

# The First Find of *Parthenina modesta* (Sorgenfrei) (Gastropoda, Pyramidellidae) in the Tarkhanian (Miocene) of Eastern Ciscaucasia

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**Abstract**—*Parthenina modesta* (Sorgenfrei, 1958) is described from the Tarkhanian of the Eastern Paratethys. The species was previously known only from the Miocene of the North Sea.

**Keywords:** *Parthenina modesta*, Neogene, Miocene, Eastern Paratethys, Russia

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## INTRODUCTION

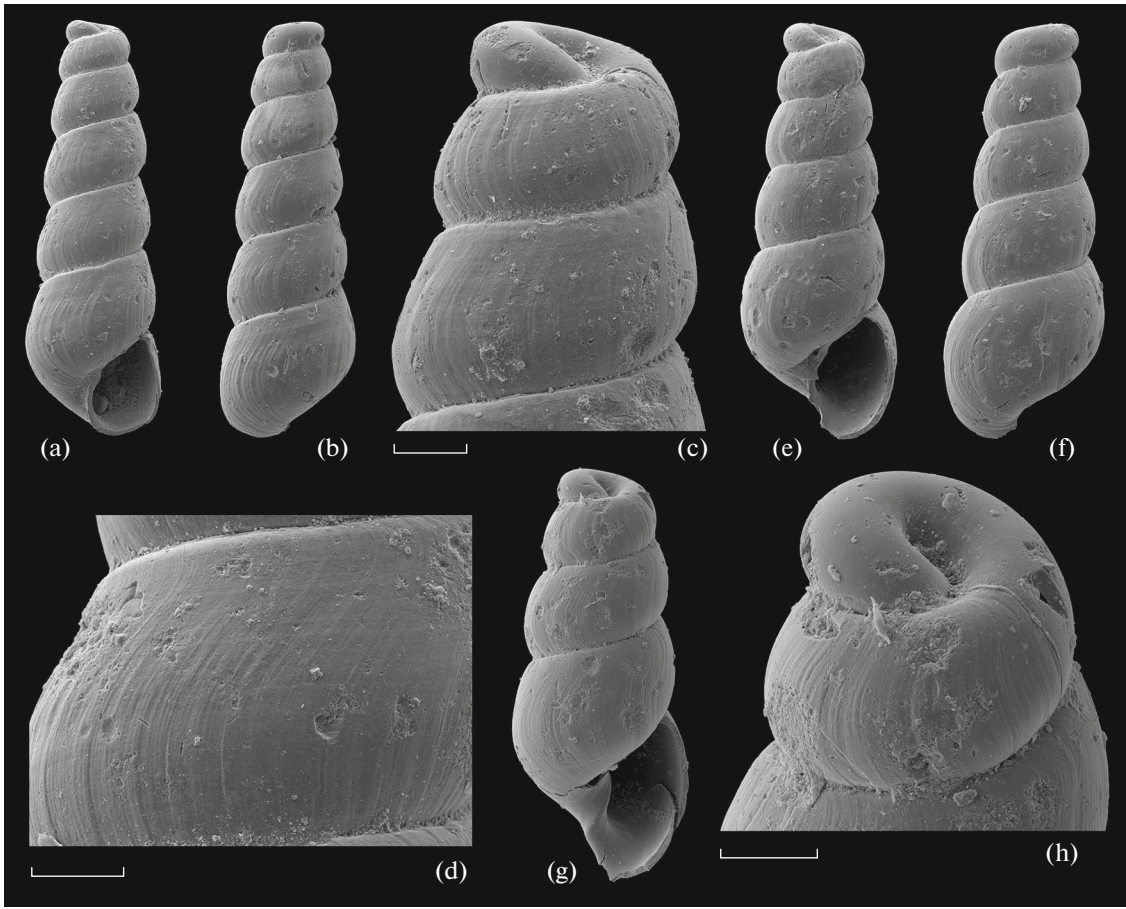
The study of the Tarkhanian deposits of western Ciscaucasia was accompanied by sampling of the malacofauna. As a result, many previously unknown small-sized gastropod species have been discovered, including Pyramidellidae, one of which I assigned to *Parthenina modesta* (Sorgenfrei, 1958). This species was known from the Miocene deposits of the North Sea but has never been previously recorded from the Neogene of the Mediterranean basins and the Atlantic coast. As shown in the reconstructions in an atlas on the paleogeography of Paratethys (Lithological..., 2004), there was no connection between the North Sea and the Paratethys and the Mediterranean in the Neogene. The above reconstructions are based on previous studies. The connections of the Paratethys with other marine basins in the Paleogene and Neogene were discussed in detail by Báldi (1989). He showed that only in the Paleogene, two straits existed between the Paratethys and the North Sea. The first was located along the Rhine Graben and closed by the end of the Oligocene. The second strait extended from Poland to Ukraine through the Dnieper-Donets Depression and disappeared closer to the Oligocene. Báldi ruled out later connections between the Paratethys and the North Sea. A similar reconstruction was shown by Rögl (1999). In a recent review Popov et al. (1993) suggested that the last connection between the Paratethys and the Mediterranean basins with the North Sea was at the end of the Oligocene, in the Chattian. However, the earliest finds of *P. modesta* date back to the Early Miocene (Late Burdigalian).

At present, the Tarkhanian of Eastern Paratethys is correlated by paleomagnetic data and nannoplankton with the middle part of the Langhian (Palcu et al.,

2019). Consequently, *P. modesta* could have entered the Paratethys through straits with Mediterranean basins through the Atlantic, travelling round the European land. Therefore, it would be reasonable to expect finds of this species on the migration route. The absence of *P. modesta* in the Mediterranean basins can be explained by poor knowledge of the malacofauna of the Lower and Middle Miocene. The last summary on the pyramidellids of this region was made by Sacco (1892). It lists only one species for the Langhian, and none for the Lower Miocene. The rest of the species are indicated from Serravallian (cited in Sacco as Elveziano). Knowledge of the family has not improved since then.

The best studied group are the mollusks from the Badenian of Central Paratethys. The Badenian correlates with the Langhian and the lower part of the Serravallian, but only Friedberg (1928, pl. 27, fig. 11) illustrated shells very similar to *P. modesta* from the lower Badenian of Korytnica (Poland). They are identified as *Eulimella nitidissima* (Montagu). In the diagnosis, Friedberg indicated a transaxial protoconch, which is not shown in the figure, but is characteristic of this species. He depicted shells with whorls curled in one plane, as in *Parthenina modesta*, with a coaxial protoconch. Other characters also correspond to those of *P. modesta*.

The taxonomic lists of the Atlantic Miocene (France), where the biota is much better studied, do not contain *P. modesta*. Lozouet et al. (2001) described a very similar form from Aquitaine, France, identified as *Murchisonella* cf. *bezanconi* (Cossmann, 1892). It differs from *P. modesta* in the more planispiral protoconch and a stronger spiral ornamentation. *M. bezanconi* also has a deeper opisthocytic bend of the growth



**Fig. 1.** *Parthenina modesta* (Sorgenfrei, 1958); Pshekha River; Middle Tarkhanian, sample PSh3-type1: (a–d) specimen PIN, no. 5646/1 (shell height 1.9 mm): (a) apertural view, (b) reverse view, (c) apical part of the shell, (d) growth striae and microstriae on the shell surface; (e, f) specimen PIN, no. 5646/2 (shell height 1.7 mm): (e) apertural view, (f) reverse view; (g, h) specimen no. PIN, no. 5646/3 (shell height 1.15 mm): (g) folds on the columella; (h) protoconch. Scale bar 100  $\mu\text{m}$ , for other figures the shell height is given.

striae at the top of the whorl. It is not known whether the studied species has a columellar fold, which, like in *Parthenina modesta*, may not be visible from the aperture.

As *P. modesta* possesses a coaxial protoconch, convex whorls and strongly curved growth striae, this species strongly resembles representatives of the family Murchisonellidae. However, the well-developed columellar fold indicates that *P. modesta* belongs to the family Pyramidellidae. Stein et al. (2016) illustrated species of *Parthenina* with reduced or poorly developed ornamentation. These are *Parthenina cimbrica* (Kautsky, 1925), in which early ornamented whorls are replaced by smooth whorls, or *P. nodifera* (Sorgenfrei, 1958) and *P. toftlundensis* (Sorgenfrei, 1958) with a weakly expressed ornamentation. According to other characters, they demonstrate a strong similarity with *P. modesta*, which confirms that the latter belongs to the genus *Parthenina*.

*P. modesta* from the Miocene of the North Sea is associated with mollusk assemblages that lived in

basins with normal salinity. The type locality (Denmark) of *P. modesta* is characterized by alternating micaceous clays and medium-fine-grained sands (Sorgenfrei, 1958). In the Miste Member (Netherlands), this species occurs in sands (Janssen, 1986). There are no data on the lithology of other localities. In the Eastern Paratethys, *P. modesta* is known from the “typical” Tarkhanian assemblages. The latter include communities of variously silty calcareous clays and Tarkhanian marl with a characteristic abundance of shells of *Euspira* and *Aporrhais*. All communities with *P. modesta* are confined to the upper sublittoral. Probably, they were located near the boundary of the influence of regular storms, i.e., at a depth of about 50 m. The occurrence of *P. modesta* in the Tarkhanian shows that the species was able to tolerate significant changes in salinity. For the middle Tarkhanian, it is estimated by the author in the range between 20 and 30‰. At the same time, the population density reaches a large value against a background of a decrease in the species diversity of communities. For

example, in publications on the fauna of the North Sea (Sorgenfrei, 1958; Janssen, 1986; Stein et al., 2016), these are samples of up to a few tens of shells, while on the Pshékha River, saturation reaches 90–100 shells per kilogram of rock.

## MATERIAL

The material is housed in the collections of the Borissiak Paleontological Institute, Russian Academy of Sciences (PIN), coll. no. 5646. The study was supported by the Russian Foundation for Basic Research, project no. 17-05-00047.

## SYSTEMATIC PALEONTOLOGY

### Genus *Parthenina* Bucquoy, Dautzenberg et Dollfus, 1883

#### *Parthenina modesta* (Sorgenfrei, 1958)

? *Eulimella nitidissima*: Friedberg, 1928, pl. 27, fig. 11.

*Chrysallida modesta*: Sorgenfrei, 1958, p. 309, pl. 67, fig. 228, pl. 68, fig. 228.

*Chrysallida (Parthenina) modesta*: Janssen, 1984, p. 342, pl. 14, fig. 8; Kuster-Wendenburg, 1986, p. 373, pl. 1, fig. 6; Moths et al., 2010, p. 84, pl. 46, fig. 4; Stein et al., 2016, p. 145, text-fig. 75a–f.

*Evalea* sp.: Wienrich, 2007, p. 743, pl. 122, fig. 5, pl. 160, fig. 6.

**Holotype.** Geological Survey of Denmark, unnumbered; Denmark, borehole near the village of Arnum; Middle Miocene, Arnum Formation. Figured by Sorgenfrei, 1958, pl. 67, fig. 228.

**Description** (Fig. 1). The shell is very small, about 2 mm high, consisting of one smooth whorl of the coaxial protoconch and at least five whorls of the teleoconch. The whorls of the teleoconch are convex, with a maximum width in the lower half of the lateral side, separated by a deepened suture. The lateral side merges smoothly into a convex base. The surface of the whorls is smooth, or the finest spiral streams are visible. The growth striae are clearly pronounced, at the top of the whorl they form an opisthocyrt bend, below turning into prosocyrt ones. The columella has a prominent columellar fold, which is not visible in the aperture, but is observed when the shell is broken off. The aperture is oval, rounded anteriorly, with a non-thickened outer lip.

**Remarks.** Wienrich (2007, p. 739, pl. 122, fig. 2 and pl. 160, fig. 2) identified as *P. modesta* another species differing in a stouter shell of more rapidly expanding whorls and with a medi axial protoconch. The identification of *P. modesta* based on a single small fragment from the Gram Formation, Tortonian, Denmark, is also doubtful (Schnetler, 2005, p. 120, pl. 9, fig. 3).

**Occurrence.** Upper Burdigalian–Langhian of the North Sea Basin (Arnum Formation, Miste Member, Hemmoorian, Reinbeckian: northern Germany, Denmark, Netherlands); Middle Tarkhanian of Western Ciscaucasia.

**Material.** Middle Tarkhanian: Krasnodar Region, Apsheron District, village of Shirvanskaya,

Pshékha River downstream of the bridge: samples PSh1 (13 specimens), PSh1-2 (9 specimens), PSh3-type 1 (761 specimens), PSh3-type2 (14 specimens), PSh3-2 (156 specimens); Republic of Adygea, Maikop District, cliff on the right bank of the Belaya River, 1 km upstream of Semikolennyi Creek (13 specimens).

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