BADENIAN SMALL GASTROPODS FROM LĂPUGIU DE SUS (FĂGET BASIN, ROMANIA). RISSOIDAE FAMILY

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Abstract We have sampled two outcrops along Coșului Valley (Lăpugiu de Sus, Romania). The processed samples have revealed a rich and diverse small gastropod fauna. The Rissoidae family is dominating. We have systematically assigned, described and illustrated 15 species. The Rissoinae subfamily (12 species) is represented by seven species of genus *Alvania*: *Alvania* (*Alvania*) *productilis*, *Alvania* (*Alvania*) *perregularis*, *Alvania* (*Alvania*) *ampulla*, *Alvania* (*Alvania*) *helenae*, *Alvania* (*Alvania*) *transiens*, *Alvania* (*Alvania*) *oceani* and *Alvania* sp., two species of genus *Manzonia*: *Manzonia* (*Manzonia*) *scalaris*, and *Manzonia* sp., as well as three species of genus *Rissoa*: *Rissoa clotho*, *Rissoa acuticosta*, and *Rissoa costeiensis*. Additionally, subfamily Rissoininae is represented by three species of genus *Rissoina*: *Rissoina* (*Phosinella*) *steinabrunnensis*, *Rissoina (Rissoina) vindobonensis*, and *Rissoina (Rissoina) pusilla*.

Keywords: gastropods, Rissoidae, Lower Badenian, Lăpugiu de Sus, Romania

INTRODUCTION

Lăpugiu de Sus is located south from Mureș River, in Făget Basin, a post-tectonic Neogene basin representing an eastwards extension of the Pannonian Basin (Mutihac, 1990) (Fig. 1).

The basement is represented by the Poiana Ruscă crystalline rocks consisting of graphitic schists, chloritic-sericitic schists, sericitic-chloritic schists, sericitic phyllites, black quartzites, crystalline limestones and dolomites of the Ghelar and Padeș Series (Gherasi et al., 1968). The oldest sedimentary rocks in the region are Mesozoic in age, and are represented by limestones and flysch deposits overlain by epicontinental neritic sediments (Dușa, 1969). On their top, Badenian marly-clayey deposits with thin interlayers of sands and corallinacean limestones (Nițulescu, 1930; Moisescu, 1955; Dușa, 1958, 1969), Sarmatian clays, marls and sands (Huică and Dragu, 1970), Pannonian sands and clayey-sands (Dușa, 1969), Pontian sands, gravels and clays (Orășanu et al., 1970) and Quaternary sediments mainly consisting of terraces (Dușa, 1969), develop. Magmatic products were also described from this area, *i.e.*, andesitic agglomerates petrographically represented by andesites with pyroxenes and amphiboles (Dușa, 1958) (Fig. 1).

The Badenian deposits from Lăpugiu de Sus contain a rich fauna and flora; accordingly, they have been intensely studied. A large number of mollusc species, especially bivalves and large gastropods have been published already in the 19th century by Neugeboren (1858), Höernes (1851–1856), Hauer & Stache (1863), Halavats (1876), or Koch (1900). After that, numerous other authors have contributed to a better understanding of the regional geology and to an increase of the faunal inventory of the area (Nițulescu, 1930; Moisescu, 1955; Petrescu et al., 1990; Chira, 2000; Chira and Voia, 2001; Caze et al., 2010). However, small gastropods have been only mentioned, for example by Koch (1900), Nițulescu (1930), or Moisescu (1955), while Șuraru and Papp (1993)

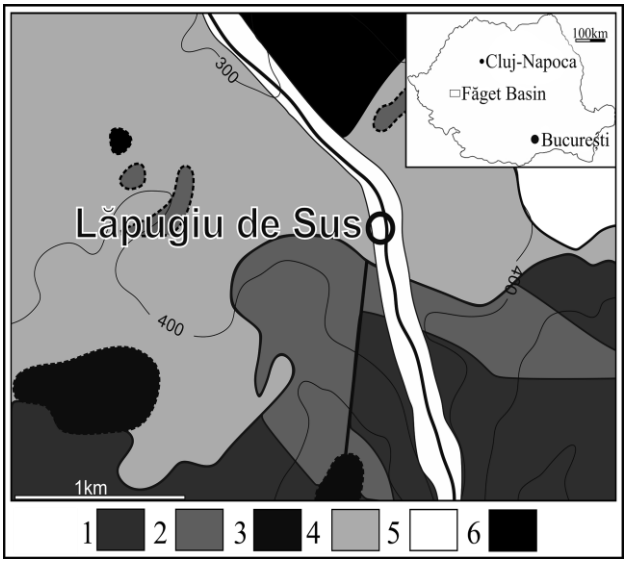

Fig. 1 - Simplified geological map of the studied area (after Lupu et al. 1991). **1** Dolomite and dolomitic limestone (Lower Carboniferous). **2** Limestone and dolomitic limestone (Lower Carboniferous). **3** Quartzitic boulders (Albian). **4** Fossiliferous sandy clays, sands, gravels, tuffs, lapilli (Lower Badenian). **5** Quaternary deposits. **6** Igneous rocks (Maastrichtian-Paleocene).

describe and illustrate several species of small gastropods, among which six species of rissoids. The rissoids are small gastropods that are still omnipresent in marine environments. As a rule, they prefer shallow waters, while the greatest species diversity is present in littoral areas (Ponder, 1985). A few genera, such as *Rissoa* and *Rissoina* are exclusively littoral organisms (Ávila et al., 2012). Most of the rissoids live on the surface of algae, underneath rock fragments, corals or any other sheltering objects. In Central Paratethys, genera *Rissoa* and *Alvania* are known at least starting with the Lower Miocene (Eggenburgian). The Rissoidae's greatest diversity was recorded in the Lower Badenian (Kowalke and Harzhauser, 2004).

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MATERIAL AND METHODS

We have sampled two outcrops along Coşului Valley near Lăpugiu de Sus. Thirteen samples were taken from each outcrop, numbered L1 to L13 for the first one and Lp1 to Lp13 for the second one. The samples have been processed following standard sample processsing protocols: drying at 104,5ºC into an oven, rehydration, boiling in water with Na_2CO_3, and rinsing by using the 63 µm-mesh sieve. After processing we found that the most abundant and well preserved rissoids were present in the samples L5, Lp2, Lp4 and Lp10. The fossils were selected, measured, identified, described and systematically classified based on microscopic observations under binocular. Photographs of the specimens were taken by using a Cannon PowerShot A640 camera attached to the Zeiss Stemi 2000-C stereomicroscope, while image processing was achieved by using the Photoshop CS6 software.
All the specimens illustrated in this paper have been registered in the collection of the Museum of Paleontology of the Babeş-Bolyai University in Cluj-Napoca (PMBBU).

SYSTEMATIC PALEONTOLOGY

The gastropods' systematic assignment below follows the principles of Bouchet and Rocroi (2005).
Class Gastropoda Cuvier, 1797
Subclass Caenogastropoda Cox, 1959
Order Littorinimorpha Golikov and Starobogatov, 1975
Superfamily Rissooidea Gray, 1847
Family Rissoidae Gray, 1847
Subfamily Rissoinae Gray, 1847
Genus *Rissoa* Desmarest, 1814
Type species: *Rissoa ventricosa* Desmarest, 1814
Rissoa acuticosta (Sacco, 1895)
Fig. 2a
1895 *Turbella* [sic!] *acuticosta* Sacc. - Sacco, p. 23
1954 *Turbella acuticosta* Sacco - Friedberg, p. 368, pl. 22, fig. 1
1973 *Rissoa acuticosta* Sacco - Bohn - Havas, 1039, pl. 3, fig. 7
1975 *Turboella* (*Turboella*) *acuticosta* Sacco - Bałuk, p. 69, pl. 8, figs. 9, 10
partim 1981 *Turboella acuticosta* Sacco - Krach, p 47, pl. 15, fig. 20
1981 *Turboella* (*Turboella*) *acuticosta* Sacco - Švagrovskỳ, p.121, pl. 37, figs. 8, 9
2000 *Turboella* (*Turboella*) *acuticosta* Sacco - Popa and Ianoliu, p. 84, pl. 2, fig. 3
2004 *Rissoa acuticosta* (Sacco) - Kowalke and Harzhauser, p. 116, fig. 4C
Material: 11 specimens, (four from L5, one from Lp2, two from L3 and four from Lp10) (one specimen PMBBU 23850)
Description: Conic, turriculated shell, consisting of six spire whorls up to 2.90 mm in height and 1.60 mm in width. The protoconch consists of about 2.5 convex spire whorls. The teleoconch shows slightly flattened profile, more convex above the incised sutures. On the first whorl, the ornaments are represented by finer, sinusoidal axial ribs that become more prominent and straight towards the last whorl. Fine spiral threads are noticeable in the interspaces between the axial ribs. The last whorl represents about 65% of the total height of the shell; it displays 12-14 axial ribs as ornaments. Five spiral threads are present on the base of the shell. The aperture is drop-like, the inner lip partly covering the umbilicus, while the external one is thickened because of the varices.
Distribution: identified in Austria (Kowalke and Harzhauser, 2004), Poland (Friedberg , 1954; Bałuk, 1975; Krach, 1981), Slovacia (Švagrovskỳ, 1981), Hungary (Bohn – Havas, 1973), Romania (Popa and Ianoliu, 2000).

Rissoa clotho Hörnes, 1856
Fig. 2b
1856 *Rissoa clotho* sp. nov. - Höernes, p. 574, pl. 48, fig. 20 a,b
1975 *Turboella* (*Turboella*) *clotho* (Hörnes) - Bałuk, p. 70, pl. 8, fig. 8
2004 *Rissoa clotho* Hörnes - Kowalke and Harzhauser, p.117, fig. 4D
Material: 13 specimens, five from L5, four form Lp2, one from Lp3and three from Lp10 (one specimen PMBBU 23851)
Description: Conical-elongated shell consisting of six whorls reaching up to 3 mm in height and 1.5 mm in width. The protoconch is build-up of 2.25 convex whorls. The teleoconch displays convex whorls separated by an incised suture. Ornamentation consists of prominent axial ribs that become more convex over the suture. On the last whorls, in their lower half, one can notice fine spiral threads, more obvious on the last whorl. This latter represents about 55% of the total shell height and is ornamented with 12 axial ribs. Oval aperture, the inner lip covers the umbilicus while the external lip displays varices.
Distribution: identified in Austria (Kowalke and Harzhauser, 2004), Poland (Bałuk, 1975).

Rissoa costeiensis Kowalke and Harzhauser, 2004
Fig. 2c
2004 *Rissoa costeiensis* sp. nov. - Kowalke and Harzhauser, p. 117, fig. 5B
Material: 12 specimens, 10 from L5, one from Lp2 and one from Lp10 (one specimen PMBBU 23852)
Description: Conical, elongated shell reaching up to 3 mm in height and 1.5 mm in width, with six whorls. The protoconch includes three convex whorls. The teleoconch shows convex whorls with incised suture and ornamentation consisting of prominent axial ribs with higher convexity in their median part. Fine spiral threads noticeable in the interspaces between the axial ribs, more prominent in the inferior half of the whorl. The last whorl is about 60% from the total height of the shell. It is ornamented with 16 axial ribs intersected by 12 spiral threads. Toward the base, 6-8 additional spiral threads are visible. Oval aperture, the inner lip partly covers the umbilicus, while the external one is thickened because of the varix.

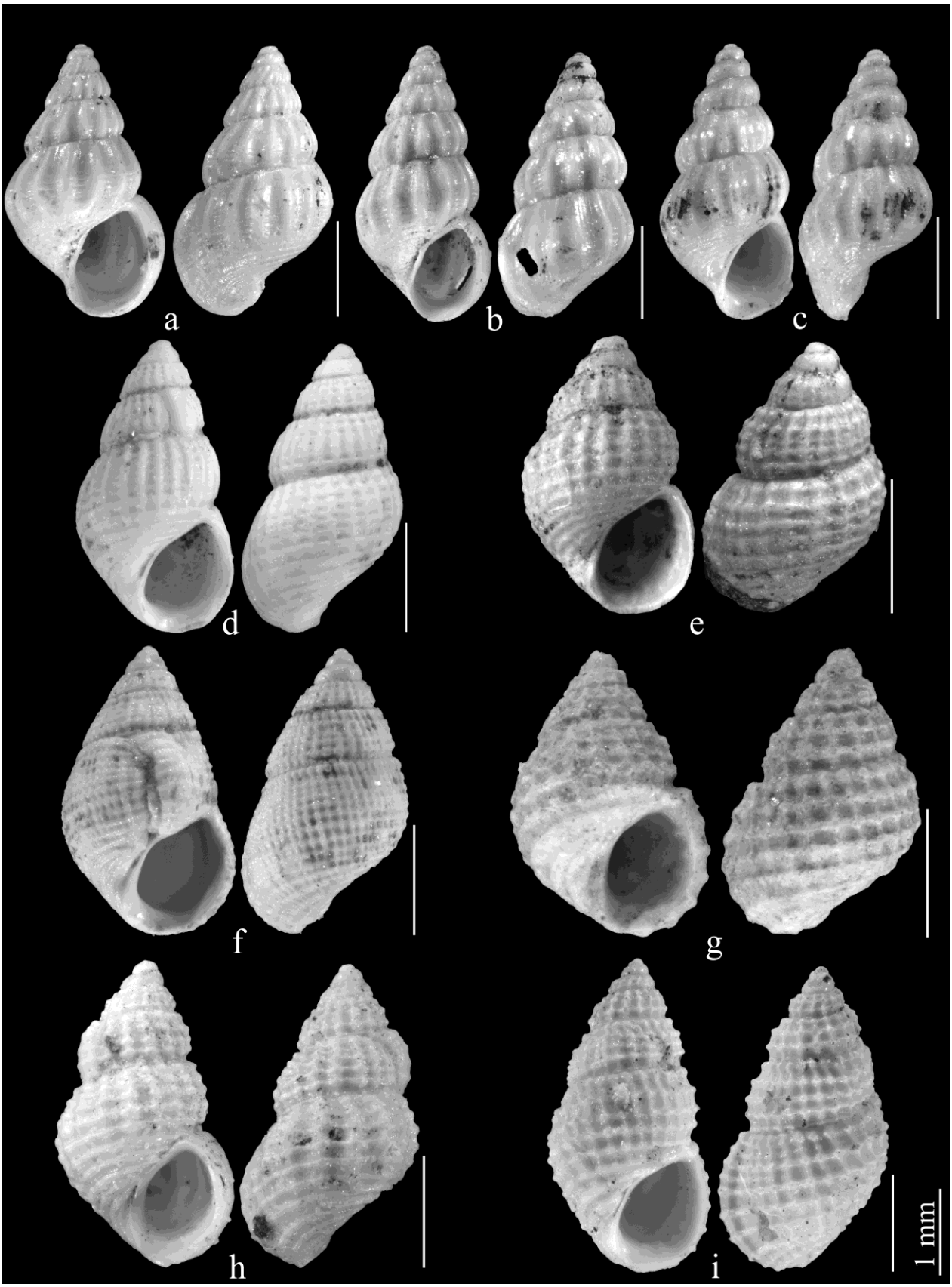

Fig. 2 - a *Rissoa acuticosta* (Sacco, 1895). **b** *Rissoa clotho* Hörnes, 1856. **c** *Rissoa costeiensis* Kowalke & Harzhauser, 2004. **d** *Alvania* (*Alvania*) *oceani* (d'Orbigny, 1852). **e** *Alvania* (*Alvania*) *productilis* Boettger, 1906. **f** *Alvania* (*Alvania*) *perregularis* (Sacco, 1895). **g** *Alvania* (*Alvania*) *ampulla* (Eichwald, 1853). **h** *Alvania* (*Alvania*) *helenae* Boettger, 1901. **i** *Alvania* (*Alvania*) *transiens* (Sacco, 1895).

Distribution: identified in Romania (Kowalke and Harzhauser, 2004).

Genus *Alvania* Risso, 1826
Subgenus *Alvania* Risso, 1826
Type species: *Turbo cimex* Linnaeus, 1758
Alvania (*Alvania*) *oceani* (d'Orbigny, 1852)
Fig. 2d
1852 *Rissoa oceani* d'Orb. - d'Orbigny, p. 29, nr. 368
1954 *Alvania oceani* d'Orb. - Friedberg, p. 377, pl. 22, fig. 13
1975 *Alvania* (*Alvania*) *oceani* (d'Orbigny) - Bałuk, p. 82, pl. 9, fig. 17
1981 *Alvania oceani* d'Orbigny - Krach, p. 49, pl. 15, fig. 1
2004 *Alvania* (*Alvania*) *oceani* (d'Orbigny) - Kowalke and Harzhauser, p. 120, fig. 7A.
Material: two specimens, one from L5 and one from Lp2 (one specimen PMBBU 23859)
Description: Elongated conical shell with five whorls; up to 2.7 mm in height and 1.40 mm in width. The protoconch is only partly preserved, as more than 2 convex whorls. Ornamentation is not visible under the stereomicroscope. Teleoconch with flattened first whorls and a last convex whorl with canaliculate suture. Ornamentation consisting of rounded axial ribs intersected by finer spiral threads; the latter become more pronounced towards the base of the shell. The last whorl represents about 65% of the total shell height. It is ornamented with 21 axial ribs intersected by 8 spiral threads. The shell base is covered by 5 spiral threads. Drop-like aperture, with inner lip covering the umbilicus and external lip showing inner denticles. Varices are present on the last-but-one whorl and in the aperture area.
Distribution: identified in Austria (Kowalke and Harzhauser, 2004), Poland (Friedberg, 1954; Bałuk, 1975; Krach, 1981).

Alvania (*Alvania*) *productilis* Boettger, 1906
Fig. 2e
1906 *Alvania* (*Alvania*) *productilis* n. sp. - Boettger, p. 156, nr. 539
1934 *Alvania* (*Alvania*) *productilis* Boettger - Zilch, p. 212, pl. 5, fig. 83
1975 *Alvania* (*Alvania*) *productilis* Boettger - Bałuk, p. 81, pl. 9, fig. 6
1981 *Alvania* (*Alvania*) *productilis* (Boettger) - Švagrovskỳ, p.117, pl. 36, fig. 6, 7
Material: two specimens from L5 (one specimen PMBBU 23854)
Description: Conical shell consisting of five whorls, up to 2.10 mm in height and 1.25 mm in width.
Protoconch consists of two convex whorls ornamented with spiral threads; the transition to the teleoconch is not well noticeable. Teleoconch with convex whorls and a well-defined suture. On the first whorl there are 20 axial ribs intersected by four spiral threads. The last whorl represents about 70% of the total shell height; it is ornamented with 20 axial ribs intersected by spiral threads. The base is ornamented with four spiral threads. The aperture is drop-like. The inner lip covers the umbilicus, while the external none is thickened due to a varix; it presents inner denticles.
Distribution: identified in Poland (Bałuk, 1975), Slovacia (Švagrovskỳ, 1981), Romania (Boettger, 1906; Zilch, 1934)

Alvania (*Alvania*) *perregularis* (Sacco, 1895)
Fig. 2f
1895 *Acinus Mariae?* var. *perregularis* Sacc.– Sacco, 18, p. 25
1954 *Alvania perregularis* Sacco - Friedberg, p. 377, pl. 22, fig 14, 15
1960 *Alvania* (*Alvania*) *perregularis* (Sacco) - Kojumdgieva and Strachimirov, p. 100, pl. 30, fig. 16 a, b
1966 *Rissoa* (*Alvania*) *perregularis* Sacco - Strausz, p. 73, pl. 46, fig. 12, 13
1973 *Alvania perregularis* Sacco – Bohn-Havas, p. 1037, pl. 3, fig. 1,2
partim 1975 *Alvania* (*Turbona*) *perregularis* (Sacco) – Bałuk, p. 85, pl. 9, fig. 14,15
1981 *Alvania (Turbona) perregularis* (Sacco) - Švagrovskỳ, p. 118, pl. 36, fig. 4
partim 1981 *Alvania perregularis* Sacco - Krach, p. 51, pl. 15, fig. 6
1993 *Alvania perregularis* Sacco - Șuraru and Papp, pl. V, fig 18
2000 *Alvania (Turbona) perregularis* (Sacco) - Popa and Ianoliu, p. 84, pl. 2, fig. 6
2004 *Alvania* (*Alvania*) *perregularis* (Sacco) – Kowalke and Harzhauser, p. 120, fig. 7B
Material: eight specimens, one from L5, one from L2, one from Lp4, and five from Lp10 (one specimen PMBBU 23855)
Description: Conical shell consisting of six whorls; up to 2.63 mm in height and 1.55 mm in width. Protoconch is consisting of about 2.75 convex whorls ornamented with finely grained spiral threads. The transition to the teleoconch is well-defined. The teleoconch shows flat whorls with canaliculate suture. Ornamentation represented by up to 37 axial ribs intersected by up to 14 spiral threads resulting in reticulated pattern with fine knots at the junctions. The last whorl represents about 70% of the total shell height. Drop-like aperture with inner lip partly covering the umbilicus. External lip with inner denticles. The shell shows varices both on the aperture area, and on other locations on the whorls.
Distribution: identified in Czech Republic (Kowalke and Harzhauser, 2004), Poland (Friedberg, 1954; Bałuk, 1975; Krach, 1981), Slovacia (Švagrovskỳ, 1981), Hungary (Strausz, 1966; Bohn – Havas, 1973), Bulgaria (Kojumdgieva and Strachimirov, 1960), Romania (Șuraru and Papp, 1993; Popa and Ianoliu, 2000).

Alvania (*Alvania*) *ampulla* (Eichwald, 1853)
Fig. 2g
1853 *Riss. ampulla m.* - Eichwald, p. 274
1954 *Alvania montagui* var. *ampulla* Eichw. - Friedberg, p. 376, pl. 22, fig 12
1966 *Rissoa* (*Alvania*) *montagui miocaenica* Sacco - Strausz, p. 74, pl. 46, fig. 19, 20
1971 *Alvania* (*Alvania*) *montagui ampulla* (Eichwald) - Rado, pl. 4, fig. 70, 86

1975 *Alvania* (*Alvania*) *montagui ampulla* (Eichwald) - Bałuk, p. 79, pl. 9, fig. 9
1981 *Alvania montagui ampulla* (Eichwald) - Krach, p. 49, pl. 15, fig. 13-15
2000 *Alvania* (*Alvania*) *montagui ampulla* (Eichwald) - Popa and Ianoliu, p. 84, pl. 2, fig. 5
2004 *Alvania* (*Alvania*) *ampulla* (Eichwald) - Kowalke and Harzhauser, p. 119, fig. 6D
Material: 44 specimens, 19 from L5, 11 from Lp2 and 14 Lp10 (one specimen PMBBU 23856)
Description: Conical shell with 5-6 whorls; up to 2.25 mm in height and 1.37 mm in width. In adult specimens, the protoconch is only partly preserved; juvenile specimens show protoconch with two convex whorls ornamented with fine spiral threads. Teleoconch with slightly convex whorls and canaliculate suture. The last whorl is about 70% of the total shell height. It is ornamented with more-pronounced 16-20 axial ribs intersected by 6 spiral threads. Towards the base, additional 3-4 spiral threads. Oval aperture, slightly sharper towards the top. The inner lip partly covers the umbilicus while the external one shows inner denticles and external varix.
Distribution: identified in Austria (Kowalke and Harzhauser, 2004), Poland (Friedberg, 1954; Bałuk, 1975; Krach, 1981), Hungary (Strausz, 1966), Romania (Rado, 1971; Popa and Ianoliu, 2000).

Alvania (*Alvania*) *helenae* Boettger, 1901
Fig. 2h
1901 *Alvania* (*Alvania*) *helenae* n. sp. - Boettger, p. 140, nr. 432
1934 *Alvania* (*Alvania*) *helenae* Boettger - Zilch, p. 211, pl. 5, fig 81
1975 *Alvania* (*Alvania*) *helenae* Boettger - Bałuk, p. 81, pl. 9, fig. 10
Material: four specimens from L5 (one specimen PMBBU 23857)
Description: Elongated conical shell with 5 whorls; up to 2.75 mm in heights and 1.63 mm in width. Protoconch consisting of about two convex whorls ornamented with spiral threads. Teleoconch with convex whorls ornamented with pronounced axial ribs intersected by finer spiral threads; knots form at the intersection. The last-but-one whorl shows one varix. The last whorl represents 65–70% of the total shell height; ornamented with 14-18 axial ribs intersected by 6 spiral threads. Towards the base, four additional spiral threads are noticeable. Drop-like aperture, with the inner lip covering the umbilicus. External lip with inner denticles and external varix.
Distribution: identified in Poland (Bałuk, 1975), Romania (Boettger, 1901; Zilch, 1934).

Alvania (*Alvania*) *transiens* (Sacco, 1895)
Fig. 2i
1895 *Alvania sculpta*? var. *transiens* – Sacco, 18, p. 27
1954 *Alvania venus* var. *danubiensis* Cossm. et Peyr. - Friedberg, p. 379, pl. 22, fig 17
1966 *Rissoa* (*Alvania*) *venus danubiensis* Cossmann and Peyrot - Strausz, p. 72, pl. 46, fig. 17,18
1975 *Alvania* (*Acinulus*) *venus transiens* Sacco – Bałuk p. 86, pl. 9, fig. 18,19
1981 *Alvania venus transiens* Sacco - Krach, p 51, pl. 15, fig. 9-12
2004 *Alvania* (*Alvania*) *transiens* (Sacco) - Kowalke and Harzhauser, p. 121, fig. 7C
Material: five specimens, three from L5 and two from Lp10 (one specimen PMBBU 23858)
Description: Elongated conical shell consisting of six whorls; up to 3.25 mm in heights and 1.60 mm in width. Protoconch consisting of about 2.75 convex whorls ornamented with spiral threads. Teleoconch with slightly convex whorls and canaliculate suture. Ornamentation consisting of axial ribs intersected by spiral threads of equal intensity. This leads to the formation of a reticulated network with sharp knots at the intersection. The last whorl is about 65% of the total shell; ornamented with 16–21 axial ribs and six spiral threads. Two additional well-defined spiral threads are noticeable towards the base. Drop-like aperture; the inner lip covers the umbilicus, external lip shows an external varix and inner denticles.
Distribution: identified in Poland (Friedberg, 1954; Bałuk, 1975; Krach, 1981), Hungary (Strausz, 1966), Austria (Kowalke and Harzhauser, 2004).

Alvania sp.
Fig. 3a
Material: one specimen (PMBBU 23853)
Description: Conical shell consisting of 6 whorls up to 2.38 mm in height and 1.55 mm in width. The protoconch consists of 2.5 convex whorls ornamented with very fine grained spiral threads. Teleoconch flattened profile and with canaliculated suture are. The ornamentation consists of axial ribs intersected by spiral threads; prominent, rounded knots result at the junction. On the first whorl, the ornamentation is represented by three spiral threads intersected by 11 axial ribs. The last whorl represents about 70% of the total shell height. The ornamentation includes 23 axial ribs and 10 spiral threads covering also the base of the shell. The aperture is rounded and slightly sharpened towards the upper part. The inner lip covers the umbilicus. The external lip is thickened due to an external varix; it presents inner denticles.
Remarks: This species is similar to recent *A. cimex* (Pliocene-Recent) in general shape (see Garilli & Parrinello, 2012, fig 6A, B). Sacco (1895, p.24, pl. 1, fig. 56) described from Miocene of Italy *Acinus cimex* var. *tauroparva* that resemble our specimen (see Ferrero Mortara et al, 1984, pl.38, fig. 9 who illustrates the collection of type species describer by Bellardi and Sacco).

Genus *Manzonia* Brusina, 1870
Subgenus *Manzonia* Brusina, 1870
Type species: *Turbo crassus* Kanmacher in J. Adams, 1798
Manzonia (*Manzonia*) *scalaris* (Dubois, 1831)
Fig. 3b
1831*Cyclostoma scalare Nov.* - Dubois de Montpereux, p. 47, pl. 3, fig. 40, 41.

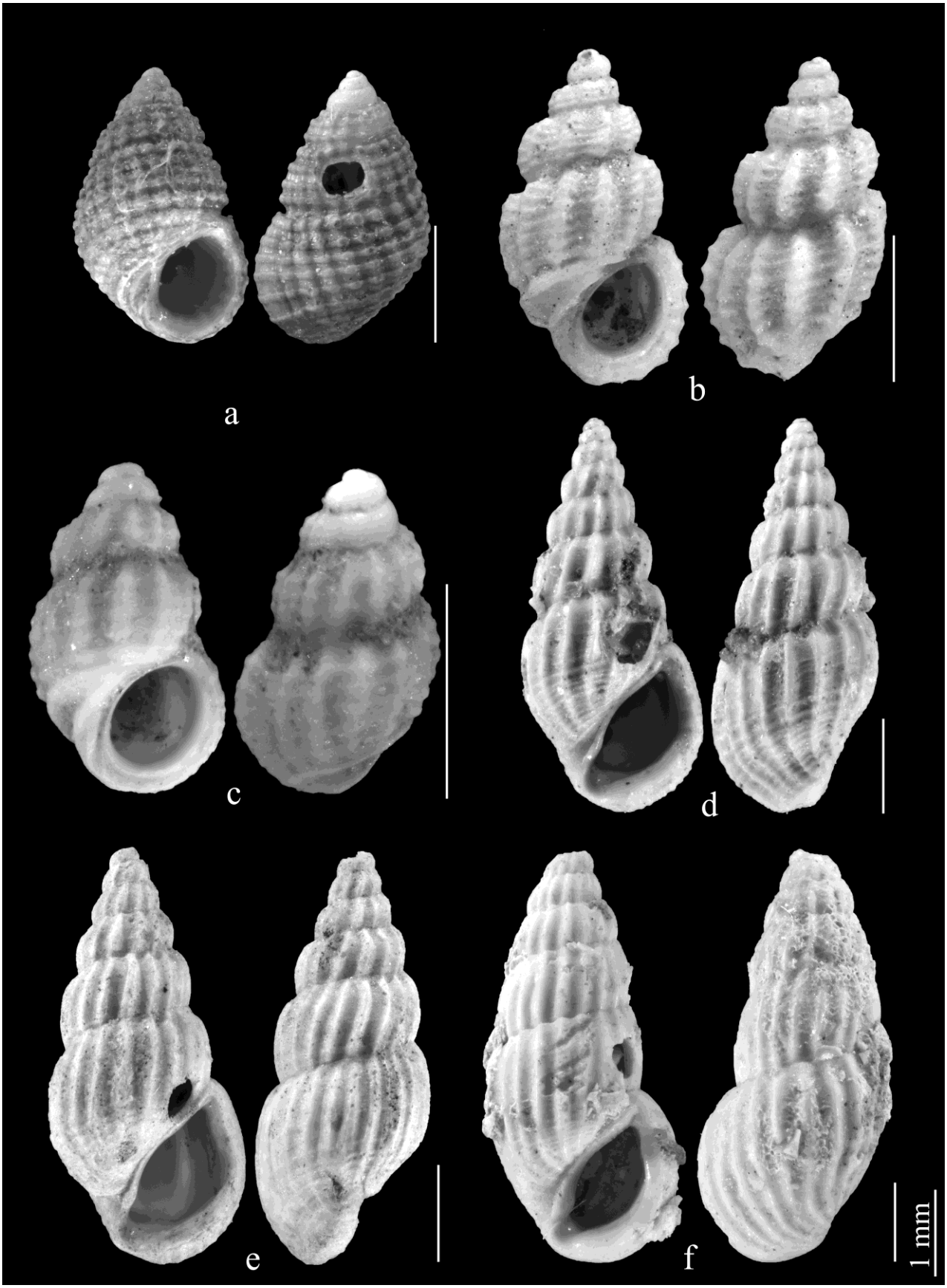

Fig. 3 - a *Alvania* sp. **b** *Manzonia* (*Manzonia*) *scalaris* (Dubois, 1831). **c** *Manzonia* sp. **d** *Rissoina* (*Phosinella*) *steinabrunnensis* Sacco 1895. **e** *Rissoina* (*Rissoina*) *vindobonensis* Sacco, 1895. **f** *Rissoina* (*Rissoina*) *pusilla* (Brocchi, 1814).

1954 *Manzonia scalaris* Dub. - Friedberg, p. 383, pl. 23, fig. 4
1973 *Rissoa* (*Manzonia*) *scalaris* Dubois. - Nicorici pl. 2, fig. 15-18
1975 *Alvania* (*Taramellia*) *scalaris* (Dubois) - Bałuk p. 75, pl. 8, fig. 13
1981 *Alvania scalaris* (Dubois) - Krach, p 51, pl. 15, fig. 17,18
2004 *Manzonia* (*M.*) *scalaris* (Dubois, 1831) - Kowalke & Harzhauser, p. 124, fig. 8D
2012 *Manzonia scalaris* (Dubois, 1831) - Garilli & Parrinello, fig. A1
Material: two specimens from L5 (one specimen PMBBU 23860)
Description: Scalarifom conical shell consisting of five whorls; up to 2.30 mm in height and 1.25 mm in width. Poorly preserved protoconch; thus, transition towards teleoconch or ornamentation could not be observed. Teleoconch with convex whorls separated by a strongly incised suture. Ornamentation consis of strong varicate axial ribs intersected by fine spiral threads. The interspaces between spiral threads are covered by extremely fine spiral threads. The last whorl represents about 65% of the total shell height. It is ornamented by 12 axial ribs intersected by seven spiral threads. Of these, two are very pronounced; they represent the ornamentation of the shell basis. Rounded aperture with strongly thickened holostome-type peristome.
Distribution: identified in: Austria (Kowalke and Harzhauser, 2004), Poland (Friedberg, 1954; Bałuk, 1975; Krach, 1981), Romania (Nicorici, 1973; Garilli and Parrinello, 2012).

Manzonia sp.
Fig. 3c
Material: one specimen from L5 (PMBBU 23861)
Description: Juvenile specimen with five scalariform whorls; 1.55 mm in height and 0.9 mm in width. Protoconch contain of about two convex whorls. Ornamentation is not visible under stereomicroscope. Teleoconch ornamented with axial ribs intersected by less-pronounced spiral threads; in-between the main threads one can notice other extremely fine spiral threads. The last whorl represents about 65% of the total shell height. Ornamentation consists of 14 axial ribs intersected by five spiral threads. Two additional, well-defined spiral threads are present towards the base. Round aperture with strongly thickened peristome.
Remarks: This specimen is similar with a juvenile *Manzonia scalaris* in general shape but differ in protoconch larger diameter and more flatten whorls and it also differ from *M. subzetlandica* by its broad opisthocline axial ribs and subordinate spiral threads.

Subfamily Rissoininae Stimpson, 1865
Genus *Rissoina* d'Orbigny, 1840
Subgenus *Phosinella* Mörch, 1876
Type species: *Rissoina inca* d'Orgbigny, 1840
Rissoina (*Phosinella*) *steinabrunnensis* Sacco 1895
Fig. 3d
1895 *Rissolina lamellosa* var. *Steinabrunnensis* Sacc. – Sacco, 18, p. 37
1966 *Rissoina* (*Phosinella*) *steinabrunnensis* Sacco - Strausz, p. 80, pl. 12, fig. 15-18
1975 *Rissoina* (*Phosinella*) *steinabrunnensis* Sacco - Bałuk, p. 95, pl. 10, fig. 4,5
1981 *Rissoina steinabrunnensis* Sacco - Krach, p 52, pl. 15, fig. 27, 28
2006 *Rissoina* (*Phosinella*) *steinabrunnensis* Sacco - Bałuk, p. 189, pl. 4, fig. 1
Material: two specimens from L5 (one specimen PMBBU 23862)
Description: Slender and elongated turriculated shell with about seven whorls; up to 4.20 mm in height and 1.90 mm in width. Protoconch consisting of about 2.5 convex whorls lacking ornamentation. Teleoconch with convex whorls and deep suture. Ornamentation consisting of prominent axial ribs, arched underneath the suture; this leads to an overall scalariform shell morphology. Fine spiral threads cross-cut the axial ribs. The last whorl represents about 55% of the total shell height. It is ornamented with 17 axial ribs intersected by 13 fine spiral threads, more pronounced towards the base. The oval aperture has an oblique orientation. Weakly incised anterior canal peristome and labrum with external varix.
Distribution: identified in: Poland (Bałuk, 1975, 2006; Krach, 1981), Hungary (Strausz, 1966).

Subgenus Rissoina d'Orbigny, 1840
Rissoina (Rissoina) vindobonensis Sacco, 1895
Fig. 3e
1895 *Rissoina bruguieri vindobonensis* Sacc.- Sacco, 18, p. 35
1960 *Rissoina* (*Rissoina*) *vindobonensis* (Sacco) - Kojumdgieva and Strachimirov, p.102, pl. 30, fig. 20 a, b
1975 *Rissoina* (*Rissoina*) *vindobonensis* Sacco - Bałuk, p. 91, pl. 10, fig. 6,7
1981 *Rissoina* (*Rissoina*) *vindobonensis* (Sacco) - Krach, p 52, pl. 15, fig. 23, 24, 29, 30
Material: one specimen from L5 (PMBBU 23863)
Description: Slender, elongated turriculated shell with more than six whorls; up to 4.3 mm in height and 1.90 mm in width.
Protoconch not fully preserved. Teleoconch with 5.5 slightly-convex whorls and incised suture. Ornamentation consisting of opisthocline axial ribs, more pronounced on the first whorls and finer on the last one. Fine spiral threads in the interspaces between the axial rib area. The last whorl represents 60% of the total shell height. Ornamentation is represented by 22 axial ribs alternating with fine spiral threads. The shell's base is ornamented with fine more pronounced spiral threads. Large and inclined aperture; covered umbilicus and external lip thickened by varix.
Distribution: identified in: Polonia (Bałuk, 1975; Krach, 1981), Bulgaria (Kojumdgieva and Strachimirov, 1960).

Rissoina (Rissoina) pusilla (Brocchi, 1814)
Fig. 3f
1814 *Turbo pusillus* nob. – Brocchi, p. 181, pl. 6, fig. 5
1954 *Rissoina pusilla* Brocc. - Friedberg, p. 356, pl. 20, fig 22
1960 *Rissoina* (*Rissoina*) *podolica* Cossmann - Kojumdgieva & Strachimirov, p. 102, pl. 30, fig. 19

1960 *Rissoina pusilla podolica* Cossmann - Strausz, p. 79, pl. 12, fig. 23-28
part 1975 *Risoina* (*Rissoina*) *podolica* Cossmann - Bałuk, p. 90, pl. 10, fig. 11
1981 *Rissoina* (*Rissoina*) *podolica* Cossmann - Švagrovskỳ, p. 122, pl. 38, fig. 1-4
1981 *Rissoina podolica* Cossmann - Krach, p 51, pl. 15, fig. 25, 26, 34, 35
1993 *Rissoina podolica* Cossmann - Șuraru & Papp, pl. V, fig. 22
2004 *Rissoina (Rissoina) pusilla* (Brocchi) - Landau et al., p. 52, pl 12, fig. 1
Material: two specimens from Lp4 (one specimen PMBBU 23864)
Description: Elongated, incompletely preserved shell; up to 5.25 mm in height and 2.5 mm in width, first whorls not included. Teleoconch with more than five flattened whorls and incised suture. Ornamentation consisting of fine axial ribs showing a straight orientation on the first whorls and a slightly sinusoidal one towards the last ones. There are 22 to 24 ribs on the last whorl. Numerous extremely fine spiral threads present in the interspaces between the axial rib areas. Three spiral threads are more prominent on the last-but-one supra-suture whorl and nine on the last whorl towards the base of the shell. Oval, siphonostome oblique aperture; umbilicus covered by labrum, the latter thickened due to the presence of a varix.
Distribution: identified in: Austria (Kowalke & Harzhauser, 2004), Poland (Friedberg, 1954; Bałuk, 1975; Krach, 1981), Slovacia (Švagrovskỳ, 1981), Hungary (Strausz, 1966), Bulgaria (Kojumdgieva and Strachimirov, 1960), Romania (Șuraru and Papp, 1993).

CONCLUSIONS

Rissoids were well-represented in the Badenian seas of the Central Paratethys. They have been described from Austria and Czech Republic (Kowalke and Harzhauser, 2004), Bulgaria (Kojumdgieva and Strachimirov 1960), Poland (Friedberg, 1954; Bałuk, 1975, 2006; Krach, 1981), Slovacia (Švagrovskỳ, 1981) and Hungary (Strausz, 1966; Bohn−Havas, 1973).
In Romania, Rissoids are known from the Transylvanian Basin and from western basins like Făget Basin, with Coștei (Boettger, 1901-1907; Zilch, 1934) and Lăpugiu de Sus being the occurrences with the highest specimen abundance and diversity.
From samples collected from two outcrops along Coșului Valley (Lăpugiu de Sus) we have described, systematically assigned and illustrated 15 Rissoidae species: *Rissoa acuticosta*, *Rissoa clotho*, *Rissoa costeiensis*, *Alvania* (*Alvania*) *productilis*, *Alvania* (*Alvania*) *perregularis*, *Alvania* (*Alvania*) *ampulla*, *Alvania* (*Alvania*) *helenae*, *Alvania* (*Alvania*) *transiens*, *Alvania* (*Alvania*) *oceani*, *Alvania sp.*, *Manzonia* (*Manzonia*) *scalaris*, *Manzonia sp.*, *Rissoina* (*Phosinella*) *steinabrunnensis*, *Rissoina (Rissoina) vindobonensis*, *Rissoina (Rissoina) pusilla*. They were assigned to two subfamilies: Rissoinae and Rissoininae, and to four genera: *Rissoa*, *Alvania*, *Manzonia* and *Rissoina*.

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REFERENCES

Adams, J., 1798. The specific characters of some minute shells discovered on the coast of Pembrokeshire, with an account of a new marine animal. The Transactions of the Linnean Society of London 3: 64–69.
Ávila, S. P., Goud, J. & Frias Martins, A. M., 2012. Patterns of diversity of the Rissoidae (Mollusca: Gastropoda) in the Atlantic and the Mediterranean Region. The scentific World Journal, vol. 2012, 30 pp.
Bałuk, W., 1975. Lower tortonian gastropods from Korytnica, Poland. Palaeontologia Polonica, 32: 1-186.
Bałuk, W., 2006. Lower tortonian gastropods from Korytnica, Poland. Palaeontologia Polonica, 56 (2): 177-220.
Boettger, O., 1901-1907. Zur Kenntnis der Fauna der mittelmiocänen Schichten von Kostej im Krassó - Szörényer Komitat, Verhand. und Mitt. des Siebenbürg für Naturw. zu Hermannstadt, 51: 1 - 200, 54- 55: 1-244.
Bohn−Havas, M., 1973. Tortonische Molluskenfauna des östlichen Mecsek−Gebirges. Annales Instituti Geologici Publici Hungarici, 53 (4): 951–1161.
Bouchet, P. & Rocroi, J.P., 2005. Classification and Nomenclator of Gastropod Families. International Journal of Malacology, 47(1-2): 1-397.
Brocchi, G., 1814. Conchiologia Fossile Subapennina con Osservazioni Geologiche Sugli Apennini e Sul Suolo Adiacente, Milano, 707 pp.
Brusina, S., 1870. Ipsa Chiereghinii conchylia, ovvero contribuzione pella malacologia adriatica desunta dal manoscritto dall'abate S. Chiereghini. Bibliotheca Malacologia 2: 1–280.
Caze, B, Saint Martin, J.P., Merle, D. & Saint Martin, S., 2010. Intérêt des motifs colorés résiduels des coquilles de mollusques pour la valorisation des sites paléontologiques et des collections: l'exemple du Badénien de Roumanie. In: Saint Martin, J.P, Saint Martin, S., Oaie, G., Seghedi, A. & Grigorescu, D. (eds.) Le patrimoine paléontologique. Des trésors du font des temps, pp 27-38.
Chira, C. & Voia, I., 2001. Middle Miocene (Badenian) Conidae from the Lăpugiu de Sus, România: Systematical and paleoecological data. Studia Universitatis Babeș - Bolyai, Seria Geologia, 46(2): 151 - 160.
Chira, C., 2000. Nannoplancton calcaros și moluște miocene din Transilvania. Ed. Carpatica, Cluj - Napoca, 183 pp.
Cox, L.R., 1959. Thoughts on the classification of the Gastropoda. Proceed ings of the Malacological Society of London 33: 239–261.

Cuvier, G., 1797. Tableau élémentaire de l'histoire naturelle des animaux. Baudoin, Paris. 710 pp.

d'Orbigny, A., 1852. Prodrome de Paléontologie Stratigraphique Universelle des Animaux Mollusques et Rayonnés faisant suite au Cours Élémentaire de Paléontologie et de Géologie Stratigraphique, Masson, Paris 196-190 pp.

Desmarest, A.G., 1814. Description des coquilles univalves du genre Rissoa. Bulletin de la Société Philomatique de Paris 3: 7–9.

Dubois de Montpereux, F., 1831. Conchyliologie fossile et apercu géognostique des formations du plateau Wolhyni−Podolien, Schropp and Companie, Berlin, 76. pp.

Dușa, A., 1958. Câteva date asupra geologiei reg. Lăpugiu de Sus - Dobra - Coștei. Studia Universitatis Babeș - Bolyai, Seria Geologia-Geographia, 2(5): 157-161.

Dușa, A.,1969. Stratigrafia depozitelor mezozoice și terțiare de la Căprioara - Coșteiu de Sus, Ed. Acad. R.S.R., București, 156 pp.

Eichwald, E., 1853. Lethaea Rossica ou Paléontologie de la Russie 3, dernićre période. Schweitzerbart, Stuttgart, 533 pp.

Ferrero Mortara, E., Montefameglio, L., Novelli, M., Opesso, G., Pavia, G. & Tampieri, R., 1984. Catalogo dei tipi e degli esemplari figurati della collezione Bellardi e Sacco, Parte II. Museo Regionale di Scienze Naturali, 7: 1-484

Friedberg, W., 1954. Poloniae finitiarumque terrarum mollusca miocaenica. Polskie Towarzystwo Geologiczne, 1: 235-628.

Garilli, V. & Parrinello, D., 2012. Taxonomy and palaeobiogeography of the Cenozoic Euro - Mediterranean rissoid gastropod *Galeodinopsi*s and its relationship with close genera. Acta Palaeontologica Polonica. http://dx.doi.org/10.4202/app.2012.0044

Gherasii, N., Mureşan, M.,Mureşan, G., Krautner, F., Krautner, H., Lupu, M., Marinescu, F., Savu, H. & Arghir-Drăgulescu, A., 1968. Harta Geologică a R.S.R, scara 1:200.000, foaia 25 Deva, Institutul de Geologie și Geofizică, București.

Golikov, A.N. and Starobogatov, Y.A.I., 1975. Systematics of prosobranch gastropods. Malacologia 15 (1): 185–232.

Gray, J.E., 1847. A list of the genera of Recent Mollusca, their synonyma and types. Proceedings of the Zoological Society of London 15: 129–219.

Halaváts, G., 1876. Felsö-Lapugy mediterrán faunája. Földtani Közlöny, 6: 229-240.

Hauer, F., Stache, G., 1863. Geologie Siebenbürgens, 637 pp.

Hörnes, M., 1851-1856. Die Fossilen Mollusken des Tertiaer-Beckens von Wien, Univalven. Abhandlungen der K. K. Geologischen Reichsanstalt, 3: 1-42, (1851), 43-208 (1852), 209-296, (1853), 297-384, (1854), 385-460, (1855), 461-736, (1856), Wien.

Huică, I. & Dragu, V., 1970. Prezența Volhinianului în culoarul Mureșului (Zona Coșava - Ohaba - Lăpugiu - Fintoag). Studii și cercetari geologice, geofizice și geologice, Seria Geologie,15(2): 441-450.

Koch, A., 1900. Die Tertiärbildungen des Beckens der siebenbürgischen Landesteile II. Neogen. Mitth. a. d. Jahrb. d. kgl. ung. geol. Anst., Budapest, 370 pp.

Kojumdgieva, E. & Strachimirov, B.,1960. Les fossiles de Bulgarie. Academie des sciences de Bulgarie, 7:1-317

Kowalke, T. & Harzhauser, M., 2004. Early ontogeny and palaeoecology of the Mid-Miocene rissoid gastropods of the Central Paratethys. Acta Palaeontologica Polonica, 49(1): 111-134.

Krach, W., 1981. Badeńskie utwory rafowe na Roztoczu Lubelskim oraz ślimaki skrzydłongi (pteropoda) w miocenie polski i ich znaczenie stratygraficzne. Polska akademia nauk - oddział w Krakowie komisja nauk geologicznych - prace geologiczne, 121: 5-140.

Landau, B., Marquet, R., &. Grigis, M., 2004. The Early Pliocene Gastropoda (Mollusca) of Estepona, Southern Spain. Part 2: Orthogastropoda, Neotaenioglossa. Palaeonthos 4: 1-108.

Linnaeus, C., 1758. Systema naturae per regna tria naturae, secundum Classes, Ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio Decima, Reformata.

Lupu, M., Marinescu, F., Roșu, E., Nicolae, I., Mureșan, M. & Popescu, A., 1991. Harta geologică a României, scara 1:50.000, foaia 88b Lăpugi - Coștei, Institutul de geologie și geofizică, București.

Moisescu, G., 1955. Date noi asupra faunei de moluște și brachiopode tortoniene de la Lăpugiul Superior, Revista Universitații C. I. Parhon și a Politehnicii București, 8: 255-286.

Mutihac, V., 1990. Structura geologică a teritoriuluiRomâniei. Ed. Tehnică, București, 419 pp.

Neugeboren, J.L., 1858. Beitrage zur Kenntniss der siebenb. Tertian-Mollusken aus dem Tegelgebilde von Ober-Lapugy. Vehr. Mitt. sieb.Ver Naturw. Hermannstadt, nr. 9. Hermannstadt.

Nicorici, E., 1973. Minutinele Badenian - superioare de la Tusa (Bazinul Șimleu). Dări de seamă ale ședințelor, 60: 93 - 114.

Nițulescu, O.,1930. Contribuțiuni la studiul geologic al regiunii Lăpugiu de Sus (Hunedoara). Revista Muzeului Geologie Mineralogie al Universitatii Cluj, 4(1): 27-45

Orășanu, T., Marinescu, F., Potocean E. &c Olteanu, R., 1970. Biostratigrafia depozitelor neogene de pe rama nord- vestică a munților Poiana Ruscă. Dări de seamă ale ședințelor, 57: 85 - 108.

Petrescu, I., Mészaros, N., Chira, C. & Filipescu, S., 1990. Lower Badenian paleoclimate at Lăpugiu de Sus (Hunedoara County), on account of paleontological investigation. Studia Universitatis Babeş-Bolyai, Geologica, 35(2): 13-21.

Ponder, W. F., 1985. A review of the genera of the Rissoidae (Mollusca: Mesogastropoda: Rissoacea). Records of the Australian Museum 4: 1-221.

Popa, M. & Ianoliu, C., 2000. Badenian mollusks from Răchitova (Hațeg Depression, Romania). Studia Universitatis Babeş-Bolyai, Geologia, 45(2): 79-92.

Rado, G., 1971. Asupra faunei miocene din Bazinul Beiuș (Badenian). Analele Universitații București, Geologie, 20, 171-184.

Risso, A., 1826. Histoire naturelle des principales productions de l'Europe méridionale et particulierement de celles des environs de Nice et des Alpes Maritimes, 4. 439 pp. F.−G. Levrault, Paris.

Sacco, F., 1890–1904. I Molluschi dei terreni terziarii del Piemonte e della Liguria. Parte XVIII. (Melaniidae, Littorinidae, Fossaridae, Rissoidae, Hydrobiidae, Paludinidae e Valvatidae). Royal Accademia delle Scienze Torino 18: 1–51.

Strausz, L., 1966. Die Miozän - Mediterranen gastropoden Ungarns. Akadémiai Kiadó, Budapest, 693 pp.

Švagrovskỳ, J., 1981. Lithofazielle Entwicklung und Molluskenfauna des oberen Badeniens (Miozän M2d) in dem Gebiet Bratislava - Devínska Nová Ves. Západné Karpaty, séria paleontológia, 7: 5-204

Șuraru, N. & Papp, C., 1993. Einge angaben über den mikrofossilen inhalt der ablagerungen des badeniens von Lăpugiu de Sus (Kreis Hunedoara). Studia Universitatis Babeș - Bolyai, Seria Geologia, 38(2): 27-36.

Zilch, A., 1934. Zur fauna des Mittel - Miöcans von Kostej (Banat). Sonderabdruck aus Senckenbergiana, 16(4/6): 193-302.