

# Middle and Late Carboniferous gastropods from the Central part of the Russian Plate: part 2. Platyceratidae

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The systematic diversity and stratigraphic distribution of the gastropod family Platyceratidae from the Middle and Upper Carboniferous rocks of the Central part of the Russian Plate have been studied.

The previously known species, *Capulus parasiticus* Trautschold, 1867, is redescribed as *Platyceras (Platyceras) parasiticum*. The well-known associations of *P. (P.) parasiticum* with crinoids are recognized as commensalism. The mode of life of *P. (P.) parasiticum* and *P. (Orthonychia) egorovi sp. nov.* and its influence on their individual variation types, as well as feasible reasons of the appearance of these types are discussed.

The muscle scar patterns of the platyceratid gastropods are studied. An attempt of analysis of functional morphology of columellar and dorsal muscles of platyceratid gastropods has been made.

Numerous findings of platyceratids attached to crinoid calyxes are considered to be an evidence of the premature death of both of them as a result of catastrophic events. Most of layers containing patches with abundant complete fossilized crinoids with attached platyceratids are suggested to be tempestites.

The genera *Strophostylus*, *Platyceras* (subgenera: *Platyceras* and *Orthonychia*) and species *S. girtyi* (Knight, 1934) are reported from the Middle and Late Carboniferous of the region for the first time.

New species described in this paper are: *Platyceras (Platyceras) neverovoensis*, *P. (Orthonychia) ivanovi*, *P. (O.) egorovi*, *Strophostylus sityensis*.

## Средне- и позднекаменноугольные гастроподы центральной части Русской плиты: часть 2. Platyceratidae.

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Изучен систематический состав и стратиграфическое распределение представителей семейства Platyceratidae из отложений среднего и верхнего карбона Центральной части Русской плиты.

Уточнена диагностика и систематическое положение *Platyceras (Platyceras) parasiticum* (Trautschold, 1867). Хорошо известная ассоциация *P. (P.) parasiticum* с криноидеями рассматривается как комменсализм. Рассмотрены образ жизни *P. (P.) parasiticum* и его влияние на типы изменчивости, и возможные причины образования этих типов.

Изучены мускульные отпечатки платицератид. Проведен морфофункциональный анализ коллюмельярного и дорзального мускулов платицератидных гастропод.

Многочисленные находки платицератид, прикрепленных к чашечкам криноидей, рассматриваются как свидетельство преждевременной смерти обоих организмов в результате катастрофических явлений. Предполагается, что большинство слоев, содержащих участки с обильными неразрозненными остатками криноидей с прикрепленными платицератидами являются штормовыми отложениями (темпеститами).

Впервые в отложениях среднего и верхнего карбона Центральной части Русской плиты отмечается присутствие родов *Platyceras* и *Strophostylus*, подродов *Platyceras* и *Orthonychia*, а также вида *S. girtyi* (Knight, 1934). Описаны новые виды: *Platyceras (Platyceras) neverovoensis*, *P. (Orthonychia) ivanovi*, *P. (O.) egorovi*, *Strophostylus sitnyensis*.

## INTRODUCTION

This article continues the study of the Middle and Late Carboniferous gastropods from the Central part of the Russian Plate and includes descriptions of members of the family Platyceratidae.

Only two works concerning the systematics of platyceratid gastropods of the Middle and Later Carboniferous of the Central part of the Russian Plate have been published more than a century ago. Trautschold [1867] described a new species, *Capulus parasiticus*, from a quarry near Myachkovo village, Myachkovian and Krevyakinian Provincial Stages. In the present paper I have transferred this species to *Platyceras (Platyceras)*. Later Trautschold [1874] described two new species: *Capulus mitraeformis* and *Capulus pumilis*. Unfortunately, their holotypes have been lost and the figures are not good enough for the comparison with the collection materials available. There are also several papers containing figures of *Platyceras (Platyceras) parasiticum* attached to the crinoid calyxes from the quarry near Myachkovo village: Trautschold [1867, pl. 5, fig. 5 a; 1879, pl. 3, figs. 7, 8]; Yakowlew and Ivanov [1956, pl. 2, fig. 1b]; Yochelson [1956, pl. 23, figs. 17-20].

In this paper, in addition to previously known *P. (P.) parasiticum*, one new species of the subgenus *Platyceras*, two new species of the subgenus *Orthonychia* Hall, 1843, and two species of the genus *Strophostylus* Hall, 1859 (one of them, *S. girtyi* (Knight, 1934), was previously known from the Mid-Pennsylvanian of Kansas) are described here. The species of *Platyceras*, *Orthonychia*, and *Strophostylus* are recorded for the first time in the region studied.

Over and above, the material from the Moscow Basin was used in several works for the consideration of crinoid-platyceratid relationships.

Trautschold [1879] noted that shells of *Platyceras (Platyceras) parasiticum* were attached near anal opening of a crinoid and therefore suggested that the mollusk could obviously utilize some of crinoid food or/and fecal materials.

Yakowlew in 1926 and in the second edition of the paper of 1956 considered crinoid-platyceratid relationships as a cleaning symbiosis or commensalism. He based on the fact, that the apertural margin of platyceratid reflects the irregularity of the tegmen surface of the host crinoid and leaves rounded imprints on the latter. The relationships were very stable according to Yakowlew [1926], the crinoid-platyceratid connection was so close that the mollusk could not leave his host after the death of the crinoid and therefore sometimes platyceratid gastropods were buried being attached to the crinoid calyxes. However, this seems to be an aspect of taphonomy rather than that of ethology. On the other hand, crinoid-platyceratid relationships were a very stable cleaning symbiosis. I believe that the relationships are commensalism.

## MATERIAL AND STRATIGRAPHIC DISTRIBUTION

All specimens used in this study were found in numerous quarries and outcrops in the Moscow Basin. The localities are shown in Fig. 1. Stratigraphic settings of several main localities are shown in Fig. 2. The stratigraphic scheme of the Middle Carboniferous of the Central part of the Russian Plate has been accepted from Shik [1979]. The total register of localities of the Middle and Upper Carboniferous gastropod specimens is given in the Supplement, with additions and corrections as compared to the register in the preceding paper [Mazaev, 1994].

The collection was supplemented by the private collection of A.P. Ivanov. The latter consists of not numerous but very important specimens some of which were taken as holotypes of *Platyceras (Orthonychia) ivanovi* sp. nov. and *Strophostylus sitnyensis* sp. nov. The crinoid calyxes with attached *P. (P.) parasiticum* were kindly offered to me by J.A. Arendt (Paleontological Institute, Russian Academy of Sciences).

All platyceratid gastropods including specimens of *Strophostylus* have fine-preserved calcite shells. It is all the more interesting because

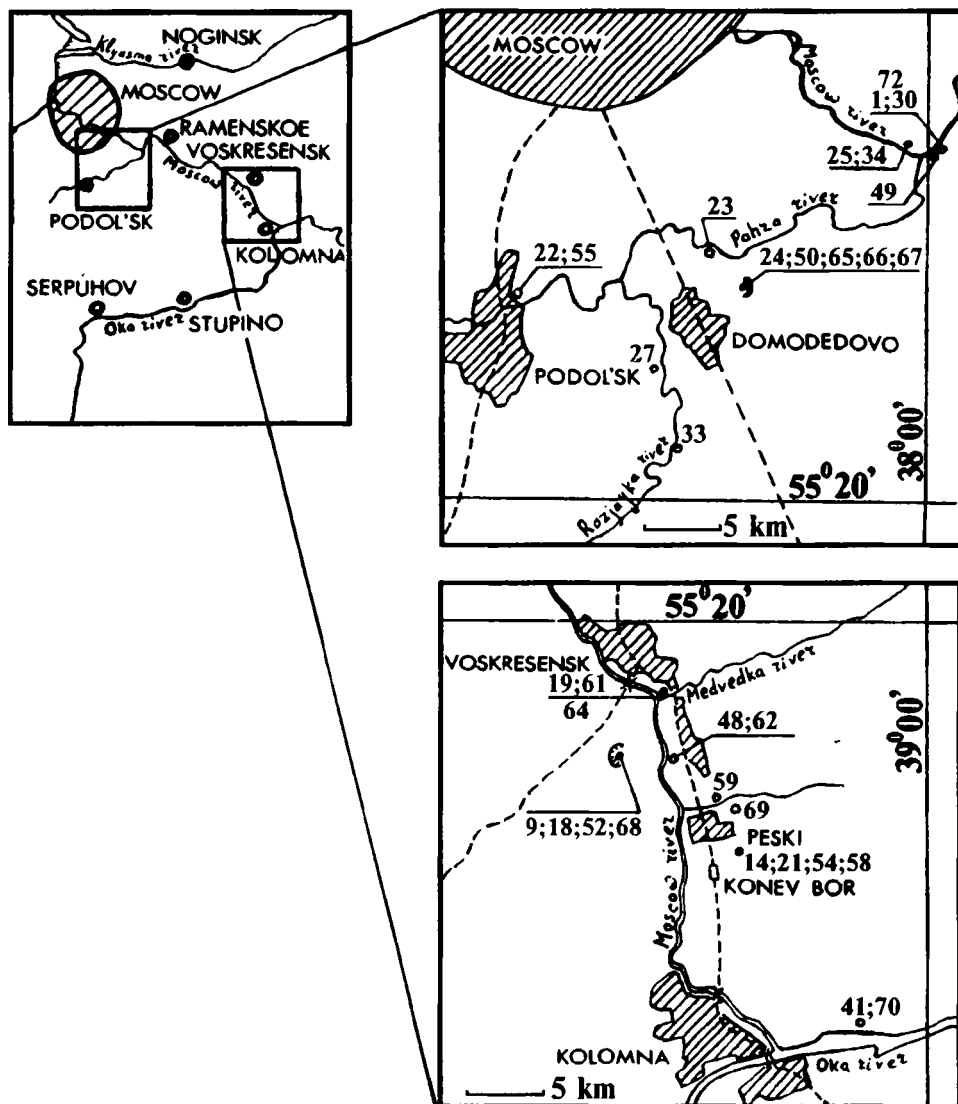


FIG. 1. Some localities of Moscowian and Kasimovian gastropods in the Moscow Basin.

РИС. 1. Некоторые местонахождения гастропод в отложениях московского и касимовского яруса Московского бассейна.

only two groups, *Euomphalacea* and *Platyceratidae*, have this type of preservation. The shells of other groups of gastropods have been dissolved and preserved as imprints. This is a natural phenomenon for all Middle and Upper Carboniferous beds of the Central part of Russian Plate with the exception of locality № 8 (= 32).

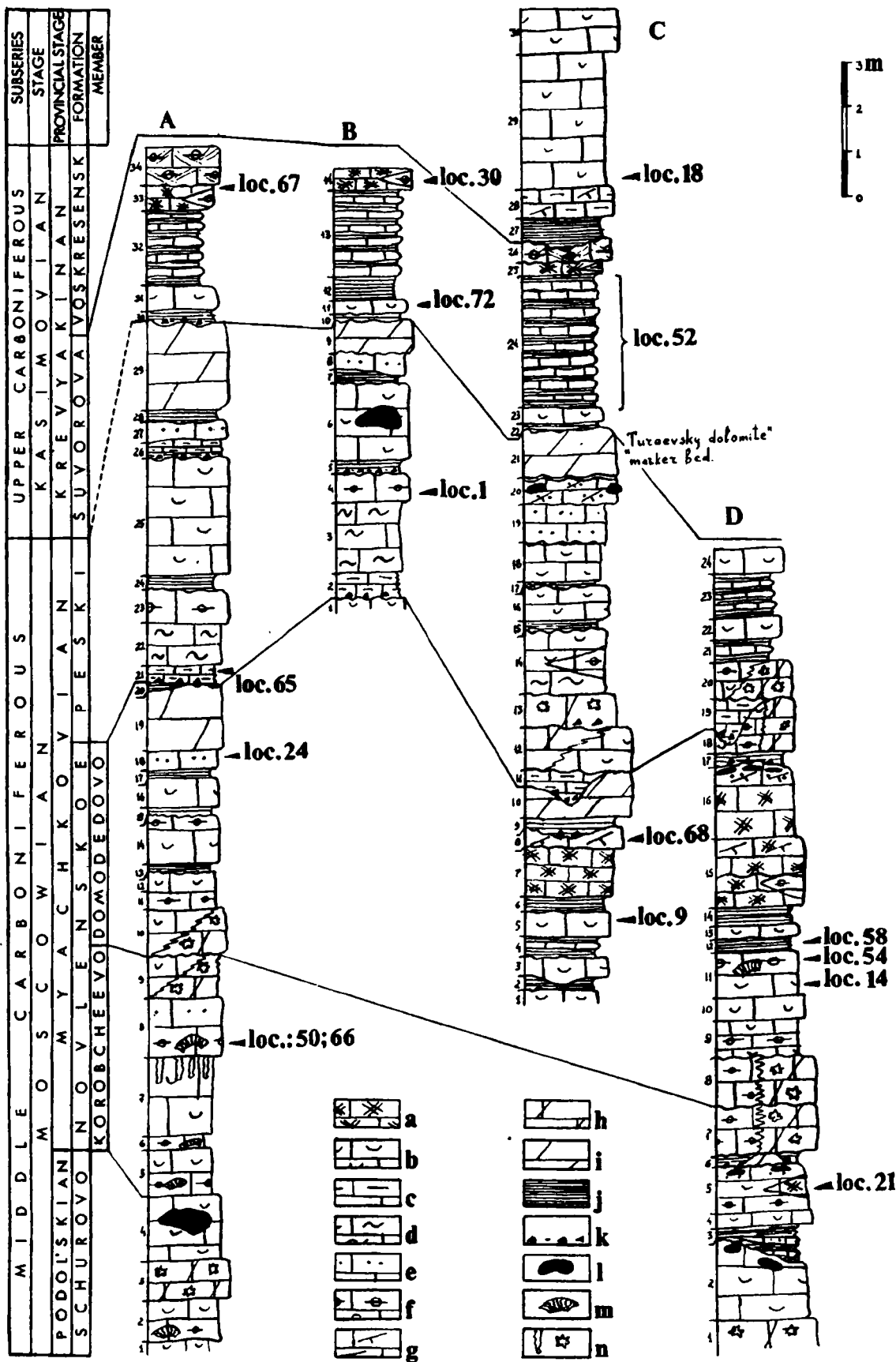
More than 110 specimens of platyceratid gastropods have been examined. Six species belonging to two genera and two subgenera of the *Platyceratidae* were identified from the studied Middle and Upper Carboniferous deposits. Their stratigraphic distribution is as follows: *Platyceras (Platyceras) parasiticum* (Trautschold, 1867) — Kaschirian, Podolskian, Myachkovian, and Krevyakinian Provincial

Stages; *P. (P.) neverovoensis* sp.nov. — Khamovnikian Provincial Stage; *P. (Orthonychia) ivanovi* sp. nov. — Myachkovian, Krevyakinian Provincial Stages; *P. (O.) egorovi* sp. nov. — Rechitzian Provincial Stage; *Strophostylus girtyi* (Knight, 1934) — Krevyakinian Provincial Stage; *S. sitnyensis* sp.nov. — Podolskian Provincial Stage.

## MORPHOLOGY

The extremely limited number of morphological features of the shell is the main difficulty in the study of the *Platyceratidae*.

The shell morphology of platyceratid gastropods has a limited number of morphological features. Moreover, the morphology of the



genus *Platyceras* get complicated by a very wide individual variation. As it has been referred in many works [Knight, 1934; Bowsher, 1955, 1956; Yochelson, 1956; etc.], this wide individual variation comes from close connection of the mollusks with crinoid calyxes. The form of calyx or anal sac is reflected by growth lines, general shape of the aperture and coiling of platyceratid gastropods.

The specimens of crinoid calyxes with attached platyceratids show that growth lines of the gastropod reflect the surface of the crinoid (Fig. 4 A-H, K).

The form of aperture in *P. (Platyceras) parasiticum* is variable. Basically, it is possible to divide the specimens into two groups: shells with elongated aperture (Fig. 5 A-O), and shells with more or less rounded aperture (Fig. 5 P-T, 6 A-T). This fact seems to depend on the individual variation and the ontogenetic stage of the crinoid host. Each group can be separated into two subgroups according to the presence or absence of a keel (Fig. 5 A-T, 6 K-T, and Fig. 6 A-J). The appearance of the keel on the shell depends on the width of anal area between the arms of the crinoid. If there is enough space on the anal area the keel is absent.

The specimens of *P. (Orthonychia) egorovi* sp. nov. can be also separated into those having high-conical shell and round aperture with reentrances and salients (Fig. 7 P-T), those having high-conical shell and oval aperture with more or less flattened margin (Fig. 7 A-O, 8 A), and those having hook-shaped conical shell and oval aperture with more or less flattened margin (Fig. 8 B-E, G-M). The shells of the first group were perhaps attached between the arms of relatively small crinoid calyxes. These correlations between gastropod and crinoid were shown by Rollins and Brezinski [1988, Fig. 3 A, B, D, E]. The shells of the second group could be attached at side of small crinoid calyxes or on their anal sac. The shells of the third group could be attached in the same manner but on large crinoid calyxes.

In this way most of morphological features of any platyceratid gastropods are not stable

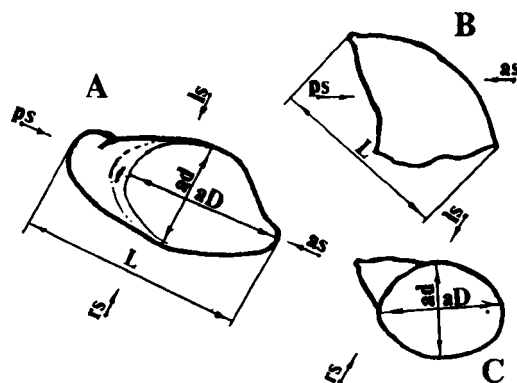


FIG. 3. Morphology of platyceratid shells: L — length (for coiled platyceratid = maximum shell diameter), aD — maximum aperture diameter, ad — minimum aperture diameter, as — anterior side, ps — posterior side, ls — left side (for coiled platyceratid = apical side), rs — right side (for coiled platyceratid = basal side).

РИС. 3. Морфология раковин платицератид: L — длина (для свернутых платицератид = максимальный диаметр раковины), aD — максимальный диаметр апертуры, ad — минимальный диаметр апертуры, as — передняя сторона, ps — задняя сторона, ls — левая сторона (для свернутых платицератид = верхняя сторона), rs — правая сторона (для свернутых платицератид = нижняя сторона).

and lose their taxonomic significance. The size, character of coiling, and number of volutions remain more or less stable.

The morphological features of *Platyceras* shell are shown in Fig. 3. A-C.

Among the platyceratid gastropods, *Platyceras* and *Orthonychia* are sedentary mollusks. Like limpets, they have horseshoe-shaped muscle scar of columellar retractor. This type of the muscle scar in platyceratid gastropods was shown in several works for *Orthonychia*: [Keyes, 1894, pl. LIV, 3l, 3m; Hyde, 1953, pl. 47, figs. 1-3, pl. 47, figs. 7-9; Yochelson, 1956, pl. 23, figs. 25, 26, 30].

The paper of R. Horny [1964] was perhaps the first attempt to give the functional analysis of muscle scar patterns of the low-spined platyceratids. Unfortunately, only the dorsal muscle scars were studied, but the columellar horse-

FIG. 2. Stratigraphic setting of some main localities of Moscowian and Kasimovian gastropods in the Moscow Basin. A — quarry near Domodedovo town, B — quarry near Kamennaya Tyagina village, C — quarry near Afanasievo village, D — quarry near Konev Bor station, a — mudstone, b — packstone, c — marly limestone, d — wackstone, e — fine grainstone, f — coarse grainstone, g — brecciated limestone, h — dolomitic limestone, i — dolomite, j — shale, k — lithoclasts, l — flint nodules, m — colonial corals, n — caverns.

РИС. 2. Стратиграфическое положение основных местонахождений московских и касимовских гастропод Московского бассейна. А — карьер около г. Домодедово, В — карьер около д. Каменная Тяжина, С — Карьер около деревни Афанасьево, D — карьер около станции Конево Бор, а — мадстоун, б — пакстоун, с — известняки глинистые, d — вакстоун, е — тонкий грайнстоун, f — грубый грайнстоун, g — брекчии, h — доломитизированный известняк, i — доломит, j — глины, k — литокласты, l — кремневые конкреции, m — колонии кораллов, n — каверны.

shoe-shaped muscle scars were left aside. However, we can see horseshoe-shaped scar in Horny's figures: [tab. 1 [7], figs. 1, 3]. These figures are reproduced here with some additions (Fig. 9 A, B).

Recently, Rollins and Brezinski [1988, p. 212] noted the following: "Our observations suggest that the lower-spined platyceratids have a single, more highly developed dorsal scar whereas the higher-spined forms possess a somewhat more symmetrical horseshoe pattern with less dorsal enlargement". However, besides the dorsal scar in lower-spined platyceratids shown by Rollins and Brezinski [fig. 8 E], we can see again a distinct horseshoe-shaped scar. Although, in the caption they noted: "A narrow ?posterior scar is also present below the spire, however" [p. 215]. This figure is reproduced here with additions (Fig. 9 C). Hyde [1953] shows for this specimen a horseshoe-shaped muscle scar only [pl. 47, figs. 7-9].

It seems to me that the shell of lower-spined platyceratids has both dorsal and columellar muscle scars, but the higher-spined forms have usually distinctly preserved columellar horseshoe-shaped muscle scars only. Such disposition of platyceratid muscle scar patterns was figured for *Orthonychia* and *Platyceras* by Harper and Rollins [1982, text-fig. 1 H,I].

There are several specimens of *P. (P.) parasiticum* with distinct muscle scars at my disposal. Besides the scar of columellar retractor, there is a round muscle scar of dorsal retractor to the right of the center on the concave surface (Fig. 9 D-F). *P. (Orthonychia)*

*ivanovi* has the same disposition of its muscle scars (Fig. 9 G).

The working effort of the columellar retractor of platyceratids with coiled shell was unevenly distributed around aperture. For this reason the dorsal retractor played an important role for more tight clamping of the shell with the tegmen surface (Fig. 10 A). The working effort of the columellar retractor of platyceratids with uncoiled conical shell was more evenly distributed around aperture. In this case a part of the dorsal retractor was diminished, obviously, this one was not reduced (Fig. 10 B).

In accordance with the above-mentioned, the uncoiled conical shells have moderately thin aperture margin but the coiled shells usually have thick inner and thin outer lips of their aperture (Fig. 10 A).

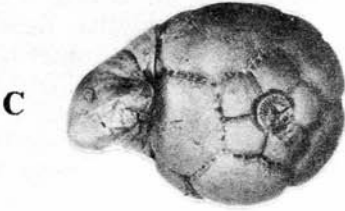
*Strophostylus* belongs to species with shell of "usual gastropod". Obviously their shell morphology did not depend on the substrate surface. Most likely they had motile mode of life.

## ETHOLOGICAL AND TAPHONOMICAL ASPECTS

According to personal communications of Yu. A. Arendt, all the crinoids from the Moscow Basin which have been collected with attached platyceratids or with their scars of attachment, belong to *Cromiocrynus simplex* Trautschold (Fig. 4 A-L). In addition, there is single specimen of *Synphocrinus cornutus* Trautschold with a platyceratid shell attached

FIG. 4. *Platyceras (Platyceras) parasiticum* (Trautschold, 1867) attached to crinoid calyxes of *Cromiocrynus simplex* Trautschold,  $\times 1.5$ : A-D — No. 137/904 (PM RAS, collected by A.P. Ivavov), quarry near Myachkovo village, Moscow Region, Myachkovian Provincial Stage; E — No. 3678/393 (PM RAS, collected by A.A. Erlanger), outcrops on Medvedka River near Schifernaya station, Moscow Region, Khamovnikian Provincial Stage; F-H — No. 1641/85 (PM RAS, collected by Yu.A. Arendt), quarry near Myachkovo village, Moscow Region, Myachkovian Provincial Stage; I — No. 137/1036, (PM RAS, collected by A.P. Ivavov), side view showing platyceratid scar at side of calyx, quarry near Myachkovo village, Moscow Region, Myachkovian Provincial Stage; J — No. 3678/393, (PM RAS, collected by by A.A. Erlanger), side view showing destroyed platyceratid shell attachment on side of calyx, the latter also bearing scar from another platyceratid; outcrops on Medvedka River near Schifernaya station, Moscow Region, Khamovnikian Provincial Stage; K, L — a specimen from the Moscow Geological Museum of Vernadskiy, quarry near Myachkovo village, Moscow Region, Myachkovian Provincial Stage: K — side view, L —  $\times 4.5$ , side view showing part of platyceratid shell attachment on side of calyx, the latter also bearing scars from another platyceratid.

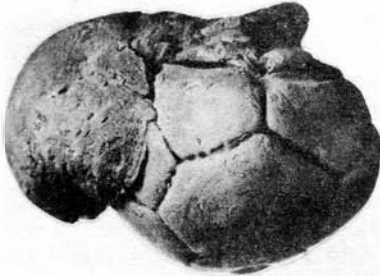
РИС. 4. *Platyceras (Platyceras) parasiticum* (Trautschold, 1867) прикрепленные к чашечкам криноидей *Cromiocrynus simplex* Trautschold,  $\times 1.5$ : A-D — No. 137/904 (ПМ РАН, сборы А.П. Иванова), Московская обл., карьер около д. Мячково, мячковский горизонт; E — No. 3678/393 (ПМ РАН, сборы А.А. Эрлангера), Московская обл., обнажение на р. Медведка около ст. Шиферная, хамовнический горизонт; F-H — No. 1641/85 (ПМ РАН, сборы Ю.А. Арндта), Московская обл., карьер около д. Мячково, мячковский горизонт; I — No. 137/1036, (ПМ РАН, сборы А.П. Иванова), вид сбоку, отпечаток платицераса прикреплявшегося сбоку чашечки, Московская обл., карьер около д. Мячково, мячковский горизонт; J — No. 3678/393, (ПМ РАН, сборы А.А. Эрлангера), вид сбоку, разрушенная раковина платицераса прикреплена сбоку чашечки, а также виден отпечаток от другого платицераса; Московская обл., обнажение на р. Медведка около ст. Шиферная, хамовнический горизонт; K, L — образец из Московского Геологического музея имени Вернадского, Московская обл., карьер около д. Мячково, мячковский горизонт: K — вид сбоку; L —  $\times 4.5$ , вид сбоку, показана часть раковины платицераса, прикрепленного на чашечке с отпечатком от другого платицераса.



E

D

G



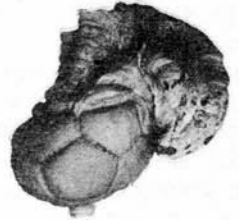
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I



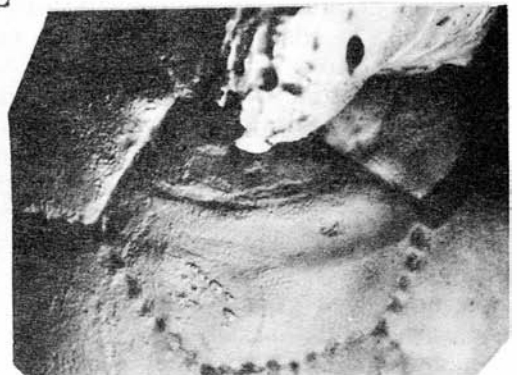
K



J



L



to its anal sac Fig. 11. In each case the platyceratids are *Platyceras (Platyceras) parasiticum*. Apparently, *P. (P.) parasiticum* and *Cromiocrinus simplex* formed a very stable symbiosis. It is of particular interest because in these rocks there are several other crinoids with similar texture of calyxes. On the other hand, Thein and Nitecki [1974, p. 126] noted the following: "*P. (Orthonychia) chesterense* has been found commonly attached to the vaults of crinoids and the sides of blastoids. Keyes [1894, p. 191] reported that specimens from Kentucky are attached to *Plerotocrinus acutus*, *P. bifurcatus*, and *P. depressus*. Meek and Worthen [1867, p. 265] recorded one adhering to the side of *Penttermites godoni*."

Several following facts can be an evidence of the fact that *P. (P.) parasiticum* was connected with its host during all its life and did not change it.

1. The presence of *P. (P.) parasiticum* on a crinoid calyx is always marked by a distinct scar of its aperture (Fig. 4 I-L).

2. The studied specimens of *P. (P.) parasiticum* have no strong breach of growth lines. On the other hand, calyxes of *C. simplex* also have different size and individual variation.

Besides, there are many findings of crinoid calyxes with several distinct platyceratid aperture scars, as well as crinoid calyxes with attached platyceratid shell and bearing scar from another one (Fig. 4 J-L). It is possible, that platyceratid could occupy a place on the crinoid host after the death of previous mollusk.

Rollins and Brezinski [1982, p.212] suggested "that platyceratids exerted a negative influence upon their hosts, either by retarding growth (stunting) or by causing premature death (or both)". As a matter of fact all findings of crinoids with attached platyceratids are in large measure an evidence of the premature death of both of them, but the multiplicity of these findings is an evidence of stable connection between them. These relationships were beneficial or neutral interactions for both of them. Most likely platyceratid gastropods were coprophagous and could also utilize organic detritus from the tegmen surface of the crinoid. In addition, "platyceratids attached to the crinoids would presumably reap the same advantages of elevation above the substrate" as it was noted by Rollins and Brezinski [1982, p.216]. The supposition that platyceratids were possibly able to drill through the anal tube [Yakowlew, 1926, 1956] has not enough support and requires additional researches.

Apparently, such gastropods as *Sirophostylus*, *Cyclonema*, and *Naticonema* were not sedentary mollusks and therefore they might move like most gastropods and consequently might

leave their host after the death of the latter. If so, the Bowsher's exclusive specimens [Bowsher, 1955, pls. 1, 2] can be turned into the taphonomic puzzle. For this reason it is necessary to examine the crinoid/platyceratid-bearing layers in more details.

Rollins and Brezinski [1988] were the first who paid attention to the character of deposits and the distribution of fossils in crinoid/platyceratid-bearing stratigraphic levels. Their specimens "...were recovered from closely spaced bedding plane surfaces along the floor of Thompson Quarry..." from "...rhythmically interbedded silty medium-gray micaceous shale and claystone, and gray lime mudstone." [p. 207]. Carbonate beds range from 5 to 7 cm in thickness, contain abundant skeletal materials, the concavo-convex shell material on the upper surface of the carbonate beds has convex-up position. "Portion of bedding surfaces provide of minimal post-mortem transport..." They noted the following: "Although the exposed bedding surfaces are only modestly fossiliferous, the faunal distribution patchy, apparently *in situ*, and most likely the result of burial events." [p. 208].

It is interesting that the lithology of stratigraphical levels containing attached platyceratids in the Moscow Basin is very similar to that described above. Most of crinoids with attached platyceratids were obtained from shale or at the boundary with a gray lime mudstone. The carbonate beds contain also abundant skeletal material. The concavo-convex shell material on the upper surface of the carbonate beds has also convex-up position. The fauna is also distributed patchily, apparently *in situ*.

It seems to me that the character of above-described deposits evidences catastrophic events. It is possible that most of findings of attached platyceratids on crinoid calyxes have been obtained from the tempestites. The preservation of the patchiness of these paleocommunities *in situ* could be provided by quickly accumulated disturbed sediments. Fast sedimentation led to premature death of both attached platyceratid and the crinoid. It is certain that during the storm choppiness the platyceratid mollusk could be clamped more tightly to the crinoid tegmen to avoid the loss of his host. Therefore most of layers very rarely contain complete crinoid calyxes and single unattached platyceratids, but several other layers sometimes contain patchiness with abundant complete stalked crinoids and complete echinoids, as well as attached and unattached platyceratids. These "crinoid fields" are well known in the Myachkovo quarry, Domodedovo quarry (layer No. 17, Fig. 2 A), and the Konev Bor quarry (layer No. 12, Fig. 2 D) from the Moscow Basin.



## SYSTEMATIC PALEONTOLOGY

Specimens described and figured are stored in the Paleontological Museum of the Russian Academy of Sciences (PM RAS), collection N 4471. All material has indivisible system of collection numbers. The first figure is the number of the collection in PM RAS, the second — the number of localities and the third — the number of the specimen from the locality.

## Family Platyceratidae Hall, 1859

Genus *Platyceras* Conrad, 1840

DISCUSSION. In 1934 *Platyceras* and *Orthonychia* were described by Knight as separate genera. Later [Knight et al., 1960] these two and several other taxa were proposed to be subgenera of *Platyceras*. Perhaps the main difference in the diagnoses of *Platyceras* and *Orthonychia* is that the earlier part of the shell is coiled in the former and not coiled in the latter. However, species of these subgenera usually have one or two whorls. Therefore, it is difficult to any researcher to determine a specimen. For example, the shell shape of *P. (Orthonychia) parva* (Swallow) is very similar to that of *P. (Platyceras) vetusta* Sowerby, but they are distinguished as different subgenera based on their earlier parts of shell. In this way, this approach seems to be very formal. However, taking into account the scantity of morphological elements and the extremely high individual variation of the group, in this paper the systematics is in accordance with Treatise on Invertebrate Paleontology [Knight et al., 1960].

Subgenus *Platyceras* Conrad, 1840

*Acroculia*: Phillips, 1841, 93; *Actita*: Fahrenkohl, 1844, 802; *Exogyroseras*: Meek, Worthen, 1868, 509; *Platyceras (Platyceras)*: Knight et al., 1960, 1240.

TYPE SPECIES: *Pileopsis vetusta* Sowerby, 1829.

DIAGNOSIS. Small or moderate irregularly capuliform shell smooth; usually with one or two whorls or rarely more; the earlier portion of the shell coiled; protoconch vermiform or normally coiled; aperture large, varying from nearly smooth to irregularly sinuate, and circular, oval or elongate in plane; ornament consisting sometimes of spines; growth lines irregular and reflect surface of attachment.

*Platyceras (Platyceras) parasiticum*  
(Trautschold, 1867)

(Fig. 4 A-H, J-L; 5 A-T; 6 A-V;  
9 D-F; 11)

*Capulus parasiticus*: Trautschold, 1867: p. 41-42, pl. 5, fig. 5 a,b; *Capulus parasiticus*: Trautschold, 1874: p. 313-314.

TYPES were lost.

TYPE LOCALITY. Quarry near the Myachkovo village, Moscow Region. Middle Carboniferous, Myachkovian Provincial Stage, or Upper Carboniferous, Krevyakinian Provincial Stage.

DIAGNOSIS. Completely coiled, smooth platyceratids of moderate size (maximum diameter of approximately 25-30 mm), about 1-1,5 volutions. Shell rapidly expanding. Upper and basal whorl surface convex; basal surface more flattened and narrower than upper. Lateral surface rounded or bears a keel. Aperture shape very irregular. Anterior lip irregularly sinuate or smooth, with a notch. Inner lip smooth and usually massive, varying in plane from nearly rounded to oval, sometimes with more or less strong angulosity. Growth lines distinct, thin.

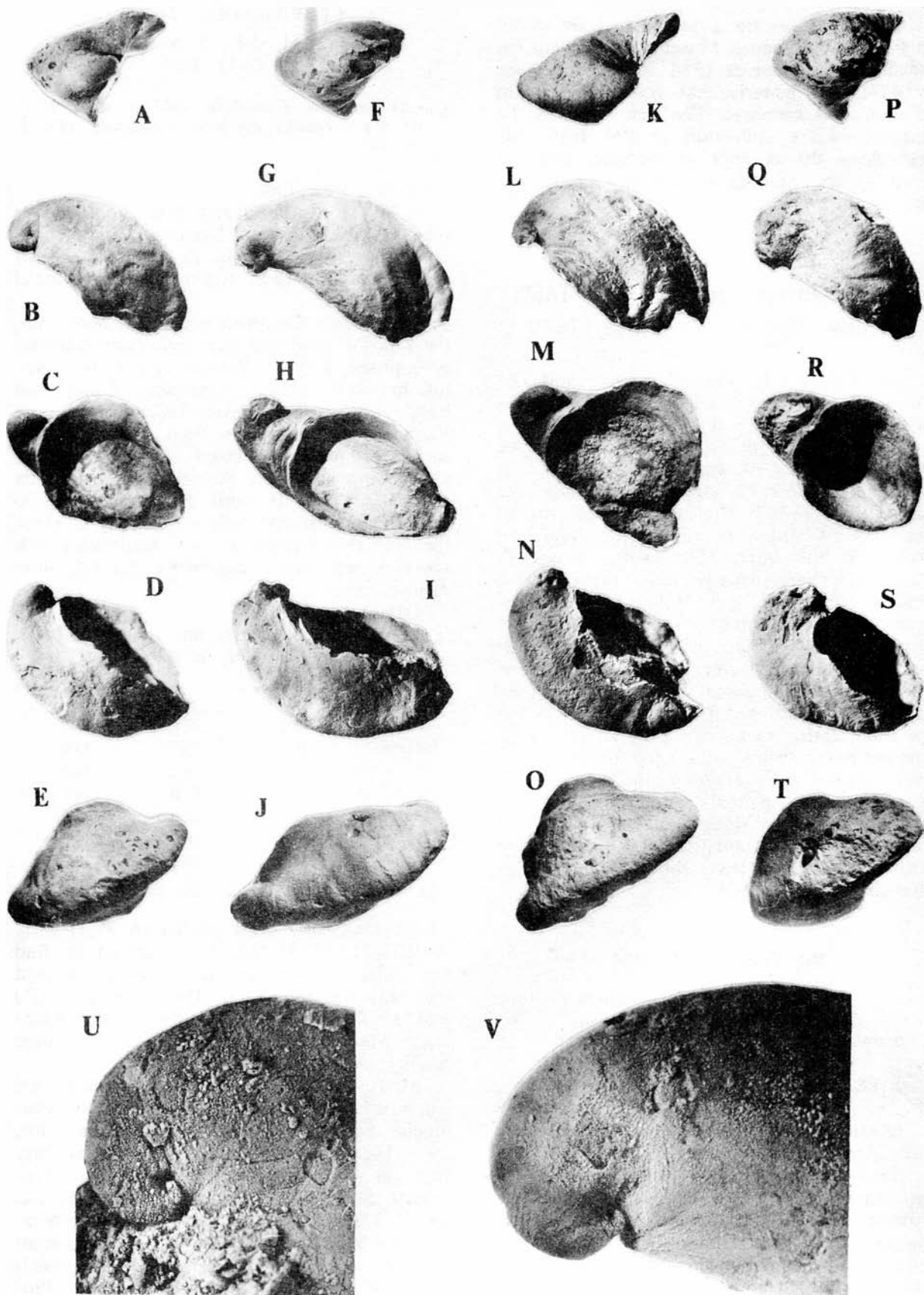
DIMENSIONS, mm:

Length (L), aperture max. diameter (aD), aperture min. diameter (ad).

No.	L	aD	ad
4471/45/6	24.0	17.0	15.0
4471/64/2	28.0	19.0	13.0
4471/58/36	25.5	19.0	18.0
4471/58/33	21.0	14.0	14.0
4471/59/4	25.0	19.0	17.5
4471/58/34	24.0	18.0	19.0
4471/20/66	23.0	19.0	18.5
4471/34/13	24.0	19.0	19.0

COMPARISON. Most similar to *P. (P.)* sp. A [Knight, 1958] but it is difficult to find any difference between them, because Knight had only two specimens. Differs from *P. (P.) pulcherrimum* Rowley, 1908 and *P. (P.) halioitoides* Meek et Worthen 1866 in having more rapidly expanding shell.

MATERIAL EXAMINED. 84 specimens are examined. Moscowian Stage: Kashirian Provincial Stage (loc. 38 — 1 specimen; loc. 39 — 1 specimen); Podolskian Provincial Stage (loc. 45 — 3 specimens); Myachkovian Provincial Stage (loc. 25 — 1 specimen; loc. 34 — 3 specimens, loc. 49 — 4 specimens; loc. 54 — 3 specimens; loc. 58 — 17 specimens; loc. 59 — 13 specimens; loc. 65 — 1 specimen). Kasimovian Stage: Krevyakinian Provincial Stage (loc. 20 — 17 specimens; loc. 52 — 5 specimens); Khamovnikian Provincial



Stage (loc. 61 — 6 specimens; loc. 62 — 3 specimens; loc. 64 — 5 specimens; loc. 69 — 1 specimen).

**OCCURRENCE.** Central part of the Russian Plate; Kaschirian, Podolskian and Myachkovian Provincial Stages, Moscowian Stage, Middle Carboniferous and Krevyakinian and Khamovnikian Provincial Stages, Kasimovian Stage, Upper Carboniferous.

***Platyceras (Platyceras)*  
*neverovoensis* Mazaev, sp. nov.**

(Fig. 12 A-E)

**HOLOTYPE.** PM RAS, No. 4471/62/1.

**TYPE LOCALITY.** Quarry near the Neverovo village. Moscow Region, Upper Carboniferous, Khamovnikian Provincial Stage. Collected by A.P. Ivanov, 1915.

**DIAGNOSIS.** Completely coiled, smooth platyceratid of moderate size (maximum diameter 21 mm), with about 2 volutions, coiled approximately in plane. Shell rapidly expanding. Upper whorl surface rounded-convex. Lateral surface rounded. Basal surface flattened; basal part of aperture destroyed. Aperture very large, in plane nearly circular or oval. Upper and anterior lips thin and sinuate. Inner lip smooth and more massive than anterior. Growth lines distinct and very thin.

**DIMENSIONS OF HOLOTYPE.** Maximum diameter of shell 21 mm, maximum width of aperture 14 mm.

**COMPARISON.** Differs from *P. (P.) subrotundum* Snider, 1915 in having more convex upper whorl surface and more flattened basal surface.

**MATERIAL EXAMINED.** The holotype only.

**OCCURRENCE.** Central part of the Russian Plate; Khamovnikian Provincial Stage, Upper Carboniferous.

**ETYMOLOGY.** Named after the village Neverovo near which the holotype was found.

[**ДИАГНОЗ.** Гладкая платицератидная раковина средних размеров (большой диаметр 21 мм), из двух быстро нарастающих округлых оборотов. Верхняя поверхность оборота округло-выпуклая. Боковая поверхность резко округлая. Нижняя поверхность оборота уплощенная. Нижняя часть устья разрушена. Устье очень большое, макушка утоплена. Устье, по видимому, округлое или овальное. Край устья сверху и спереди тонкий и синусообразно изогнут. Внутренняя губа гладкая, имеет утолщение. Линии роста четкие, очень тонкие.]

**Subgenus *Orthonychia* Hall, 1843**

*Igoceras*: Hall, 1843, 173; *Paleocapulus*: Grabau, Shimer, 1909, 686; *Geronticeras*: Grabau, 1936, 312; *Platyceras (Orthonychia)*: Knight et al., 1960, 1240.

**TYPE SPECIES:** *Platyceras (Orthonychia) subrectum* Hall, 1859.

**DIAGNOSIS.** Small or moderate irregularly curved to hook-shaped smooth platyceratid shell; earlier portion of shell free; protoconch vermiform or straight; aperture varying from nearly smooth to irregularly sinuate, usually circular or oval or elongate in plane; growth lines irregular and reflect surface of attachment.

***Platyceras (Orthonychia) egorovi*  
*Mazaev, sp. nov.***

(Fig. 7 A-T, 8 A-M)

**HOLOTYPE.** PM RAS, No. 4471/8/137.

**TYPE LOCALITY.** Outcrops between "55 km" and Gzhel stations, 150 m south of the railway, 2 m above the top of white soft limestone bed with flint nodules. Moscow Region, Upper Carboniferous, Rechitzian Provincial Stage. Collected by R.V. Egorov and A.V. Mazaev 1985—1994.

**DIAGNOSIS.** Almost straight or partially

FIG. 5. *Platyceras (Platyceras) parasiticum* (Trautschold, 1867), × 1.5: A-E — No. 4471/45/6: posterior, apical, apertural, basal, and abapertural side views; quarry near Shurovo station, Moscow Region, Podolskian Provincial Stage; F-J — No. 4471/64/2: posterior, apical, apertural, basal, and abapertural side views; outcrops on the Medvedka River near Schifernaya station, Moscow Region, Khamovnikian Provincial Stage; K-O — No. 4471/58/36: posterior, apical, apertural, basal, and abapertural side views; quarry near Konev Bor station, Moscow Region, Myachkovian Provincial Stage; P-T — No. 4471/58/33: posterior, apical, apertural, basal, and abapertural side views; from same locality; U, V — early portion of the shell with a protoconch, ×4.5: U — No. 4471/54/22, quarry near Konev Bor station, Moscow Region, Myachkovian Provincial Stage; V — No. 4471/61/7, outcrops on the Medvedka River near Schifernaya station, Moscow Region, Khamovnikian Provincial Stage.

РИС. 5. *Platyceras (Platyceras) parasiticum* (Trautschold, 1867), × 1.5: A-E — No. 4471/45/6: вид сзади, сверху, со стороны устья, снизу и со стороны, противоположной устью; Московская обл., карьер около ст. Шурово, Подольский горизонт; F-J — No. 4471/64/2: вид сзади, сверху, со стороны устья, снизу и со стороны, противоположной устью; Московская обл., обнажение на р. Медведка около ст. Шиферная, Хамовнический горизонт; K-O — No. 4471/58/36: вид сзади, сверху, со стороны устья, снизу и со стороны, противоположной устью; Московская обл. карьер около ст. Конев Бор, Мячковский горизонт; P-T — No. 4471/58/33: местонахождение то же; U, V — ранняя часть раковины с протоконхом, ×4.5: U — No. 4471/54/22, вид сзади, сверху, со стороны устья, снизу и со стороны, противоположной устью; Московская обл. карьер около ст. Конев Бор, Мячковский горизонт; V — No. 4471/61/7, Московская обл., обнажение на р. Медведка около ст. Шиферная, Хамовнический горизонт.

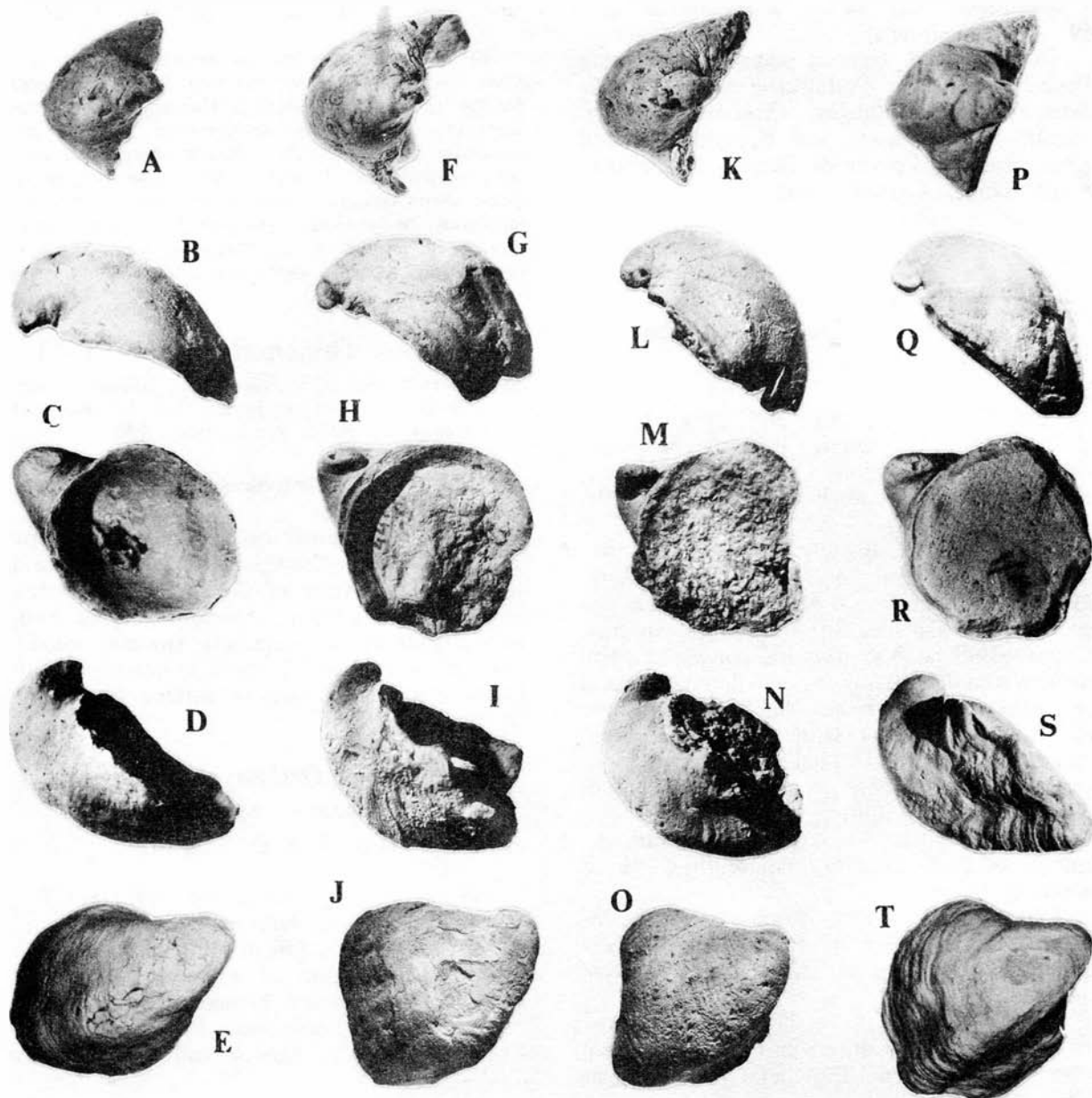


FIG. 6. *Platyceras (Platyceras) parasiticum* (Trautschold, 1867),  $\times 1.5$ : **A-E** — No. 4471/59/4: posterior, apical, apertural, basal, and abapertural side views; quarry near Peski station, Moscow Region, Myachkovian Provincial Stage; **F-J** — No. 4471/58/34: posterior, apical, apertural, basal, and abapertural side views; quarry near Konev Bor station, Moscow Region, Myachkovian Provincial Stage; **K-O** — No. 4471/20/66: posterior, apical, apertural, basal, and abapertural side views; Moscow, ZamoscwoRechye, research of metro, Krevyakinian Provincial Stage; **P-T** — No. 4471/34/13: posterior, apical, apertural, basal, and abapertural side views; quarry near Myachkovo village, Moscow Region, Myachkovian Provincial Stage.

РИС. 6. *Platyceras (Platyceras) parasiticum* (Trautschold, 1867),  $\times 1.5$ : **A-E** — No. 4471/59/4: вид сзади, сверху, со стороны устья, снизу и со стороны, противоположной устью; Московская обл. карьер около ст. Пески, Мячковский горизонт; **F-J** — No. 4471/58/34: вид сзади, сверху, со стороны устья, снизу и со стороны, противоположной устью; Московская обл. карьер около ст. Конеv Бор, Мячковский горизонт; **K-O** — No. 4471/20/66: вид сзади, сверху, со стороны устья, снизу и со стороны, противоположной устью; Москва, Замоскворечье, отвалы метро, Крeвьякинский горизонт; **P-T** — No. 4471/34/13: вид сзади, сверху, со стороны устья, снизу и со стороны противоположной устью; Московская обл. карьер около д. Мячково, Мячковский горизонт.

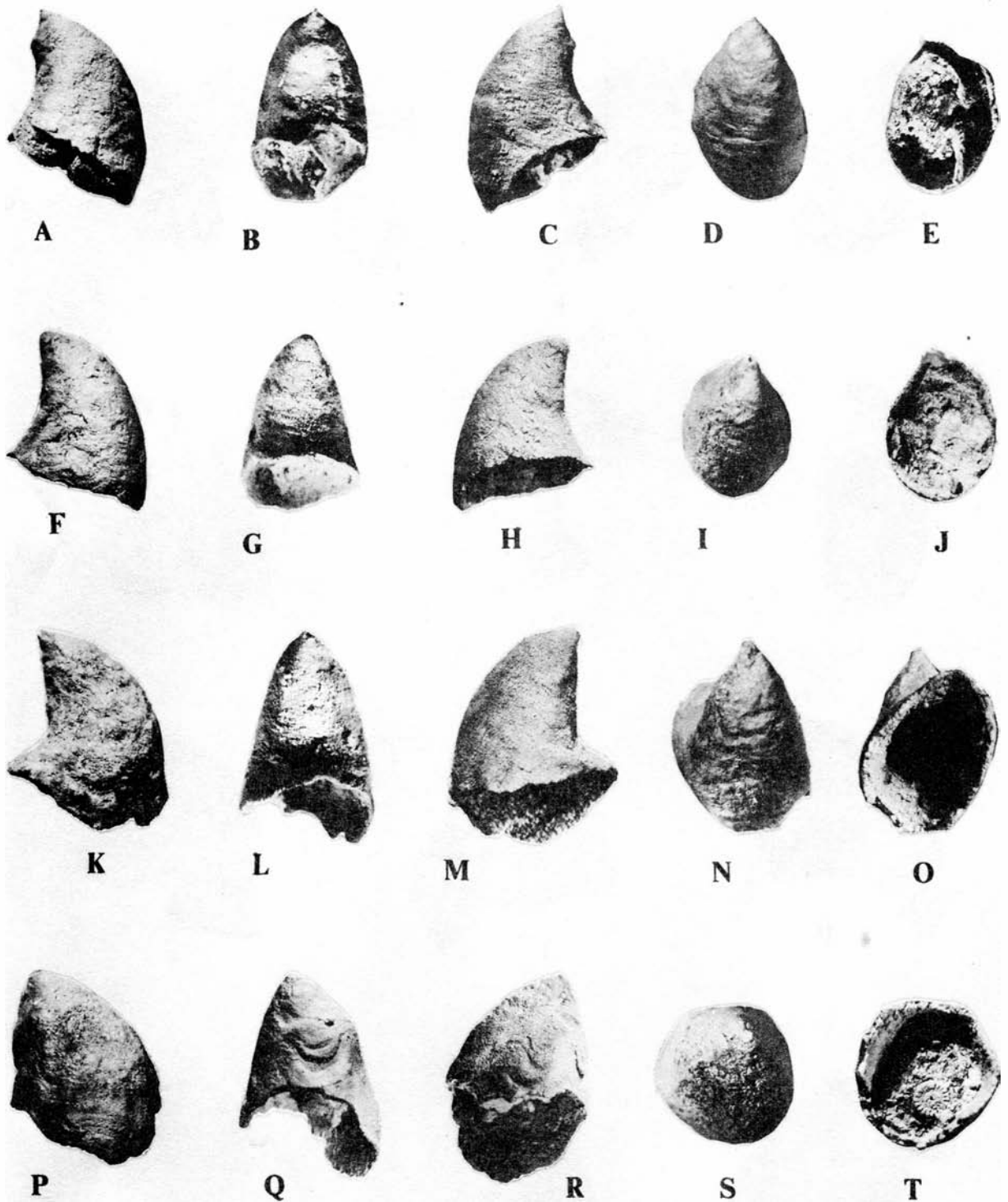
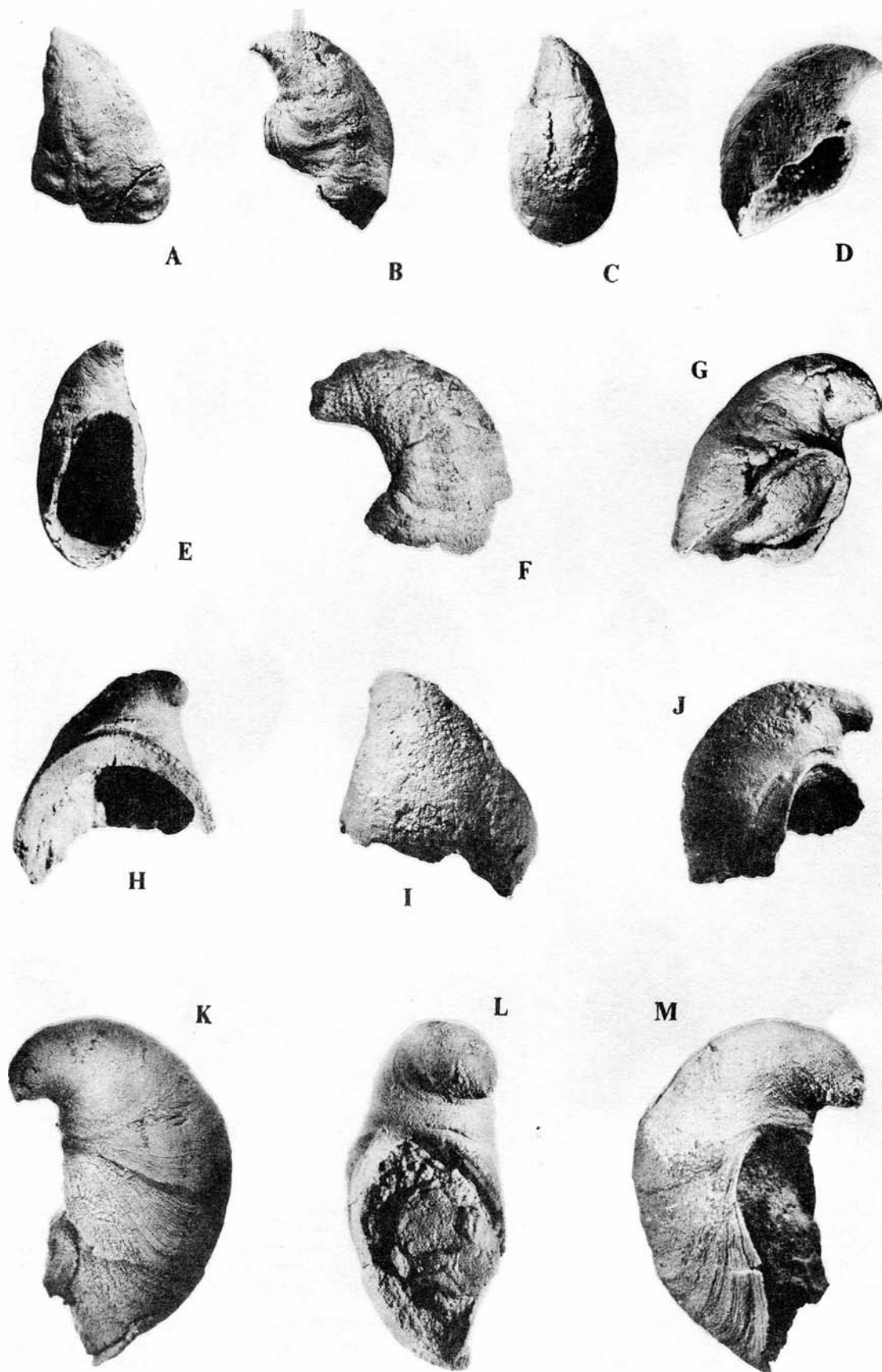


FIG. 7. *Platyceras (Orthonychia) egorovi Mazaev, sp. nov.*, outcrops between "55 km" station and Gzhel station, Moscow Region, Rechitzian Provincial Stage;  $\times 4$ : A-E — paratype No. 4471/8/135: left, posterior, right, abapertural, and apertural side views; F-J — paratype No. 4471/8/132: left, posterior, right, abapertural, and apertural side views; K-O — paratype No. 4471/8/133: left, posterior, right, abapertural, and apertural side views; P-T — paratype No. 4471/8/126: left, posterior, right, abapertural, and apertural side views.

РИС. 7. *Platyceras (Orthonychia) egorovi Mazaev, sp. nov.*, Московская обл., обнажение между ст. Гжель и "55 км", Речицкий горизонт;  $\times 4$ : A-E — паратип No. 4471/8/135: вид слева, сзади, справа, со стороны, противоположной устью, и со стороны устья; F-J — паратип No. 4471/8/132: вид слева, сзади, справа, со стороны, противоположной устью, и со стороны устья; K-O — паратип No. 4471/8/133: вид слева, сзади, справа, со стороны, противоположной устью, и со стороны устья; P-T — паратип No. 4471/8/126: вид слева, сзади, справа, со стороны, противоположной устью, и со стороны устья.



coiled smooth platyceratids of small size. Most shells moderately expanding, but some of them very rapidly expanding, most with blunt apex. Aperture nearly circular or oval in plane. Apertural lip of straight shells smooth and thin. Some specimens exhibit coiling for about three quarters of open whorl and massive inner lip. Growth lines distinct and very thin.

Dimensions, mm:

No.	L	aD	ad
4471/8/137 holotype	16.0	10.5	7.0
4471/8/135 paratype	9.0	5.5	4.5
4471/8/132 paratype	8.0	5.7	4.5
4471/8/133 paratype	9.3	7.0	5.0
4471/8/126 paratype	9.0	6.0	6.0
4471/8/129 paratype	10.3	7.0	5.4
4471/8/134 paratype	10.4	7.4	4.5

COMPARISON. Most similar to *P. (O.)* sp. 1 of Yochelson [1956] but it is difficult to find any difference between them, because Yochelson had only a single specimen. Also similar to *P. (O.) bowsheri* Yochelson, 1956, but it differs in having more blunt apex.

MATERIAL EXAMINED. 21 specimens from the type locality were examined.

OCCURRENCE. Central part of the Russian Plate; Rechitzian Provincial Stage, Upper Carboniferous.

ETYMOLOGY. The species is named in honor of R. Egorov (Zoological Museum of Moscow State University), who was the first to collect these specimens.

[ДИАГНОЗ. Маленькие, почти прямые или частично свернутые гладкие платицератиды (большой диаметр 16 мм). Раковина расширяется умеренно, большинство раковин с тупой макушкой. Устье почти круглое или овальное. У вытянутых экземпляров край устья гладкий и тонкий. Некоторые образцы имеют раковину свернутую на три четверти от полного оборота и массивную внутреннюю губу. Линии роста четкие, очень тонкие.]

### *Platyceras (Orthonychia) ivanovi*

**Mazaev, sp. nov.**

(Fig. 9 G, 12 F-N)

HOLOTYPE. PM RAS, No. 4471/34/14.

TYPE LOCALITY. Quarry near the Myachkovo village, Moscow Region. Middle Car-

boniferous, Myachkovian Provincial Stage. Collected by A.P. Ivanov, 1896.

DIAGNOSIS. Shell of moderate size (maximum diameter 27.5 mm), with angulate periphery. Shell moderately expanding. Holotype exhibits coiling for almost one complete whorl. Apex sharp. Aperture angulate in plane and almost trapezoidal. Aperture lips irregularly sinuate. Growth lines distinct and thin.

Dimensions, mm:

No.	L	aD	ad
4471/34/14 holotype	27.5	18.5	13.4
4471/52/9	6.2	4.6	3.5
4471/25/43	29.5	20	20

COMPARISON. Differs from *P. (O.) parvum* (Swallow, 1858) in having more thin and uncoiled shell. Differs from *P. (O.) chesterense* Meek et Worthen, 1867 in having more coiled shell.

MATERIAL EXAMINED. The holotype and one adult shell — loc. 25: Moscowian Stage, Myachkovian Provincial Stage; and one juvenile shell — loc. 52: Kasimovian Stage, Krevyakinian Provincial Stage.

OCCURRENCE. Central part of the Russian Plate; Myachkovian Provincial Stage, Moscowian Stage, Middle Carboniferous, Krevyakinian Provincial Stage, Kasimovian Stage, Upper Carboniferous.

ETYMOLOGY. The species is named in memory of A.P. Ivanov, who collected the holotype.

[ДИАГНОЗ. Гладкая, крючкообразно изогнутая платицератидная раковина средних размеров с угловатой периферией (большой диаметр 27,5 мм). Раковина умеренно расширяется к устью. Ранняя часть раковины крючковидно изогнута, но с более взрослой частью раковины не соприкасается. Раковина большего экземпляра имеет почти один оборот. Макушка острая. Устье угловатое, трапецевидное. Край устья тонкий, неравномерно волнистый. Линии роста четкие, тонкие.]

### Genus *Strophostylus* Hall, 1859

*Strophostylus*: Hall, 1859, 303; *Helictostylus*: Knight, 1934, 148; *Strophostylus*: Knight, 1936, 530; *Strophostylus*: Knight et al., 1960, 1242.

TYPE SPECIES: *Strophostylus andrewsi* Hall, 1859.

FIG. 8. *Platyceras (Orthonychia) egorovi* Mazaev, sp. nov., outcrops between "55 km" station and Gzhel station, Moscow Region, Rechitzian Provincial Stage, × 3.6: A — paratype No. 4471/8/129: left side view; B-E — paratype No. 4471/8/134: left, abapertural, right, and apertural side views; F — No. 4471/8/128: right side view; G — No. 4471/8/130: left side view; H-J — No. 4471/8/131: apertural, abapertural, and left side views; K-M — holotype No. 4471/8/137: right, apertural, and left side views.

РИС. 8. *Platyceras (Orthonychia) egorovi* Mazaev, sp. nov., Московская обл., обнажение между ст. Гжель и "55 км", Речицкий горизонт, × 3.6: А — паратип No. 4471/8/129: вид слева; В-Е — паратип No. 4471/8/134: вид слева, со стороны противоположной устью, справа и со стороны устья; F — No. 4471/8/128: вид справа; G — No. 4471/8/130: вид слева; H-J — No. 4471/8/131: вид со стороны устья, стороны, противоположной устью, и слева; K-M — голотип No. 4471/8/137: вид справа, со стороны устья и слева.

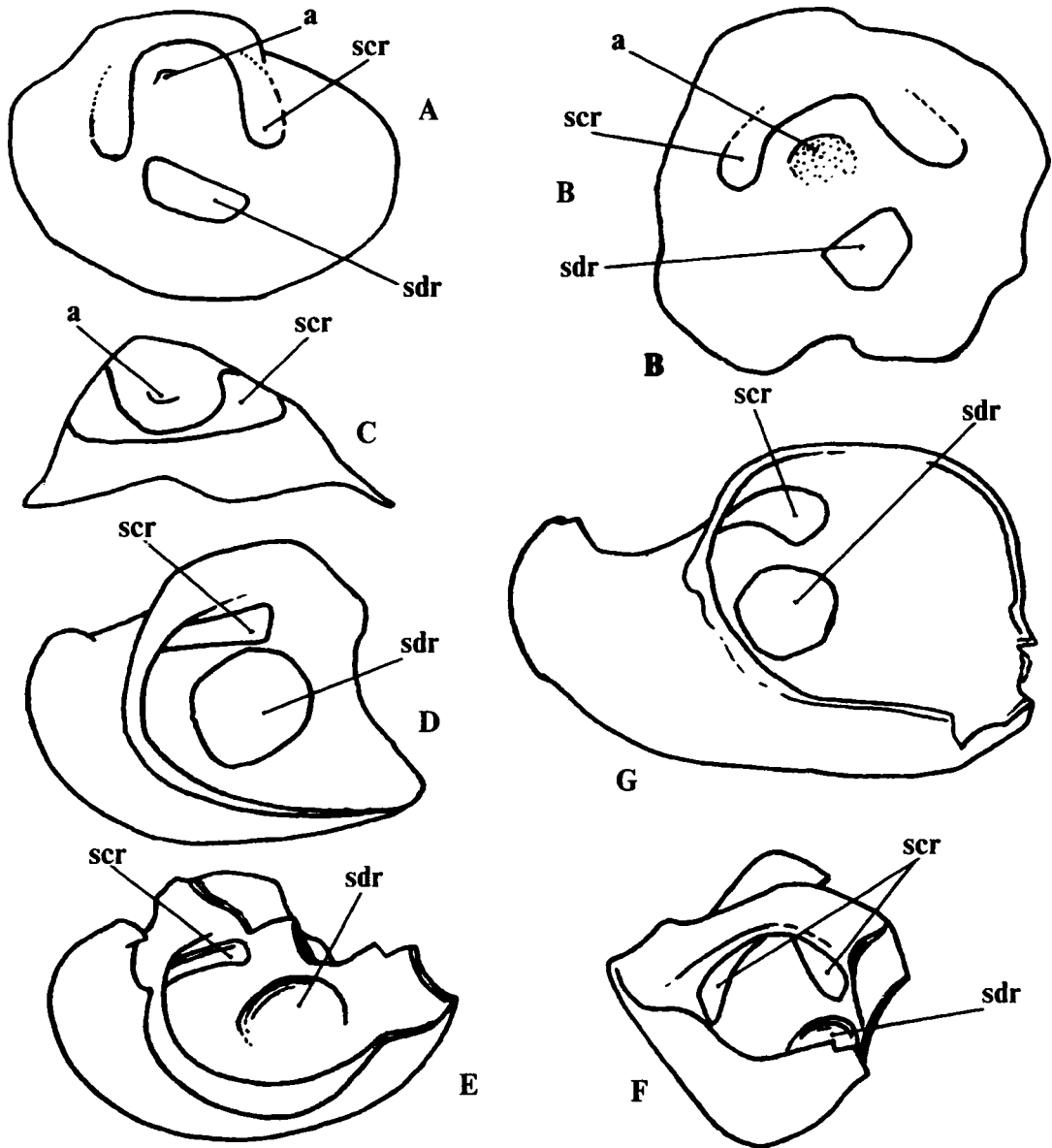


FIG. 9. The muscle scar patterns of *Platyceras*. **A, B** — *Platyceras* (?*Orthonychia*) sp.,  $\times 2.2$ : by Horny [1964, tab. 1 (7), figs 1, 3], with additions, No. NM-L 5913 (Geological-paleontological department of the National Museum of Prague), Barrandian Area, Central Bohemia, Lower Devonian, Koneprusy Limestone; **C** — *Platyceras* (*Platyceras*) *sciotoensis* (Hyde),  $\times 2$ : from Rollins and Brezinski [1988, fig. 8 E]  $\times 1$ , with additions, holotype No. 19876 (12650) (Ohio State University), Beyer member of the Logan formation (Mississippian) at Sciotoville, Ohio; **D-F** — *Platyceras* (*Platyceras*) *parasiticum* (Trautschold, 1867)  $\times 3$ : **D** — No. 4471/58/24, quarry Konev Bor, Moscow Region, Myachkovian Provincial Stage; **E, F** — No. 4471/54/8, from same locality; **G** — *Platyceras* (*Orthonychia*) *ivanovi* sp. nov., holotype No. 4471/34/14  $\times 3$ , quarry near Myachkovo village, Moscow Region, Myachkovian Provincial Stage. **a** — apex; **scr** — scar of columellar retractor; **sdr** — scar of dorsal retractor.

РИС. 9. Мускульные отпечатки *Platyceras*. **A, B** — *Platyceras* (?*Orthonychia*) sp.,  $\times 2.2$ : по Горному [1964, таб. 1 (7), figs 1, 3], с дополнениями, No. NM-L 5913 (геологический, палеонтологический отдел Пражского Национального Музея), Центральная Богемия, Баррандский р-он, нижний девон, известняк конепрузи; **C** — *Platyceras* (*Platyceras*) *sciotoensis* (Hyde),  $\times 2$ ; по Роллинсу и Брезинскому [1988, fig. 8 E], с дополнениями, голотип No. 19876 (12650) (Государственный Университет в Огайо), Сциотовилл, Огайо, пачка бейер, формации логан, миссисипий; **D-F** — *Platyceras* (*Platyceras*) *parasiticum* (Trautschold, 1867),  $\times 3$ : **D** — No. 4471/58/24, Московская область, карьер около ст. Конев Бор, мячковский горизонт; **E, F** — No. 4471/54/8, местонахождение то же; **G** — *Platyceras* (*Orthonychia*) *ivanovi* sp. nov., голотип No. 4471/34/14,  $\times 3$ , Московская область, карьер около д. Мячково, Мячковский горизонт. **a** — макушка; **scr** — отпечаток колюмеллярного ретрактора; **sdr** — отпечаток дорзального ретрактора.



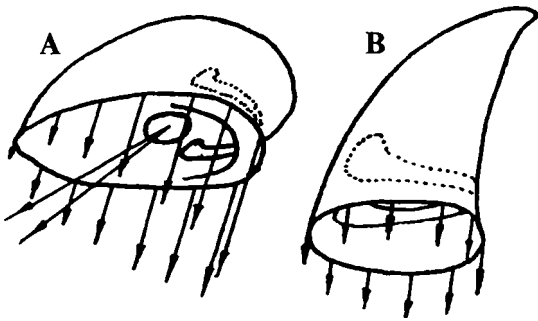


FIG. 10. The scheme of working effort distribution of the columellar retractor: A — *Platyceras* (also showing working effort distribution of the dorsal retractor), B — *Orthonychia*. (Explanation in the text).

РИС. 10. Схема распределения усилий, создаваемых коллюмельярным ретрактором: А — для *Platyceras* (показано также распределение усилий дорзального ретрактора), В — для *Orthonychia*. (Объяснение в тексте).

**DIAGNOSIS.** Smooth naticiform shell, aperture wide, with spiral columellar plate or slightly twisted columella.

### *Strophostylus sitnyensis*

#### *Mazaev, sp. nov.*

(Fig. 13 A-D)

**HOLOTYPE.** PM RAS, No. 4471/60/1.

**TYPE LOCALITY.** Outcrops on the bank of the Kaschirka River, near Staraya Sitnyensis Village (Near Stupino Town), Moscow Region; Lowest part of the Podolskian Provincial Stage, Moscowian Stage, Middle Carboniferous. Yellow dolomitic limestone bed. Coll. A.P. Ivanov, 1912.

**DIAGNOSIS.** Shell of moderate size (maximum diameter 17 mm) with about 2 moderately expanding whorls. Aperture large and oval in plane. Upper, basal, and anterior lips thin and smooth. Columella slightly twisted. Base anomphalous. Growth lines distinct and thin.

**DIMENSIONS OF HOLOTYPE** — Maximum diameter of shell 17 mm, height of shell 13 mm.

**COMPARISON.** Differs from *Strophostylus girtyi* (Knight, 1934) in having more moderately expanding whorls and oval aperture.

**MATERIAL EXAMINED.** The finely preserved holotype only.

**OCCURRENCE.** The type locality only.

**ETYMOLOGY.** Named after village Staraya Sitnya near which the holotype was found.

[ДИАГНОЗ. Гладкая натикообразная раковина средних размеров; (максимальный диаметр 17 мм) состоит примерно из двух умеренно расширяющихся оборотов. Устье широкое, овальное. Край устья тонкий и глад-

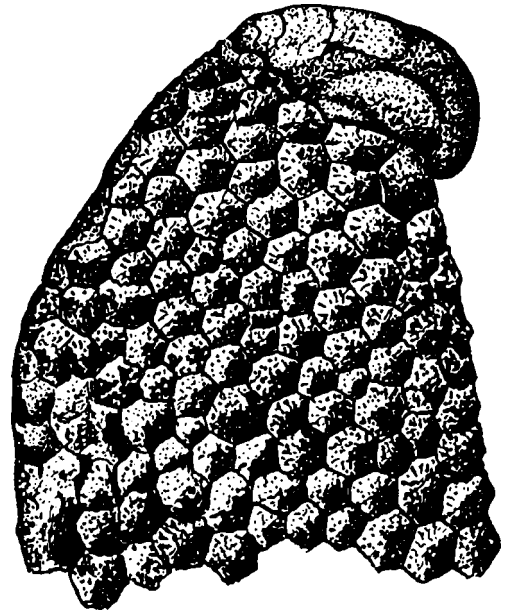


FIG. 11. *Platyceras (Platyceras) parasiticum* (Trautschold, 1867) over the anal sac of the *Synphocrinus cornutus*, Trautschold;  $\times 1$ : No. 137/14 (PM RAS, collected by A.P. Ivanov), from Yakowlew and Ivanov [1956, pl. 2, fig. 1b]; fragment; quarry near Myachkovo village, Moscow Region, Myachkovian Provincial Stage.

РИС. 11. *Platyceras (Platyceras) parasiticum* (Trautschold, 1867) на анальном мешке *Synphocrinus cornutus*, Trautschold;  $\times 1$ : No. 137/14 (ПМ РАН, сборы А.П. Иванова), по Яковлеву и Иванову [1956, таб. 2, фиг. 1b]; фрагмент; Московская обл., карьер около д. Мячково. Мячковский горизонт.

кий. Столбик с уплощенным спирально изогнутым краем. Пупок отсутствует. Линии нарастания тонкие, едва заметные.]

### *Strophostylus girtyi* (Knight, 1934)

(Fig. 13 E-H)

*Helictostylus girtyi*: Knight, 1934, 165, pl 25, figs. 2 a-f;  
*Helictostylus girtyi*: Newell, 1935, 353, pl. 34, figs. 1-5; *Strophostylus girtyi*: Knight, 1936, 530.

**TYPES.** University of Kansas, and Peabody Museum, Yale University.

**TYPE LOCALITY.** Olathe ("Stoner") limestone of the Stanton Formation, Missouri series (Moore). The cement plant at Fredonia, Kansas.

**DIAGNOSIS.** Shell of moderate size (maximum diameter 20 mm), with about 2 rapidly expanding whorls. Aperture very large and constitutes greater part of shell. Aperture more or less rounded in plane. Upper, basal, and anterior lips thin and smooth. Columella slightly twisted. Base anomphalous. Growth lines distinct and thin.

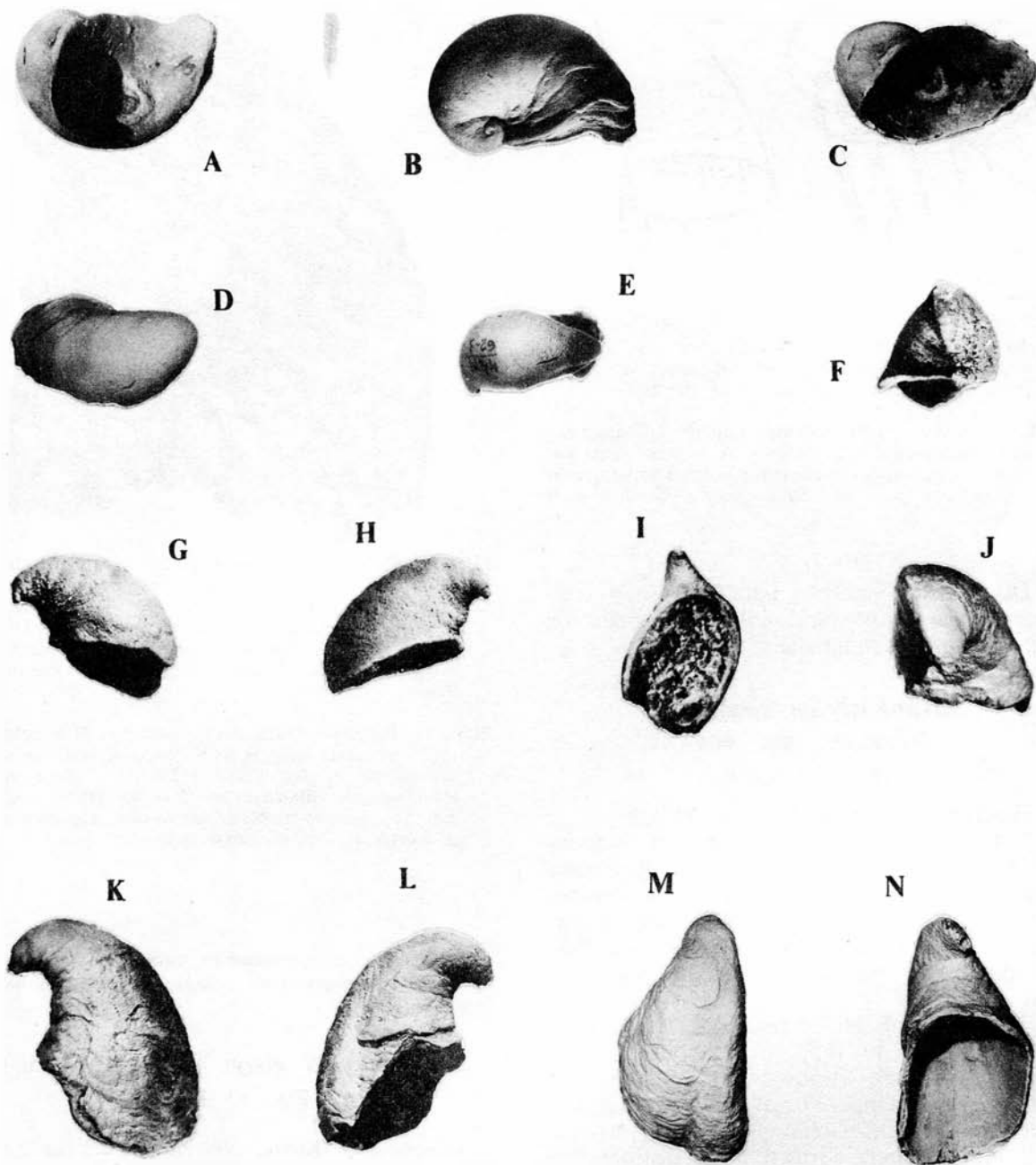


FIG. 12. A-E — *Platyceras (Platyceras) neverovoensis* Mazaev, sp. nov.,  $\times 1.5$ : holotype No. 4471/62/1: basal, apical, abapertural, and posterior side views; quarry near the Neverovo village, Moscow Region, Khamovnikian Provincial Stage; F-N — *Platyceras (Orthonychia) ivanovi* Mazaev, sp. nov., F-I — No. 4471/52/9,  $\times 6$ : posterior, right, left, and abapertural side views; quarry near Afanasievo village, Moscow Region, Krevyakinian Provincial Stage; J-N — holotype No. 4471/34/14,  $\times 1.5$ : posterior, left, right, abapertural, and apertural side views; quarry near Myachkovo village, Moscow Region, Myachkovian Provincial Stage.

РИС. 12. А-Е — *Platyceras (Platyceras) neverovoensis* Mazaev, sp. nov.,  $\times 1.5$ : голотип No. 4471/62/1: вид снизу, сверху, со стороны устья, стороны, противоположной устью, и сзади; Московская обл., карьер около д. Неверово, Хамовнический горизонт; F-N — *Platyceras (Orthonychia) ivanovi* Mazaev, sp. nov., F-I — No. 4471/52/9,  $\times 6$ : вид сзади, справа, слева и со стороны устья; Московская обл., Афанасьевский карьер, кривякинский горизонт; J-N — голотип No. 4471/34/14,  $\times 1.5$ : вид сзади, слева, справа, со стороны, противоположной устью, и со стороны устья; Московская обл., Мячковский карьер, мячковский горизонт.

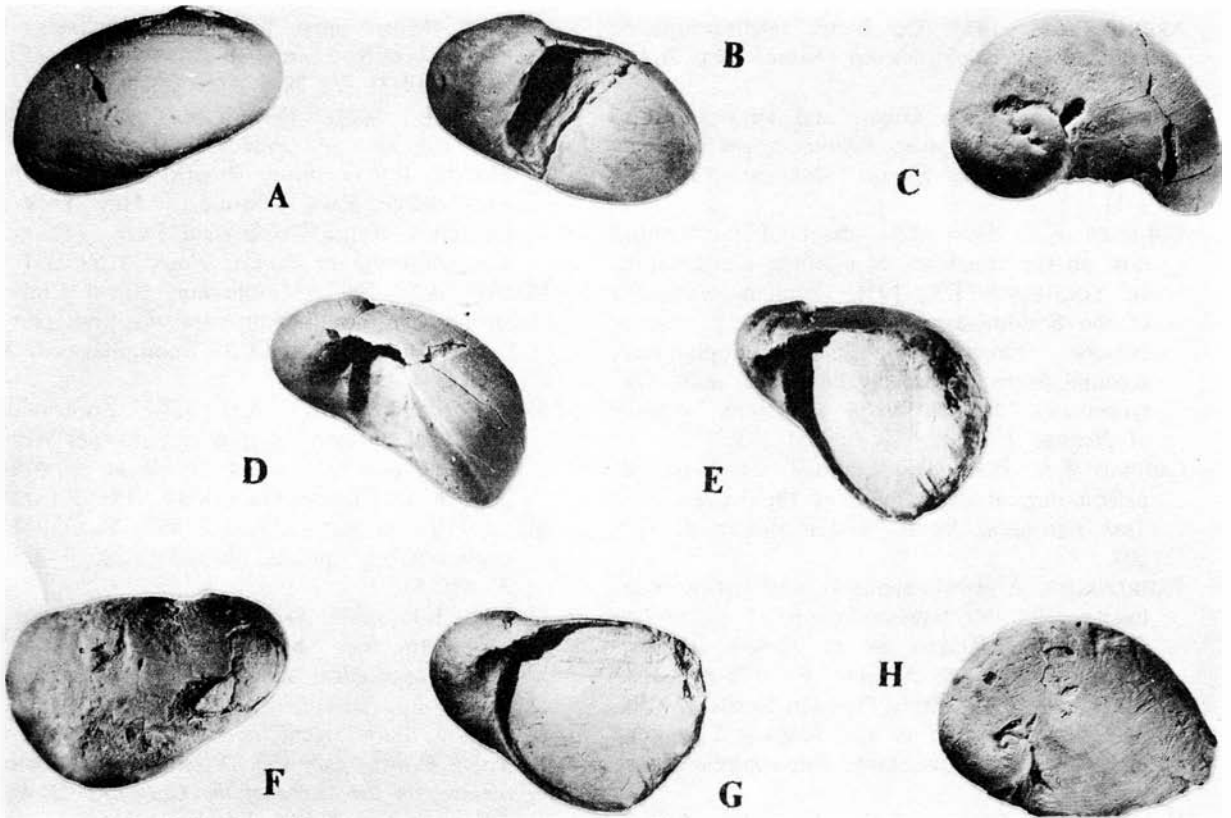


FIG. 13. A-D — *Strophostylus sitnyensis* Mazaev, sp. nov.,  $\times 2$ : holotype No. 4471/60/1: abapertural, apertural, apical, and oblique apertural side views; outcrops on the Kaschirka River, near Staraya Sitnya Village (near Stupino Town), Moscow Region; Lowest part of the Podolskian Provincial Stage; E-H — *Strophostylus girtyi* (Knight, 1934)  $\times 2$ : No. 4471/72/1: oblique apertural, abapertural, apertural, and apical side views; quarry near Kamennaya Tyagina village, Moscow Region; Krevyakinian Provincial Stage.

РИС. 13. A-D — *Strophostylus sitnyensis* Mazaev, sp. nov.,  $\times 2$ : голотип No. 4471/60/1: вид со стороны, обратной устью, со стороны устья, сверху и сбоку от устья; Московская обл., обнажение на р. Каширке, около д. Старая Ситня, Ступинский район; нижняя часть подольского горизонта; E-H — *Strophostylus girtyi* (Knight, 1934)  $\times 2$ : No. 4471/72/1: вид сбоку от устья, со стороны, противоположной устью, со стороны устья и сверху; Московская обл., карьер около д. Каменная Тяжина; кривякинский горизонт.

**DIMENSIONS** — Maximum diameter of shell 20 mm, height of shell 13 mm.

**COMPARISON.** Differs from *Strophostylus sitnyensis* sp. nov. in having more widely expanding whorls and rounded aperture.

**MATERIAL EXAMINED.** Single specimen of very good preservation from loc. 72.

**OCCURRENCE.** Kansas, U.S.A.; Stanton Formation, Missouri Series (Moore). Central part of the Russian Plate; Krevyakinian Provincial Stage, Kasimovian Stage, Upper Carboniferous.

[ДИАГНОЗ. Гладкая натикообразная раковина средних размеров состоит примерно из двух быстро расширяющихся оборотов (максимальный диаметр 20

мм). Устье очень широкое, округлое. Край устья тонкий и гладкий. Столбик с уплощенным спирально изогнутым краем. Пупок отсутствует. Линии нарастания тонкие, едва заметные.]

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## SUPPLEMENT

### REGISTER OF LOCALITIES

Abbreviations: AR — Arkhangelsk Region; MR — Moscow Region; RR — Ryzan' Region; TR — Tver' Region; VR — Vladimir Region.

1. MR, quarry near Kamennaya Tyagina village. 3 m below base of the "Turaevsky dolomite" marker bed. Myachkovian Provincial Stage. Coll. A.V. Mazaev, 1991-1992.
2. MR, quarry near Shelkovo town. 3.7 m above top of motley shale beds. Ameruvian Provincial Stage. Coll. A.V. Mazaev, 1982-1992.
3. MR, quarry near Rusavkino village. 0.5 m above top of motley shale beds. Rechitzian Provincial Stage. Coll. A.V. Mazaev, 1991.
4. MR, quarry near Shelkovo town. 4.5 m above top of motley shale beds. Ameruvian Provincial Stage. Coll. A.V. Mazaev, 1982-1992.
5. MR, quarry near Shelkovo town. 0.5 m above top of motley shale beds. Ameruvian Provincial Stage. Coll. A.V. Mazaev, 1991.
6. MR, quarry about 1.5 km to the north of Gzhel station. 2 m above top of motley shale beds. Ameruvian Provincial Stage. Coll. A.V. Mazaev, 1991.
7. MR, outcrops between "55 km" and Gzhel stations, 150 m south of the railway. White soft limestone bed with flint nodules. Rechitzian Provincial Stage. Coll. A.V. Mazaev, 1991.
8. MR, outcrops between "55 km" and Gzhel stations, 150 m south of the railway. 2 m above top of white soft limestone bed with flint nodules. Rechitzian Provincial Stage. Coll. R.V. Egorov, A.V. Mazaev 1985-1991.
9. MR, quarry near Afanasievo village. About 9.5 m below base of the "Turaevsky dolomite" marker bed. Myachkovian Provincial Stage. Coll. A.V. Mazaev, 1991.
10. VR, the first quarry near Melehovo-Fedotovo village. Highest limestone beds. Gzelian Stage. Coll. P.B. Kabanov, 1990.
11. VR, quarry near Georgievo village. 12 m below base of the motley shale beds. Rechitzian Provincial Stage. Coll. A.V. Mazaev, 1991.
12. VR, quarry near Georgievo village. 6.5 m below base of the motley shale beds. Rechitzian Provincial Stage. Coll. A.V. Mazaev, 1991.
13. VR, quarry near Georgievo village. Highest limestone beds. Rechitzian Provincial Stage. Coll. A.A. Shkolin, 1991.
14. MR, quarry near Konev Bor station. Lowest part of the layer No 11, white bioclastic packstone. Myachkovian Provincial Stage. Coll. A.V. Mazaev, 1982-1992.
15. VR, quarry near Dobryatino station. Lowest limestone bed layer 3. Rechitzian Provincial Stage. Coll. A.V. Mazaev, 1991.
16. VR, quarry near Dobryatino station. Lowest limestone bed layer 4. Rechitzian Provincial Stage. Coll. A.V. Mazaev, 1991.
17. VR, quarry near Dobryatino station. Fusuline limestone bed of lower part of section. Rechitzian Provincial Stage. Coll. A.V. Mazaev, 1991.
18. MR, quarry near Afanasievo village. About 5.5 m above top of the "Turaevsky dolomite" marker bed. Krevyakinian Provincial Stage. Coll. A.V. Mazaev, 1987-1991.
19. MR, outcrop near Shifernaya station, on the bank of the Medvedka River. Top of the section, white bioclastic mudstone bed. Khamovnikian Provincial Stage. Coll. A.V. Mazaev, 1991.
20. Moscow, Zamoscowrechy, research of metro. Krevyakinian Provincial Stage. Coll. A.V. Mazaev, 1982-1991.
21. MR, quarry near Konev Bor station. Layer No. 5, white bioclastic mudstone. Myachkovian Provincial Stage. Coll. A.V. Mazaev, A.E. Oleinik, 1982-1988.
22. MR, quarry near Podolsk town. Highest limestone beds. Myachkovian Provincial Stage. Coll. V.N. Sinelnikova, 1952-1959.
23. MR, quarry near Yamskoe village. Highest limestone beds. Myachkovian Provincial Stage. Coll. V.N. Sinelnikova, 1952-1959.
24. MR, quarry near Domodedovo town. About 7.5 m below base of the "Turaevsky dolomite" marker bed. Myachkovian Provincial Stage. Coll. A.V. Mazaev, 1982-1984.
25. MR, quarry near Myachkovo village. Myachkovian Provincial Stage. Coll. V.N. Sinelnikova, 1952-1959.
26. RR, quarry near Kasimov town. Krevyakinian Provincial Stage. Coll. N.V. Zernetskaya, 1977.
27. MR, quarry near Nikitskoe village. Myachkovian Provincial Stage. Coll. V.N. Sinelnikova, 1952-1959.
28. MR, quarry near Tuchkovo station. Myachkovian Provincial Stage. Coll. V.N. Sinelnikova, 1952-1959.
29. Moscow, Dorogomilovo, outcrops on the bank of the Moscow River. Kasimovian Stage. Coll. A.P. Ivanov, 1907.
30. MR, quarry near Kamennaya Tyagina village. 3

m above top of the "Turaevsky dolomite" marker bed. Krevyakinian Provincial Stage. Coll. P.B. Kabanov, 1991.

31. Moscow, Fili, bottom of Moscow River. Upper part of Middle or lower part of Upper Carboniferous. Coll. A.G. Kuznetsov, 1982.

32. MR, outcrops between 55 km and Gzhel stations, 150 m south of the railway. Highest limestone beds. Rechitzian Provincial Stage. Coll. by A.P. Ivanov, 1897-1918.

33. MR, outcrops on the bank of the Rozjayka River, near Sudakovo village. Myachkovian Provincial Stage. Coll. V.N. Sinelnikova, 1952-1959.

34. MR, quarry near Myachkovo village. Myachkovian Provincial Stage. Coll. A.P. Ivanov, 1896.

35. VR, outcrops near Egor'ovo village. Upper Carboniferous. Coll. T.A. Dobrolubova, 1937.

36. MR, outcrops near Noginsk town, Amerevian Provincial Stage. Coll. V.N. Sinelnikova, 1967.

37. MR, outcrops on the bank of the Kiyasma River near Amer'ovo village. Amerevian Provincial Stage. Coll. A.P. Ivanov, 1907.

38. MR, outcrops near Kashira town. Kashirian Provincial Stage. Coll. A.P. Ivanov, 1916.

39. Moscow, Zamoskworechye, research of metro. Kashirian Provincial Stage. Coll. A.V. Mazaev, 1982-1991.

40. MR, outcrops on the bank of the Moscow River near Lutzino village. Myachkovian Provincial Stage. Coll. A.P. Ivanov, 1907.

41. MR, quarry near Korobcheevo village on the Oka River. Top of the section, layer of the yellow coarse grainstone. Myachkovian Provincial Stage. Coll. V.N. Sinelnikova, 1952-1959.

42. MR, quarry near Schurovo station. Highest limestone beds. Podolskian Provincial Stage. Coll. A.V. Mazaev, A.E. Oleinik, 1983-1988.

43. MR, quarry near Polyany village (about 5 km south of Shurovo station). Podolskian Provincial Stage. Coll. A.V. Mazaev, 1983-1988.

44. MR, quarry near Pirochi village. 1,5 m above top of horizon of large flint corals. Podolskian Provincial Stage. Coll. A.V. Mazaev, 1983-1988.

45. MR, quarry near Shurovo station. Highest limestone beds. Podolskian Provincial Stage. Coll. A.P. Ivanov, 1907.

46. TR, outcrops near Ulitino village on bank of the Volga River. Myachkovian Provincial Stage. Coll. A.P. Ivanov, 1907.

47. MR, outcrops near Obratztovo village on the bank of the Lopasnya River. Kaschirian Provincial Stage. Coll. A.P. Ivanov, 1896.

48. MR, outcrops near Neverovo village. Khamovnikian Provincial Stage. Coll. P.A. Gerasimov, 1928.

49. MR, outcrops on the bank of the Moscow River near Kamennaya Tyagina village. Myachkovian Provincial Stage. Coll. P.A. Gerasimov, 1929.

50. MR, quarry near Domodedovo town. About 14 m below base of the "Turaevsky dolomite" marker bed, layer of the white coarse grainstone. Myachkovian Provincial Stage. Coll. A.V. Mazaev, 1982-1993.

51. MR, quarry near Pirochi village. 1 m below base of horizon of large flint corals. Podolskian Provincial Stage. Coll. A.V. Mazaev, 1983-1988.

52. MR, quarry near Afanasievo village. The packet of motley clay beds above "Turaevsky dolomite" marker

bed. Krevyakinian Provincial Stage. Coll. A.V. Mazaev, 1983-1990.

53. RR, quarry near Scherbatovo village. Upper part of Kasimovian Stage or lower part of Gzelian Stage. Coll. N.V. Zernetskaya, 1977.

54. MR, quarry near Konev Bor station. Top part of the layer No 11, white coarse grainstone. Myachkovian Provincial Stage. Coll. A.V. Mazaev, 1983-1993.

55. MR, quarry near Podolsk town. White limestone just below White or green marl limestone bed. Podolskian Provincial Stage. Coll. A.V. Mazaev, 1982-1984.

56. AR, Upper Carboniferous.

57. AR, left bank of Pinega River near Rojevo village. Myachkovian Provincial Stage. Coll. P.B. Kabanov, 1991.

58. MR, quarry near Konev Bor station. Layer No 12, motley shale beds. Myachkovian Provincial Stage. Coll. A.V. Mazaev, 1983-1993.

59. MR, quarry near Peski station. Motley shale beds. Myachkovian Provincial Stage. Coll. A.P. Ivanov, 1907.

60. MR, outcrops near Staraya Sitnya village, (near Stupino Town). Podolskian Provincial Stage. Coll. A.P. Ivanov, 1912.

61. MR, outcrops on Medvedka River near Schifernaya station. Motley shale beds. Khamovnikian Provincial Stage. Coll. A.P. Ivanov, 1915.

62. MR, quarry near Neverovo village. Khamovnikian Provincial Stage. Coll. A.P. Ivanov, 1915.

63. MR, quarry near Rusavkino village. About 2,5 m above top of motley shale beds. Rechitzian Provincial Stage. Coll. A.P. Ivanov, 1896-1918.

64. MR, outcrops on Medvedka River near Schifernaya station. Motley shale beds. Khamovnikian Provincial Stage. Coll. A.V. Mazaev, 1983.

65. MR, quarry near Domodedovo town. About 5,5 m below base of the "Turaevsky dolomite" marker bed. Myachkovian Provincial Stage. Coll. A.V. Mazaev, 1982-1984.

66. MR, quarry near Domodedovo town. 14 m below base of the "Turaevsky dolomite" marker bed, layer of the white coarse grainstone. Myachkovian Provincial Stage. Coll. V.N. Sinelnikova, 1958.

67. MR, quarry near Domodedovo town. 3 m above top of the "Turaevsky dolomite" marker bed, layer of the white bioclastic mudstone. Krevyakinian Provincial Stage. Coll. A.V. Mazaev, 1994.

68. MR, quarry near Afanasievo village. About 8 m below base of the "Turaevsky dolomite" marker bed. Myachkovian Provincial Stage. Coll. A.V. Mazaev, 1987-1991.

69. Moscow, outcrops near Belokamennaya station. Motley clay beds. Krevyakinian Provincial Stage. Coll. A.V. Mazaev, 1983.

70. MR, quarry near Korobcheevo village on the Oka River. Top of the section, yellow coarse grainstone. Myachkovian Provincial Stage. Coll. A.V. Mazaev, 1994.

71. MR, outcrops on the left bank of Moscow River at 1 km down of Rusa River issue. Lower part of upper *Ivanovia* biostrom. Ulitino member of Podolskian Provincial Stage. Coll. P.B. Kabanov, 1993.

72. MR, quarry near Kamennaya Tyagina village. Packetstone bed just above the "Turaevsky dolomite" marker bed. Krevyakinian Provincial Stage. Coll. A.S. Zubarev, 1993.