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New and Rare Species of Freshwater Bivalves from the Soviet Far East*

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Nodularia (Magadaninaia) extremalis sp. n. from Magadan Oblast, *Anemina (Anemina) shadini deflexa* ssp. n. and *A. (Buldowskia) zatravkini* sp. n. from southern Primorye are described. *Buldowskia* is considered a subgenus of the genus *Anemina*. The subgenera *Amuranodonta* and *Cristariopsis* and the subfamily Nodulariinae are considered invalid. Data are presented on the glochidia of *Arsenievinaia sihotealinica*. The taxonomic position of some species is discussed.

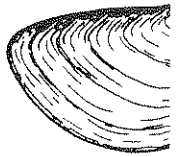
The freshwater bivalve fauna of the Soviet Far East is unusually diverse, containing more species than any other region in the USSR. Study of representatives of the superfamily Pisidioidea is only just beginning, but considerable information about the species composition of the Unionidae and Margaritiferidae has accumulated over the last 20 years (Moskvicheva, 1973; Zatravkin and Starobogatov, 1984; Zatravkin and Bogatov, 1987; Bogatov and Zatravkin, 1988).

✧ Although around 64 species of unionids and margaritiferids are known from the Soviet Far East, this number cannot be considered final since, on the one hand, some regions are still poorly studied, and, on the other, the status of many taxa remains unclear. There is no doubt that in systematic studies of freshwater bivalves it is not enough to use only traditional characters; however, use of new ones is associated with problems. Thus, for example, delimiting species on the basis of the curvature of the frontal section is well supported by study of glochidia (Antonova and Starobogatov, 1988), but often finds no agreement by electrophoretic investigations (Kodolova and Logvinenko, 1987; Logvinenko et al., 1987, 1988). No less complicated is the question of generic assignment of the Far East unionids, and therefore this article, in addition to describing new species, concerns itself with some problems in the taxonomy of known forms. Holotypes and paratypes of the new species and subspecies are deposited in the Zoological Museum of the Far East University. The following abbreviations are used: *H*—shell height at the umbones, *H'*—height at the ligament, *L*—shell length, *B*—shell convexity (both sides). We thank Ya.I. Starobogatov for his great help in the identification of certain species.

Genus *Nodularia* Conrad, 1853

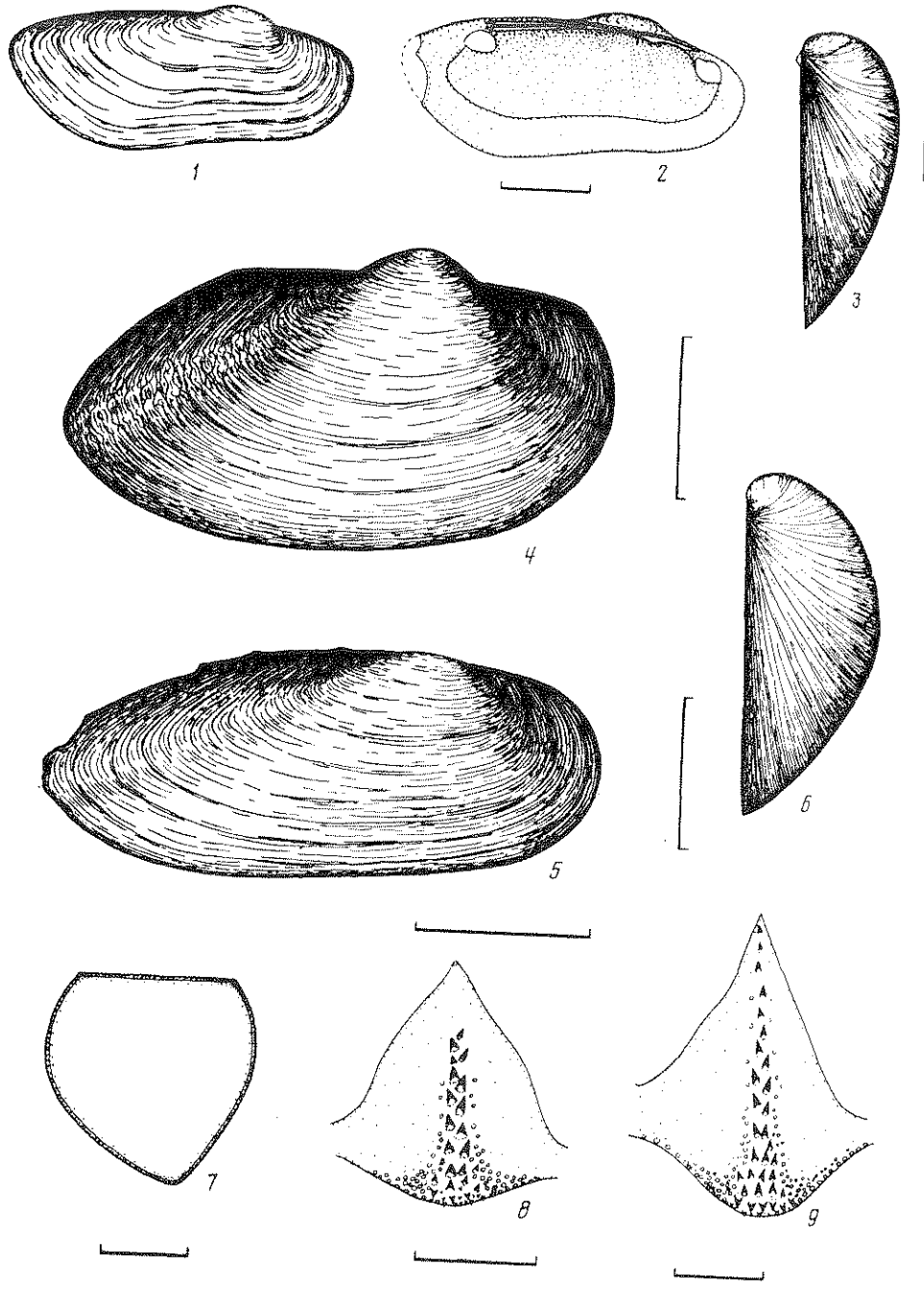
Recently *Nodularia* and the closely related genus *Middendorffinaia* were assigned to the subfamily Nodulariinae (Zatravkin and Bogatov, 1987). No diagnosis or information about the

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Nodularia (Magadaninaia) extremalis sp. n. (1-3), *Anemina (Anemina) shadini deflexa* ssp. n. (4-9), *A. (Buldowskia) zatrawkini* sp. n. (5, 6), and *Arsenievinaia sihotealinica* (7-8): 1, 4, 5—right valve; 2—inside of left valve; 3, 6—left valve from the anterior margin; 7—glochidium; 8, 9—rostrum of the glochidium. Bar: 1, 2, 4, 5—30 mm; 3—5 mm; 6—20 mm; 7—100 μm; 8—40 μm; 9—50 μm.

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composition of this subfamily was given at the time. As Ya.I. Starobogatov informed us, the principal differences between the Nodulariinae and Unioninae involve the nature of the umbonal sculpturing. However, in *Nodularia* the umbonal sculpturing is similar to that in other unionids, and it is no accident that this genus is often considered a synonym of *Unio* (Haas, 1969). There are also no principal differences between the glochidia of *Nodularia* and *Unio* (Antonova and Starobogatov, 1988). Thus, although we consider *Nodularia* a valid genus, its elevation to subfamily status, in our view, is not substantiated.

Subgenus *Magadaninaia* Martynov et Tshernyshev, subgen. n.

Type species: *Nodularia extremalis* sp. n.

Diagnosis. Shell elongated, oval, expanding in the posterior part. The posteriormost point of the shell lies markedly higher than the level of the middle of the height of the shell. The dorsal margin is almost straight, is markedly inclined forward along its entire length.

Comparison. *Nodularia* differs from the two known subgenera in the characteristic shape of the shell.

Nodularia (Magadaninaia) extremalis Martynov et Tshernyshev, sp. n.
(Fig. 1-3)

Material. Holotype: No. 254, IX 1969, Magadan Oblast, Ol'skiy District, in a river not far from Motykleyka Village. No paratypes.

Description. *L* 37 mm, *H* 17.4 mm, *H'* 17 mm, *B* 13.3 mm.

The shell is irregularly convex, moderately thick-walled. The most prominent point of the lateral surface is 0.42 times shell length from the anterior margin and 0.69 times its height from the ventral margin. The umbones protrude markedly beyond the contour of the valve, are 0.32 times shell length from its anterior margin. The anterior margin is rounded, turns into the ventral margin smoothly and dorsal margin sharply. The ventral margin is slightly concave. The posterior margin is markedly wider than the anterior. The surface of the shell is smooth, shiny. The periostracum is sandy to light brown, in some places with a reddish tint. The umbonal sculpturing is typical of the genus and developed only in the preumbonal region. On the left valve, both anterior teeth are still distinctly separated, the inner one is smaller than the outer and situated below the umbo. The posterior teeth of this valve are almost straight, smooth, the outer one is a little shorter than the inner. On the right valve, the anterior inner tooth is in the form of a semicircular plate, the outer one is rudimentary but quite visible. The posterior tooth is slightly arched. The nacre is white, greenish pink. The anterior muscle impressions are deep.

Genus *Anemina* Haas, 1969.

Subgenus *Anemina* s. str.

Anemina

Material. Holotype: Vladivostok, name of the collector is not given; paratypes: same locality. Holotype: *L* 95.9 mm and 50 mm, respec-

Description. Shell length from the umbo to shell length 0.40-0.51. 0.47 ± 0.02 , respectively. The umbo is very small. (Starobogatov, 1988) It is similar to the

Distribution. Station (Nadezhdin)

Comparison. *shadini shadini*, it is the most prominent of characters, the shell is more extended and shifted to the right. *A.s. deflexa* are the most prominent. It varies from 0.74 to 0.85. *coviridis* to subspecies

According to Starobogatov (1988) *Buldowskia* differs from *Anemina* in the shape of the wing, and in the umbonal sculpturing. In the taxonomy of the genus *Anemina* differ somewhat. However, the type species is *Anemina parva*. However, the type species is described in *B. parva*. However, for the glochidia, the type species is *B. parva* (Starobogatov, 1988), and therefore it is correct to consider the genus erected by Moskvina (Starobogatov, 1987). If there are no significant differences

Anemina (Anemina) shadini deflexa Martynov et Tshernyshev, ssp. n.
(Fig., 4, 9)

Material. Holotype: No. 333-A, 27 III 1986. Primorskiy (maritime) Territory, vicinity of Vladivostok, nameless lake near Cape Basargin, depth 0.7–1 m, mud, collected by A.V. Chernyshev; paratypes: several tens of specimens collected from the same locality. Dimensions of the holotype: *L* 95.9 mm, *H* 54.4 mm, *B* 46.8 mm. Largest specimen had these measurements: 109, 55, and 50 mm, respectively.

Description. Shell irregularly elliptical, thin-walled, swollen. Umbones 0.34–0.38 times shell length from the anterior margin. Most prominent point of the lateral surface is 0.41–0.48 times shell length from the anterior margin (mean for 35 specimens, 0.44 times). Ratio of height of the umbo to shell length is 0.48–0.57, ratio of convexity to height 0.83–0.91, of convexity to shell length 0.40–0.51. Mean values of these ratios for 35 specimens are 0.54 ± 0.02 , 0.87 ± 0.02 , and 0.47 ± 0.02 , respectively. Periostracum predominantly brown. In young individuals, the ridge by the umbo is very often slightly concave. Glochidia are typical of the species (Antonova and Starobogatov, 1988); however, small spines on the hook are more numerous (Fig., 9). Otherwise, it is similar to the nominate subspecies.

Distribution. Except for the type locality, we found one shell in a canal near Kiparisovo Station (Nadezhdinskiy District, Primorskiy Territory).

Comparison. Differs from the nominate subspecies in having a more elongate shell (in *A. shadini shadini*, it varies from 0.57 to 0.64), umbones shifted to the anterior end, in the position of the most prominent points of the lateral surface, and in coloration of the periostracum. In a number of characters, the new subspecies resembles *A. fuscoviridis*, which differs from *A. shadini* in a more extended and less convex shell and in having the prominent parts of the lateral surface of the shell shifted to the anterior margin. The shape of the shell and position of the prominent point in *A.s. deflexa* are the same as in *A. fuscoviridis*. The ratio of convexity to shell height in the latter varies from 0.74 to 0.85 (data taken from type material) and therefore it makes sense to revise *fuscoviridis* to subspecies status—*A. shadini fuscoviridis*.

Subgenus *Buldowskia* Moskvicheva, 1973 stat. n.

According to many workers (Zatravkin and Bogatov, 1987; Bogatov and Zatravkin, 1988), *Buldowskia* differs from *Anemina* in having a more elongated shell, absence of a clear posterior wing, and in the umbones not protruding or weakly protruding. In addition, representatives of both taxa differ somewhat in the shape of the glochidia (in *Anemina*, they are slightly asymmetrical). However, the type species of *Buldowskia*—*B. sujfunica*, has an oval shell, low posterior wing described in *B. parva*, and within *Anemina* there are species with a weakly prominent umbones. As for the glochidia, they are studied only in two species of *Buldowskia* (Antonova and Starobogatov, 1988), and therefore it is too early to judge the reliability of the data. All these facts suggest that it is correct to consider *Buldowskia* a subgenus of the genus *Anemina*. The genus *Amuranodonta*, erected by Moskvicheva (1973) recently was reduced to a subgenus of *Anemina* (Zatravkin and Bogatov, 1987). If we compare the diagnoses of both subgenera, then it appears that in practice there are no significant differences between them. For example, the new species described below

identically conforms to the diagnoses of both subgenera and may be assigned to *Buldowskia* only on the basis of its distribution since representatives of *Amuranodonta* occur in the Amur Basin.

Anemina (Buldowskia) zatrawkini Martynov et Tshernyshev, sp. n.

(Fig., 5, 6)

Material. Holotype No. 84-A, 3 VIII 1984, 3 VIII 1984, Primorskiy Territory, irrigation canal not far from Kiparisovo Station (Nadezhdinskiy District), depth about 1 m, mud, collected by M.G. Kazykhanova and Yu.N. Nazarov. No paratypes.

Description. *L* 96 mm, *H* 44 mm, *H'* 44.6 mm, *B* 34 mm. Shell elongate, oval, uniformly swollen, thin-walled, brittle. Umbones wide, not protruding above the valve contour, situated 0.27 times shell length from the anterior end of the shell. Anterior margin uniformly rounded, at the transition to the dorsal margin, there is a weakly visible corner. Ventral margin mostly straight or weakly arched. Dorsal margin is somewhat inclined forward anterior to the umbones and posterior to it weakly arched and subparallel to the ventral margin. The most prominent point of the posterior edge is below the middle of the shell height. The most prominent point of the lateral surface is 0.57–0.59 times shell height from the ventral margin and 0.39–0.40 times shell length from the anterior margin. The posterior ridge is rounded. Umbonal sculpturing consists of weakly arched ridges. Periostracum is light brown. Only the anterior of the muscle impressions are well marked. Nacre is either white or greenish blue, with oily spots.

Comparison. The new species differs from all representatives of the subgenus *Buldowskia* in having the umbo shifted more to the anterior end. In terms of the degree of convexity and extension of the shell, *A. (B.) zatrawkini* resembles *A. (B.) kijaensis*, from which it differs in the position of the posteriormost position of the shell.

Below, data are presented on the habitat and taxonomic position of a number of rare and interesting species.

Middendorffinaia shadini Moskv. et Star., 1973 (= *M. dulkeitiana* Moskv. et Star., 1973). Several tens of shells and live specimens from a canal near Kiparisovo Station. Analysis of the variability of our material indicated that it is impossible to find clear-cut distinctions between *M. shadini* and *M. dulkeitiana*. According to Zatravkin and Bogatov (1987), the former is characterized by a *H/L* ratio of at least 0.57, *B/H* of no more than 0.79, in latter *H/L* is no more than 0.56 and *B/H* at least 0.80. At the same time, in one of the paralectotypes of *M. shadini*, the *H/L* ratio is 0.56 and *B/H* is 0.80. The largest specimen from our collection had *L* 72 mm, *H* 37 mm, *B* 27.9 mm, that is, *H/L* as in *M. dulkeitiana* and *B/H* as in *M. shadini*.

Sinanodonta fukudai Modell, 1945. Collected by V.A. Rakov in the Gladkaya River (Khasanskiy District, Primorskiy Territory) and by us in a canal near Kiparisovo Station. According to V.A. Rakov (personal communication), the glochidia in this species are markedly asymmetrical, shell height exceeds length, the ventral corner is rounded.

S. primorjensis Bog. et Zatr., 1988. Several shells in the canal at Kiparisovo Station. This species, as well as *S. crassitesta* Moskv., is placed by the number of workers in a separate sub-

genus, *Cristariop* with a rudimenta (1973). However, band is found in *S* genera.

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genus, *Cristariopsis* Moskv., which differs from *Sinanodonta* s. str. in having a thick-walled shell with a rudimentary posterior tooth and a broad dull band on the inner margin (Moskvicheva, 1973). However, in *S. primorjensis*, the rudiment of the tooth is not pronounced and a wide dull band is found in *S. renzini*. These facts force us to refute the division of *Sinanodonta* into two subgenera.

Anemina (Buldowskia) kijaensis Moskv., 1973. Several specimens found by V.S. Labay in the Bira River basin.

Aresnievinaia sihotealinica (Zatr. et Star., 1984) (= *A. zimini* Zatr. et Bog., 1987). Several tens of live specimens from Lake Zapovednoye not far from Zapovednyy Village (Primorskiy Territory). Height of the shells of the glochidia 292–298 μm , shells are markedly asymmetrical, with a byssal thread and rounded ventral corner (Fig., 7, 8). The specimen in which the glochidia were studied had the following dimensions: *L* 168 mm, *H* 75 mm, *B* 57 mm, with umbones 0.28 times shell length from the anterior end. In this species, the shell elongates with age and the umbones shift anteriorly. *A. zimini* is considered a synonym of this species, differing from *A. sihotealinica* only in having a more convex shell. The range of variation of *B/H* in our specimens (0.65–0.76), however, raises a doubt on their classification.

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