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First record of *Tectura compressiuscula* (Patellogastropoda, Lottiidae) from the Middle Miocene of Hungary

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Riassunto

Viene descritto il ritrovamento di un piccolo patellogastropodo della famiglia Lottiidae, *Tectura compressiuscula* (Eichwald, 1830), nel giacimento miocenico (Badeniano inferiore) di Sámsonháza, Ungheria. Questa specie non è stata precedentemente segnalata per l'Ungheria, e gli esemplari raccolti sono di maggiori dimensioni rispetto a quelle usuali nella sua area di distribuzione (Polonia, Ucraina e Moldavia, Badeniano della Paratetide centrale e Sarmaziano della Paratetide orientale). La morfologia della protoconca e della teleoconca, così come la microstruttura della conchiglia, sono simili a quelle di *Tectura zboroviensis* (Friedberg, 1928) del Badeniano della Paratetide centrale. Questo ritrovamento contribuisce ad estendere le nostre conoscenze sulla dispersione dei piccoli patellogastropodi della famiglia Lottiidae nel bacino della Paratetide durante il Miocene. Viene fornita una dettagliata descrizione ed illustrazione (SEM) della specie.

Abstract

A new minute patellogastropod *Tectura compressiuscula* (Eichwald, 1830) belonging to the family Lottiidae was discovered in Lower Badenian sandy deposits of Hungary (Sámsonháza). The specimens found are unusually large for the species, known from a wide range in the Paratethys. The protoconch and teleoconch morphology, as well as the shell microstructure, are similar to those of *Tectura zboroviensis* (Friedberg, 1928) from the Badenian of Central Paratethys. This finding has implications about the palaeogeographic distribution of small-shelled patellogastropods in the Paratethyan Basin during the Miocene.

Key words

Gastropoda, Patellogastropoda, Lottiidae, *Tectura*, Systematics, Miocene, Hungary.

Introduction

The small-shelled representatives of patellogastropods, though not occurring abundantly, settled various shallow to deeper normal marine and brackish water habitats in the Oligocene and Miocene of the Mediterranean, Paratethys and North Sea Basin. They have been studied by many authors (Eichwald, 1830-1853; Karsten, 1849; von Koenen, 1882; Sinzov, 1892; Friedberg, 1928; Kolesnikov, 1935; Jekelius, 1944; Anderson, 1959; Bałuk, 1975; Janssen, 1984; Harzhauser & Kowalke, 2002; Anistratenko & Anistratenko, 2007), but yet insufficiently.

The protoconch and teleoconch morphology of two patellogastropod specimens from the Lower Badenian (Langhian stage of the standard scale) sandy outcrop at Sámsonháza (Hungary) point to *Tectura compressiuscula* (Eichwald, 1830). This species has a typical patellogastropod protoconch indicative of a planktonic early development, with a free-swimming larval stage. The affinity of these shells with other Miocene *Tectura* is also supported by their similarity in shell structure with *Tectura zboroviensis* (Friedberg, 1928) from the Badenian of Central Paratethys (Anistratenko et al., 2006). Both species appears have not been mentioned in the paleontological literature as being recorded from Hungary (e.g. Csepreghyné Meznerics, 1954; Strausz, 1966; Báldi, 1986).

Although the exact taxonomic attribution of the patellogastropods here investigated requires confirmation, we assign them provisionally to the family Lottiidae Gray, 1840, as herein discussed.

Material and methods

The present work is based on two specimens, found in 2008, from the Lower Badenian locality at Buda Hill, "Mogyoróspuszta", Hungary (**Fig. 1**), known in the paleontological literature as Sámsonháza (Csepreghyné Meznerics, 1954).

The shell microstructure of *Tectura compressiuscula* was investigated using some fragments of one partially broken specimen. The SEM images were obtained in the Institute of Geological Sciences, National Academy of Sciences of the Ukraine (Kiev) (IGS NANU in the following). The material was mounted on stubs, sputter-coated with platinum and then documented using a JSM-6490 Scanning Electron Microscope. The figured specimen is housed at IGS NANU.

Nomenclatural notes and taxonomy

Concerning the Miocene patellogastropods, we accept the genus name *Tectura* Gray, 1847 (type species *Patella*

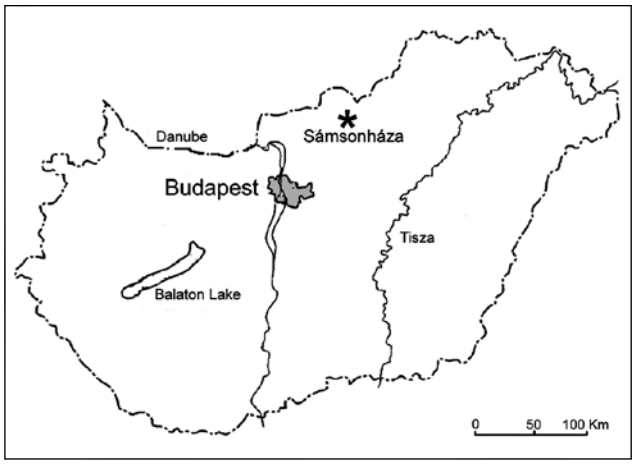

Fig. 1. Location of the outcrop at Sámsonháza, Hungary, where *T. compressiuscula* was found.

Fig. 1. Ubicazione dell'affioramento a Sámsonháza, Ungheria, in cui è stata trovata *T. compressiuscula*.

virginea O.F. Müller, 1776) as a valid generic name for the Miocene lottiids that have the typical protoconch morphology seen in *Patella virginea*. However, there is considerable uncertainty in this attribution, since these Middle-Miocene "*Tectura*" species differ substantially from *Tectura virginea* in having an aragonitic outer shell layer, whereas the latter has a calcitic one (for more details see Anistratenko et al., 2006, Anistratenko & Anistratenko, 2007).

Many authors considered *Tectura* either as a synonym of *Acmaea* Eschscholtz in Rathke, 1833 (*Acmaea* Eschscholtz, 1828 is a *nomen nudum*), or as a subgenus of the genus *Acmaea* (e.g. Knight et al., 1960; Bałuk, 1975). Golikov & Starobogatov (1975) considered *Tectura* as a separate genus and suggested using "Tecturidae Gray, 1847" for the family name instead of "Acmaeidae Carpenter, 1857" because the former has priority. According to modern systematics, the genus *Tectura* belongs in the Acmaeoidea, family Lottiidae (e.g. Sasaki, 1998).

Shell microstructure

It is known that some patellogastropods are characterized by having both calcitic and aragonitic shell layers and this is interpreted as the most primitive gastropod shell structure. Calcitic layers in the patellogastropod shells include foliated and homogeneous structures, whereas aragonitic layers are predominantly crossed-lamellar. Some families, *e.g*. the Patellidae, possess both foliated and crossed-lamellar structures, whereas the Lottiidae have shells with thin outer calcitic homogeneous layers and inner aragonitic crossed-lamellar layers (MacClintock, 1967; Lindberg, 1998; Forli et al., 2004).

Our results revealed that the shell wall of *Tectura compressiuscula* only consists of a simple type of aragonitic crossed-lamellar structure (**Fig. 2**), with no calcitic layer. This structure is the same as in the Badenian *Tectura zboroviensis* and in the species of the genus *Blinia* O. Anistratenko, Bandel & V. Anistratenko, 2006 from the Sarmatian of the Paratethys (Anistratenko et al., 2006). In spite of this similarity, the embryonic shell of *Blinia* species indicates a lecithotrophic larval development, without a short free-swimming larval stage following the yolk-rich embryogenesis.

Most of *T. compressiuscula* shell is composed of one layer of crossed lamellae in which the needles of the two directions of lamellae of the first order commonly intersect (**Fig. 2**). A similar structure is known from the oldest confirmed record patellid, the Upper Triassic *Scutellastraea costulata* (Münster, 1841) from the San Cassiano Formation of Northern Italy, and from a patellogastropod species of similar shape from the Paleocene of Alabama (Bandel, 1982). Moreover that species has a typical patellid protoconch, resembling that of both *Tectura* species mentioned here.

The outer layer of *T. compressiuscula* also resembles that of *T. zboroviensis*: it is thin, porous and aragonitic in construction. These characters clearly distinguish both species from *Patella* and its relatives, which have a calcitic outer layer with a characteristic layered structure, usually quite thick and with a rather complex structure (Anistratenko et al., 2006).

Systematics

Class Gastropoda Cuvier, 1797
Order Patellogastropoda Lindberg, 1986
Family Lottiidae Gray, 1840
Tectura Gray, 1847
(Type species *Patella virginea* O.F. Müller, 1776, Northern Atlantic and Mediterranean Sea)

Tectura compressiuscula (Eichwald, 1830)
(**Figs 2a-c, 3a-d**)

Pileopsis compressiuscula Eichwald, 1830: p. 214.
Acmaea compressiuscula – Eichwald, 1850: p. 82, pl. 6, figs 19a-c.
Tectura compressiuscula – Friedberg, 1928: p. 534, pl. 35, fig. 6.

Material

Two specimens from the Lower Badenian of Sámsonháza, Hungary, IGS NANU, Sámsonháza_1/2009 (ex coll. B. Dell'Angelo).

Description

Shell limpet-like, small, high-conical. The apex in adult specimens is positioned almost centrally or somewhat tilted backward; the apical angle (measured from the front view) varies between 60° and 75° in different specimens. The aperture is moderately broad oval. The protoconch is directed backward, elongated, and positioned asymmetrically relative to the sagittal axis of the teleoconch. The transition from the embryonic shell to the early teleoconch is distinct. The sculpture consists of numerous fine concentric growth lines crossed by radial ribs, producing the "waffle" ornamentation. The outer sculptured layer is commonly peeled off and the sur-

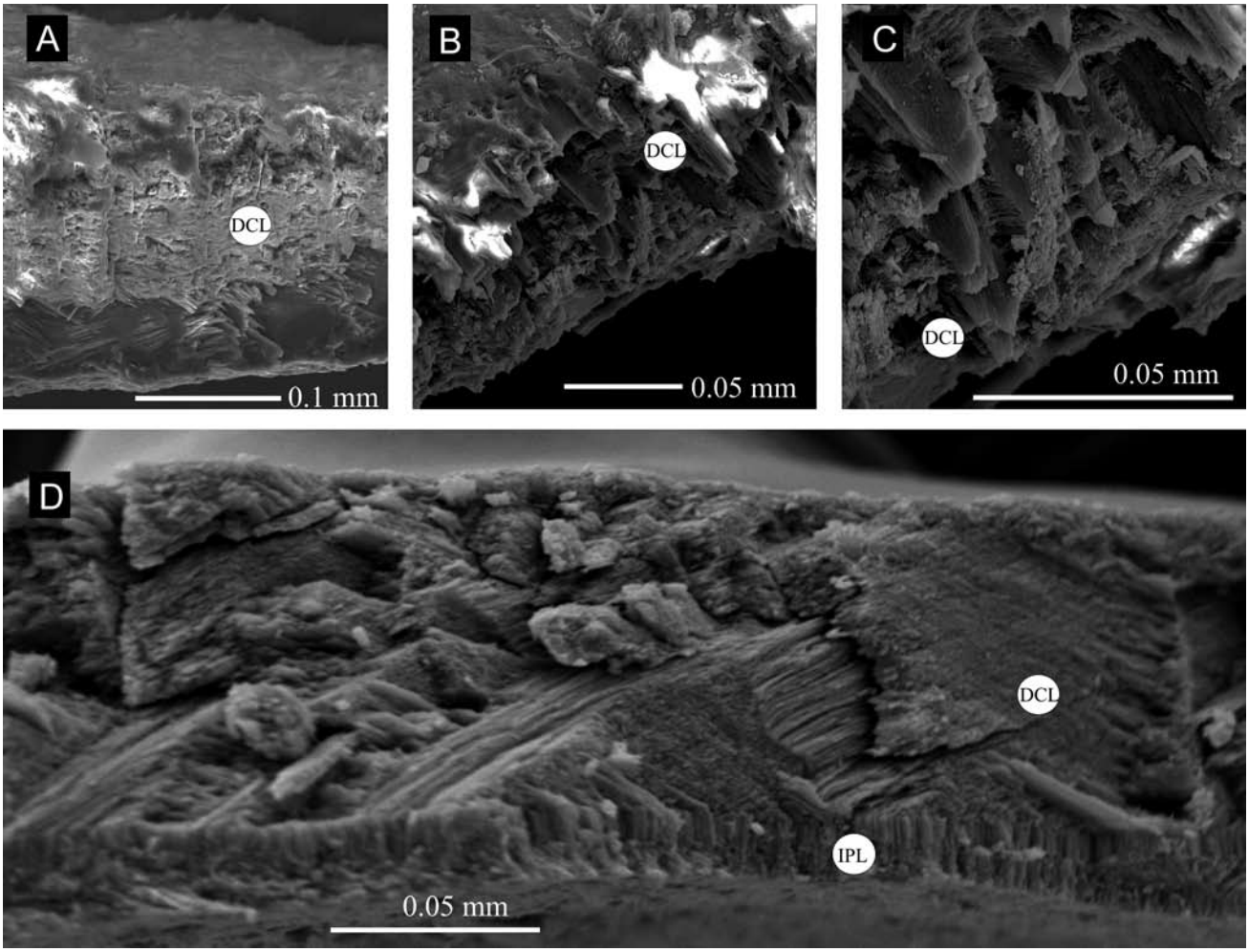

Fig. 2. Shell structure of lottiids discussed in the text. **A-C.** *Tectura compressiuscula* (Eichwald, 1830). SEM images of cross-sections, showing the dissected aragonitic crossed lamellar structure (DCL) and the aragonitic porous outer layer of the shell; inner prismatic layer is not visible and apparently absent. **D.** *Tectura zboroviensis* (Friedberg, 1928). Specimen (IGS NANU, 18/2003) from the Chokrakian of Yurkino (Crimea Peninsula, Ukraine), reveals the similar composition with crossed lamellar layer (DCL) and inner prismatic layer (IPL).

Fig. 2. Struttura conchigliare dei lottidi discussi nel testo. **A-C.** *Tectura compressiuscula* (Eichwald, 1830). Immagini di sezioni trasversali al microscopio elettronico, che mostrano la struttura aragonitica a lamelle incrociate (DCL) e lo strato aragonitico esterno poroso della conchiglia; lo strato prismatico interno non è visibile ed è apparentemente assente. **D.** *Tectura zboroviensis* (Friedberg, 1928). Esemplare (IGS NANU, 18/2003) dal Chokrakiano di Yurkino (Penisola di Crimea, Ucraina) che rivela una struttura simile, con uno strato a lamelle incrociate (DCL) e uno strato prismatico interno (IPL).

face of the teleoconch in most adult individuals appears smooth, or at least lacks the radial ribs.

Measurements

LS – 8.5, HS – 6.9, WS – 5.2, AP – 5.0 (specimen IGS NANU, Sámsonháza_1/2009); LS – 8.2, HS – 5.5, WS – 5.4, AP – 4.4 (specimen IGS NANU, Sámsonháza _2/2009). AP – apex position, i.e. distance of apex from frontal edge (Abbreviations: HS – height of shell; LS – length of shell; WS – width of shell; size in mm).

Remarks

The study specimens correspond fairly well in shape and proportions to the original description (Eichwald, 1830: p. 214) and to the subsequent re-description and illustration of *Acmaea compressiuscula* (Eichwald 1850: p. 82, pl. 6, fig. 19a-c). The specimens of *T. compressiuscula* from the Badenian of Hungary differ from all the known records from the Paratethys Middle Miocene in its larger teleoconch. Unfortunately, because of a thick layer of crust covering in part the surface, it was impossible to assess the original size of the protoconch. *Tectura compressiuscula* differs from *T. zboroviensis* in having a comparatively higher shell (ratio HS/LS up to about 0.8), which is also compressed laterally, whereas the latter species is characterized by a clear broad oval outline of the aperture.

Distribution

According to Anistratenko & Anistratenko (2007), the distribution of *Tectura compressiuscula* ranges from the Badenian of Central Paratethys to the Early Sarmatian (Serravallian of the standard scale) of Eastern Paratethys, i.e. eastern Poland and the Volhynian-Podolian region of Ukraine. The species was also recorded from the Badenian and Sarmatian reef facies of Moldova (Anistratenko & Anistratenko, 2007).

This finding has biogeographic implications, as it extend our knowledge on the dispersal of the planktonic

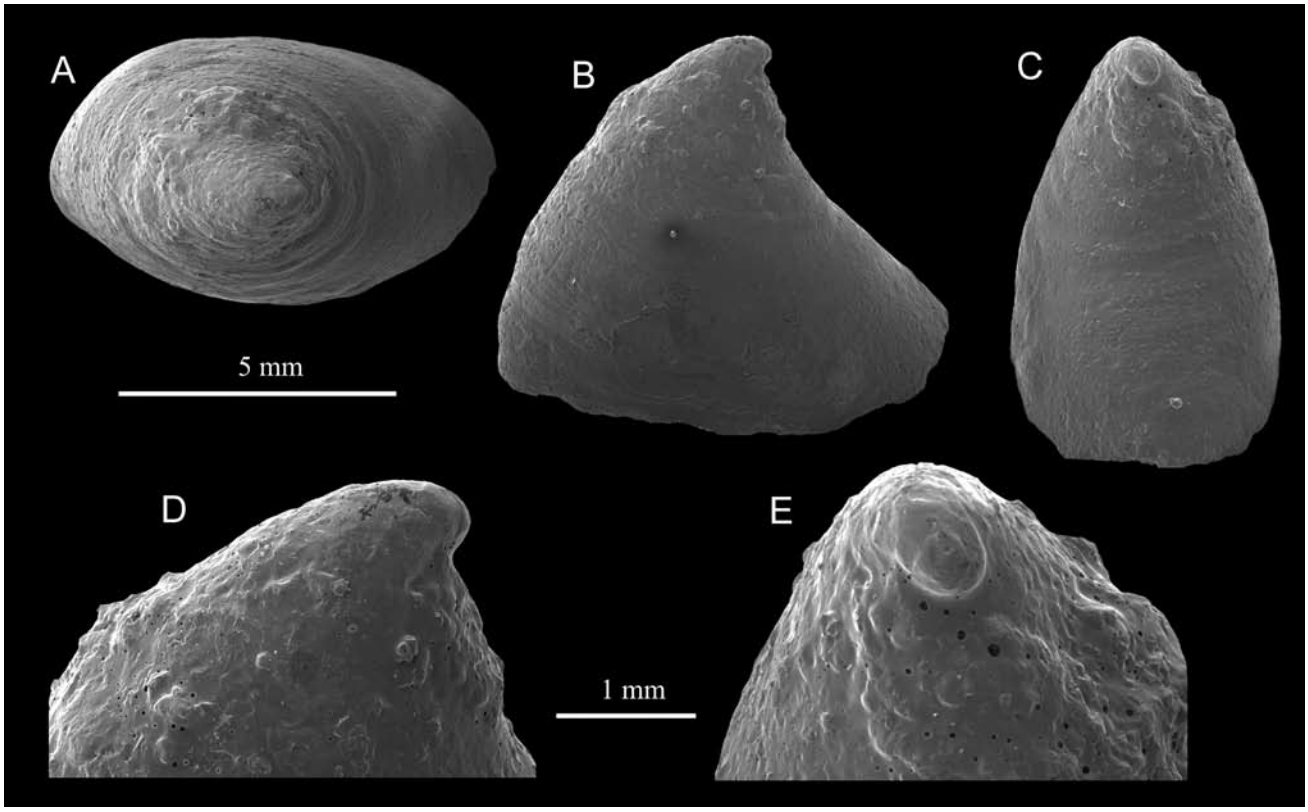

Fig. 3 A-D. *Tectura compressiuscula* (Eichwald, 1830). **A.** Apical view. **B.** Left lateral view. **C.** Posterior view. **D.** Details of left lateral view of the embryonic shell. **E.** Details of posterior view of the embryonic shell; the coiled part of the protoconch is visible.

Fig. 3 A-D. *Tectura compressiuscula* (Eichwald, 1830). **A.** Vista apicale. **B.** Vista laterale sinistra. **C.** Vista posteriore. **D.** Dettagli della vista laterale sinistra della conchiglia embrionale. **E.** Dettagli della vista posteriore della conchiglia embrionale; è visibile la parte avvolta della protoconca.

and lecithotrophic representatives of the family Lottidae in the Miocene of the Central Paratethys.

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