5, fig. 9.

Holotype. A holotype was not designated.

Description (Figs. 3k-3n). The valves are medium-sized, more rarely small, thick, and elongated. The harmonic and lateral margins are parallel along the most of the valve, but sharply converge near the terminal margin of the valve. The calcite layer is well developed (occasionally up to 3-4 mm thick at the valve width of about 1 cm). The ribs are relatively coarse and widely spaced along the entire valve. They become even coarser approaching the terminal margin and are extended toward the harmonic margin. Sometimes the rib surface possesses small pores in the middle part. This is apparently due to the state of preservation of the aptychi. The inner surface of the valves is covered by numerous thin growth lines (Figs. 3k, 3n). Their course does not follow the course of the ribs. Close to the lateral margin, the growth lines become curved toward the beak.

Variability. The ribs' thickness and density may vary. This character does not seem to be connected to the stratigraphic position of the finds.

Comparison. The species under description is distinguished from the similar species *L. lamellosus* (Parkinson), which has ornamentation of a similar type (Oppel, 1863, pi. 70, fig. 2; Quenstedt, 1846-1849, p. 312, pi. 22, figs. 20a, 20b; 1887-1888, pi. 125, fig. 17; Trauth, 1938, pi. 11, figs. 1-12; Rogov, 2002a, pi. 1, fig. 6) by the considerably coarser ornamentation and the more parallel lateral and harmonic margins. This species differs from the coarsely ornamented species *L. kachhensis* (Waagen, 1875, pi. 11, figs. 8a, 8b; Trauth, 1938, pi. 12, figs. 18, 19; Rogov, 2002a, pi. 1, fig. 8) in the more strongly curved ribs in the proximity of the terminal margin of the valve and in the rib width

and inter-rib distance changing more slowly in ontogeny. A small *Lamellaptychus* sp. juv., found in the Faunal Horizon *neoburgense* in the Gorodoshche section (Fig. 3o) is distinguished from *L. submortilleti* by the very weakly developed ornamentation and wider valves. More likely, it belongs to one of the small haploceratins *Lingulaticeras* or *Pseudolissoceras*, also found in these beds (Rogov, 2002b). Very similar aptychi were figured as belonging to *Pseudolissoceras* (Barthel, 1962, pi. 2, fig. 7; Parent, 2001, fig. 7G).

Remarks. Kimmeridgian-Early Tithonian *L. submortilleti* can be considered as aptychi of *Neochetoceras subnudatum*-*N. steraspis*. The Late Tithonian-Berriasian *L. submortilleti*, could possibly belong to *Substreblites*.

Occurrence. Upper Kimmeridgian-Lower Tithonian of Germany, Upper Kimmeridgian-Berriasian of the Western Carpathians, Berriasian of Azerbaijan, Upper Kimmeridgian-Lower Volgian (from the *fallax* Subzone to the top of the Beds with *Neochetoceras steraspis*-*Lingulaticeras solenoides* inclusive) of Povolzhye.

Material. Five specimens, incomplete valves (mostly without apex) and two specimens that can be assigned to this species only provisionally. Specimens 4986/24, 4986/27 from the quarry near the village of Murzitsy (Sechenovskii District, Nizhegorodskii Region); Lower Volgian Substage, *klimovi*, Beds with *N. steraspis*-*L. solenoides*; 4986/25, 4986/26 bank of the Volga River near the village of Gorodishche; 4986/25 Upper Kimmeridgian, *autissiodorensis* Zone, *fallax* Zone; 4986/26 Lower Volgian, *klimovi*, Beds *N. steraspis*-*L. solenoides*; 4986/23 outcrop in the gully near the village of Polevye-Bikshiki, Batyrevskii District, Chuvashiya; the same age.

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