Does *Gyraulus rossmaessleri* (Gastropoda: Planorbidae) inhabit Siberia?

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Abstract. The paper deals with new findings of the species *Gyraulus* (*Lamorbis*) *rossmaessleri* (Auerswald in A. Schmidt, 1852) in waterbodies of Siberia. It was commonly accepted earlier that this species has an entirely European distribution, however, the newly obtained data show that the range of the species covers almost all the territory of Siberia as well. The taxonomic position of two related species: *Planorbis planoconcavus* Westerlund, 1897, described from the Altay Region, and *Anisus starobogatovi* Frolova, 1984 from the Northern Kazakhstan is discussed. A new synonymy is established: *Planorbis rossmaessleri* Auerswald in Schmidt = *Planorbis planoconcavus* Westerlund, syn. n. The assumption that *Anisus starobogatovi* is a junior synonym of *P. rossmaessleri* is offered, though because of the absence of the type series of the former species, it is not possible to establish such a synonymy definitely.

Kurzfassung. Kommt *Gyraulus rossmaessleri* (Gastropoda: Planorbidae) in Sibirien vor? – Die Arbeit befasst sich mit Neunachweisen von *Gyraulus* (*Lamorbis*) *rossmaessleri* (Auerswald in A. Schmidt, 1852) aus Gewässern Sibiriens. Es war bisher allgemein anerkannt, dass diese Art ausschließlich eine europäische Verbreitung besitzt. Neue Daten haben uns allerdings gezeigt, dass das Verbreitungsgebiet ebenso Sibirien umfasst. Der taxonomische Status zweier nahestehender Arten: *Planorbis planoconcavus* Westerlund, 1897, beschrieben aus der Altay Region und *Anisus starobogatovi* Frolova, 1984 aus dem Norden Kasachstans, wird diskutiert. Eine neue Synonymie wird vorgestellt: *Planorbis rossmaessleri* Auerswald in Schmidt = *Planorbis planoconcavus* Westerlund, syn. n. Es wird die Annahme vertreten, dass *Anisus starobogatovi* ein jüngeres Synonym von *P. rossmaessleri* ist, obwohl die Typusserie der erstgenannten Art nicht auffindbar und es eigentlich nicht möglich ist, dieses Synonym eindeutig zu etablieren.

Резюме. Обитает ли *Gyraulus rossmaessleri* (Gastropoda: Planorbidae) в Сибири? – В работе обсуждаются новые и известные из литературных источников данные о находках вида *Gyraulus* (*Lamorbis*) *rossmaessleri* (Auerswald in A. Schmidt, 1852) в водоемах Сибири. Традиционно считается, что ареал этого вида целиком европейский, однако вновь полученные данные показывают, что он распространен также почти по всей территории Сибири. Обсуждается таксономическое положение двух близких видов *Planorbis planoconcavus* Westerlund, 1897, описанного из водоемов Алтая, и *Anisus starobogatovi* Frolova, 1984 из Северного Казахстана. Предлагается новая синонимия: *Planorbis rossmaessleri* Auerswald in Schmidt = *Planorbis planoconcavus* Westerlund, syn. n. Высказано предположение, что *Anisus starobogatovi* также является младшим синонимом *Planorbis rossmaessleri*, с достоверностью утверждать это невозможно, так как типовая серия *A. starobogatovi* недоступна, и место хранения её неизвестно.

Key words. Planorbidae, *Gyraulus rossmaessleri*, geographic distribution, Siberia.

Introduction

The generic position of a snail species, described originally as *Planorbis rossmaessleri* Auerswald (in A. Schmidt, 1852), is still disputable. Western European malacologists unanimously place this species into the genus *Gyraulus* Agassiz in Charpentier, 1837 (Piechocki 1979; Meier-Brook 1964, 1983; Glöer 2002), whereas their Russian and Ukrainian colleagues consider it to be a member of the genus *Choanomphalus* Gerstfeldt, 1859, most representatives of which inhabit the Baikal Lake (Starobogatov 1967; Stadnichenko 1990; Starobogatov et al., 2004). Initially, Starobogatov (1967) placed *Ch. rossmaessleri* into the subgenus *Lamorbis* Starobogatov, 1967, but recently Prozorova & Starobogatov (1997) have established a separate subgenus *Pseudogyraulus* of the genus *Choanomphalus* with *Ch. rossmaessleri* as

the type species. Another two species, namely *Ch. planoconcavus* (Westerlund, 1897) and *Ch. ochoticus* Prozorova et Starobogatov, 1997, were included there as well (PROZOROVA & STAROBOGATOV 1997, 1999; STAROBOGATOV et al. 2004; KANTOR & SYSOEV 2005).

The bounds of geographic distribution of *Gyraulus rossmaessleri* are still unclear as well. In all recent taxonomic reviews and catalogues, both Western European and Russian, the species is considered as having an entirely European distribution (STAROBOGATOV 1977; PIECHOCKI 1979; MEIER-BROOK 1983; STADNICHENKO 1990; STAROBOGATOV et al. 2004; KANTOR & SYSOEV 2005; in GLÖER 2002 the range of the species is erroneously designated as 'holarktisch'; P. Glöer, pers. comm.). According to MEIER-BROOK data (MEIER-BROOK 1983), *Gyraulus rossmaessleri* inhabits the Central and Eastern parts of Europe southward up to the northern shore of the Black Sea.

On the other hand, this species has repeatedly been recorded in waterbodies situated outside Europe, namely in the Western and Eastern parts of Siberia. First, VNUKOVSKY (1929) found it in water reservoirs of the southern part of the Western-Siberian plain, and, subsequently, BELYAKOVA & KRIVOSHEINA (1971) have recorded *G. rossmaessleri*[1] in the Altay Region. Later, the species was found in the Yenisei River basin by CHEREMNOV (1972) and GUNDRIZER (1983, 1984). The latter author collected it north of the Arctic Circle in the waterbodies of tundra zone along with such European species as *Lymnaea glutinosa, L. tumida, Planorbarius corneus* and others (GUNDRIZER 1983). ZATRAVKIN (1980) included *G. rossmaessleri* into his checklist of Mollusca inhabiting waterbodies of the Ilmeny Reserve (Southern Urals). At last, shells of this species were found in the Holocene sediments of the Altay Mountains (POPOVA et al. 1994).

All these findings and recordings led us to suspect that the geographic range of *G. rossmaessleri* is much wider in reality than it is commonly recognized. Unfortunately, none of those papers where *G. rossmaessleri* is recorded from Siberia contains descriptions or pictures of the shells. Moreover, B.G. Johansen, who re-examined in 1937 the Vnukovsky's collection in the Zoological Museum of the Tomsk University, has ascertained that shells determined by the latter as "*Planorbis rossmaessleri*" belong, in fact, to a quite another species and even to a quite different subclassis. It was found these were representatives of *Valvata sibirica* Middendorff (cited in MIROSCHNICHENKO 1954).

Therefore an extensive search in malacological collections of Russian scientific institutions where samples of *G. rossmaessleri* from Siberia could be housed has been carried out. It was the only way to verify or refute our suspicion. As a result, we found several new sites in Urals and Siberia where *G. rossmaessleri* occurs, and these findings allow us to contend definitely that the geographic range of the species is much broader than it is considered usually (MEIER-BROOK 1983; STADNICHENKO 1990; STAROBOGATOV et al. 2004).

Material and methods

1. Museum collections examined. While searching in museum collections, our aim was twofold: 1) to find the original samples of authors, who recorded *G. rossmaessleri* from Siberia earlier (see above); and, 2) to check, whether there are another samples of *G. rossmaessleri* from Siberian waterbodies not mentioned up to now. Thus, malacological collections of the Zoological Institute of RAS in Sankt-Petersburg (ZIN, hereafter), Zoological Museum of the Institute of Plant and Animal Ecology RAS in Yekaterinburg (IPAE), Zoological Museum of the Tomsk University, and Museum of Siberian Water Molluscs of the Omsk State Pedagogical University (MSWM) were examined. These collections contain a large number of specimens of Siberian molluscs, which have been accumulated since 1840s, when A.Th. von Middendorff

[1] Since the time that STAROBOGATOV (1967) offered to place the species under consideration into the genus *Choanomphalus*, all Russian authors, including those quoted hereafter, have followed to this proposition, designating it as *Choanomphalus rossmaessleri* in their faunistic surveys and checklists.

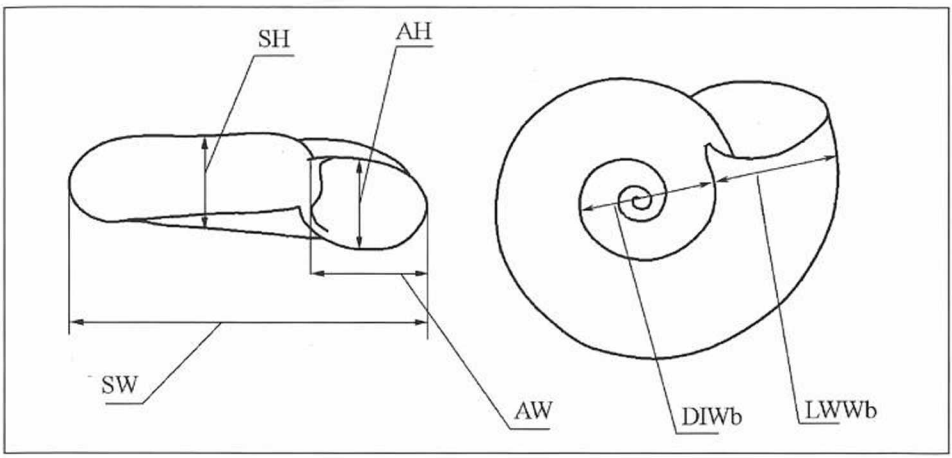

Fig. 1. The scheme of discoidal shell measurement. SH – shell height, SW – shell width, AH – aperture height, AW – aperture width, DIW_b – diameter of inner whorls from the basal surface, LWW_b – last whorl tube width from the basal surface.

made his research trip to Siberia (see MIDDENDORFF 1851). Older collections, for example that of Gebler, who published the first faunistic paper on Siberian freshwater snails (GEBLER 1829), are apparently lost.

Thus, we had an opportunity to examine a great number of planorbids from Siberia and adjacent territories collected during more than 150-year period of research. In total, about 17500 specimens of planorbid snails, both dried shells and fixed animals, were examined. As a result, only 32 empty shells of *G. rossmaessleri* from different sites of Siberia have been discovered. Our special search for alive specimens of this extremely rare in Siberia species in the waterbodies of the southern part of the Western Siberian plain (1999–2005) was unsuccessful. Additionally, five specimens of *G. rossmaessleri* were obtained from P. Glöer's collection (Danube River basin, Pleinting, Bavaria) for the purpose of comparison with Siberian representatives of the species.

Besides, two samples (including the type series) of *Planorbis planoconcavus* Westerlund, 1897 containing 16 empty shells in total, from the collection of ZIN were examined. This species is regarded as closely related to *G. rossmaessleri* (PROZOROVA & STAROBOGATOV 1997, 1999).

2. Species diagnostics and measurements. Since we have no fixed specimens of the species from Siberia, taxonomic diagnostics was carried out by using of conchological features only. Such morphologic traits as whitish columellar lip, rounded whorls without keel or angle, wide and deep funnel-like umbilicus, and regular axial (not spiral as in *G. albus*!) sculpture (striae or riblets) are very characteristic for *G. rossmaessleri* and enable to distinguish it from the allied species. These conchological features are clearly defined in our specimens from Siberia and correspond well to the original diagnosis of this species (SCHMIDT, 1852) as well as to the most recent descriptions (MEIER-BROOK 1983; STADNICHENKO 1990; PROZOROVA & STAROBOGATOV 1997; GLÖER 2002; STAROBOGATOV et al. 2004). We realize that such a way of species identification has some disadvantages because of certain shell variability peculiar to *Gyraulus* species and it should be supported by the anatomical investigation at least, however, those species of *Gyraulus*, which are most similar to *G. rossmaessleri* and may be confused with the latter (especially *G. laevis* and *G. parvus*), are not known in Siberia (MEIER-BROOK 1983; GLÖER 2002; STAROBOGATOV et al. 2004). Moreover, the conchological method is the only mode of investigation of oldest malacological collections that provide us invaluable information on species composition and distribution of freshwater molluscs in the past.

In all, 47 shells of *G. rossmaessleri* and *P. planoconcavus* were measured using a binocular microscope with calibrated eyepiece, and six linear measurements were made from each shell (Fig. 1). The whorl counting was carried out according to the common scheme (MEIER-BROOK 1983; STAROBOGATOV et al. 2004) with precision to 1/8. In addition to linear measurements, two morphometric indices, which are considered to have diagnostic importance for distinguishing between these species (PROZOROVA & STAROBOGATOV 1999; STAROBOGATOV et al. 2004) were calculated. These are the ratio of aperture height and aperture width (AH/AW), and the 'index of inner whorls' (IIW) established by PROZOROVA & STAROBOGATOV (1996). The latter is defined as ratio between diameter of inner whorls and width of the tube of the last whorl (see Fig. 1, and PROZOROVA & STAROBOGATOV 1996 for details). IIW can be measured from either apical or basal surfaces of shell. Here we used the second variant (IIW_{BAS}) only.

Results and discussion

It was ascertained, those collections on the base of which previous recordings of *G. rossmaessleri* in Siberia were made, are inaccessible for re-examination now. Several years ago we attempted to discover the V. Gundrizer's collection in the Biological & Biophysical Institute of the Tomsk State University, where he worked in 1980s, and we have found that it is lost. In the remains of Zatravkin's collections from the Ilmeny Reserve that are housed in the ZIN collection specimens of *G. rossmaessleri* have not been found. The actual position of Vnukovsky, Krivosheina and Cheremnov collections is unknown. Therefore we can neither confirm nor disprove findings of *G. rossmaessleri* in Siberia known from the literature sources. Therefore the results of this study is mainly based on several new findings of *G. rossmaessleri* in museum collections.

The comparison between specimens of *Gyraulus rossmaessleri* from Siberia and Europe (Danube River basin, Germany) has revealed that these shells possess identical traits and can be regarded as conspecific (Fig. 2). In Siberia, the species was found in the southern and western parts of the Irtysh River basin, in the Yamal Peninsula (the Lower Ob' River basin), and in the Upper Lena River basin (Table 1). Probably, it occurs throughout the Yenisei drainage basin as well (CHEREMNOV 1972; GUNDRIZER 1983, 1984), though we could not see any specimen of *G. rossmaessleri* from this region.

Thus, *G. rossmaessleri* is rather widely distributed in Siberia (Fig. 3), and its overall geographic range covers a large extent of Northern Palearctic, from Central Europe in the west to Eastern Siberia in the east (see Table 1). The finding of two empty shells of the species in the transpolar zone of Western Siberia (Yamal peninsula) is the most striking. Though we cannot verify this fact by dissection, it agrees well with data of GUNDRIZER (1983), who has found this species in the transpolar zone of Middle Siberia. Though, *G. rossmaessleri* is extremely rare in Siberia, and occurs sporadically. Almost all of the findings of *G. rossmaessleri* in Siberia, known to date, were made in temporary waterbodies, and it conforms to opinion of MEIER-BROOK (1983), BERIOZKINA & STAROBOGATOV (1988), and BERAN (2005), who believe that the species is strictly confined to habitats of this kind.

PROZOROVA & STAROBOGATOV (1997, 1999) suppose that there is another species closely related to *G. rossmaessleri* in Siberia, namely *Choanomphalus planoconcavus* (Westerlund, 1897), described from the vicinity of Semipalatinsk City in the Upper Irtysh River basin. Besides the type series, only one sample of this species is housed in the malacological collection of ZIN. It was gathered in the Aley River near Rubtzovsk City (see Table 1), and this site is situated close to the type locality of *Planorbis planoconcavus*.

The anatomical structure of *Ch. planoconcavus* is unknown (PROZOROVA, STAROBOGATOV 1997), but the species is very similar to *G. rossmaessleri* by its shell features. According to STAROBOGATOV et al. (2004), all differences between these taxa lie in the values of two morphometric indices. 1) IIW_{BAS} in *G. rossmaessleri* exceeds 1.10, whereas in *Ch. planoconcavus* it is less than 0.95; 2) aperture height in *G. rossmaessleri* is 'almost equal' to aperture width, but in *Ch. planoconcavus* aperture width exceeds aperture height (STAROBOGATOV et al. 2004).

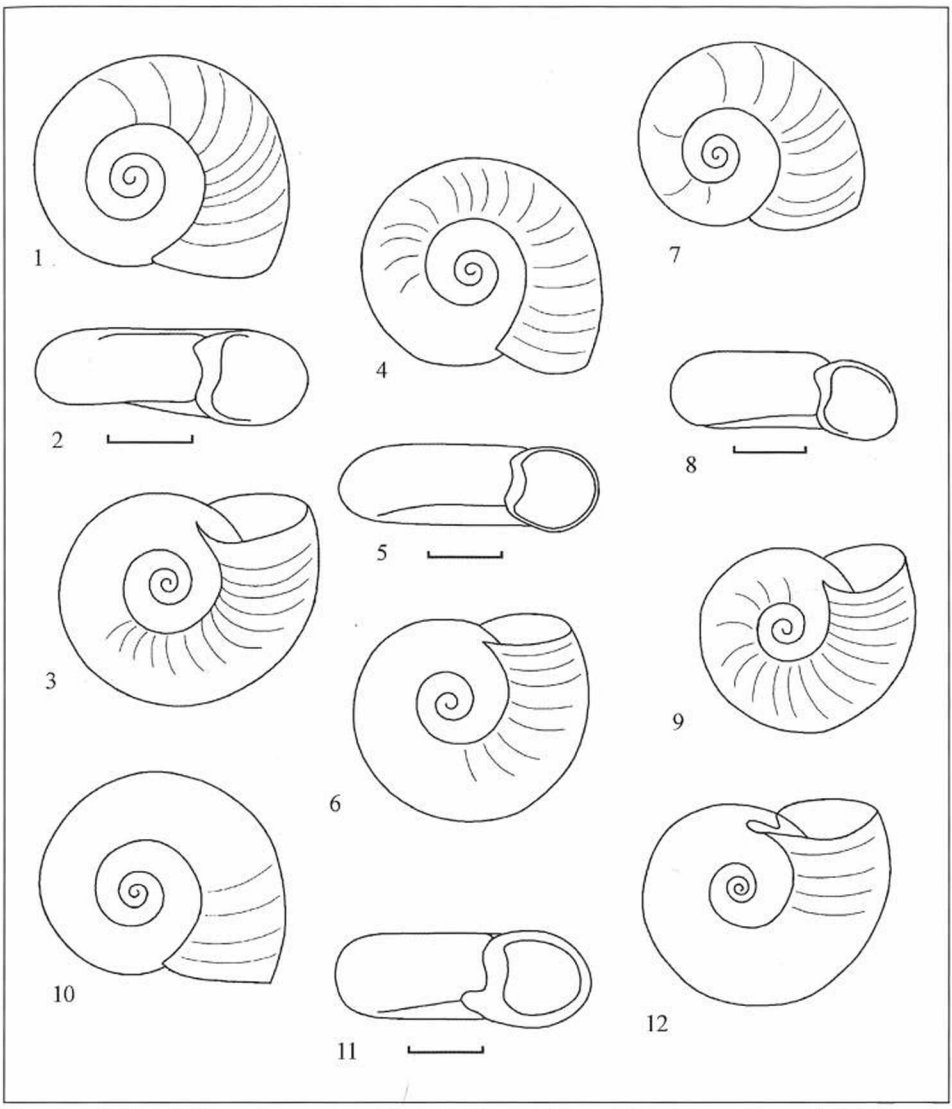

Fig. 2. Shells of *Gyraulus rossmaessleri* (1–9) and *Planorbis planoconcavus* (10–12). 1–3. A temporary waterbody on the right side of the Danube river, near Pleinting, Bavaria; 4–6. A temporary wetland in the floodplain of the Irtysh River near Bogdanovka village; 7–9. A wetland in the floodplain of the Lena River near Kirensk City; 10–12. Vicinity of Semipalatinsk City, Upper Irtysh River basin (№ 1 from the type series of *Planorbis planoconcavus,* obviously young specimen). Scale bar 1 mm.

Unfortunately, the original description of *Planorbis planoconcavus* by WESTERLUND (1897) does not contain differential diagnosis and is based on a small sample of empty shells. The author has not designated the holotype of the species.

Having investigated the conchological variation of *G. rossmaessleri* from the waterbodies of Siberia (Fig. 4), we revealed that the index of inner whorls is subject to considerable changes during ontogeny, and it correlates significantly with the number of shell whorls (Fig. 5).

Tab. 1. Samples of planorbid species used in the study.

Sampling locality, place of keeping and museum number	n	Date of sampling, collector name	Latitude	Longitude
Gyraulus rossmaessleri				
1. Germany, Danube River basin, Pleinting, a temporary wetland in the floodplain on the right side of the Danube River. MSWM № 14-011.	5	14.09.2005. G. Falkner & M. Colling	48°39′ N	13°06′ E
2. Russia, Chelyabinsk Region, the Ilmeny Reserve, an unnamed wetland in the 234 square. IPAE № 5052	3	06.08.2001. N.G. Erokhin	55°00′ N	60°12′ E
3. Kazakhstan, Northern Kazakhstan Region, Zhaksy-Zhangistau Lake. MSWM № 14-006	1	16.08.1986. S.I. Andreeva & N.I. Andreev	52°38′ N	68°12′ E
4. Russia, Tyumen Region, Yamal Peninsula, the western shore of the Syavta-To Lake. MSWM № 14-013	2	09.09.1971. V.N. Dolgin	69°18′ N	70°32′ E
5. Russia, Omsk Region, an unnamed wetland in the floodplain of the Irtysh River near Atak village. MSWM № 14-005	5	24.06.1998. N.I. Andreev & E.A. Lazutkina.	56°49′ N	74°38′ E
6. Russia, Omsk Region, brook in vicinity of Atak village. MSWM № 14-008	2	15.05.2004. A.V. Karimov.	56°49′ N	74°38′ E
7. Russia, Omsk Region, the floodplain of the Irtysh River near Bogdanovka village. MSWM № 14-007	1	12.08.2001. M.V. Vinarski & A.V. Karimov	54°06′ N	74° 47′ E
8. Russia, Irkutsk Region, a wetland in the floodplain of the Lena River near Kirensk City. MSWM № 14-004	19	17.07.2003. M.V. Vinarski.	57°45′ N	108°10′ E
Choanomphalus planoconcavus				
9. Kazakhstan, Semipalatinsk City. ZIN № 1 in the systematic catalogue. The type series.	3	1887. Suworzev	50°22′ N	80°15′ E
10. Russia, Altay Region, Aley River near Rubtzovsk City. ZIN № 2	13	18.07.1923. Obolensky.	51°30′ N	81°14′ E

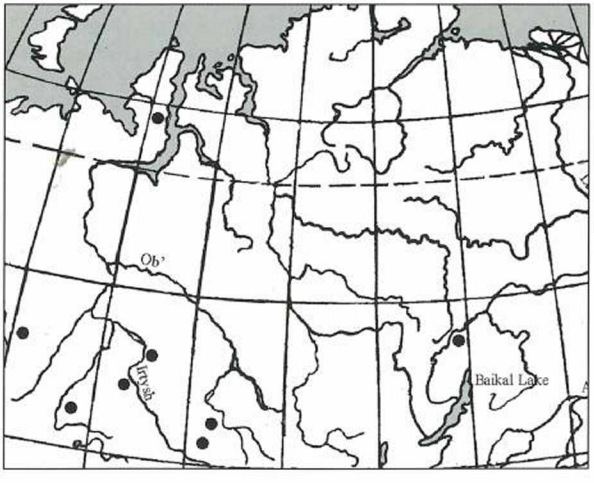

Fig. 3. New findings of *Gyraulus rossmaessleri* in Urals and Siberia.

It restricts noticeably the extent of using of the index for distinguishing between the species. Indeed, among 'pure' *G. rossmaessleri* all 'young' shells (i.e. shells with a small whorl number) and even some out of adult individuals have the values of IIW_{BAS} lesser than 1.10, and sometimes lesser than 0.95, hence these can be determined formally as *Ch. planoconcavus* or as intermediate forms between two species. One can discover all three forms (i.e. 'pure' *rossmaessleri*, 'pure' *planoconcavus*, and transient forms between these) within a single sample without clear morphological boundaries that would separate them. Among *G. rossmaessleri* from the Danube River basin examined by us, three of five specimens can be regarded nominally as intermediates between *Ch. planoconcavus* and *G. rossmaessleri* since these exhibit the values of IIW_{BAS} between 0.95 and 1.10 (see Fig. 5), and only two correspond quantitatively to *Ch. rossmaessleri* sensu STAROBOGATOV et al. (2004).

Another diagnostic index, namely AH/AW, seems to be unreliable in this case as well. This index varies considerably in samples of *G. rossmaessleri* from different sites in Siberia and Europe, and does not correlate with whorl number (Fig. 5), i.e. is not dependent on age.

Thus, following the diagnostic key of STAROBOGATOV et al. (2004), one can discover shells that correspond formally to *Ch. planoconcavus* far outside the Altay Region where the species was known to date. Hence, the ranges of *Ch. planoconcavus* and *G. rossmaessleri* are not separated spatially as STAROBOGATOV et al. (2004) believe, and these forms can coexist in a single habitat, though it seems impossible to distinguish their from each other in an unambiguous way. In our opinion, it is a clear evidence of their conspecificity.

The examination of the type series of *Planorbis planoconcavus* (see Fig. 2, 10–12) and of the sample of this species from the Aley River has confirmed this hypothesis. Among these shells we could find both 'pure' *Ch. planoconcavus* and 'pure' *G. rossmaessleri*, and some shells were determined as 'intermediate forms' according to the values of diagnostic indices (Table 2).

Since except of two morphometric indices that were offered by PROZOROVA & STAROBOGATOV (1997) there are no other features enabling to separate these species from each other, we are inclined to acclaim that *Planorbis planoconcavus* Westerlund, 1897 is the junior objective synonym of *Planorbis rossmaessleri* Auerswald in Schmidt, 1852, **syn.n.**

In addition, we can suppose that there is one more junior synonym of *Planorbis rossmaessleri* in the malacofauna of Siberia. This is the enigmatic species *Anisus starobogatovi* Frolova, 1984, described from Northern Kazakhstan with the type locality 'the floodplain of the Ishim River in 18 kilometers from Petropavlovsk' (FROLOVA 1984). The original description of the species is rather brief and contains neither designation of the holotype nor information on where the type materials of *A. starobogatovi* were housed. To the best of our knowledge, these materials were not placed in the Zoological Institute or in another scientific institution where Soviet malacologists usually placed the type series of newly described species. Moreover, FROLOVA (1984) has not supplied the description with a differential diagnosis, and the original picture of *A. starobogatovi* shell (Fig. 6) is so poor with taxonomically significant details that it is hard to judge definitely on systematic position of this species. However, these disadvantages do not permit us to reject the taxonomic name *Anisus starobogatovi* as a nomen nudum (see article 13 of ICZN, 1999).

Fortunately, much more information concerning this species one can discover in the FROLOVA's unpublished PhD Thesis (FROLOVA 1973). The description of *A. starobogatovi* given in this manuscript is more detailed, and the photo of shell is given instead of drawing there. In conchological description, the author notes the presence of funnel-like umbilicus and fine radial striae on the shell of A. starobogatovi. On the ground of these data we would claim that '*Anisus starobogatovi*' Frolova is nothing but *Choanomphalus rossmaessleri* that has been taken by the author for a distinct species and described as a new taxon. The indirect evidence of it is the fact that FROLOVA (1984) has not included *Ch. rossmaessleri* in her checklist of Northern Kazakhstan freshwater molluscs. Moreover, since 1984 *A. starobogatovi* has never been recorded from Northern Kazakhstan, even by those authors who dealt specially with planorbid snails (KARIMOV 2005).

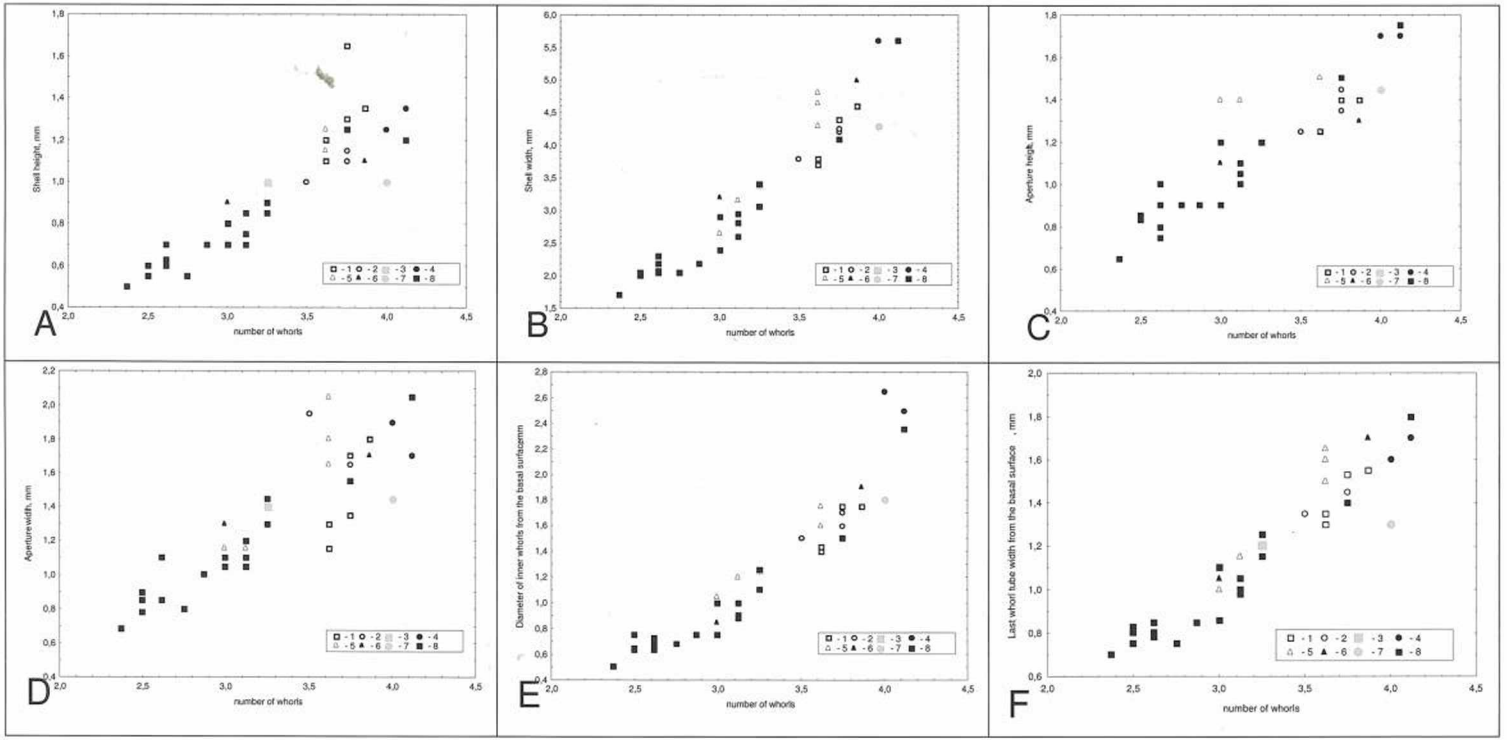

Fig. 4. Relationships between whorl number and shell measurements of *G. rossmaessleri*: shell height (A), shell width (B), aperture height (C), aperture width (D), diameter of inner whorls from the basal surface (E), and last whorl tube width from the basal surface (F). Numbers on legend correspond to numbers of sampling localities in Table 1.

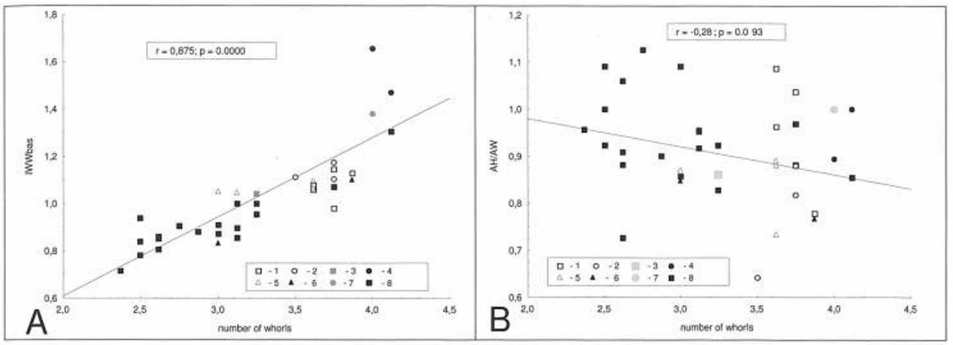

Fig. 5. Relationships between whorl number and values of morphometric indices used for the distinguishing between *Gyraulus rossmaessleri* and *Choanomphalus planoconcavus*: index of inner whorls from the basal surface (A) and the AH/AW ratio (B). Numbers on legend correspond to numbers of sampling localities in Table 1.

Tab. 2. Values of AH/AW index in *Planorbis planoconcavus* shells.

Whorl number	AH, mm	AW, mm	AH/AW	Formal identification*
The type series (vicinity of Semipalatinsk)				
3.50	1.6	1.8	0.89	*planoconcavus*
3.50	1.5	1.3	1.15	*rossmaessleri*
3.75	1.5	1.3	1.15	*rossmaessleri*
Aley River (near Rubtzovsk)				
3.25	1.0	1.1	0.91	*planoconcavus*
3.37	1.2	1.3	0.92	*planoconcavus*
3.37	1.1	1.1	1.00	*rossmaessleri*
3.50	1.4	1.5	0.93	*planoconcavus*
3.50	1.4	1.4	1.00	*rossmaessleri*
3.62	1.4	1.6	0.88	*planoconcavus*
3.62	1.5	1.6	0.94	*planoconcavus*
3.87	1.7	1.9	0.90	*planoconcavus*

*following to recent key (STAROBOGATOV et al. 2004).

To acclaim this synonymy decidedly we need to discover the type material of *A. starobogatovi*. The other aim for the further study is the investigation of *Choanomphalus ochoticus* Prozorova et Starobogatov, 1997 which is thought to be a closely related to *G. rossmaessleri* species (PROZOROVA & STAROBOGATOV 1997, 1999). To date it is known from the type locality only (STAROBOGATOV et al., 2004). For the present, we established that the species *Gyraulus rossmaessleri* is not an endemic of Europe and that its range also covers Northern Asia westward of the Lena drainage basin.

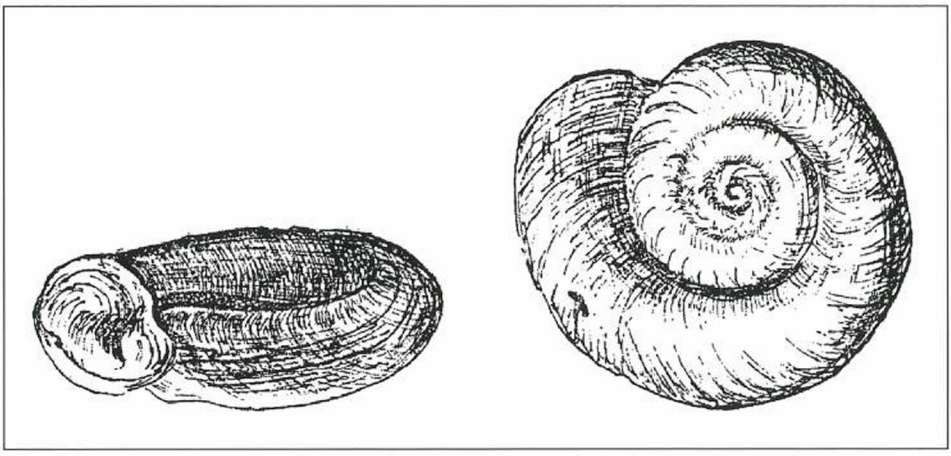

Fig. 6. The original picture of shell of *Anisus starobogatovi* (after FROLOVA 1984). Scale bar is absent in the original text.

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