

## MIDDLE MIOCENE (BADENIAN) CONIDAE FROM LĂPUGIU DE SUS, ROMANIA: SYSTEMATICAL AND PALAEOECOLOGICAL DATA

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**ABSTRACT.** The paper presents in synthesis the conids from Lăpugiu de Sus, especially those which are preserved in the collections of Palaeontology-Stratigraphy Museum of the Babeș-Bolyai University. Conids, carnivorous gastropods who lived in shallow waters from neritic zones, in warm seas, respectively subtropical to tropical, with a normal salinity, have been the most diversified gastropods at Lăpugiu de Sus during the Middle Miocene (Badenian). There are also species which could tolerate slight decreasing of salinity such as *Conus (Conolithus) dujardini brezinae*. It was remarked that the conids from Lăpugiu de Sus lived in the conditions of shore-offshore zones where the temperature of water was about 21°C.

**KEYWORDS:** Gastropods, Conidae, Middle Miocene (Badenian), systematic, palaeoecology, collections, Cluj - Napoca Museum.

### I. INTRODUCTION

The famous fossiliferous site from Lăpugiu de Sus is located in the Mureș River passageway. The Neogene sedimentary is situated between andesitic agglomerates in the north and the Poiana Ruscă Mountains's epicrystalline in the south.

At Lăpugiu de Sus Early Badenian deposits occur. Papp (1976) separated within these deposits the lower boundary of the Early Badenian, which can be followed in few sections cropping out on Crușuța Vinii Valley, and Fântâni Valley. The upper boundary of Early Badenian is outcropping in well-opened sections, such as those from Coșului Valley, Munteanului Valley, and Berii Valley. Most of the studied conids are from Coșului Valley.

The very rich fauna from the Early Badenian deposits from Lăpugiu de Sus was mentioned since 1845 by Bielz. Palaeontological and stratigraphical data on Lăpugiu de Sus Basin are given in Stur (1863), Hauer & Stache (1863), Halovats (1876), Hoernes & Auinger (1879), Koch (1898, 1900), Kadic (1906), Nițulescu (1930), Moisescu (1955), Orășanu et al. (1971), Papp (1976), Petrescu et al. (1990), Chira (1994), a. o.

In 1900, the mollusks list from Lăpugiu de Sus already contained a number of 833 species specified by Koch. This number was enlarged subsequently by numerous researches, thus today there are more than thousand species.

Among mollusks, the gastropods have a higher frequency and among gastropods most of species belong to Conidae.

In a monographic study about the Neogene, Koch (1900) had already specified the presence of 45 species of *Conus*, the most representative genus from

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Lăpugiu de Sus. Nițulescu (1930) mentioned seven species, Moisescu (1955) six species, Papp (1976) – fourteen (all these being already mentioned by Koch, 1900).

## II. SYSTEMATIC ACCOUNT

In the Paleontology-Stratigraphy Museum from Babeș-Bolyai University (Faculty of Biology and Geology) there are eight collections, respectively: Koch, Melka, Protescu, Buda, Papp, Șuraru, Nițulescu, and Chira.

We analysed both the *Conidae* collections exposed in the Paleontology-Stratigraphy Museum and the samples recently collected, and we noticed the existence of a number of 37 species and subspecies. The most frequent species are: *Conus (Conolithus) dujardini dujardini* DESHAYES and *C. (Lithoconus) mercatti miocensis* SACCO, 1893.

The species represented only by one specimen are:

- C. (Leptoconus) tarbelianus* GRATELOUP;
- C. (Chelyconus) marii* SACCO, 1893;
- C. (Chelyconus) noe* BROCC, 1814;
- C. (Chelyconus) mucronatolaevis* SACCO, 1893;
- C. (Lithoconus) daciae* HOERNES & SACCO, AUINGER 1893;
- C. (Stephanoconus) subnocturnus* d'ORBIGNY;
- C. (Stephanoconus) subgranosus* SACCO, 1893;
- C. (Dendroconus) voeslauensis* HOERNES & AUINGEER.

The maximum size belongs to *C. (Lithoconus) mercatti subaustriaca* SACCO, 1893 which has 93,63 mm in height (H) and 61,24 mm in width (L). The species *Conus (Conolithus) dujardini dujardini* DESHAYES has the smaller dimensions, 11,72 mm in height and 5,62 mm in width respectively.

The *Conidae* systematics from Lăpugiu de Sus (Tab. 1) was followed after Strausz (1966), and also with references to Baluk (1997). To actualise these species of *Conus* according to the current synonymy we used the papers of Baluk (1997) taking into consideration also the papers of Hoernes (1856), Koch (1900), Friedberg (1931 - 1934), Csepregy-Meznerics (1956), Kojumdgieva & Strachimirov (1960), Hall (1964), Nicorici & Sagatovici (1973), Papp (1976) and Svagrovsky (1981).

The Conids from the eight collections of the Paleontology-Stratigraphy Museum from Cluj – Napoca are given according to the available bibliographical data, with seven subgenera: *Conolithus* HERRMANNSEN, 1847; *Leptoconus* SWAINSON, 1840; *Lithoconus* MOERCH, 1850; *Chelyconus* MOERCH, 1852; *Cleobula* IREDALE, 1930; *Stephanoconus* MOERCH, 1852; *Dendroconus* SWAINSON, 1840. Among these, we were able to identify 34 species, one of them having 8 subspecies. The complete number of species and subspecies is 37.

It must be mentioned that, according to Baluk (1997), some differences occur, comparing with Strausz (1966) (Tab. 1), concerning the synonymy.

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Table 1.

Systematics of the analysed conids: Class GASTROPODA,  
Subclass PROSOBRANCHIA, Order NEOGASTROPODA, Suprafamily CONACEA,  
Family CONIDAE SWAINSON, 1840, Genus *Conus* LINNE, 1758

SUBGENUS	SPECIES	SUBSPECIES	AUTHOR
	<i>antiquus</i> <i>ventricosus</i> <i>raristriatus</i>		LAMARK, 1810 BRONN BELLARDI & MICH., 1840
<i>Conolithus</i> HERRMANNSEN, 1847	<i>antediluvianus</i> <i>dujardini</i>  <i>dujardini</i>	   <i>dujardini</i> <i>brezinae</i>	BRUGUIERE, 1792 DESHAYES, 1845  HOERNES & AUINGER
<i>Leptoconus</i> SWAINSON, 1840	<i>extensus</i> <i>tarbelianus</i> <i>brochii</i>		PARTSCH, 1856 GRATELOUP SACCO, 1893
<i>Lithoconus</i> MOERCH, 1850	<i>subacuminatus</i> <i>mercatti</i>  <i>mercatti</i>  <i>mercatti</i>  <i>hungaricus</i>  <i>daciae</i>	<i>miocenicus</i>  <i>subaustriaca</i>  <i>canaliculato-</i> <i>depressa</i>	d'ORBIGNY, 1852 SACCO, 1893  SACCO, 1893  SACCO, 1893  HOERNES & AUINGER, 1879 HOERNES & AUINGER
<i>Chelyconus</i> MOERCH, 1852	<i>vindobonensis</i>  <i>fuscocingulatus</i> <i>suessi</i>  <i>enzenfeldensis</i>  <i>puschi</i> <i>ponderous</i> <i>pelagicus</i>  <i>marii</i>  <i>noe</i> <i>cf. noe</i>  <i>ottiliae</i>  <i>olivaeformis</i> <i>mucronatolaevis</i>		PARTSCH &HOERNES, 1848 HOERNES, 1856 HOERNES & AUINGER, 1879 HOERNES & AUINGER, 1879 MICHELOTTI, 1847 BROCCHI, 1814 BROCCHI  SACCO, 1893  BROCCHI, 1814 BROCCHI, 1814  HOERNES & AUINGER, 1879 HOERNES & AUINGER SACCO, 1893
<i>Cleobula</i> IREDALE, 1930	<i>Berghausi</i>  <i>subraristriatus</i> <i>cf. subraristriatus</i>	<i>vaceki</i>	HOERNES & AUINGER, 1879 COSTA, 1866 COSTA, 1866
<i>Stephanoconus</i> MORCH, 1852	<i>subnocturnus</i> <i>subigranosus</i>		d'ORBIGNY, 1852 SACCO, 1893
<i>Dendroconus</i> SWAINSON, 1840	<i>betulinoides</i> <i>voeslauensis</i>  <i>aff. piruloides</i> <i>berghausi</i>	   <i>bifasciolata</i>	LAMARK, 1810 HOERNES & AUINGER, 1879 DODERLEIN SACCO, 1893

After Baluk (1997), the present – day synonymy is:

**Conus (Conolithus) dujardini** Deshayes, 1845

(= *Conus antediluvianus* Bruguières

= *Conus (Conolithus) dujardini brezinae* Hoernes & Auinger);

**Conus (Lautoconus) posticestriatus** Kojumdgieva, 1960

(= partim *Conus (Chelyconus) suessi* Hoernes & Auinger);

**Conus (Lithoconus) berghausi** Michelotti, 1847

(= *Conus (Dendroconus) daciae* Hoernes & Auinger

= *Conus (Lithoconus) mercati daciae* (Hoernes & Auinger)

= *Conus (Dendroconus) vaceki* Hoernes & Auinger

= *Conus (Cleobula) berghausi vaceki* Hoernes & Auinger

= *Conus (Dendroconus) voeslauensis* Hoernes & Auinger);

**Conus (Lithoconus) betulinoides** Lamarck, 1810

(= *Conus (Dendroconus) betulinoides* Lamarck);

**Conus (Chelyconus) ponderosus** Brocchi, 1814

(= *Conus ponderosus* Brocchi

= *Conus (Chelyconus) enzesfeldensis* Hoernes & Auinger);

**Conus (Chelyconus) pyrula** Brocchi, 1814

(= ? *Conus (Chelyconus) ottiliae* Hoernes & Auinger

= ? *Conus (Chelyconus) olivaeformis* Hoernes & Auinger

= *Chelyconus mucronatolaevis* Sacco);

**Conus (Chelyconus) rotundus** Hoernes & Auinger, 1879

(= partim *Conus ventricosus* Bronn);

**Conus (Chelyconus) vindobonensis** Partsch in Hoernes, 1856

(= partim *Conus ventricosus* Bronn

= *Conus (Chelyconus) vindobonensis* Partsch

= ? *Conus fuscocingulatus* Bronn).

### III. PALAEOECOLOGICAL DATA

#### Bathymetry

The bathymetric distribution of contemporaneous species of *Conus* (Hall, 1964) point out that most of the species can be found in shore zones or in neritic zones with shallow water. Hall (1964) assumed that it was possible that most of Conidae (from Piedmont) belonging to “Burdigalian-Helvetian” could have lived in waters in the area between ebb line and about 10 m ( no more than 20 m) depth.

It is estimated that the *Conids* from Lăpugiu de Sus lived in the neritic area with shallow water, except for *Conus (Conolithus) dujardini*, *C. (Conolithus) antediluvianus* and *C. (Chelyconus) pushi*, which might have lived in deeper marine waters.

#### Feeding and substratum

Hall (1964) assumed that *Conus* species from Miocene ages had different ways of feeding and that they lived in the same substratum as the contemporary ones. By analogy with present-day Conids, as well as with those from Piedmont presented by Hall (1964), we may assume that most of Conids from Lăpugiu de Sus lived on, or buried in the sand, having various preferences regarding food, such as: polychaetes worms or enteropneusts, gastropods etc.

### Sea-surface temperature

In present-day areas of the Mediterranean Sea, where only one species of *Conus*: *C. ventricosus* GMELIN (= *C. mediterraneus* HWASS) lives, the lowest temperature at the sea-surface in Adriatic Sea is about 10°C, during four month per year and the mean value is between 18-20°C, slightly raised in the rest of the year. In the Ligurian and Tyrrhenian Seas sea-surface temperatures are slightly increased (12-13°C) during five months starting with November.

If the temperature is an important factor that influences the entire existence of *Conus*, then the Early Badenian Sea from Lăpugiu de Sus area was warmer than the present-day Mediterranean Sea because here 45 species were specified (Koch, 1900).

Therefore, we may conclude that the marine paleoclimate was a tropical one where the temperature at sea-surface exceeded 20°C.

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**PLATE I:**

- 1.a, b; 4.a, b *Conus ventricosus* BRONN - Inv. 11271, x 0.86; Inv. 1126, x 1.71
- 2.a, b *Conus raristriatus* BELLARDI & MICHELOTTI - Inv. 11277, x 0.87
- 3.a, b *Conus antiquus* LAMARCK - Inv. 2651, x 1.73
- 5.a, b *Conus (Conolithus) dujardini dujardini* DESHAYES - Inv. 23212, x 2.13
- 6.a, b *Conus (Conolithus) antediluvianus* BRUGUIERE - Inv. 11276, x 1.51

**PLATE II:**

- 1.a, b *Conus (Leptoconus) extensus* PARTSCH - Inv. 1842, x 0.69
- 2.a, b *Conus (Lithoconus) mercatti caniculatodepresa* SACCO - Inv. 12479, x 0.87
- 3.a, b *Conus (Lithoconus) mercatti miocenicus* SACCO - Inv. 23214, x 1
- 4.a, b *Conus (Lithoconus) mercatti subaustriaca* SACCO - Inv. 23211, x 0.90
- 5.a, b *Conus (Chelyconus) vindobonensis* PARTSCH - Inv. 2613, x 1.49

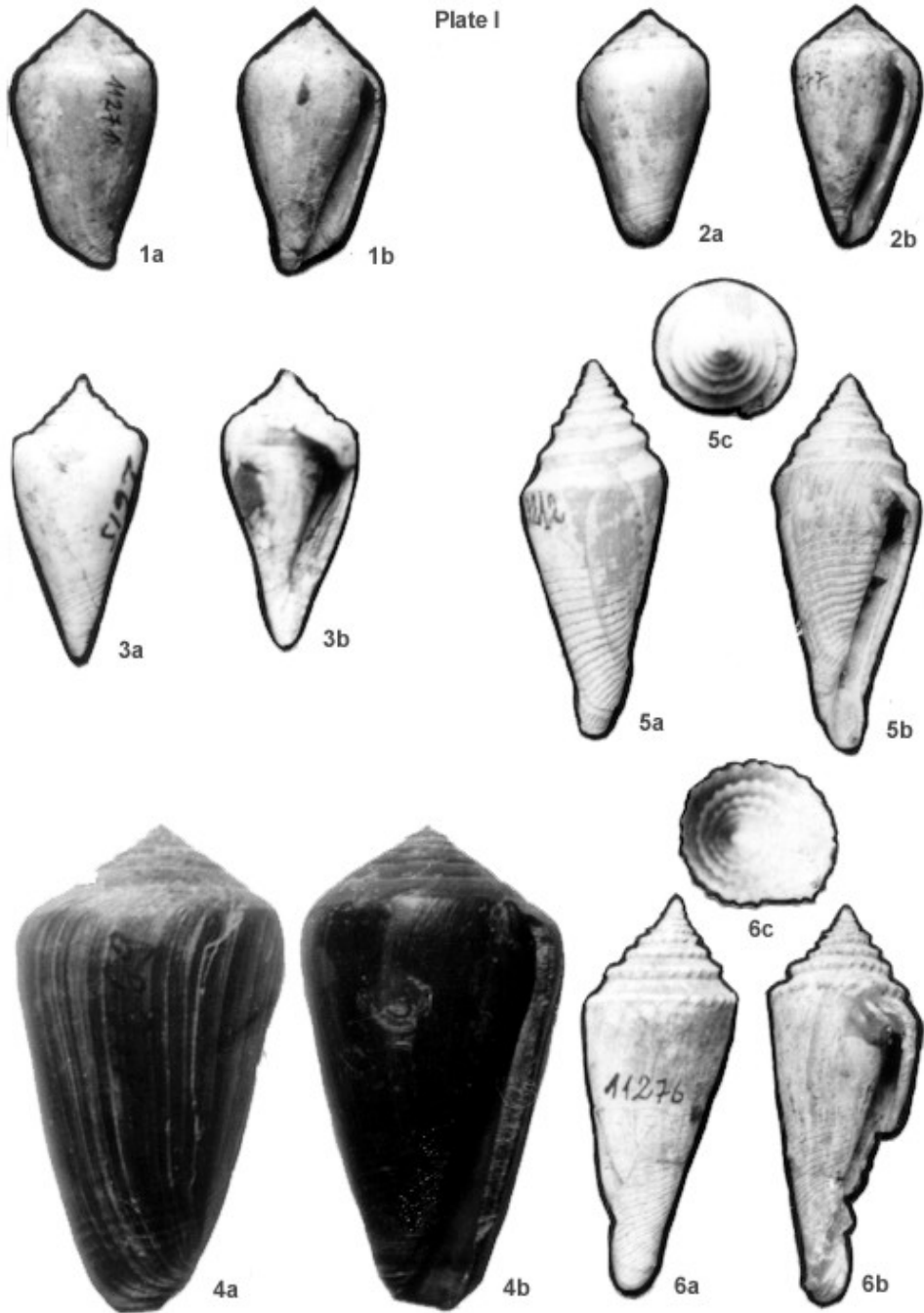
**PLATE III:**

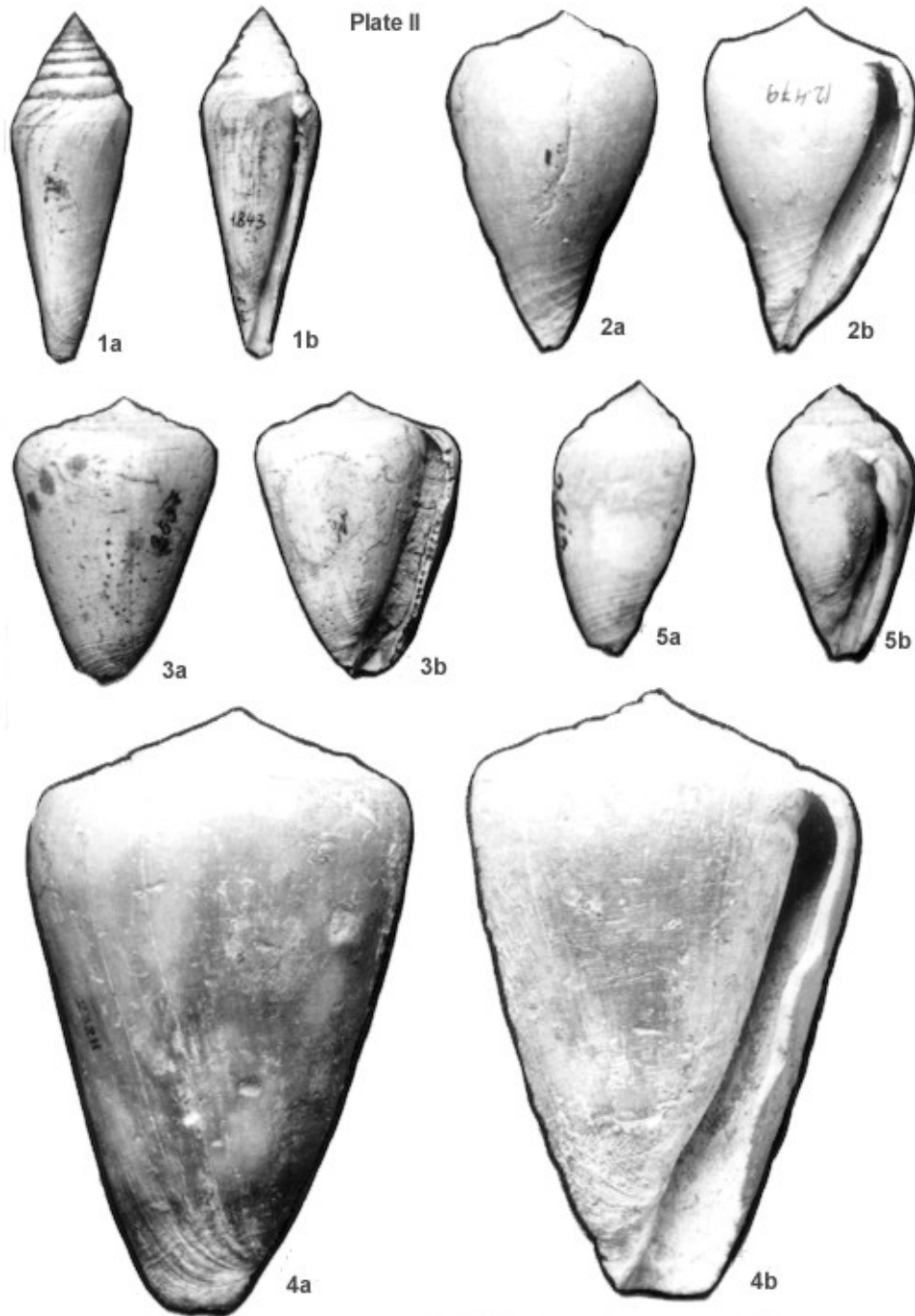
- 1.a, b *Conus (Chelyconus) ponderosus* BROCCCHI - Inv. 2509 B, x 0.86
- 2.a, b *Conus (Chelyconus) noe* BROCCCHI - Inv. 12216, x 0.96
- 3.a, b *Conus (Chelyconus) enzesfeldensis* HOERNES & AUINGER - Inv. 18961, x 1

**PLATE IV:**

- 1.a, b *Conus (Chelyconus) puschi* MICHELOTTI - Inv. 1843 A, x 1.07
- 2.a, b *Conus (Chelyconus) marii* SACCO - Inv. 11280, x 0.85
- 3.a, b *Conus (Dendroconus) betulinoides* LAMARCK - Inv. 11273, x 0.87
- 4.a, b *Conus (Dendroconus) voeslauensis* HOERNES & AUINGER - Inv. 18953, x 1.52
- 5.a, b *Conus (Cleobula) berghausi vaceki* HOERNES & AUINGER - Inv. 2593, x 1.95.

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