

Contributions to eratoid systematics (Mollusca, Gastropoda, Trivioidea), 5. Middle Miocene, Badenian Eratoidae from Borsodbóta (Hungary)

Dirk Fehse¹ & Jozef Grego²

¹Nippeser Str. 3, D-12524 Berlin, Germany; dirk.fehse@rohde-schwarz.com

²Limbová 23, SK-97409 Banská Bystrica, Slovakia; jozef.grego@evonik.com

Received 18 August 2010; revised version accepted 23 February 2012

A species-rich, middle Miocene, eratoid fauna collected at Borsodbóta ('Királdi-útbevágás', Borsod-Abaúj-Zemplén County, Hungary) is presented and two new species, *Cypraeerato yolandae* sp. nov. and *Cypraeerato badenica* sp. nov., are described. All Miocene Eratoidae of Europe that occurred in the Paratethys are revised and neotypes for *Erato subcypraeola* d'Orbigny, 1852, *E. incrassata* Coppi, 1876, *E. spiralis* Sacco, 1894 and *E. hemmoorensis* Schilder, 1929 are designated. The fauna is compared with those recorded from other European Miocene deposits.

KEY WORDS: Miocene, Badenian, Paratethys, Hungary, Austria, Italy, France, Gastropoda, Eratoidae, new species, neotype designation

Introduction

In previous papers (Fehse & Landau, 2002a, b; 2003) the Eratoidae of the Oligocene, late Miocene (early Redonian) and early Pliocene (Zanclean) of Europe were reviewed. In the present paper the review of European Tertiary eratoids is continued.

The locality of Borsodbóta ('Királdi-útbevágás', Borsod-Abaúj-Zemplén County, Hungary) is the richest early Badenian deposit for triviid and eratoid species known to date, with two dozen taxa. Almost all of the gastropod species represented in the shell grit of the sandy sediment are small; this might be due to a mechanical sorting effect by water currents similar to Sceaux d'Anjou (département Maine-et-Loire, France) (Brébion, 1964, p. 680; Fehse & Landau, 2002b, p. 91). This deposit probably represents a near-shore environment and deposition under slightly warmer conditions than today at the same latitude, which is indicated by the occurrence of numerous thermophilic gastropod genera, including *Neosimnia*, *Zonarina*, *Oliva*, *Conus*, *Pterynotus*, *Terebra* and others. However, other 'warm-water' families, such as Cypraeidae, are poorly represented. Lists of non-eratoid taxa were published by Csepregy-Meznerics (1969a-c; 1970) and the occurrence of most species could be confirmed by our own collecting in 2006/2007. The geology and chronostratigraphy of the bioclastic gravelly sands of Borsodbóta are described by Moissette *et al.* (2007) and Bohonné Havas *et al.* (2005).

In the systematic part below only references that include shell images are included in the synonymy of each species. Due to erroneous identifications observed in many papers it is impossible to know which taxa authors dealt with when only species names were mentioned or listed.

Most of the type specimens are illustrated herein for the first time. Several neotypes are designated due to various taxonomic problems. Two new species in the genus *Cypraeerato* Schilder, 1932a are described as *C. yolandae* sp. nov. and *C. badenica* sp. nov.

In his 'Monograph of the subfamily Eratoinae' Schilder (1933) mentioned many morphological features including the development of pustules, the presence of a dorsal sulcus, shell dimensions, *etc.* that were supposed to characterize each *Erato* species. A detailed study of hundreds of specimens of all Recent and fossil species within the family, however, has shown that those features are unsuitable because there is a high rate of intraspecific variability. Specimens from Borsodbóta are usually smaller and less inflated than those found in Italian and French deposits. The main characteristics used to separate eratoid species are the appearance of the dentition, the terminal ridge and the ventral folds that are developed from the most anterior columellar denticles. Therefore it is not always easy to discuss these distinguishing features. Images of the ventral folds are more important and the reader is invited to study the drawings and photographs given herein.

It is noteworthy that all species referred to herein became

extinct during the Tortonian, late Miocene. In the Messinian, late Miocene, a new suite of species arose (Fehse & Landau, 2002b). A detailed overview of the shell morphology of Eratoidea can be found in Fehse (2011: 148, text fig. 1).

In older literature concerning the Central Paratethys the frequently applied chronostratigraphical indication 'Badenian' (no longer in official use) covers the Langhian and the early part of the Serravallian of modern nomenclature. We maintain the term Badenian in citations, as it is frequently impossible to ascertain the correct modern stage name. Locality names, sometimes differing from present day usage, are cited as given in the literature.



Figure A. Map of Hungary and location of Borsodbóta in the county of Borsod-Abaúj-Zemplén (adapted from http://en.wikipedia.org/wiki/File:Hungary_location_map.svg).

Abbreviations

To denote the repositories of material referred to herein, the following abbreviations are used:

- CS F.A. Schilder collection, now in SMF.
- BS Bellardi & Sacco collection, Museo Regionale di Scienze Naturali, Turin, Italy.
- DFB Dirk Fehse collection, Berlin, Germany.
- GIH Geological Institute, Budapest, Hungary.
- JGS Jozef Grego collection, Banská Bystrica, Slovakia.
- NHMW Naturhistorisches Museum, Vienna, Austria.
- SMF Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt am Main, Germany.
- UW Uniwersytet Warszawski Warsaw, Poland.
- ZVH Zoltán Vicián collection, Budapest, Hungary.
- ZSM Zoologische Staatssammlung, Munich, Germany.

In descriptions of species:

- L length of the shell including spire.
- W width of the shell.
- H height of the shell.
- CT number of columellar denticles.
- LT number of labral denticles.
- * first valid description.

Systematic palaeontology

- Superfamily Trivioidea Troschel, 1863
- Family Eratoidea Schilder, 1925
- Subfamily Eratoinae Schilder, 1925
- Genus *Eratopsis* Hoernes & Auinger, 1879

Type species – *Eratopsis barrandei* Hoernes & Auinger, 1879, by monotypy.

Discussion – Species of *Eratopsis* are characterised by their ovate outline, the ribbed ventrum and pustulated dorsum.

Eratopsis barrandei Hoernes & Auinger, 1879

Plate 15, figs 1-4

- *1879 *Eratopsis barrandei* Hoernes & Auinger, p. 64, pl. 8, fig. 8a-c.
- 1924 *Erato subcypraeola* (d'Orb.) – Cossmann & Peyrot, p. 392 (pars), pl. 11, figs 44, 45.
- 1933 *Erato (Eratopsis) barrandei* Hoernes & Auinger (1880) – Schilder, p. 249, 254, 260, text fig. 61.
- 1941 *Erato (Eratopsis) barrandei* (Hoernes & Auinger) – Wenz, p. 960, text fig. 2785.
- 1955 *Erato (Eratopsis) barrandei* Hoernes & Auinger – Korobkov, p. 245, pl. 46, fig. 11.
- 1956 *Erato (Erato) subcypraeola* D'Orbigny – Csepregy-Meznerics, p. 395, pl. 4, fig. 6.
- 1962 *Erato subcypraeola* Orbigny – Strausz, p. 156, pl. 75, fig. 25, text fig.
- 2002a *Eratopsis barrandei* Hoernes & Auinger, 1880 – Fehse & Landau, p. 29, fig. 20.

Locus typicus – Niederleis, Austria (Badenian, Langhian, middle Miocene).

Type material – Lectotype, NHMW 1863/0015/0612 (Hoernes & Auinger, 1879, pl. 8, fig. 8a-c), designation herein (Pl. 15, fig. 1). The syntypes of *Eratopsis barrandei* Hoernes & Auinger, 1879 are deposited at NHMW together with their 'variety A which is in fact *Erato transiens* Boettger, 1884.

Geographic distribution – Niederleis, Austria. Borsodbóta, Hungary. Salies de Béarn, SW France (Schilder, 1932b, p. 87).

Chronostratigraphic distribution – Badenian, Langhian, and Serravallian, middle Miocene.

Material studied – Two specimens from Orthez (France), middle Miocene (Serravallian) (DFB). Two specimens from Borsodbóta, Hungary (JGS).

Original description – Hoernes & Auinger (1879, p. 64): 'Die kleine, zierliche Schale dieser Art ist kegelförmig, oben stark aufgeblasen, unten verschmälert, das Gewinde ist sehr niedrig, undeutlich, weil durch starke Schalenabsonderung verdeckt. An beiden Mundrändern stehen zahl-

reiche und deutliche Zähne, die Sculptur besteht auf dem stark gewölbten Rücken aus Körnern, welche wie bei *Pustularia* [Swainson, 1840.→ Cypraeidae] durch einen glatten Längsstreifen, der hier etwas schräg verläuft, getrennt werden. Die Unterseite weist an der Mündung von den Zähnen ausstrahlende, fadenartig erhabene Querlinien auf, ähnlich jenen, welche die Sculptur bei *Trivia* [Triviidae] bilden’.

Translation: ‘The minute, elegant shell of this species is conical, posteriorly strongly inflated, anteriorly narrowed, the spire is very low, indistinct, because covered by a thick callus. Both apertural lips bear numerous and distinct teeth, the ornament of the strongly arched dorsum consists of pustules that are separated as in *Pustularia* (Swainson, 1840.→ Cypraeidae) by a smooth, slightly oblique sulcus. On the ventral side thread-like elevated, transverse lines are seen, radiating from the teeth, resembling the ornament in *Trivia* (Triviidae)’.

Range of variation – The height of the spire and the number of labral denticles varies. Some specimens have a wider labrum than others.

Dimensions – Lectotype: L = 3.5 mm, W = 2.8 mm, H = 2.2 mm, LT 14, CT 9.

Discussion – This species is easily separated from all other eratoid species by its columellar and labral folds that cover the entire ventrum. Its appearance is similar to the genus *Eratotrivia* Sacco, 1894 but in *Eratopsis* the folds are restricted to the ventrum and the dorsum is pustulated whereas in *Eratotrivia* the whole shell is costulated.

Bałuk (1995, p. 190) commented on *E. barrandei* and its varieties and related species. Unfortunately, his study of Hoernes & Auinger’s (1879, pl. 8, figs 8-10) specimens and Boettger’s remarks (1884, p. 137. 1901, p. 10) was incomplete because he did not consider *E. barrandei* as a species. Otherwise he would have recognised the Strausz specimen (1962, pl. 75, fig. 25) as *E. barrandei*. Therefore, Bałuk (1995, pl. 12, fig. 1 and pl. 13, figs 4-6) confused *Erato italica* Schilder, 1932a, *E. laevilabiata* Sacco, 1894 and *E. turonica* Schilder, 1933 with *E. barrandei* and did not include an actual specimen of the latter.

Genus *Cypraeerato* Schilder, 1932a

Type species – *Erato bimaculata* Tate, 1878, by monotypy.

Discussion – Species of *Cypraeerato* are characterised by the hidden apex and the shells have a distinct pear-shaped appearance.

***Cypraeerato yolandae* sp. nov.**

Plate 1, fig. 3; Plate 2, figs 1-3

1995 *Erato* (*Eratopsis*) *subcypraeola* (d’Orbigny, 1852) – Bałuk, pl. 13, fig. 3.

Locus typicus – Korytnica, Poland (Badenian, Langhian, middle Miocene).

Type material – Holotype (Pl. 1, fig. 3; Pl. 2, fig. 2), UW BkK-G449; paratypes, SMF 337212 (5 specimens).

Derivatio nominis – Named after the daughter of the senior author.

Geographic distribution – Poland, Hungary.

Chronostratigraphic distribution – Badenian, Langhian, and Serravallian, middle Miocene.

Additional material studied – Six specimens (DFB 8905), 8 specimens (JGS), 41 specimens (ZVH), all from Borsod-bóta (Hungary), middle Miocene (Badenian); 1 specimen from Korytnica (Poland), middle Miocene (Badenian) (UW; after Bałuk, 1995: pl. 13, fig. 3).

Description – Shell medium sized, relatively fragile, pear-shaped, with an obsolete spire. Protoconch and subsequent whorls completely covered by callus, suture not visible. Junction with teleoconch indistinct. Body whorl almost 90% of total height, shouldered adapically, with the maximum diameter at $\frac{1}{4}$ of the distance from the adapical suture, evenly tapering below and only slightly constricted at the ventrum. Posterior part of the shell usually covered with minute to large pustules, concentrated mostly around the spire. Dorsum rounded with an obsolete dorsal sulcus represented by at least a dimple behind the anterior extremity in fully adult specimens. The whole shell surface is covered by a thick, glossy callus. Aperture comprises about 95% of total shell height, slightly curved and narrow. Labrum defines the shell length, thickened, smooth, rounded and sloping slightly into the aperture, rounded at outer margin, bearing 17 to 20 teeth, which extend onto the labrum to a variable distance. Siphonal canal short, rounded and straight. Anal canal simple, slightly indented. Columella curved, with a weakly developed inner carinal ridge and an anteriorly thickened parietal lip. Columellar denticles posteriorly obsolete or absent. Anterior 2-4 denticles are developed into folds with incised interstices. Basal folds run obliquely across the base. Fossula obsolete, not delimited from the columella. Terminal ridge simple.

Range of variation – The labrum is sometimes flattened and the labral folds are close-set and less developed. The shell is more or less pustulated. The spire is very slightly elevated in some specimens. The length of the shell varies between 4.4 and 7.1 mm.

Dimensions – Holotype: L = 7.1 mm, W = 5.0 mm, D = 4.7 mm, LT 17, CT –.

Discussion – The pear-shaped shell outline clearly separates the new species from all known Miocene eratoid species. The natural history of the genus *Cypraeerato* is still mostly unknown. The earliest species – *Cypraeerato prae-*

cursor (Cossmann & Pissarro, 1905) – is known from the middle Eocene of northern France. There are considerable chronologic and geographic gaps between this species and the next oldest taxon – *Cypraeerato marshalli* (Marwick, 1929) – from the late Oligocene of New Zealand. However, the gap between the two recent taxa – *Cypraeerato bimaculata* (Tate, 1878) (Fig. 3.5) and *Cypraeerato gemma* (Bavay, 1917) – and the fossil taxa is even larger. The two new Miocene species described herein narrow the latter gap and hopefully additional new finds will close the remaining gaps.

Cypraeerato yolandae sp. nov. differs from the French Eocene species by the dentition. The latter possesses labral denticles that are continued as close-set folds onto the entire labrum. The anterior ventral folds are more numerous and somewhat resemble *C. gemma*.

The fossil New Zealand species differs from *C. yolandae* sp. nov. by its simple shell shape. *Cypraeerato marshalli* has a narrow labrum with denticles restricted to the inner labral margin, there is only one anterior ventral fold and several small, knob-like columellar denticles.

Cypraeerato yolandae sp. nov. differs from *C. badenica* sp. nov. by the less inflated, more pustulated shell with a dorsal sulcus, by the narrower labrum with coarser denticles, the wider aperture, the narrower columella and by the developed anterior basal folds. The developed basal folds make it especially easy to separate both species. Its shell shape separates the new species not only from *C. yolandae* sp. nov. but from all its congeners and other Miocene eratoid species.

Bałuk (1995: 191) already observed the different shell morphology of the new species but considered these features to be conspecific with *Erato subcypraeola* (d'Orbigny, 1852). However, not only the shell outline separates *C. yolandae* sp. nov. from all of its congeners, but also the ventral aspects and especially the shape of the ventral folds in combination with the terminal ridge. According to Bałuk the specimen illustrated in Strausz (1962, pl. 75, fig. 25) should be similar to the new species. Unfortunately, he did not realise that Strausz's specimen is a subadult specimen of *Eratopsis barrandei* Hoernes & Auinger, 1879 as is indicated by the completely folded ventrum.

***Cypraeerato badenica* sp. nov.**

Plate 1, fig. 4; Plate 2, figs 4-5, Plate 3, figs 1-4

Locus typicus – Borsodbóta, 'Királdi-útbevágás', county Borsod-Abaúj-Zemplén, Hungary (early Badenian, Langhian, middle Miocene).

Type – Holotype (Pl. 3, fig. 1), ZSM 20090084; paratype, SMF 337213 (1 specimen).

Derivatio nominis – Named after Baden, Austria, the original type locality of the Badenian stage.

Geographic distribution – Hungary, France.

Chronostratigraphic distribution – Badenian, Sarmatian, Langhian and Serravallian, middle Miocene.

Material studied – Four specimens (DFB 8906), 2 specimens (JGS), 7 specimens (ZVH), all from Borsodbóta (Hungary), middle Miocene (Badenian). 1 specimen from Thenay (France), middle Miocene (Serravallian) (DFB 5798).

Description – Shell medium sized, relatively fragile, inflated pear-shaped, with an obscured spire. Protoconch and subsequent whorls completely covered by callus, suture not visible. Junction with teleoconch indistinct. Body whorl almost 90% of total height, shouldered adapically, with the maximum diameter just below the adapical suture, evenly tapering below and only slightly constricted at the ventrum. Shell usually smooth. Dorsum rounded with an obscured dorsal sulcus represented by at least a dimple behind the anterior extremity in fully adult specimens. The whole shell surface is covered by thin callus. Aperture comprises about 100% of total height, slightly curved and very narrow. Labrum defines the shell length, wide, thickened, smooth, rounded and sloping slightly into the aperture, rounded at outer margin, bearing 16 to 20 fine, irregular teeth, which extend only slightly onto the labrum to a variable distance. Siphonal canal short, rounded and straight. Anal canal simple, slightly indented. Columella wide, curved, with a weakly developed inner carinal ridge and an edged parietal lip. Columellar denticles posteriorly obsolete or absent. Fossula obsolete, not delimited from the columella. Terminal ridge simple.

Range of variation – In some specimens a few, very minute pustules are visible on the dorsum. One specimen shows a deep dorsal dimple behind the anterior extremity whereas other specimens show a very shallow dorsal sulcus. All other specimens are completely smooth. The length of the shell varies between 4.9 and 6.8 mm.

Dimensions – Holotype 1: L = 6.8 mm, W = 4.8 mm, H = 3.8 mm, LT 21, CT –.

Discussion – *Cypraeerato badenica* sp. nov. differs from *C. yolandae* sp. nov. by the more inflated, rather smooth shell with an obscured or absent dorsal sulcus, by the wider labrum with finer denticles, the narrower aperture, the wider columella and by lacking anterior basal folds. The missing basal folds make it especially easy to separate both species. Its shell shape separates the new species not only from *C. yolandae* sp. nov. but from all its congeners and other Miocene eratoid species.

The fossil New Zealand *C. marshalli* differs from *C. badenica* sp. nov. by its simple shell shape with a narrow labrum, denticles that are restricted to the inner labral margin, the single anterior ventral fold and several small, knob-like columellar denticles.

Cypraeerato yolandae sp. nov. differs from *C. badenica* sp. nov. by the less inflated, more pustulated shell with a dorsal sulcus, by the narrower labrum with coarser den-

ticles, the wider aperture, the narrower columella and by the developed anterior basal folds. The developed basal folds make it especially easy to separate both species. Its shell shape separates the new species not only from *C. yolandae* sp. nov. but from all its congeners and other Miocene eratoid species.

Genus *Erato* Risso, 1826

Type species – *Voluta cypraeola* Brocchi, 1814, by monotypy.

Discussion – Species of *Erato* are characterised by a conical apex and the shells have a distinct biconical appearance. Most shells are smooth, but occasionally weakly pustulated around the apex. Ventral folds few in number and simple.

***Erato subcypraeola* d'Orbigny, 1852**

Plate 1, fig. 5; Plate 4, figs 1-5

- 1834 *Marginella cypraeola* Grateloup, p. 300 [*non Voluta cypraeola* Brocchi, 1814 = *Erato cypraeola* (Brocchi, 1814)].
- 1847 *Marginella cypraeola* Grateloup, pl. 42, figs 33, 34 [*non Voluta cypraeola* Brocchi, 1814 = *Erato cypraeola* (Brocchi, 1814)].
- *1852 *Erato subcypraeola* d'Orbigny, p. 51.
- 1894 *Erato (Erato) laevis* var. *subcypraeola* (D'Orb.) – Sacco, p. 58, pl. 3, figs 62a, b.
- non 1924 *Erato subcypraeola* (d'Orb.) – Cossmann & Peyrot, pl. 11, figs 44, 45 [= *Eratopsis barrandei* Hoernes & Auinger, 1879].
- non 1924 *Erato subcypraeola* (d'Orb.) – Cossmann & Peyrot, pl. 11, figs 46, 47 [= *Erato* cf. *asulcata* Sacco, 1894].
- 1924 *Erato subcypraeola* (d'Orb.) – Cossmann & Peyrot, p. 392 (pars), pl. 11, figs 48-51.
- 1933 *Erato (Erato) subcypraeola* d'Orbigny (1852) – Schilder, p. 249, 254, 272, text fig. 64.
- 1954 *Erato laevis* Don. – Strausz, p. 24, 43, pl. 7, figs 149a, b (*non* Donovan).
- 1969 *Eratopsis barrandei planulosa* (Bon.) – Csepregy-Meznerics, p. 23, pl. 6, figs 9, 13 (*nomen nudum*).
- 1995 *Erato (Eratopsis) subcypraeola* (d'Orbigny, 1852) – Bałuk, p. 190, pl. 13, figs 1, 2.
- non 2001b *Eratopsis subcypraeola* (d'Orbigny, 1852) – Lozouet *et al.*, p. 42, pl. 16, fig. 3 (= *Erato* cf. *germanica* Schilder, 1929).

Locus typicus – Mérignac, dép. Gironde, SW France (Burdigalian, early Miocene).

Type – Lost (Dr. B. Cahuzac, University of Bordeaux, pers. comm.). Neotype (Pl. 1, fig. 5, Pl. 4, fig. 1) designated herein (see Discussion below): specimen CS 40. Schilder (1933, text fig. 64) illustrated a specimen CS 60 from Mérignac. During an examination of Schilder's collection in January 2009 no such specimen could be located. The specimen must be considered lost.

Geographic distribution – 'Colli Torinesi, Baldissero, Sciolze, Stazzano', Italy (Sacco, 1894, p. 58). Mérignac, Le Valduc, Saucats: Peloua, Cestas, SW France (Schilder, 1932b, p. 88). Bóta, Hungary (Csepregy-Meznerics, 1969, p. 23), Poland, Portugal, Romania.

Chronostratigraphic distribution – Aquitanian, early Miocene, through Badenian, Langhian and Serravallian, middle Miocene.

Material studied – Four specimens from Saucats, Le Péloua (France), early Miocene (Burdigalian) (DFB). Two specimens from Cacela Velha (Portugal), middle Miocene (Serravallian) (DFB). Four specimens from St Avit (France), early Miocene (Aquitanian) (DFB). More than 50 specimens from Corbleu, Moulin de Carreau (France), early Miocene (earliest Burdigalian) (DFB). Thirteen specimens (DFB), 7 specimens (JGS); 2 specimens (SMF 337209), all from Borsodbóta (Hungary), middle Miocene (Badenian). Four specimens from Lăpugiu de Sus (Romania), middle Miocene (Badenian) (DFB). Two specimens from Korytnica (Poland), middle Miocene (Badenian) (UW BkK-G450 & BkK-G451).

Description – Shell is medium sized, relatively fragile, elongated pear-shaped, with an elevated, somewhat pointed spire. Protoconch mostly covered by callus, but visible in a few specimens. It consists of 1½ to 2 inflated whorls and a minute nucleus. Protoconch rounded. Suture indistinct. Teleoconch consists of approximately ¾ whorls. Spire covered by very thick callus, which covers the suture. Body whorl almost 90% of total height, shouldered adapically, with the maximum diameter at ¼ of the distance from the adapical suture, evenly tapering below and only slightly constricted at the ventrum. Dorsum usually covered with minute to large pustules, concentrated mostly around the spire. Dorsum rounded. Dorsal sulcus incised but represented by at least a dimple behind the anterior extremity in fully adult specimens. Aperture comprises about 85% of total height, almost straight and narrow. Labrum broad, thickened, smooth, somewhat flattened and sloping slightly into the aperture, rounded at the outer margin, bearing 16 to 19 teeth of irregular strength, which extend onto the labrum for a variable distance. Siphonal canal short, indented, rounded and straight. Columella almost straight, with a weakly developed inner carinal ridge and a slightly thickened parietal lip. Columellar denticles vary from 15 to 17 in number. Anterior 3-5 denticles are developed as folds, running obliquely across the ventrum, the remaining ones weakly developed or obsolete. Fossula not delimited from the columella. Inner fossular margin slightly constricted. Terminal ridge simple.

Range of variation – The pustules on the shell surface vary in strength and number. Sometimes the whole shell is completely pustulated (Bałuk, 1995, pl. 13, fig. 1) whereas other specimens are almost smooth (Bałuk, 1995, pl. 13, fig. 2). The dorsal sulcus can be strongly developed or reduced to a dimple behind the anterior extremity. The an-

terior ventral folds vary slightly in number. The shell outline could vary from stout, almost ovate to somewhat elongated and pyriform. The labral denticles vary in strength, shape and spacing.

Dimensions – Neotype: L = (6.5) mm, W = 4.3 mm, D = 3.6 mm, LT 16, CT –. The spire is incomplete, therefore, the real length cannot be determined.

Discussion – The Grateloup collection is housed in the University of Bordeaux (France). Unfortunately, it is in poor condition, especially concerning the labels. The type specimen of Grateloup's *Marginella cypraeola*, renamed *Erato subcypraeola* by d'Orbigny (1852, p. 51), cannot be located and has to be considered lost (Dr. B. Cahuzac, pers. comm.). The specimen illustrated by Schilder (1933, text fig. 64, CS 40) is herewith designated neotype (ICZN 75.3.3, 75.3.5, 75.3.7). The neotype locality is Mérignac, SW France (ICZN 75.3.1, 75.3.6).

Erato subcypraeola (d'Orbigny, 1852) differs from *Eratopsis barrandei* by the smooth posterior ventrum. The always elevated spire, the coarse and numerous ventral folds, the rather irregularly shaped labral denticles and folds separate *E. subcypraeola* from both *Cypraeerato* species described herein.

Lozouet *et al.* (2001b) offered interpretations of illustrated species, but they did not discuss their decisions of taxa they synonymized. In their interpretation *Erato aquitana* Schilder, 1932c and *E. subcypraeola* are synonymous and they illustrated a specimen as *E. subcypraeola* that is most probably identical with *Erato germanica* Schilder, 1929. However, the dentition of *E. subcypraeola* and *E. aquitana* is coarse and somewhat irregular whereas the specimen of Lozouet *et al.* (2001b) exhibits fine and numerous denticles that are restricted to the inner labral edge. The appearance of the ventral folds is rather simple and corresponds well with *E. germanica*. In contrast *E. subcypraeola* has a larger number of ventral folds that are also close-set. *Erato aquitana* also has a simply styled anterior ventral portion but it possesses a denticulated inner fossular margin and sometimes a folded fossula which is rarely observed in Eratoidae. Although Lozouet *et al.* (2001b) referred to Schilder's (1933) monograph they arrived at an erroneous identification. Schilder's drawings and his explanations are helpful to separate the two synonymized species and to correctly identify their specimens from the Aquitanian (early Miocene) of Saucats, Lariéy, SW France.

***Erato incrassata* Coppi, 1876**

Plate 1, fig. 1; Plate 5, figs 1-2; Plate 7, fig. 3

1862 *Marginella incrassata* Doderlein, p. 24 (*nomen nudum*).

*1876 *Erato laevis* Donovan, Var. *incrassata* Coppi, p. 9.

1878 *Erato ventricosa* Locard, p. 44 [non Gray, 1832 = *Archierato cocconii* (Schilder, 1933)].

1887 *Erato laevis* var. *incrassata* (Des.) – Pantanelli & Mazzetti, 67, pl. 2, fig. 8 (*lapsus calami*: Deshayes has never published the taxon).

1894 *Erato (Erato) laevis* var. *deritincrassata* Sacco, p. 58, pl. 3, fig. 63a, b.

1933 *Erato (Erato) incrassata incrassata* Coppi (1876) – Schilder, pp 250, 254, 265, text fig. 74.

1995 *Erato (Erato) pernana* (Sacco, 1894) – Baluk, pl. 12, fig. 2.

Locus typicus – Montegibbio, Italy (Modena province) (Tortonian, late Miocene).

Type – The whereabouts of Doderlein's type specimen is unknown. It could not be located in any Italian public collection and must be considered lost. Unfortunately, neither Doderlein nor Coppi illustrated the shell. The specimen illustrated by Schilder (1933, text fig. 74; CS 5086) from the type locality Montegibbio is herewith designated neotype (Pl. 1, fig. 1; Pl. 5, fig. 1) in accordance with ICZN 75.3).

Geographic distribution – Montegibbio, Paullo, Stazzano, Italy; Lyon, SE France; Holdy, Poland (Schilder, 1932b: 89), Hungary.

Chronostratigraphic distribution – Aquitanian, early Miocene, to Tortonian, late Miocene.

Material studied – 1 specimen from Saint-Martin-d'Oney (France), early Miocene (Aquitanian) (DFB). Four specimens from Thenay (France), middle Miocene (Langhian) (DFB). One specimen from Paulmy, Pauvrely (France), middle Miocene (Langhian) (DFB). One specimen from Montegibbio (Italy), late Miocene (Tortonian) (DFB). One specimen from Pest (Hungary), middle Miocene (Badenian) (DFB). One specimen from Borsodbóta (Hungary), middle Miocene (Badenian) (JGS). One specimen from Korytnica (Poland), middle Miocene (Badenian) (UW BkK-G444).

Description – Shell medium sized, relatively fragile, inflated pear-shaped, with a slightly elevated, somewhat pointed spire. Protoconch mostly covered by callus, but visible in few specimens. It consists of 1½ to 2 inflated whorls and a minute nucleus. Protoconch rounded. Suture indistinct. Teleoconch consists of about 2¾ whorls. Spire covered by thick callus, which covers the suture. Body whorl almost 95% of total shell height, shouldered adapically, with the maximum diameter at one fifth of the distance from the adapical suture, evenly tapering below and somewhat constricted at the ventrum. Dorsum usually smooth, rounded. Dorsal sulcus reduced to a dimple behind the anterior extremity in fully adult specimens. Aperture about 85% of total shell height, almost straight and narrow. Labrum widest posteriorly, thickened, smooth, somewhat flattened and sloping slightly into the aperture, declivous anteriorly, rounded at the outer margin, bearing 16 to 20 coarse, close-set teeth, which extend onto the labrum over

a variable distance. Siphonal canal short, protruded, rounded and straight. Columella slightly curved, with a weakly developed inner carinal ridge and a slightly thickened parietal lip. Columellar denticles developed anteriorly, posteriorly obsolete. Anterior 3-5 denticles are extended into folds, which run obliquely across the ventrum, the remaining ones weakly developed or obsolete. Fossula not delimited from the columella. Inner fossular margin slightly protruded. Terminal ridge coarse, simple, close-set with anterior ventral fold. First and second ventral folds distant.

Range of variation – The shell inflation and its size, the width of the labrum and the ventral constriction vary slightly.

Dimensions – Neotype: L = 9.6 mm, W = 6.6 mm, D = 5.6 mm, LT 16, CT –.

Discussion – Coppi (1876: 9) wrote: ‘Anche di questa varietà Doderlein (Cenn. Geol., p. 24), forma la sua specie *E. incrassata*. Le principali difference dal tipo sono la maggiore robustezza del guscio, il labro più crasso, più inflesso, più espanso e fortemente crenulato. Se non vi avessero graduazioni per le quali facilmente si confonde col tipo, forse la specie del Doderlein non sarebbe del tutto mal fondata’.

Erato incrassata differs from *Eratopsis barrandei* and both new *Cypraeerato* species as described for *E. subcypraeola* and can be separated from the latter by the smooth shell, the regular and close-set labral denticles and folds, by the anteriorly declivous labrum, and by the distant first and second ventral fold.

This species seems to be the ancestor of *Erato andecavica* Schilder, 1933 known from the Redonian, late Miocene of NW France (Fehse & Landau, 2002b). Schilder (1933, p. 259) also observed the similarity and wrote: ‘*andecavica*, nov., *Erato*. Allied to *incrassata*, but often larger, labial [*sic*] teeth finer. the posterior columellar teeth often become well recognisable, but the dorsal impression which replaces the sulcus anteriorly, is mostly wanting’. *Erato incrassata* can also be separated from *E. andecavica* by the lower number of ventral folds.

***Erato kimakowiczi* Boettger, 1884**

Plate 1, fig. 6; Plate 6, figs 1-5; Plate 7, figs 1, 4

- *1884 *Erato Kimakowiczi* Boettger, p. 137.
- 1901 *Erato (Eratopsis) kimakowiczi* Bttgr. – Boettger, p. 11.
- 1906 *Erato (Eratopsis) kimakowiczi* Bttgr. – Boettger, p. 4.
- 1933 *Erato (Erato) kimakowiczi kimakowiczi* Boettger (1884) – Schilder, p. 250, 254, 266, text fig. 67.
- 1934 *Erato (Erato) subcypraeola* (d’Orbigny) – Zilch, p. 249, pl. 14, figs 69a, b.
- 1956 *Erato laevis punctata* Csepregy-Meznerics, p. 395, 445, pl. 4, figs 4, 5.

Locus typicus – Lăpugiu de Sus, Valea Coşului, Romania (Badenian, Langhian, middle Miocene).

Type – Lectotype (Pl. 1, fig. 6; Pl. 6, fig. 1) designated by Zilch (1934, p. 249), SMF XII 2206a.

Geographic distribution – Colli Torinesi, Baldissero, Sciolze, Stazzano, Italy (Sacco, 1894, p. 58). Kostej: Valea semini, Parau ungurului Lapugy: Parau muntanului und Valea cosului (Boettger, 1901, p. 11). Kostej: Valea casilor, Romania (Boettger, 1905, p. 4). Méridnac, Le Valduc, Saucats: Peloua, Cestas, SW France (Schilder, 1932b, p. 88). Bóta, Hungary (Csepregy-Meznerics, 1969, p. 23), Austria, Romania.

Chronostratigraphic distribution – Badenian, Langhian, and Serravallian, middle Miocene.

Material studied – Two specimens from Braunsdorf near Grund (Austria), middle Miocene (Badenian). Seventeen specimens (DFB), 41 specimens (JGS), 25 specimens (SMF 337214), all from Borsodbóta (Hungary), middle Miocene (Badenian). One specimen from Pest (Hungary), middle Miocene (Badenian) (DFB). Fourteen specimens from Lăpugiu de Sus (Romania), middle Miocene (Badenian) (DFB).

Original description – Boettger, 1884, p. 137: ‘*E. Kimakowiczi* ... steht etwa in der Mitte zwischen *E. transiens* und *Eratopsis Barrandei*, ist wie letztere ausgezeichnet durch oft sehr deutliche Körnersculptur und besitzt ähnlich wie diese auf der Höhe des Rückens eine sogen. Rückenrinne oder zum mindesten einen grubenförmigen Eindruck (als Rest derselben) oberhalb des Schnabels, beides Charaktere, die der lebenden *E. laevis* durchaus fehlen. Von *E. Barrandei* var. A [in Hoernes & Auinger, 1879, pl. 8, fig. 9a-9c = *Erato transiens* Boettger, 1884], mit der sie nach der anderen Seite hin Ähnlichkeit hat, trennt sie das stets höhere Gewinde, das eckig (wie bei *E. laevis*) heraustretende Oberende der Mündung und zahlreicheren Zähnchen der rechten Mundlippe.

Description – Shell medium sized, relatively fragile, broadly pear-shaped, with a slightly elevated, somewhat pointed spire. Protoconch mostly covered by callus, but visible in one specimen. It consists of 1 to 1½ depressed whorls with a minute nucleus. Suture indistinct. Teleoconch consists of approximately 3½ whorls. Spire covered by thick callus, which covers the suture. Body whorl almost 95% of total shell height, shouldered sub-centrally, evenly tapering below and only slightly constricted at the ventrum. Dorsum usually covered with minute pustules, concentrated mostly around the spire. Dorsum rounded. Dorsal sulcus incised but represented by at least a dimple behind the anterior extremity in fully adult specimens. Aperture comprises c. 90% of total height, almost straight and narrow. Labrum wide, thickened, smooth, somewhat flattened and slightly sloping into the aperture, rounded at the outer margin, bearing 15 to 18 coarse teeth, which extend onto the labrum for a variable distance. Siphonal canal short, indented, rounded and straight. Columella almost straight, with an inner carinal ridge restricted along the

columella and a rather edged parietal lip. Columellar denticles posteriorly obsolete or absent. Anterior 3-5 denticles developed into coarse folds. Ventral folds run in different obliqueness across the ventrum, the remaining ones weakly developed or obsolete. Fossula not delimited from the columella. Terminal ridge simple.

Range of variation – The shell inflation and its size, the height of the spire, the width of the labrum and the development of the dorsal sulcus and the pustules vary.

Dimensions – Holotype: L = 10.0 mm, W = 6.3 mm, D = 5.1 mm, LT 18, CT 17.

Discussion – The distribution outside the northern Paratethys as mentioned by Sacco (1894, p. 58) and especially in the earlier (Aquitanian, Burdigalian) formations of the French localities referred to by Schilder (1932b, p. 88) could not be confirmed although larger samples were examined. Even in French localities of the same age no specimen of *Erato kimakowiczi* Boettger, 1884 was found. *Erato kimakowiczi* differs from *Eratopsis barrandei* by the smooth ventrum, too. The always elevated spire, the coarse and numerous ventral folds, the rather irregularly shaped labral denticles and folds separate *E. kimakowiczi* from both *Cypraeerato* species described herein.

***Erato transiens* Boettger, 1884**

Figure B; Plate 1, fig. 7; Plate 8, figs 1-5

- 1852 *Erato laevis* Don. – Hoernes, p. 79, pl. 8, figs 16a, b (non Donovan).
- *1884 *Erato transiens* Boettger, p. 137.
- 1914 *Erato* c.f. *spiralis* Dod. – Friedberg, p. 143, pl. 8, figs 4a, b.
- 1929 *Erato* cf. *transiens* Seg. – Schilder, p. 12, text fig. 5.
- 1929 *Erato transiens* Boettg. – Schilder, p. 12.
- 1933 *Erato (Erato) transiens transiens* Boettger (1884) – Schilder, p. 250, 254, text figs 69-71.
- 1956 *Erato laevis punctata* Csepregy-Meznerics, p. 395, pl. 4, figs 4, 5.
- 1960 *Erato (Erato) laevis* (Donovan, 1799) – Kojumdgieva & Strachimirov, p. 125, pl. 34, figs 10a, b (non Donovan).
- 1962 *Erato laevis* – Strausz, pl. 74, figs 13, 14.
- 1969 *Erato laevis* Don. – Csepregy-Meznerics, p. 23, pl. 6, figs 10, 12 (non Donovan).
- 1977 *Erato transiens transiens* – Cate, p. text figs 32, 32a.
- 1995 *Erato transiens* Boettger, 1884 – Bałuk, p. 190.
- 1995 *Erato (Eratopsis) elongata* Seguenza, 1880 – Bałuk, pl. 12, fig. 4 (non Seguenza).
- 2001b *Eratopsis subcypraeola* (d'Orbigny, 1852) – Lozouet et al., p. 42, pl. 16, fig. 3 (non d'Orbigny).
- 2003 *Erato* cf. *transiens* Boettger, 1884 – Fehse & Landau, p. 19, fig. 1/3a-c, fig. 2/3d.

Locus typicus – Steinabrunn, Austria (Badenian, Langhian, middle Miocene).

Type – Lectotype (Pl. 1, fig. 7; Pl. 8, fig. 1) designated herein, NHMW 1846/0037/0091 (see Discussion for details)

Geographic distribution – Baden, Gainfarn, Nussdorf, Nikolsburg (Muschelberg), Pötzleinsdorf, Grund, Szobb bei Gran in Ungarn, Austria (Hoernes, 1852, p. 79). Bahrenfeld, N Germany (Schilder, 1929, p. 12). Niederleis, Lissitz, Baden, Gainfarn, Nikolsburg, Steinabrunn, etc, all Austria. Pöls, Szob, Lapugy, Kostej, Donau-Becken (Schilder, 1932b, p. 89). Keletcserhát, Szob, Bóta, Balaton (Csepregy-Meznerics, 1969, p. 23), France, Hungary, Poland, Romania, Slovakia.

Chronostratigraphic distribution – Chattian, late Oligocene, to Badenian, Langhian and Serravallian, middle Miocene.

Material studied – Seven specimens from Saint-Paul-lès-Dax, Abesse (France), late Oligocene (Chattian) (DFB). Four specimens from Saint-Martin-d'Oney (France), early Miocene (Aquitanian) (DFB). One specimen from Orthez (France), middle Miocene (Langhian) (DFB). One specimen from Thenay (France), middle Miocene (Langhian) (DFB). Two specimens from Gainfarn (Austria), middle Miocene (Badenian) (DFB). Two specimens from Steinabrunn (Austria), middle Miocene (Badenian) (DFB). One specimen from Rohožník (Slovakia), middle Miocene (Badenian) (DFB). One specimen from Szob (Hungary), middle Miocene (Badenian) (DFB); 20 specimens (DFB), 21 specimens (JGS), 11 specimens (SMF 33711), all from Borsodbóta (Hungary), middle Miocene (Badenian). One specimen from Lăpugiu de Sus (Romania), middle Miocene (Badenian) (DFB). One specimen from Korytnica (Poland), middle Miocene (Badenian) (UW BkK-G441).

Description – Hoernes, 1852, p. 79: '*E. testa subconoidea, vel pyriformi, polita. spira prominula, obtusiuscula. anfractibus 3-4 obsoletis; aperture angustata, labro extus marginato, intus denticulato; columella ad basin dentate.* ...

Die Schale ist glatt, ungestreift, birnförmig, oben aufgeblasen, spitz, nach unten sehr verschmälert, das Gewinde ist breit kegelförmig, etwas überfirnisst und daher mit undeutlicher Naht; die innere Lippe ist oben nur mit verkümmerten kleinen, unten mit etwas runzligen Zähnen (nicht Falten, wie in den meisten Beschreibungen vorkommt) besetzt; die äussere Lippe ist gerade, setzt oben rundekig ab, nach aussen gerändert, nach innen mit sehr gleichmässigen (20-25) Zähnen versehen. Diese Zähnen wechseln sehr in ihrer Anzahl; an einem Exemplar vom Muschelberg bei Nikolsburg sind deren nur 13 vorhanden; die Mündung ist gerade und durchaus fast gleichbreit.

Description – Fehse & Landau, 2003, p. 19: Shell is medium sized, relatively fragile, elongated pear-shaped, with an elevated, somewhat pointed spire. Protoconch mostly covered by callus, but visible in several specimens. It con-

sists of 2 to 2½ depressed whorls, with well-marked lines and a minute nucleus. Suture clearly marked and incised. Junction with teleoconch is indistinct. Teleoconch consists of about ¾ whorls. Spire covered by very thick callus, which covers the suture. Body whorl almost 90% of total height, shouldered adapically, with the maximum diameter ¼ distance from the adapical suture, evenly tapered below and only slightly constricted at the base. Dorsum usually covered with minute to large pustules, concentrated mostly around the spire. The dorsum is rounded and bears a dorsal sulcus represented by at least a dimple behind the anterior extremity in fully adult specimens. The whole shell surface is covered by thick, glossy callus. Aperture comprises about 85% of total height, somewhat sinuous and narrow. Outer lip thickened, smooth, flattened and sloping slightly into the aperture, rounded at the outer margin, bearing 17 to 21 strong teeth, which extend onto the lip to a variable distance. Siphonal canal is short, rounded and straight. Columella sinuous, with a weakly developed inner carinal ridge and a thickened parietal lip. The denticles on the parietal lip varies from 17 to 22 in number. The anterior 3-5 denticles are developed into folds, which run obliquely across the base, the remaining weakly developed. Fossula marked by a shallow concavity, not delimited from the columella. Terminal ridge is simple’.

Range of variation – Several specimens in the type lot possess small pustules. The range extends with numerous intermediate stages from smooth to relatively strongly ornamented at the apical area.

Dimensions – Lectotype: L = 11.0 mm, W = 6.0 mm, H = 5.1 mm, LT 23, CT –.

Discussion – Boettger (1884: 137) published a review on the paper of Hoernes & Auinger (1879, p. 63) where *Eratopsis* was described as a new genus. Hoernes & Auinger (1879, p. 64, pl. 8, figs 8-10) published *Eratopsis barrandei* as new and illustrated the type species in plate 8, figs 9 and 10 as two ‘varieties’. Unfortunately, Boettger’s commentary is somewhat complicated and unclear especially concerning the identity of *Erato transiens* Boettger, 1884 because he always mentioned ‘*Erato laevis* Donov.’ in connection with his new species, but Hoernes & Auinger did not assign ‘*E. laevis*’ to *Eratopsis* and Boettger did not illustrate the type specimen. The confusion is further complicated by his additional description of *Erato hoernesii* Boettger, 1902. Again Boettger (1902, p. 11) referred to ‘*E. laevis*’ mentioned by Hoernes & Auinger. The only clue to the identity of both species is their size differentiation. Boettger (1884, p. 11) mentioned for *E. transiens* a length of more than 10 mm and of approximately 4 mm for *E. hoernesii*. Hoernes & Auinger (1879, p. 63) referred for ‘*Erato laevis* Donovan’ to Hoernes (1852, p. 79, pl. 8, fig. 16a, b) who illustrated a large, elongated, smooth specimen. Only the specimen shown by Hoernes corresponds well with Boettger’s discussion of *E. transiens*. Boettger did not designate a type for *E. transiens* because he just renamed Hoernes’ ‘*Erato laevis* Donovan’.

On all original labels in Boettger’s collection the name ‘*Erato transiens*’ is deleted and replaced by ‘*Erato hoernesii*’. According to this circumstance and Boettger’s reference to Hoernes & Auinger’s ‘*Erato laevis*’ the specimen of Hoernes must be considered the type specimen for *E. transiens* (M. Harzhäuser, pers. comm.), which we designate herein as lectotype. The specimens of Hoernes’ original illustration was kept together with more than a hundred other shells from Steinabrunn. It is, therefore, impossible to recognise the type specimen (M. Harzhäuser, pers. comm.). Similarly, the small size and the granulation mentioned equate *E. hoernesii* with both varieties illustrated by Hoernes & Auinger (1879, plate 8, figs 9 and 10). Zilch (1934, p. 249, pl. 14, figs 70a, b) had already designated a lectotype for *E. hoernesii*.

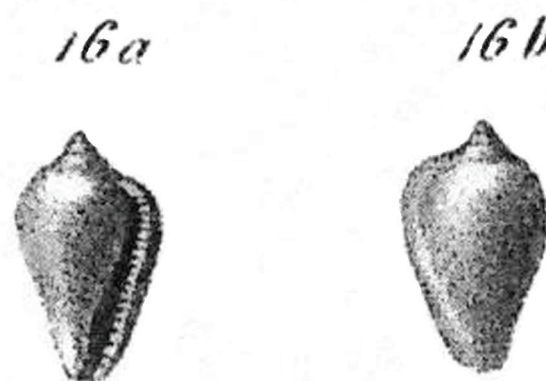


Figure B. *Erato transiens* Boettger as ‘*Erato laevis* Don.’ from Hoernes (1852, pl. 8, fig. 16a, b) (magnified).

Lozouet *et al.* (2001a, p. 54, pl. 4, figs 1-4) reported *Erato transiens* from the Aquitanian of Saint-Martin-d’Oney (‘Meilhan’), France. Boettger referred to Hoernes (1852, pl. 8, figs 16a, b) for the type of *E. transiens* and not to Hoernes & Auinger (1879, pl. 8, figs 9a-c) as stated by Lozouet *et al.* (2001a). The two specimens shown by Hoernes and by Hoernes & Auinger (1879) represent two different species that could be confused when the original descriptions are studied. However, the specimens that Lozouet *et al.* illustrated have an inflated, stout shell, a thick terminal ridge, and few, coarse labral denticles thus differing from *E. transiens*. The appearance of both specimens correspond to *Erato hemmoorensis* Schilder, 1929, rather than *E. laevilabiata* Sacco, 1894 (*Erato hoernesii* Boettger, 1901 is a junior synonym) because of the knob-like labral denticles and the shape of the terminal ridge.

***Erato spiralis* Sacco, 1894**

Plate 1, fig. 8; Plate 9, figs 1-3

- 1862 *Marginella spiralis* Doderlein, p. 24 (nomen nudum).
- *1894 *Erato (Erato) spiralis* (Dod.) – Sacco, p. 61, pl. 69, fig. 69a, b.

- 1914 *Erato* c.f. *spiralis* Dod. – Friedberg, p. 143, pl. 8, fig. 4.
1929 *Erato elongata* Seg. – Schilder, text fig. 5.
1933 *Erato (Erato) spiralis spiralis* Sacco (1894) – Schilder, p. 250, 254, 272, text fig. 78.
1939 *Erato (Erato) spiralis* Sacco – Schilder, p. 171, pl. 7, fig. 19.
1995 *Erato (Erato) elongata* Seguenza, 1880 – Baluk, pl. 12, figs 5, 6.
2002^a *Erato spiralis* Döderlein, 1862 in Sacco, 1894 – Fehse & Landau, p. 28, figs 14a, b.
2002^b *Erato spiralis* Döderlein, 1862 [*sic*] – Fehse & Landau, p. 94.

Locus neotypicus – Montegibbio near Modena, Italy (Tortonian, late Miocene).

Neotype designation – Döderlein's (1862) taxon *Marginella spiralis* is a *nomen nudum*. Sacco (1894, p. 61, pl. 69, figs 69a, b) validated the taxon by giving a description and illustrations, based on a specimen from the Döderlein collection, originating from S. Agata. Unfortunately, that specimen could not be located in Modena (where Döderlein's collection is housed) and has to be considered lost (pers. comm. D. Ormezzano, Università di Torino). Sacco's description and drawings, however, are insufficient to separate the species from its congeners, necessitating the designation of a neotype (ICZN 75.3.1). We here-with designate the specimen from the Tortonian of Montegibbio, illustrated by Schilder (1933, fig. 78) (CS 5087) as neotype (Pl. 1, fig. 8; Pl. 9, fig. 1) of *Erato spiralis* Sacco, 1894.

Geographic distribution – S. Agata, Montegibbio, Italy (Sacco, 1894: 61); Kostej, Romania; Gainfarn, Steina-brunn, Austria; Holdy, Poland; Bahrenfeld, N Germany (Schilder, 1932b: 89), Hungary.

Chronostratigraphic distribution – Badenian, Langhian, and Serravallian, middle Miocene, to Tortonian, late Miocene.

Material studied – Four specimens (DFB), 2 specimens (JGS), both samples from Borsodbóta (Hungary), middle Miocene (Badenian). Two specimens from Korytnica (Poland), middle Miocene (Badenian) (UW BkK-G442, BkK-G443).

Original description – Sacco, 1894, p. 61: 'Testa medio-parva, laevis, elongato-fusoidea; spira elatissima. Labium columellare sublaeve, vel depressissime, fere oblite pluridenticulatum; in regione basali, bi vel triplicatum, longitudinaliter intus laevissime depressum, extus laeviter subangulatum; labium externum intus laeve, extus permarginatum. Apertura substricta'.

Description – Shell fairly large sized, fragile, elongated pear-shaped, with an elevated, somewhat pointed spire. Protoconch mostly covered by callus, but visible in two

specimens. It consists of 1 to 1½ depressed whorls and a minute nucleus. Suture slightly visible. Teleoconch consists of up to 4½ whorls. Spire covered by thin callus, which covers the suture. Body whorl almost 80% of total shell height, shouldered adapically, with its maximum diameter at ¼ of the distance from the adapical suture, evenly tapering below and only slightly constricted at the ventrum. Dorsum smooth, rounded. Dorsal sulcus reduced to a dimple behind the anterior extremity in fully adult specimens. Aperture comprises about 75% of total shell height, almost straight and fairly wide. Labrum narrow, slightly thickened, smooth, somewhat rounded, rounded at the outer margin, bearing 16 to 19 close-set, coarse teeth of irregular strength, which extend barely onto the labrum for a variable distance. Siphonal canal short, indented, rounded and straight. Columella almost straight, with a weakly developed inner carinal ridge and a rounded parietal lip. Columellar denticles coarse, up to 15 in number. Anterior 1-3 denticles are developed into folds, which run obliquely across the ventrum, the remaining ones weakly developed or obsolete. Fossula not delimited from the columella. Inner fossular margin somewhat protruded. Terminal ridge simple.

Range of variation – The shell inflation varies slightly. The labral folds are more or less developed.

Dimensions – Neotype: L = (8.0) mm, W = 5.0 mm, H = 4.2 mm, LT 17, CT 14. The spire is incomplete, therefore, the actual length when complete cannot be determined.

Discussion – *Erato spiralis* differs from *E. transiens* by the coarser denticles and dental folds. The ventral folds are also coarser and less close-set. In a similar manner *E. spiralis* differs from *E. kimakowiczi*. Shells of *E. kimakowiczi* from Borsodbóta are more inflated than those from Romania. Therefore it is possible to separate Borsodbóta specimens of *E. spiralis* from *E. kimakowiczi* by the shell shape. *Erato spiralis* is separated from *E. incrassata* by the less inflated shell. The ventral folds of the latter are slightly more numerous and close-set as well as elongated. *Erato subcypraeola* possesses finer, more numerous and close-set ventral folds.

***Erato planulosa* Sacco, 1894**

Plate 1, fig. 9; Plate 10, figs 1-3

- 1842 *Marginella planulosa* Bon. – Sismonda, p. 42 (*nomen nudum*)
1847 *Marginella planulosa* Bon. – Sismonda, p. 42 (*nomen nudum*).
1852 *Marginella planulosa* Bon. – d'Orbigny, p. 51 (*nomen nudum*).
*1894 *Erato (Eratopsis) barrandei* var. *planulosa* (Bon.) – Sacco, p. 62, pl. 3, fig. 70a, b.
1894 *Erato (Eratopsis) barrandei* var. *subsulcata* Sacco, p. 62, pl. 3, fig. 71.
1894 *Erato (Eratopsis) barrandei* var. *tauroasulcata* Sacco, p. 63, pl. 3, fig. 72a, b.

- 1894 *Erato (Eratopsis) barrandei* var. *asulcata* Sacco, p. 63.
 1894 *Erato (Eratopsis) barrandei* var. *subgranulosa* Sacco, p. 63, pl. 3, fig. 73.
 1914 *Erato (Eratopsis) Barrandei* R.H.i.A. var. *tauroasulcata* Sacco – Friedberg, p. 144, pl. 8, fig. 5a, b.
 1933 *Erato (Erato) kimakowiczi planulosa* Sacco (1894) – Schilder, p. 249, 254, 268, text figs 65, 66.
 1933 *Erato (Erato) taurofusata* Sacco (1894) – Schilder, p. 273.
 1952 *Erato (Erato) cypraeola gallica* Schilder, 1932 – Glibert, p. 262 (pars), pl. 3, fig. 3c-e.
 1984 *Eratopsis barrandei* var. *planulosa* Sacco, 1894 – Ferrero Mortara *et al.*, p. 157, 329, pl. 28, fig. 3a-c.
 1984 *Eratopsis barrandei* var. *subgranulosa* Sacco, 1894 – Ferrero Mortara *et al.*, pp. 157, 329.
 1984 *Erato laevis* var. *taurofusata* Sacco, 1894 – Ferrero Mortara *et al.*, p. 157.

Locus typicus – Colli Torinesi, Italy ('Elveziano', Burdigalian, early Miocene).

Type material – Lectotype (Pl. 1, fig. 9, Pl. 10, fig. 1) designated herein: BS 044.16.001.

Geographic distribution – Colli Torinesi, Baldissero, Sciolze, Italy (Sacco, 1894, p. 62); Carry, Le Valduc, France; Torino, Italy; Grund, Forchtenau, Raussnitz, Austria; Podhorce, *etc.*, Poland (Schilder, 1932b, p. 88); Pontlevoy, France (Glibert, 1952, p. 262), Hungary.

Chronostratigraphic distribution – Eggenburgian, Burdigalian, early Miocene, to Badenian, Langhian, and Serravallian, middle Miocene.

Material studied – Three specimens (DFB), 5 specimens (JGS), 1 specimen (SMF 337208), all from Borsodbóta (Hungary), middle Miocene (Badenian). Lectotype (designation herein) of *Erato subasulcata* Sacco, 1894 (BS 043.16.002); Colli Torinesi, Italy ('Elveziano', Burdigalian, early Miocene).

Original description – Sacco, 1894, p. 62: 'Testa plerumque major, oblongior. Denticuli columellares extus non producti, saepe depressiores vel subobliti. Denticuli labii externi saepe rariores inter se distantiores'.

Description – Shell medium sized, elongated pear-shaped, with an elevated, somewhat pointed spire. Protoconch covered by callus, not visible in the available specimen. Suture indistinct, number of whorls of protoconch and teleoconch not observable. Spire covered by very thick callus, which covers the suture. Body whorl almost 85% of total shell height, shouldered adapically, with the maximum diameter at ¼ of the distance from the adapical suture, evenly tapering below and only slightly constricted at the ventrum. Dorsum usually covered with minute to large pustules. Dorsum rounded. Dorsal sulcus incised but represented by at least a dimple behind the anterior extremity in fully adult specimens. Aperture comprises *c.* 80% of total height, slightly sinuous and narrow. Labrum broad, thickened,

smooth, somewhat rounded, anteriorly declivous and sloping slightly into the aperture, rounded at the outer margin, bearing 18 to 22 fine, irregular teeth, which extend onto the labrum for a variable distance. Siphonal canal short, indented, rounded and straight. Columella almost straight, with a weakly developed inner carinal ridge and a slightly thickened parietal lip. Columellar denticles varies from 15 to 17 in number. Anterior 2-4 denticles are developed into fine folds, which run obliquely across the ventrum, the remaining ones weakly developed or obsolete. Fossula not delimited from the columella. Terminal ridge biplicated.

Range of variation – The shell varies in globosity. The shells are more or less pustulated.

Dimensions – Lectotype: L = 6.6 mm, W = 4.3 mm, H = 3.5 mm, LT 16, CT 12.

Discussion – Compare the discussion of *Erato laevilabiata* Sacco, 1894. Schilder (1933, p. 269) wrote concerning the authorship of *Erato planulosa*: '... The name had been used before in MS by Bonelli and as *nomen nudum* by Sismonda (1842 and 1847)'. Therefore, Sacco is the first who validated the name.

Sacco (1894, p. 58) mentioned the variation *taurofusata* in connection with his discussion on *Erato subcypraeola* d'Orbigny, 1852 writing: 'Le forme del Miocene piemontese sono generalmente più strette e più fusoidi che non quelle del Miocene di Dax, specialmente di quelle della Turrena, per modo che se ne potrebbe forse costituire una var. *taurofusata*'. The identity of *E. taurofusata* is questionable because there is no description and Sacco did not designate or illustrate a type specimen. Schilder studied the Miocene specimens in the collection of Sacco & Bellardi and concluded (1933, p. 273): '... All specimens formerly thought to belong to a smooth Helvetian species of *Erato* (Schilder, 1932[b]) most probably are worn or young *planulosa*, as no shell is preserved in a way which would justify retaining *taurofusata* as distinct species'. According to Schilder's results *E. taurofusata* is a *nomen dubium* and not listed herein although Schilder & Schilder (1971, p. 14) mentioned *E. taurofusata* as a subspecies of *E. spiralis* Sacco, 1894. Unfortunately, both have never discussed their conclusions.

Glibert (1952, p. 262) mentioned several localities in the Loire Basin, France but according to his illustration (pl. 3, fig. 3) he confused several species to be *E. gallica*. Therefore, it cannot be confirmed that *E. gallica* really occurs at the referred localities.

The species *Erato subasulcata* Sacco, 1894, *E. tauroasulcata* Sacco, 1894, *E. asulcata* Sacco, 1894, and *E. subgranulosa* Sacco, 1894 are simply junior synonyms of *Erato planulosa* and are more or less inflated and granulated, and/or the dorsal sulcus is developed or obsolete. The latter modifications in the shell morphology do not justify a separation at species level. As all these forms occur in the same stratigraphic level and they are seemingly convicts, it even is not possible to maintain these names on subspecific level. The type specimen of *Erato subgranu-*

losa Sacco, 1894 is, furthermore, poorly preserved and cannot be separated from *E. planulosa*.

***Erato laevilabiata* Sacco, 1894**

Plate 1, figs 11, 15, 16; Plate 11, figs 1-7; Plate 15, fig. 5

- 1879 *Eratopsis barrandei* (Varietät A), Hoernes & Auinger, p. 64, pl. 8, figs 9, 9a, b.
1879 *Eratopsis barrandei* (Varietät B), Hoernes & Auinger, p. 64, pl. 8, figs 10, 10a, b.
*1894 *Eratopsis barrandei* var. *laevilabiata* Sacco, p. 62.
1902 *Erato (Eratopsis) hoernesii* Boettger, p. 10.
1906 *Erato (Eratopsis) hoernesii* Bttgr. – Boettger, p. 4.
?1914 *Erato laevis* Don. – Friedberg, p. 142, pl. 8, figs 3a, b.
1933 *Erato (Eratopsis) asulcata* Sacco – Schilder, p. 249, 254, 258, 260, text fig. 60.
1934 *Erato (Erato) transiens* Boettger – Zilch, p. 249, pl. 14, figs 70a, b.
1995 *Erato (Eratopsis) barrandei* Hoernes & Auinger, 1880 – Baluk, p. 190, pl. 12, fig. 1.

Locus typicus – Niederleis, Austria (Badenian, Langhian, middle Miocene).

Type – Lectotype (Pl. 1, fig. 15; Pl. 11, fig. 2) designated herein, NHMW 1863/0015/0612. The catalogue numbers of the type specimens of *E. barrandei* and *E. laevilabiata* are identical. The first author discussed this with Dr Mathias Harzhauser of NHMW but the answer was that *E. laevilabiata* will not get a new number.

Geographic distribution – Niederleis, Austria (Hoernes & Auinger, 1979, p. 64); Kosteĵ, Valea semini, Părău unguru-lui; Lapugy: Părău muntanului und Valea coşului, Romania (Boettger, 1901, p. 11); Kosteĵ: Valea căsilor, Romania (Boettger, 1905, p. 4), Hungary, Poland.

Chronostratigraphic distribution – Badenian, Langhian, and Serravallian, middle Miocene.

Material studied – Syntype of *Eratopsis barrandei* var. A (NHMW 1863/0015/0612; specimen illustrated in Hoernes & Auinger, 1879, pl. 8, figs 9, 9a, b).

The 'variety A' of *Eratopsis barrandei* Hoernes & Auinger, 1879 (= *Erato laevilabiata* Sacco, 1894) is housed in NHMW together with the syntypes of the actual *E. barrandei*. Lectotype of *Erato hoernesii* Boettger, 1901 (SMF XII 2205a). Twenty specimens (DFB), 27 specimens (JGS), 13 specimens (SMF 337216), all from Borsodbóta (Hungary), middle Miocene (Badenian). One specimen from Korytnica (Poland), middle Miocene (Badenian) (UW BkK-G446).

Original description – Boettger, 1901, p. 10: 'Char. Diff. ab *E. laevi* Donov. *spira occulta, superficie testae hic illic et praecipue in spira et prope varicem granulata*. Es ist dies die von Höernes & Auinger als *Erato laevis* Donov. aus Lapugy and Kosteĵ erwähnte Schnecke, die dieser zwar

sehr ähnlich und als ihr Vorläufer zu betrachten, durch das mit Schmelz bedeckte Gewinde aber in allen Alterszuständen zu unterscheiden ist. Das zweite Kennzeichen, die an *E. (Eratopsis) barrandei* Hö. Au. erinnernde Skulptur, zeigt sich nur an besonders gut erhaltenen Stücken. Spitze Knötchen erscheinen in bis drei Längsreihen auf und hinter dem Mundvarix namentlich nach der Gehäusebasis hin, und ebenso liegen mehr oder weniger zahlreiche Knötchen entweder strahlenförmig abwärts steigend oder häufiger ganz unregelmässig verteilt auf der Spira. Der rechte Mundsaum zählt 9-11 kräftige Zahnfalten, bei *E. laevis* Donov. etwa 15 weit undeutlichere'.

Description – Shell small sized, widely pear-shaped, with a short, somewhat pointed spire. Protoconch mostly covered by thick callus. Suture indistinct. Appearance and number of whorls of protoconch and teleoconch not observable. Spire covered by very thick callus, which covers the suture. Body whorl almost 90% of total shell height, shouldered adapically, with the maximum diameter at $\frac{1}{3}$ of the distance from the adapical suture, evenly tapering below and only slightly constricted at the ventrum. Dorsum usually covered with large pustules. Dorsum rounded. Dorsal sulcus incised but represented by at least a dimple behind the anterior extremity in fully adult specimens. Aperture comprises c. 80% of total shell height, almost straight and fairly narrow. Labrum very wide, thickened, smooth, rounded and sloping slightly into the aperture, rounded at the outer margin, bearing 10 to 13 coarse, irregular teeth, which extend onto the labrum for a variable distance. Siphonal canal short, widely indented, rounded and straight. Columella smooth, almost straight, with a weakly developed inner carinal ridge and an obsolete parietal lip. Columellar denticles obsolete or absent. Fossula not delimited from the columella. Inner fossular margin slightly constricted. Terminal ridge biplicated.

Range of variation – Some shells are strongly pustulated whereas others are almost smooth. The dorsal sulcus is sometimes almost obsolete. The shell shape varies from ovate to pyriform with the spire more or less elevated.

Dimensions – Lectotype: L = 4.8 mm, W = 3.5 mm, H = 2.9 mm, LT –, CT 13. Lectotype of *E. hoernesii*: L = 4.4 mm, W = 3.1 mm, H = 2.5 mm, LT 10, CT 12.

Discussion – Compare the discussion of *Erato transiens* Boettger, 1884, above. Schilder (1933, p. 266) assigned *Erato laevilabiata* Sacco, 1894 as a synonym to *Erato asulcata* Sacco, 1894. However, Sacco (1894, p. 62) referred to the 'variety A' in the description of *Eratopsis barrandei* Hoernes & Auinger, 1879. This species has a biplicate terminal ridge without further anterior ventral folds and less numerous, coarse labral denticles. In contrast *E. asulcata* (synonymous with *Erato planulosa* Sacco, 1894) has a simple terminal ridge with several anterior ventral folds and more numerous, finer labral denticles that are continued as fine folds onto the labrum. Therefore, based on these distinct differences, *E. laevilabiata* cannot

be a synonym of *E. asulcata*.

Schilder (1933, p. 266) wrote, concerning the labral denticles: ‘... the outer lip of the type specimen (Mus. Vienna) is not smooth as the figure seems to show, but it exhibits eleven distinct labial teeth’. It is true that the labrum was originally not smooth but the denticles were not preserved. Therefore, it is questionable how Schilder could count the denticles in the type specimen. But there is an additional question about Schilder’s discussions. On page 266 Schilder assigned *E. laevilabiata* as a synonym to *E. asulcata* (see above), but on page 260 he stated: ‘... Hoernes & Auinger’s var. A = *laevilabiata*, var. B = *asulcata*’. Schilder based his conclusions on the illustrated specimens of Hoernes & Auinger (1879). We were able to study both questionable specimens – variety A and B, and determined that the differences are conspecific as the dentition is almost identical: coarse labral denticles and simple appearing ventral folds. The only difference between them is the shell outline but the height of the spire is not a distinguishing feature.

Erato hemmoorensis Schilder, 1929

Figure C; Plate 1, fig. 2; Plate 5, figs 3-6; Plate 7, fig. 2

- ?1872 *Erato laevis* Don. – von Koenen, p. 123.
- 1925 *Erato laevis* – Kautsky, p. 87.
- *1929 *Erato subcypraeola hemmoorensis* Schilder, p. 11, text fig. 4.
- 1933 *Erato (Eratopsis) hemmoorensis* Schilder (1929) – Schilder, p. 249, 254, 265, text fig. 54.
- 2001a *Hespererato transiens* (Boettger, 1884) – Lozouet *et al.*, p. 54, pl. 4, figs 1-4.

Locus typicus – Borehole 15 = (58B/8) (711/2): 154-159 m, Beeringen, W Venlo, The Netherlands (Breda Formation, Hemmoorian, Langhian, middle Miocene)

Neotype designation – The type material of *Erato hemmoorensis* was destroyed during World War 2 (Dr U. Kotthoff and Dr Weitschatt of the Hamburg University, pers. comm.) (ICZN, Art. 75.3.4), therefore, the designation of a neotype is necessary (ICZN 75.3.1). Fortunately, such a specimen is available in the SMF (253707/1) and it is designated herein as neotype (Figure C), according to ICZN 75.3. The neotype locality also is Beeringen, 154-159 m below surface, The Netherlands.

Geographic distribution – Wentorf, Germany (Schilder, 1929, p. 11); Beeringen, The Netherlands; France, Hungary.

Chronostratigraphic distribution – Aquitanian, early Miocene, to Sarmatian, Serravallian, middle Miocene.

Material studied – Five specimens from Saint-Martin-d’Oney (France), early Miocene (Aquitanian) (DFB). Two specimens from Villandraut (France), early Miocene (Burdigalian) (DFB). Four specimens from Manthelan

(France), middle Miocene (CS; DFB). Four specimens from Paulmy (France), middle Miocene (Langhian) (DFB). Four specimens from Trois Moulins (France), middle Miocene (Langhian) (DFB). Six specimens (DFB), 32 specimens (JGS) and 16 specimens (SMF 337217), all from Borsodbóta (Hungary), middle Miocene (Badenian).

Original description – (Schilder, 1929, p. 11): ‘Größe und Gestalt wie bei *germanica intermedia*, AR. [Aussenrand] bei ziemlicher Verdickung weniger deutlich gerandet, AL. [Aussenlippe] schmaler, in der Mitte kaum verbreitert, AZ. [Aussenzähne] über 1/3 AL. [Aussenlippe]-Breite verlängert ..., sehr grob und distant; die 1. TZ. [Terminalzahn]-Falte ist wenig deutlich, die 2. dagegen bis fast zum Außenrande scharf rippenartig verlängert und nach innen als verstärkter Vorderrand der auffällig breiten, aber seichten Foss. [Fossula] fortgesetzt. IZ. [Innenzähne] ebenfalls grob und sehr distant, nur bis zur halben Schalenlänge erkennbar, IL. [Innenlippe] hinten glatt’.



Figure C. *Erato hemmoorensis* Schilder, 1929, neotype; borehole 15 (58B/8) (711/2), 154-159 m below surface, Beeringen, W Venlo, The Netherlands (Breda Formation, Hemmoorian, Langhian, middle Miocene). J. Görges collection, ex P. Tesch 1912; F.A. Schilder det. (probably Dec. 1943/ Jan. 1944 according to correspondence). Photograph: S. Hof and R. Janssen. SMF 253707/1. Bar represents 5 mm.

Description – Shell medium sized, relatively fragile, elongated pear-shaped with an elevated, somewhat pointed spire. Protoconch mostly covered by callus, but visible in one specimen. It is rounded and consists of 1 to 1½ inflated whorls and a minute nucleus. Suture indistinct. Teleoconch of c. 2½ whorls. Spire covered by callus, which hides the suture. Body whorl almost 80% of total shell height, shouldered adapically, with the maximum diameter at ¼ of the distance from the adapical suture, evenly tapering below and only slightly constricted at the ventrum. Dorsum smooth, rounded. Dorsal sulcus absent Aperture comprises approximately 75% of total shell height, almost straight and narrow. Labrum wide, thickened, smooth, somewhat flattened and sloping slightly into the aperture, rounded at the outer margin, bearing 9 to 14 teeth of irregular strength, that extend onto the labrum for a variable distance. Siphonal canal short, indented, rounded and straight. Colu-

mella curved, constricted at fossular section, without inner carinal ridge and a slightly thickened parietal lip. Columellar denticles only developed anteriorly. Anterior 1-3 denticles developed into folds, which run obliquely across the ventrum, the remaining ones weakly developed or obsolete. Fossula not delimited from the columella. Inner fossular margin constricted. Terminal ridge simple.

Range of variation – In some specimens the spire is considerably elevated. Also in some specimens, the labral denticles are less numerous and very coarse. The shell inflation varies.

Dimensions – Neotype: L = 5.5 mm, W = 4.0 mm, H = 2.7 mm, LT 12, CT –.

Discussion – Specimens formerly identified as *Erato hemmoorensis* in the collection of the Natuurhistorisch Museum Rotterdam from Antwerp, Belgium (2 specimens) and from Miste-Winterswijk, The Netherlands (1 specimen) and in the collection of NCB Naturalis, Leiden from Miste-Winterswijk, The Netherlands (RGM 225489, 1 specimen; *Erato (Eratopsis) exmaugeriae hemmoorensis* Schilder, 1929 – Janssen, 1984, p. 191, pl. 8, fig. 5) turned out to be *Erato germanica* Schilder, 1929.

Erato hemmoorensis differs from the afore mentioned *Erato* species by its small size, the coarse dentition, and the broad, biplicate terminal ridge.

***Erato italica* Schilder, 1932a**

Plate 1, fig. 10; Plate 4, figs 4-6

1894 *Erato (Eratopsis) laevis* var. *pernana* Sacco, p. 60 (*pars*).

*1932 *Erato italica* Schilder, p. 20.

1933 *Erato (Erato) italica* Schilder (1932) – Schilder, p. 250, 254, text fig. 62.

1995 *Erato (Eratopsis) barrandei* Hoernes & Auinger – Baluk, pl. 13, fig. 5.

Locus typicus – Torino, Italy (Langhian, middle Miocene).

Type material – Holotype (Pl. 1, fig. 10; Pl. 4, fig. 5), CS 3439, 1 paratype, CS 3438.

Geographic distribution – France, Hungary, Italy, Poland.

Chronostratigraphic distribution – Aquitanian, early Miocene, to Badenian, Langhian and Serravallian, middle Miocene.

Material studied – One specimen from Saint-Martin-d'Oney (France), early Miocene (Aquitanian) (DFB). One specimen from Trois Moulins (France), middle Miocene (Langhian) (DFB). Sixteen specimens (DFB) and 3 specimens (JGS) from Borsodbóta (Hungary), middle Miocene (Badenian). One specimens from Korytnica (Poland), mid-

dle Miocene (Badenian) (UW BkK-G448).

Original description – (Schilder, 1932a, p. 21): ‘Questa forma liscia di *Erato* ricorda per i suoi caratteri generali la *E. germanica* Schilder del Miocene medio germanico, ma si distingue per il minor numero di Pd. In esemplari della stessa dimensione (13 a 15 Pd nella *germanica* e 10 a 12 nella *italica*). Per il numero di Pd. ricorda perciò *E. hemmoorensis* Schild. ma nella *italica* la Pt non consta di una piega trasversale, ma, come nella *germanica*, di numerose pieghe oblique convergenti’.

Description – Shell medium sized, relatively fragile, pear-shaped, with an elevated, rounded spire. Protoconch mostly covered by callus, but visible in several specimens. It consists of 1 to 1½ depressed whorls and a minute nucleus. Protoconch clearly separated from teleoconch. Suture indistinct. Teleoconch consists of c. 3¼ whorls. Spire covered by thick callus, which covers the suture. Body whorl almost 90% of total shell height, shouldered adapically, with the maximum diameter almost at the adapical suture, evenly tapering below and only slightly constricted at the ventrum. Dorsum rounded, usually smooth. Dorsal sulcus obscured. Aperture comprises c. 85% of total shell height, almost straight and fairly narrow. Labrum narrow, slightly thickened, smooth, somewhat flattened, rounded at the outer margin, bearing 12 to 14 knob-like, coarse teeth. Siphonal canal short, indented, rounded and straight. Columella slightly sinuous. Anterior 1-2 columellar denticles developed into folds, which run obliquely across the ventrum, the remaining ones weakly developed or obsolete. Fossula obscured. Terminal ridge simple.

Range of variation – Sometimes the shell surface is irregularly covered with pustules and a dorsal sulcus might be represented by at least a dimple behind the anterior extremity in fully adult specimens.

Dimensions – Holotype: L = 4.1 mm, W = 2.7 mm, H = 2.3 mm, LT 13, CT –.

Discussion – *Erato italica* differs from the afore mentioned species by its simple terminal ridge and the lack of ventral folds, as well as labral denticles that are slightly extended as folds onto the labrum. *Erato hemmoorensis* and *E. praecedens* also lack the ventral folds but they both possess a biplicate terminal fold.

***Erato gallica* Schilder, 1932b**

Plate 1, fig. 12; Plate 9, fig. 4; Plate 12, figs 1-5

1837 *Voluta cypraeola* Dujardin, p. 302 (*non Voluta cypraeola* Brocchi, 1814).

1866 *Voluta laevis* da Costa, p. 52, pl. 11, fig. 6 [preoccupied, *non Voluta laevis* Donovan, 1804 = *Erato voluta* (Montagu, 1803)].

1902 *Erato laevis* Don. – Couffon, p. 131.

1924 *Erato (Eratopsis?) marginella* Cossmann & Peyrot,

- 1924, p. 394 (*nomen dubium*).
 *1932b *Erato gallica* Schilder, p. 255.
 1932c *Erato (Erato) transiens gallica* Schil. – Schilder, p. 89.
 1933 *Erato (Erato) transiens gallica* Schilder (1932) – Schilder, p. 250, 254, 264, text fig. 68.
 1952 *Erato (Erato) cypraeola gallica* Schilder, 1932 – Glibert, p. 262, pl. 3, fig. 3a, b.
 1956 *Erato laevis* Donovan – Csepregy-Meznerics, p. 433, pl. 4, figs 7, 8.
 ?1962 *Erato laevis* – Strausz, pl. 74, figs 13, 14.
 2002b *Erato gallica* Schilder, 1932 – Fehse & Landau, p. 96, fig. 22a-c.

Locus typicus – La Placette, dep. Aude, France (Langhian, middle Miocene).

Type material – Holotype (Pl. 1, fig. 12; Pl. 12, fig. 1), CS 3638; paratype 1 CS 10 (Pontlevoy); paratype 2 CS 11 (Pontlevoy); paratype 3 CS 3662 (Le Clos); paratype 4 CS 3664 (Le Clos); paratype 5 CS 47 (Manthelan); paratype 6 CS 49 (Manthelan); paratype 7 CS 4069 (Manthelan).

Geographic distribution – Manthelan, Pontlevoy, La Placette, Anjou, Angers, France; ? Cacula, Portugal (Schilder, 1932b); Szob, Hungary (Strausz, 1962), Austria.

Chronostratigraphic distribution – Eggenburgian, Burdigalian, early Miocene, to Badenian, Langhian and Serravallian, middle Miocene.

Material studied – Three specimens from Corbleu, Moulin de Carreau (France), early Miocene (Burdigalian) (DFB). One specimen from Villandraut (France), early Miocene (Burdigalian) (DFB). Three specimens from Manthelan (France), middle Miocene (Langhian) (DFB). Four specimens from Thenay (France), middle Miocene (Langhian) (DFB). Four specimens from Paulmy (France), middle Miocene (Langhian) (DFB). One specimen from Steina-brunn (Austria), middle Miocene (Badenian) (DFB). One specimen from Szob (Hungary), middle Miocene (Badenian) (DFB). Three specimens (DFB) and 1 specimen (JGS) from Borsodbóta (Hungary), middle Miocene (Badenian).

Original description – (Schilder, 1932c, p. 255): ‘Die im Helvet der Touraine und von Anjou sehr häufige *Erato* mit radialartigen vorderen IZ. [Innenzähne] und deutlicher, wenn auch nicht sehr breiter F. [Fossula] hatte bisher keinen eigenen Namen, obwohl sie von den gleich alten Formen ... durch die ... deutlichen Unterschiede in Größe, Gestalt und Zahnzahl gut zu trennen ist ... *E. gallica* ist also gegenüber ihren fossilen Verwandten durch bedeutendere Größe und relativ geringe Zahnzahl ausgezeichnet, wobei die IZ. [Innenzähne] ... meist noch weniger zahlreich sind als die AZ. [Aussenzähne]. Die Schale erscheint meist glatt, doch konnte ich an vielen Stücken Spuren einer Rückenfurche (meist nur in Form einer kleinen Delle über dem VE. [Vorderende]) und bei 2 Stücken von La Placette

... Spuren einer feinen Körnelung an der Sp. [Spira] und an den angrenzenden Teilen des letzten Umganges feststellen ...’.

Description – Shell medium sized, relatively fragile, pear-shaped with an elevated, rounded spire. Protoconch mostly covered by callus, but visible in one specimen. It consists of 1 to 1½ depressed whorls and a minute nucleus. Suture faintly visible. Teleoconch consists of approximately 3½ whorls. Spire covered by callus hiding the suture. Body whorl almost 80% of total shell height, with the maximum diameter at ⅓ of the distance from the adapical suture, evenly tapering below and somewhat constricted at the ventrum. Dorsum irregularly covered with minute pustules around the spire. Dorsum rounded. Dorsal sulcus represented by at least a dimple behind the anterior extremity in fully adult specimens. Aperture comprises c. 75% of total shell height, almost straight and narrow. Labrum thickened, smooth, somewhat rounded and sloping slightly into the aperture, rounded at the outer margin, bearing up to 20 rather fine teeth, which extend slightly onto the labrum. Siphonal canal short, indented, rounded and straight. Columella slightly curved, with a weakly developed inner carinal ridge and a rounded parietal lip. Columellar denticles posteriorly obscured (16 in holotype). Anterior 3-5 denticles are developed as folds. Basal folds run with different obliqueness across the ventrum, the remaining ones weakly developed or obsolete. Fossula not delimited from the columella. Inner fossular margin protruded. Terminal ridge simple.

Range of variation – The number and condition of the labral dentition vary considerably and could sometimes be very coarse and less numerous (down to 14 in number).

Dimensions – Holotype: L = 8.4 mm, W = 6.4 mm, H = 5.3 mm, LT 20, CT 16.

Discussion – Lamarck (1810, p. 99, 108) used the name ‘*Cypraea ovulata*’ twice. The first name (1810, p. 99) was given to a Recent triviid species from South Africa. He used the same name for a fossil eratoid taxon but its identity is mysterious because no type specimen could be located in Lamarck’s collection and his description is not decisive. The latter is a primary homonym and has been redescribed by Schilder (1932c, p. 89 as *Erato (Erato) transiens gallica*).

The very numerous, fine, close-set ventral folds separate *Erato gallica* from the other mentioned *Erato* species. The shell is also large and globose. Shells of *E. kimakowiczi* that are found together with *E. gallica* at Borsodbóta have a similar shell outline but the appearance of the ventral folds separates both species immediately.

***Erato praecedens* Schilder, 1933**

Plate 1, fig. 13; Plate 13, figs 1-8

- *1933 *Erato (Eratopsis) pernana praecedens* Schilder, p. 249, 254, 270, text fig. 55.

- ?1969 *Eratopsis barrandei planulosa* (Bon.) – Csepregy-Meznerics, pl. 6, fig. 20.
1995 *Erato (Erato) pernana* Sacco, 1894 – Bałuk, pl. 12, fig. 3.
2002b *Erato praecedens* Schilder, 1933 – Fehse & Landau, p. 97, fig. 19a-c.

Locus typicus – Montegibbio, Italy (Tortonian, late Miocene).

Type material – Holotype (Pl. 1, fig. 13; Pl. 13, fig. 1), CS 5088.

Geographic distribution – France, Hungary, Italy, Poland.

Chronostratigraphic distribution – Badenian, Langhian and Serravallian, middle Miocene, to Pannonian, Tortonian, late Miocene.

Material studied – Four specimens from Orthez (France), middle Miocene (Serravallian) (DFB).

Eight specimens (DFB), 28 specimens (JGS) and 12 specimens (SMF 337215) from Borsodbóta (Hungary), middle Miocene (Badenian). Nine specimens from Lăpugiu de Sus (Romania), middle Miocene (Badenian) (DFB). One specimens from Korytnica (Poland), middle Miocene (Badenian) (UW BkK-G445). One 1 specimen from Montegibbio (Italy), late Miocene (Tortonian) (DFB). Two specimens from Sabbi di Stazzano (Italy), late Miocene (DFB).

Original description – (Schilder, 1933, p. 270): ‘*praecedens*, nov., *Eratopsis*. The Tortonian [= Serravallian] representative of *pernana*; it differs by size, shape, and coarser denticulation. Type from Monte Gibbio ... The shells from Monte Gibbio usually are slightly smaller and broader than three specimens from Tetti Borelli, which represent the Tortonian [= Serravallian] *cypraeola* in Sacco’s fauna of Piedmont (Mus. Torino): L = 40-52 vs. 52-54, BL = 74 vs. 70’.

Description – Shell small sized, relatively fragile, ventral shape almost triangular, with a slightly elevated, somewhat rounded spire. Protoconch mostly covered by callus, but visible in several specimens. It consists of 1 to 1½ globose whorls and a minute nucleus. Suture faintly visible. Teleoconch consists of c. 2¼ whorls. Spire covered by thin callus hiding the suture. Body whorl approximately 90% of total shell height, shouldered adapically, with the maximum diameter at one fifth of the distance from the adapical suture, evenly tapering below and only slightly constricted at the ventrum. Dorsum rounded, smooth. Dorsal sulcus absent or obscured. Aperture comprises c. 85% of total shell height, almost straight and narrow. Labrum narrow, slightly thickened, smooth, rounded, bearing 15 to 18 minute teeth. Siphonal canal short, rounded and straight. Columella almost straight, with a weakly developed inner carinal ridge and a rounded parietal lip. Columellar posteriorly obscured. Fossula not delimited from the colu-

mella. Terminal ridge biplicate.

Range of variation – The shells are more or less strongly inflated.

Dimensions – Holotype: L = 4.9 mm, W = 3.3 mm, H = 2.9 mm, LT 15, CT –.

Discussion – *Erato praecedens* Schilder, 1933 differs from its congeners by its generally smaller, rather triangular than pear-shaped shell with a low spire. The shell outline is somewhat similar to the two *Cypraerato* species described above. However, *E. praecedens* differs from both of them by the elevated spire that defines the shell length. *Erato praecedens* differs from the similar sized *E. laevilabiata* Sacco, 1894 (with fewer pustulations) by the shell shape but especially by the finer, more numerous labral teeth.

***Erato turonica* Schilder, 1933**

Plate 1, fig. 14; Plate 14, figs 1-5

- 1866 *Erato laevis* Don. – Pereira da Costa, p. 52, pl. 11, fig. 6a, b.
*1933 *Erato (Erato) incrassata turonica* Schilder, p. 250, 254, 273, text fig. 72.
1995 *Erato (Eratopsis) barrandei* Hoernes & Auinger, 1880 – Bałuk, pl. 13, figs 4, 6.

Locus typicus – Manthelan, Indre-et-Loire, France (Serravallian, middle Miocene).

Type material – Holotype (Pl. 1, fig. 14; Pl. 14, fig. 1), CS 45; paratype 1, CS 46; paratype 2, CS 48.

Geographic distribution – France, Hungary, Poland.

Chronostratigraphic distribution – Badenian, Langhian, and Serravallian, middle Miocene.

Material studied – Four specimens from Ferrière-Larçon (France), middle Miocene (Langhian) (DFB). One specimen from Trois Moulins (France), middle Miocene (Langhian) (DFB). Six specimens from Orthez (France), middle Miocene (Serravallian) (DFB). Four specimens (DFB). 7 specimens (JGS) and 1 specimen (SMF 337210) from Borsodbóta (Hungary), middle Miocene (Badenian). Two specimens from Korytnica (Poland), middle Miocene (Badenian) (UW BkK-G447, BkK-G449).

Original description – (Schilder, 1933, p. 273): ‘*turonica*, nov., *Erato*. Differs from *gallica* of the same horizon in Western France by the coarser teeth and the broader fossula; besides the new species is less variable in size, usually it does not exhibit the slightest trace of a dorsal impression anteriorly, and few specimens are granulate on the spire (percentage of granulate specimens = 12 vs. 86 in *gallica*). Type from Manthelan ...’.

Description – Shell medium sized, relatively fragile, elongated pear-shaped, with an elevated, rounded spire. Protoconch mostly covered by callus, but visible in several specimens. It consists of 1 to 1½ depressed whorls and a very minute nucleus. Suture faintly visible. Teleoconch consists of almost four whorls. Spire covered by thin callus hiding the suture. Body whorl almost 80% of total height, rounded apically, with the maximum diameter at ½ of the distance from the apical suture, evenly tapering below and slightly constricted at the ventrum. Dorsum usually smooth and rounded. Dorsal sulcus represented by at least a dimple behind the anterior extremity in fully adult specimens. Aperture comprises c. 75% of total shell height, almost straight and fairly narrow. Labrum thickened, smooth, somewhat flattened and sloping slightly into the aperture, rounded at the outer margin, bearing 12 to 15 coarse teeth of irregular strength, which extend slightly onto the labrum. Siphonal canal short, indented, rounded and straight. Columella almost straight, with a weakly developed inner carinal ridge and a rounded parietal lip. Columellar denticles coarse, varying from 10 to 12 in

number. Anterior 1-3 denticles are developed as short folds, running obliquely across the ventrum, the remaining ones weakly developed or obsolete. Fossula not delimited from the columella. Inner fossular margin slightly protruded. Terminal ridge biplicate.

Range of variation – Sometimes the shell is somewhat pustulated. The shell inflation varies and the shell outline is more or less pyriform. The development of the labral folds vary.

Dimensions – Holotype: L = 6.6 mm, W = 4.7 mm, H = 3.8 mm, LT 17, CT 15.

Discussion – The wide, coarse, less oblique ventral folds in *Erato turonica* are very distinct and separate this taxon from all other *Erato* species referred to. Only *E. incrassata* possesses similar ventral folds but *E. turonica* is furthermore not so inflated and the labrum is narrower. The latter taxon might also be ancestral to *E. incrassata*.

| Epoch | Oligocene | | | | Miocene | | | | | | |
|--------------------------------------|-----------|----------|------------|-------------|------------|--------------|-----------|-----------|-----------|---------|--|
| | early | | late | | early | | | middle | | late | |
| | Rupelian | Chattian | Aquitanian | Burdigalian | Langhian | Serravallian | Tortonian | Messinian | Pannonian | Pontian | |
| Standard stages | | | | | | | | | | | |
| Stages | | | | | Eggenburg. | Ott-nang. | Karpart. | Badenian | Sarmatian | | |
| <i>Eratopsis barrandei</i> | | | | | | | | ————— | | | |
| <i>Cypraeerato yolandae</i> nov. sp. | | | | | | | | ————— | | | |
| <i>Cypraeerato zoltani</i> nov. sp. | | | | | | | | ————— | | | |
| <i>Erato subcypraeola</i> | | | | | | | | ————— | | | |
| <i>Erato incrassata</i> | | | | | | | | ————— | | | |
| <i>Erato kimakowiczi</i> | | | | | | | | ————— | | | |
| <i>Erato transiens</i> | | ————— | | | | | | ————— | | | |
| <i>Erato spiralis</i> | | | | | | | | ————— | | | |
| <i>Erato planulosa</i> | | | | | | | | ————— | | | |
| <i>Erato laevilabiata</i> | | | | | | | | ————— | | | |
| <i>Erato hemmoorensis</i> | | | | | | | | ————— | | | |
| <i>Erato italica</i> | | | | | | | | ————— | | | |
| <i>Erato gallica</i> | | | | | | | | ————— | | | |
| <i>Erato praecedens</i> | | | | | | | | ————— | | | |
| <i>Erato turonica</i> | | | | | | | | ————— | | | |

Figure D. Chronostratigraphic distribution of the discussed species, after Hancock & Skinner (2000, Appendix 1b) and Mandic *et al.* (2002, text fig. 3).

Conclusions

The observed diversity of the Eratoidae at Borsodbóta cannot even tentatively be explained. A similar diversity has been reported from Estepona, Spain (Fehse & Landau, 2002a) and another is confirmed by specimens from the middle Miocene of the Touraine Basin, France, in the collection of the first author. However, the composition of the molluscan fauna at each locality - Borsodbóta, Estepona and Touraine Basin - is quite different and cannot be used to draw conclusions about the Eratoidae. A present day example is the high concentration of eratoid species (almost 20) in the Philippines. Again it cannot be explained because our knowledge of the Eratoidae biology is barely in its infancy. A little further south the diversity of the Eratoidae is far lower, but this is not the case for other groups of molluscs (*e.g.* Triviidae). We can only take note of this diversity without being able to explain it.

Acknowledgements

We are very grateful to Mathias Harzhauser (NHMW) for the illustrations of *Eratopsis barrandei*, *Erato laevilabiata* and *E. transiens*; to Siegrid Hof, Eike Neubert and Ronald Janssen (SMF) for the photographs of *E. hemmoorensis*, *E. kimakowiczi* and *E. hoernesii*; to Ronald Pouwer (NCB Naturalis, Leiden, The Netherlands) for the photographs of *E. germanica* (formerly identified as *E. hemmoorensis*); to Kees Moeliker (Natuurhistorisch Museum, Rotterdam, The Netherlands) for the loan of their *E. hemmoorensis* that are now identified *E. germanica*; to Daniele Ormezzano (University of Turin, Italy) for his help and search for several types (especially of specimens in the collection of Doderlein) in Italian public collections; to Lindsey T. Groves (Los Angeles County Museum, USA) and Ronald Janssen (SMF) for reviewing the manuscript and for helpful suggestions; to Ronald Janssen and Helmut Krock (Lüneburg,

Germany) for copies of papers; to Arie W. Janssen (Xewkija, Malta) for composing Fig. A and helpful suggestions and to Virginie Héros (Muséum National d'Histoire Naturelle, Paris, France) for information concerning Locard's paper (1878). Also Steven Tracey (The Natural History Museum, London, UK) improved the manuscript with additional remarks.

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Plate 1.

1. *Erato incrassata* (Coppi, 1876), **neotype**; Montegibbio, Italy; Tortonian; late Miocene; CS 5086.
2. *Erato hemmoorensis* Schilder, 1929; Manthelan, France; Serravallian, middle Miocene; CS 4068.
3. *Cypraerato yolandae* nov. sp.; **holotype**, Korytnica, Poland; Badanian, middle Miocene; UW BkK-G449.
4. *Cypraerato badenica* nov. sp.; Borsodbóta, Hungary; Badanian, middle Miocene; ZVH.
5. *Erato subcypraeola* d'Orbigny, 1852, **neotype**; Méridac, France; Burdigalian, early Miocene; CS 40.
6. *Erato kimakowiczi* Boettger, 1884, **lectotype**; Lăpugiu de Sus, Romania; Badanian, middle Miocene; SMF XII 2206a.
7. *Erato transiens* Boettger, 1884, **lectotype**; Steinabrunn, Austria; Badanian, middle Miocene; NHMW 1846/0037/0091.
8. *Erato spiralis* Döderlein in Sacco, 1894, **neotype**; Montegibbio, Italy; Tortonian, late Miocene; CS 5087.
9. *Erato planulosa* Sacco, 1894, **lectotype**; Colli Torinesi, Italy; Burdigalian, early Miocene; BS 044.16.001.
10. *Erato italica* Schilder, 1932a, **holotype**; Torino, Italy; Langhian, middle Miocene; CS 3439.
11. *Erato laevilabiata* Sacco, 1894, **lectotype** of *Erato hoernesii* Boettger, 1901; Lăpugiu de Sus, Romania; Badanian, middle Miocene; SMF XII 2205a.
12. *Erato gallica* Schilder, 1932b, **holotype**; La Placette, France; Langhian, middle Miocene; CS 3638.
13. *Erato praecedens* Schilder, 1933, **holotype**; Montegibbio, Italy; Tortonian, late Miocene; CS 5088.
14. *Erato turonica* Schilder, 1933, **holotype**, Manthelan, France; Langhian, middle Miocene; CS 45.
15. *Erato laevilabiata* Sacco, 1894, **lectotype**; Niederleis, Austria; Badanian, middle Miocene; NHMW 1863/0015/0612.
16. *Erato laevilabiata* Sacco, 1894; Lăpugiu de Sus (= 'variety B' of Hoernes & Auinger, 1879, pl. 8, fig. 10a-c), Niederleis, Austria; Badanian, middle Miocene; NHMW 1864/0001/0294.

Bar represents 5 mm.

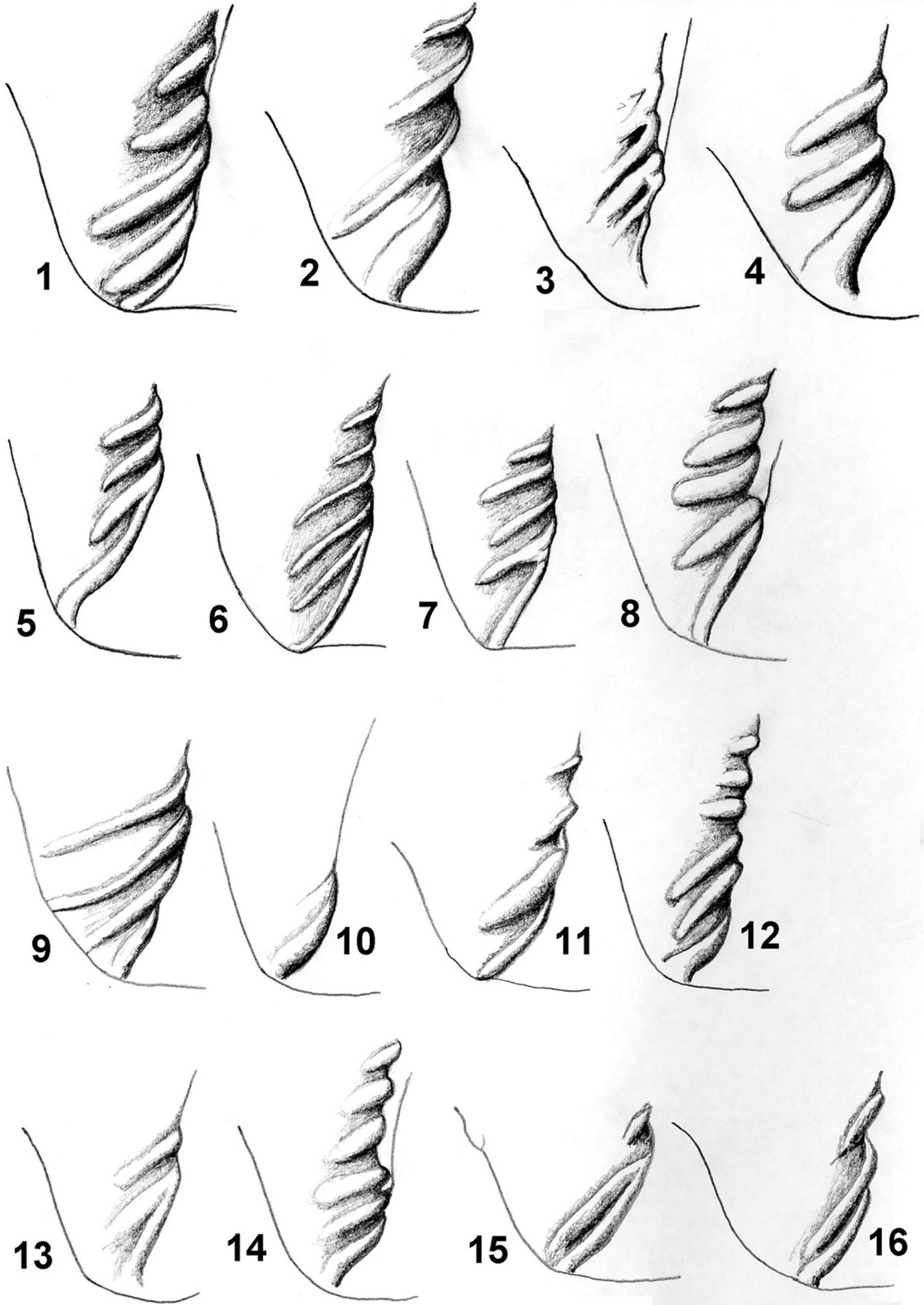


Plate 1.

Plate 2.

1. *Cypraeerato yolandae* nov. sp.; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8905A.
2. *Cypraeerato yolandae* nov. sp., **holotype**; Korytnica, Poland; Badenian, middle Miocene; UW BkK-G449.
3. *Cypraeerato yolandae* nov. sp.; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8905B.
4. *Cypraeerato badenica* nov. sp.; Borsodbóta, Hungary; Badenian, middle Miocene; ZVH.
5. *Cypraeerato badenica* nov. sp.; Thenay, France; Serravallian, middle Miocene; DFB 5798.

a: dorsal views, b: apertural views. Bar represents 5 mm.

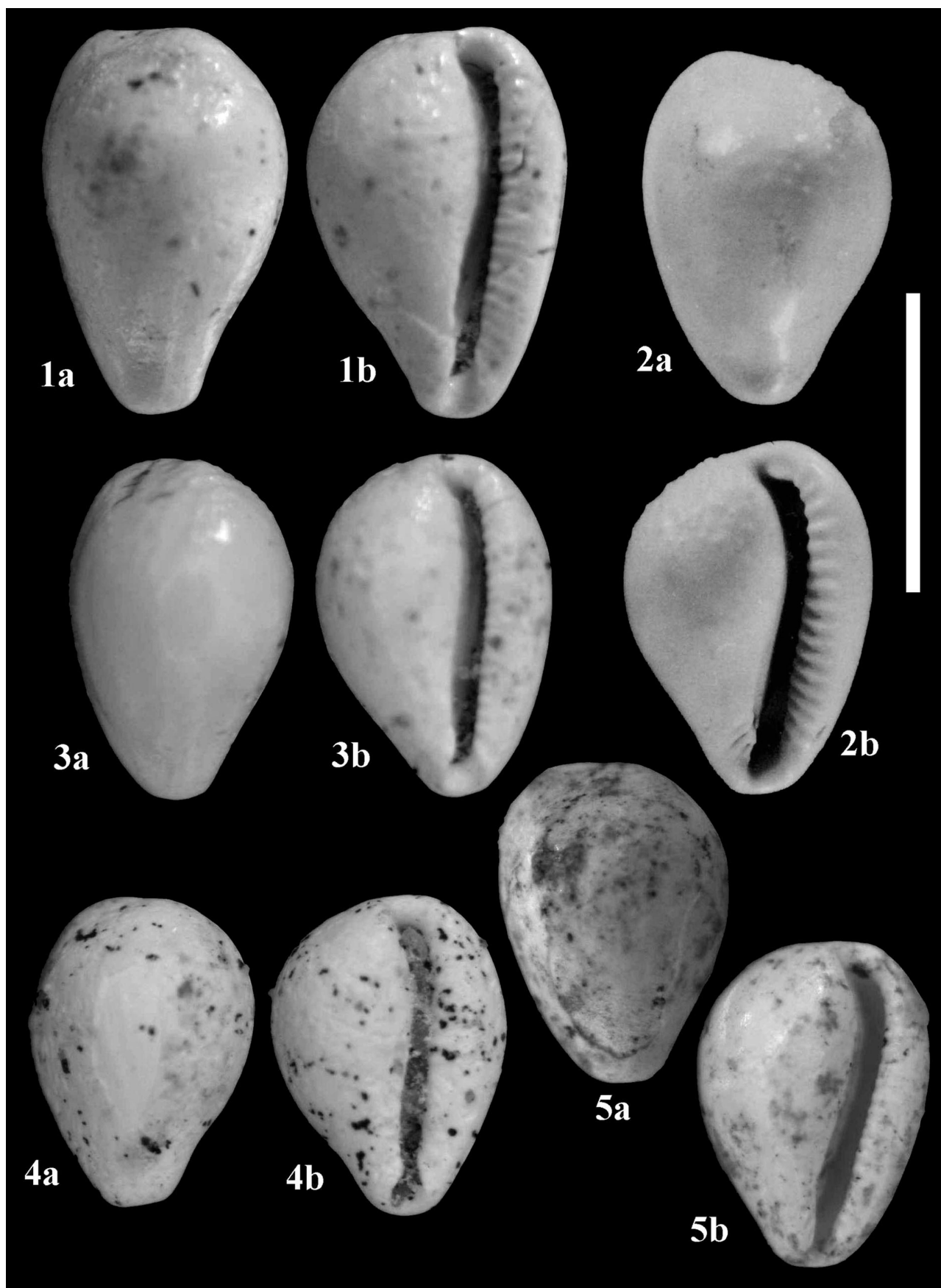


Plate 2.

Plate 3.

1. *Cypraeerato badenica* nov. sp., **holotype**; Borsodbóta, Hungary; Badenian, middle Miocene; ZSM 20090084.
2. *Cypraeerato badenica* nov. sp.; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8906B.
3. *Cypraeerato badenica* nov. sp.; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8906A.
4. *Cypraeerato badenica* nov. sp.; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8906C.
5. *Cypraeerato bimaculata* (Tate, 1878); Cairns, Queensland, Australia; Recent; DFB 9549.

a: dorsal views, b: apertural views. Bar represents 5 mm.

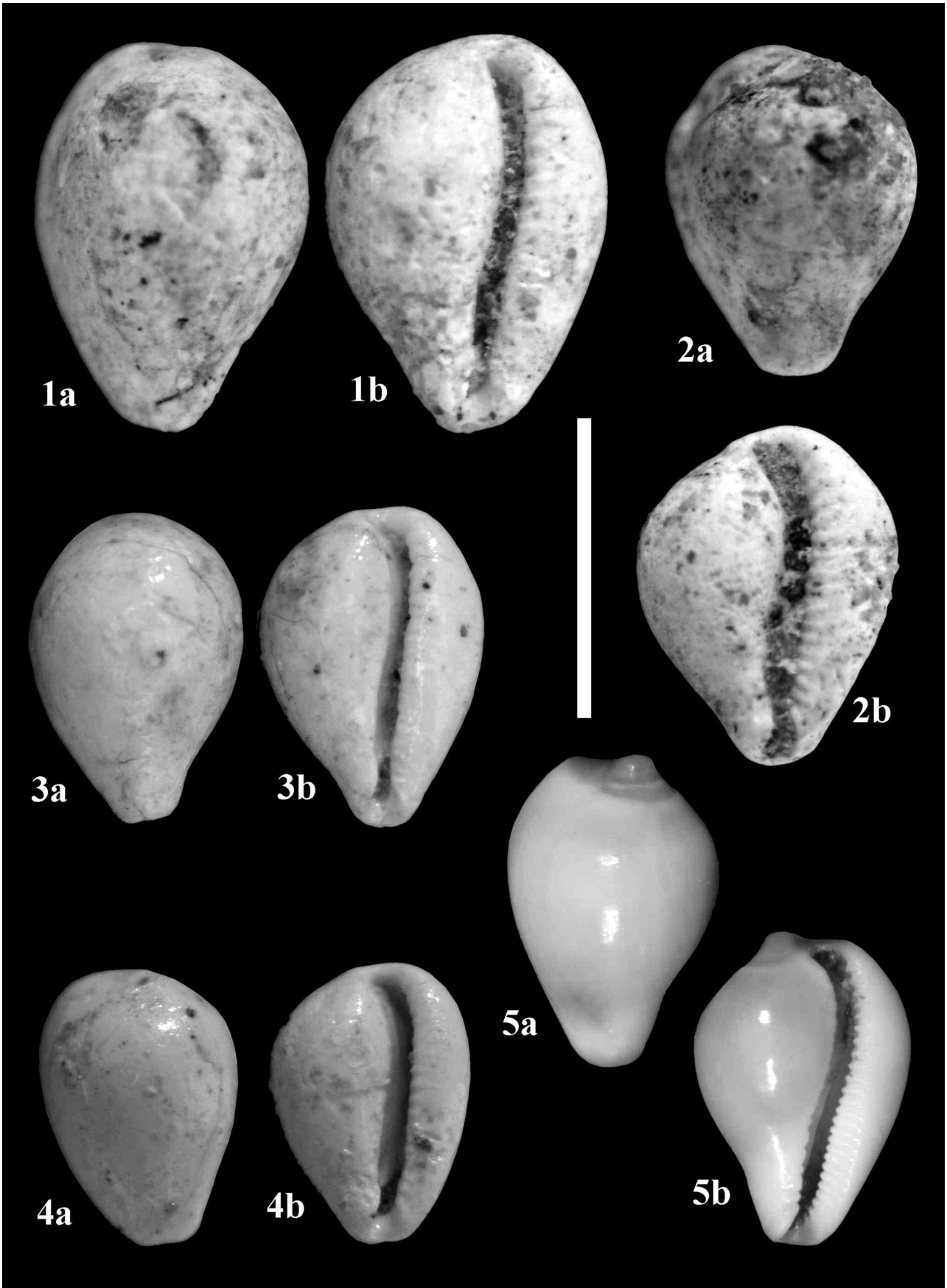


Plate 3.

Plate 4.

1. *Erato subcypraeola* d'Orbigny, 1852, **neotype**; Méridignac, France; Burdigalian, early Miocene; CS 40.
2. *Erato subcypraeola* d'Orbigny, 1852; Borsodbóta, Hungary; Badanian, middle Miocene; DFB 8909A.
3. *Erato subcypraeola* d'Orbigny, 1852; Borsodbóta, Hungary; Badanian, middle Miocene; DFB 8909B.
4. *Erato subcypraeola* d'Orbigny, 1852; Lăpugiu de Sus, Romania; Badanian, middle Miocene; DFB 6948A.
5. *Erato subcypraeola* d'Orbigny, 1852; Lăpugiu de Sus, Romania; Badanian, middle Miocene; DFB 6948B.

a: dorsal views, b: apertural views. Bar represents 5 mm.

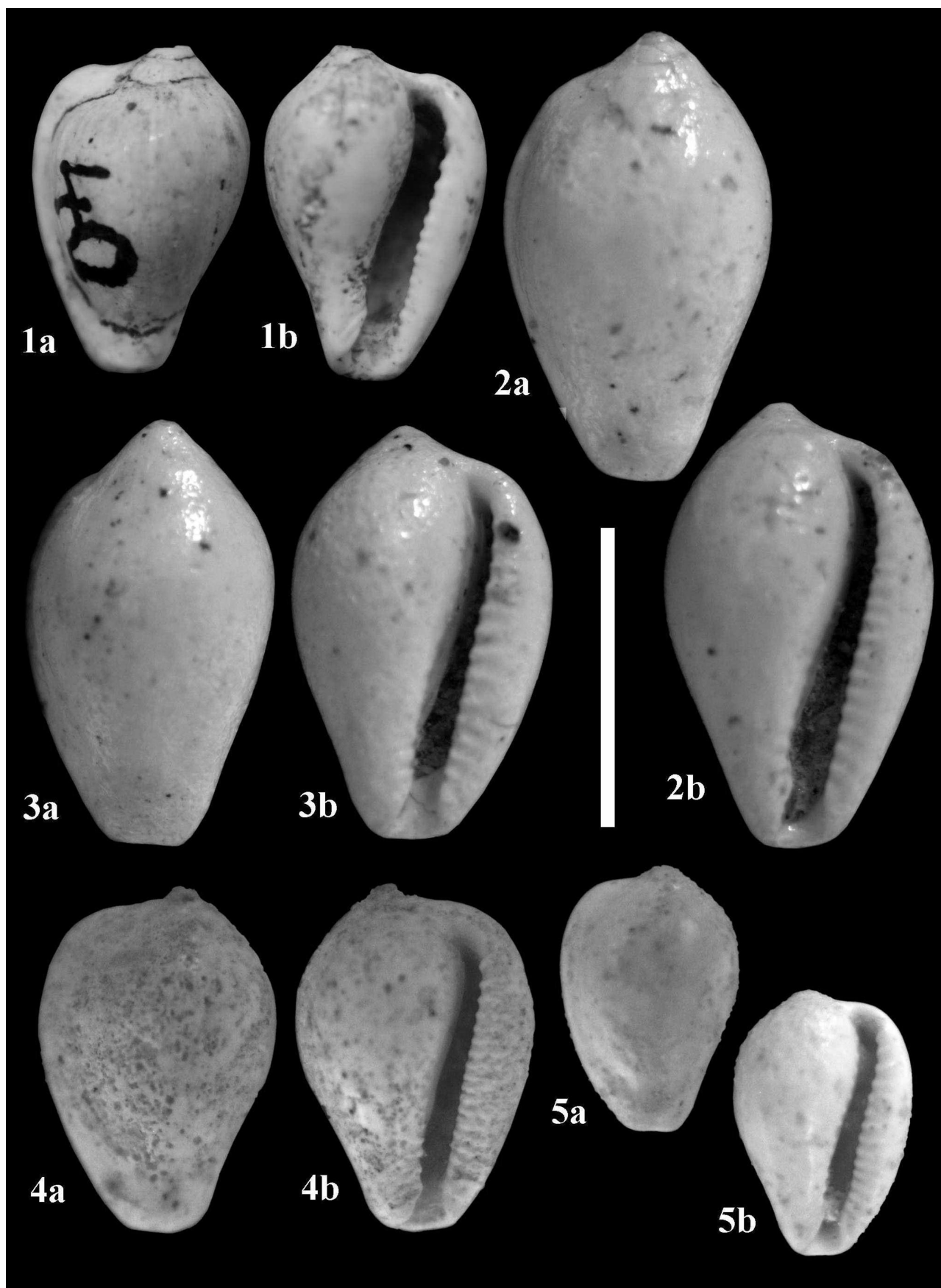


Plate 4.

Plate 5.

1. *Erato incrassata* (Döderlein *in* Coppi, 1876), **neotype**; Montegibbio, Italy; Tortonian, late Miocene; CS 5086.
2. *Erato incrassata* (Döderlein *in* Coppi, 1876); Borsodbóta, Hungary; Badenian, middle Miocene; DFB 6817.
3. *Erato hemmoorensis* Schilder, 1929; Manthelan, France; Serravallian, middle Miocene; CS 4068.
4. *Erato hemmoorensis* Schilder, 1929; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8907A.
5. *Erato hemmoorensis* Schilder, 1929; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8907B.
6. *Erato hemmoorensis* Schilder, 1929; Saint-Martin-d'Oney, France; Aquitanian, early Miocene; DFB 5794A.

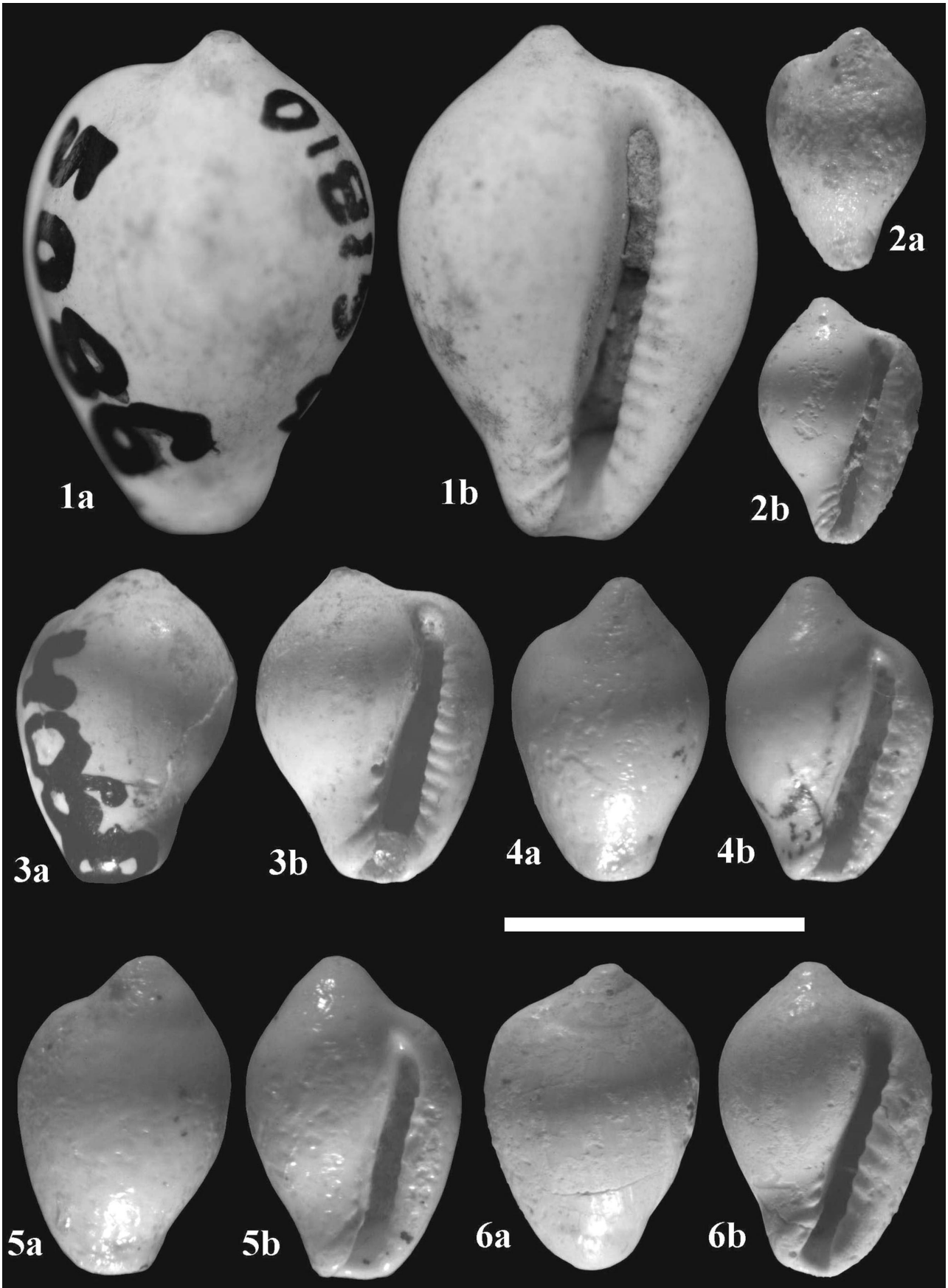


Plate 5.

Plate 6.

1. *Erato kimakowiczi* Boettger, 1884, **lectotype**; Lăpugiu de Sus, Romania; Badenian, middle Miocene; SMF XII 2206a.
2. *Erato kimakowiczi* Boettger, 1884; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8611A.
3. *Erato kimakowiczi* Boettger, 1884; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8611B.
4. *Erato kimakowiczi* Boettger, 1884; Lăpugiu de Sus, Romania; Badenian, middle Miocene; DFB 6949A.
5. *Erato kimakowiczi* Boettger, 1884; Lăpugiu de Sus, Romania; Badenian, middle Miocene; DFB 6949B.

a: dorsal views, b: apertural views. Bar represents 5 mm.

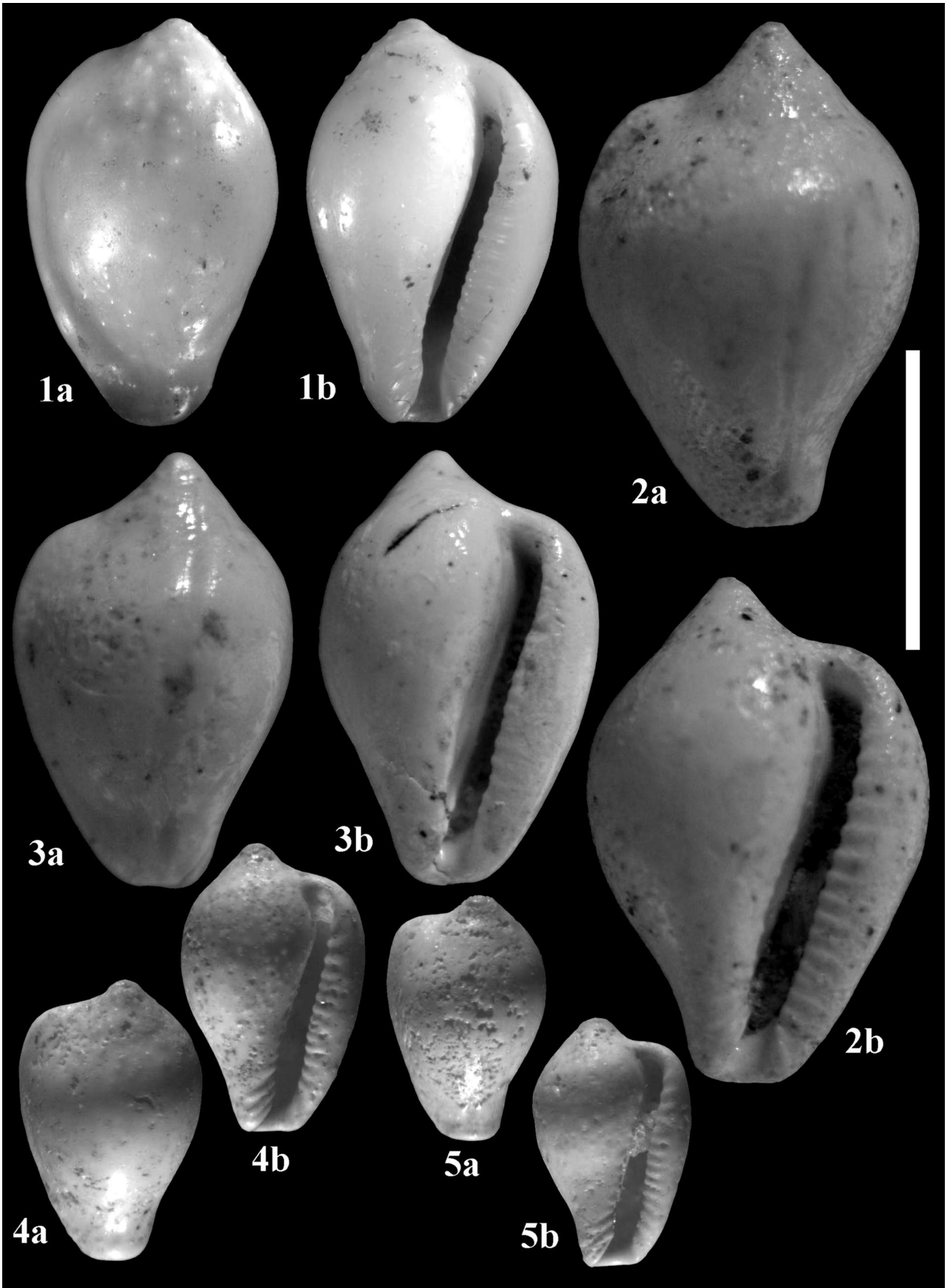


Plate 6.

Plate 7.

1. *Erato kimakowiczi* Boettger, 1884; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8611C.
2. *Erato hemmoorensis* Schilder, 1929; Saint-Martin-d'Oney, France; Aquitanian, early Miocene; DFB 5794B.
3. *Erato incrassata* (Döderlein in Coppi, 1876); Trois Moulins, Faluns de Touraine, France; Serravallian, middle Miocene; DFB 974A.
4. *Erato kimakowiczi* Boettger, 1884; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8611D.

a: dorsal views, b: apertural views. Bar represents 5 mm.

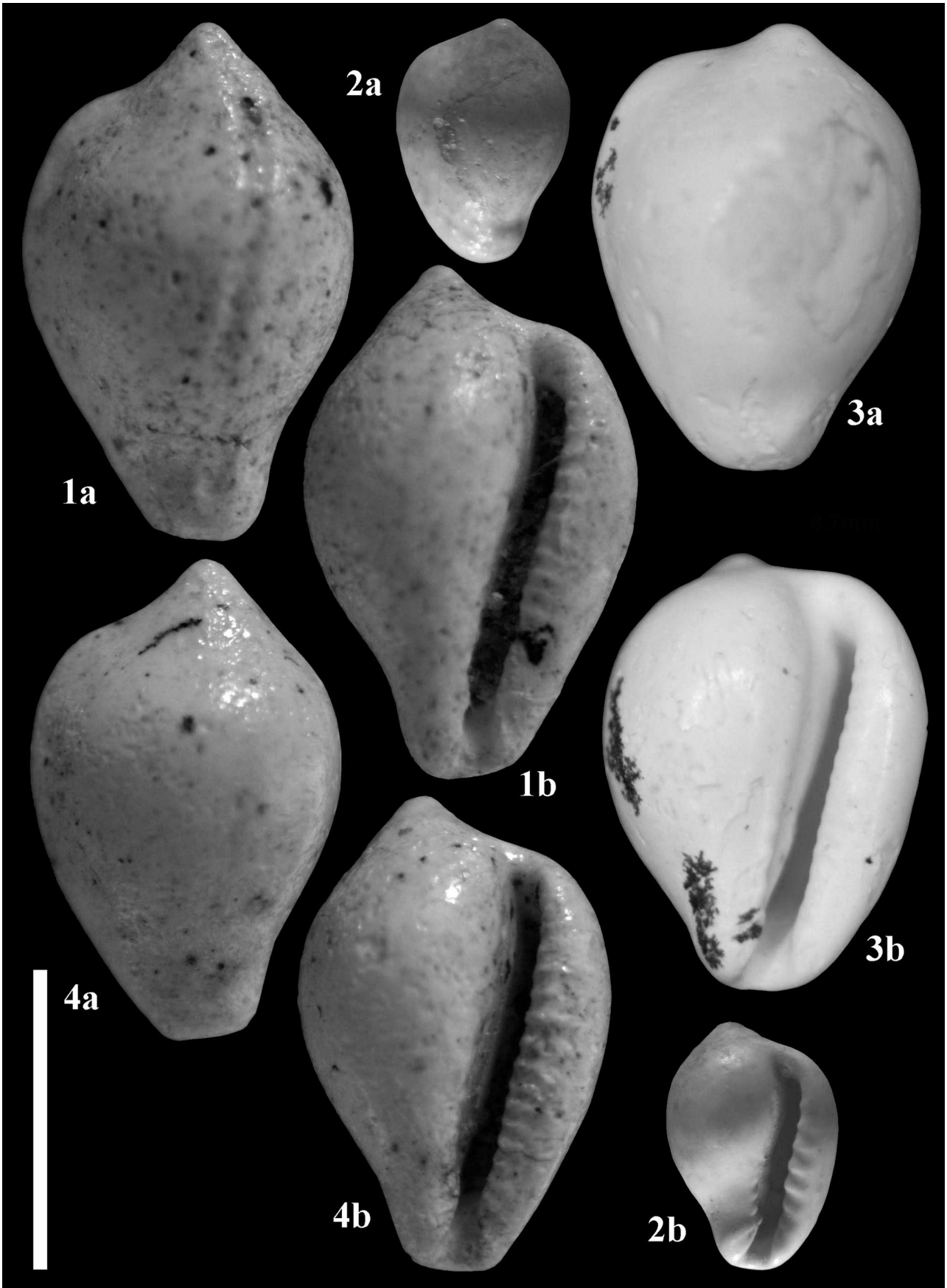


Plate 7.

Plate 8.

1. *Erato transiens* Boettger, 1884, **lectotype**; Steinabrunn, Austria; Badenian, middle Miocene; NHMW 1846/0037/0091.
2. *Erato transiens* Boettger, 1884; Lăpușiu de Sus, Romania; Badenian, middle Miocene; DFB 6887A.
3. *Erato transiens* Boettger, 1884; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8912A.
4. *Erato transiens* Boettger, 1884; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8912B.
5. *Erato transiens* Boettger, 1884; Pest, Hungary; Badenian, middle Miocene; DFB 6816.

a: dorsal views, b: apertural views. Bar represents 5 mm.

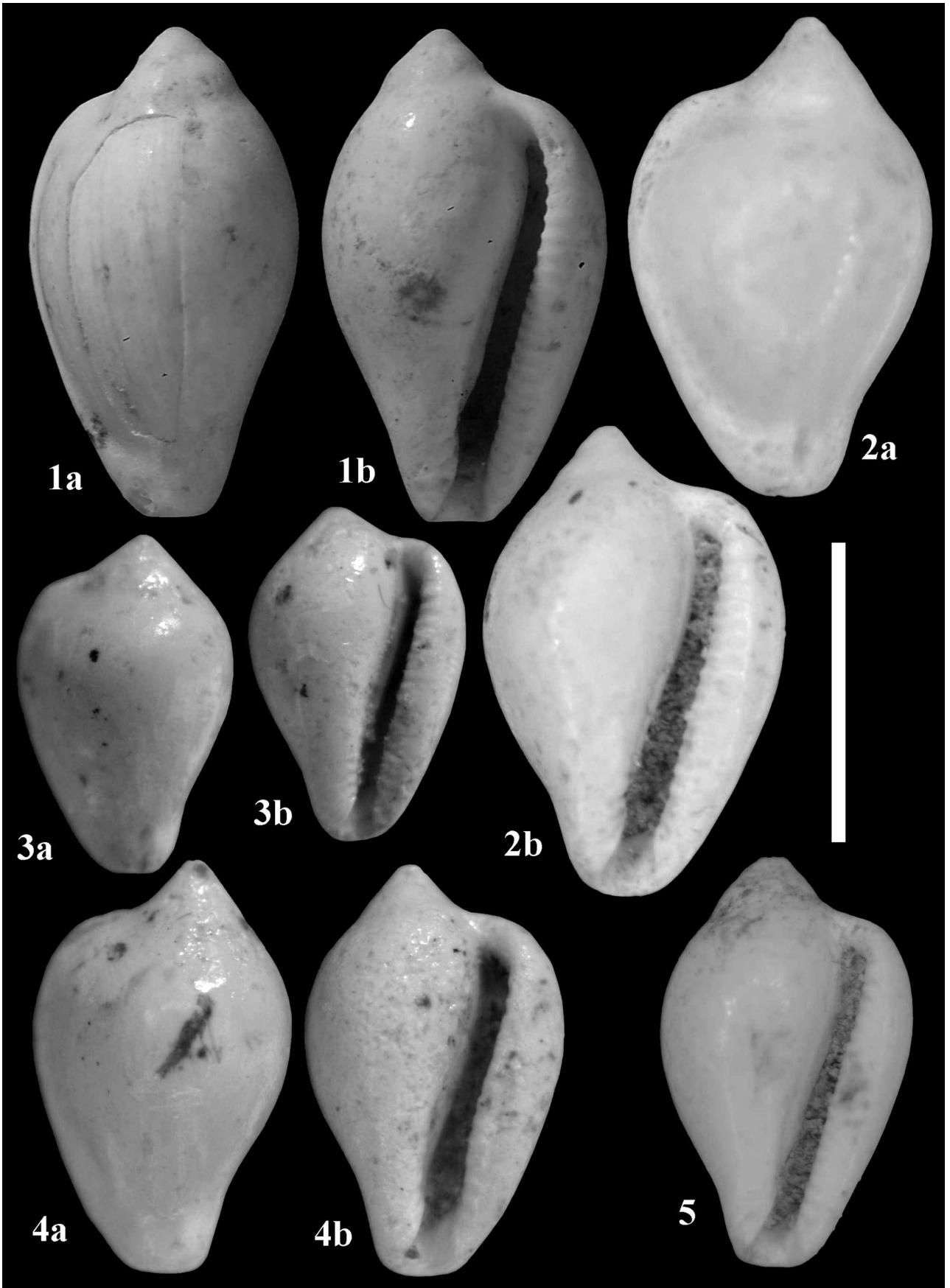


Plate 8.

Plate 9.

1. *Erato spiralis* Döderlein in Sacco, 1894, **neotype**; Montegibbio, Italy; Tortonian, late Miocene; CS 5087.
2. *Erato spiralis* Döderlein in Sacco, 1894; Borsodbóta, Hungary; Serravallian, middle Miocene; DFB 9366A.
3. *Erato spiralis* Döderlein in Sacco, 1894; Borsodbóta, Hungary; Serravallian, middle Miocene; DFB 9366B.
4. *Erato gallica* Schilder, 1932b; Pest, Hungary; Badenian middle Miocene; DFB 5809.

a: dorsal views, b: apertural views. Bar represents 5 mm.

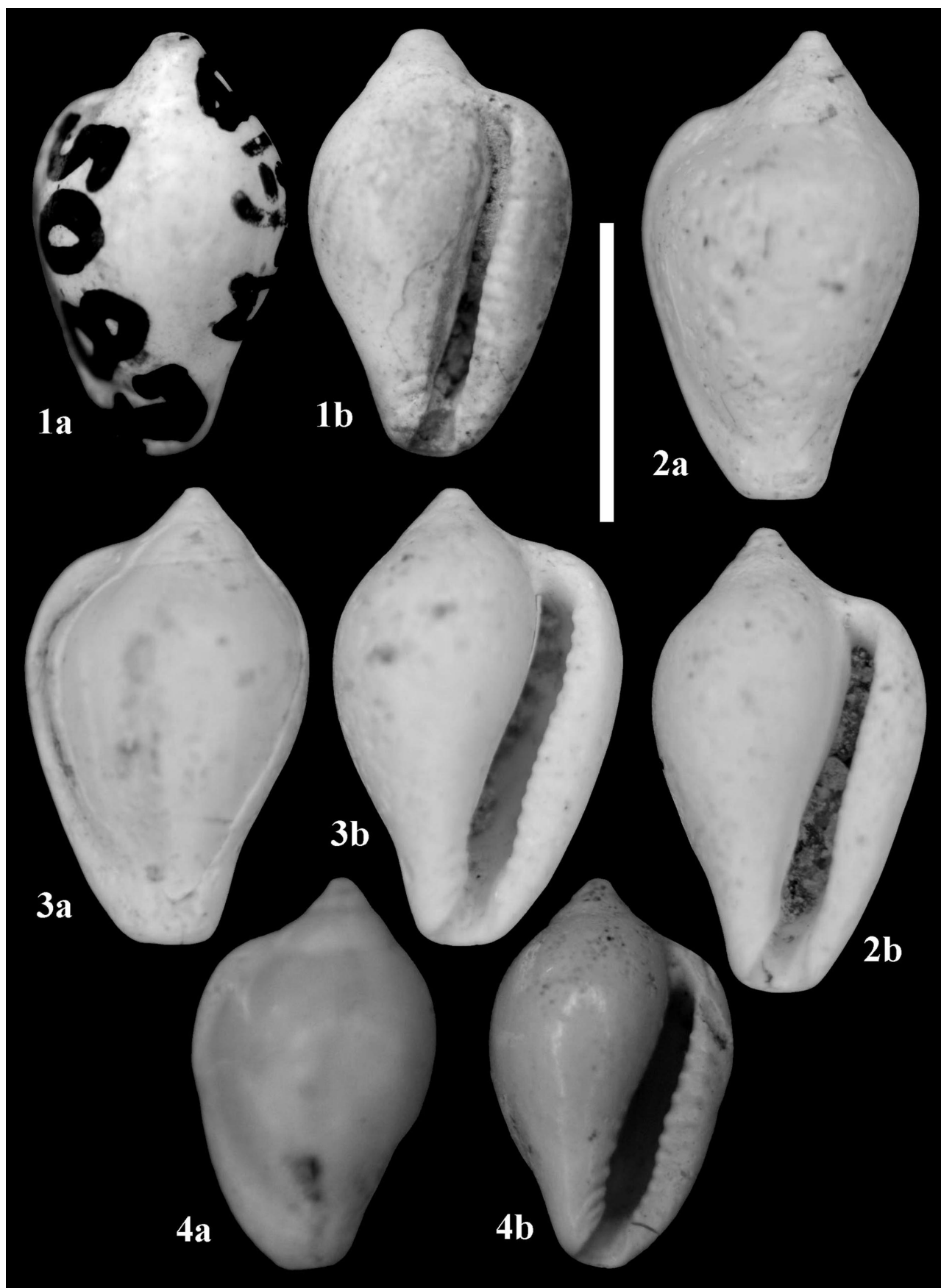


Plate 9.

Plate 10.

1. *Erato planulosa* Sacco, 1894, **lectotype**; Colli Torinesi, Italy; Burdigalian, early Miocene; BS 044.16.001.
2. *Erato planulosa* Sacco, 1894; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8910A.
3. *Erato planulosa* Sacco, 1894; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8910B.
4. *Erato italica* Schilder, 1932a; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8915A.
5. *Erato italica* Schilder, 1932a, **holotype**; Torino, Italy; Langhian, middle Miocene; CS 3439.
6. *Erato italica* Schilder, 1932a; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8915B.

a: dorsal views, b: apertural views. Bar represents 5 mm.

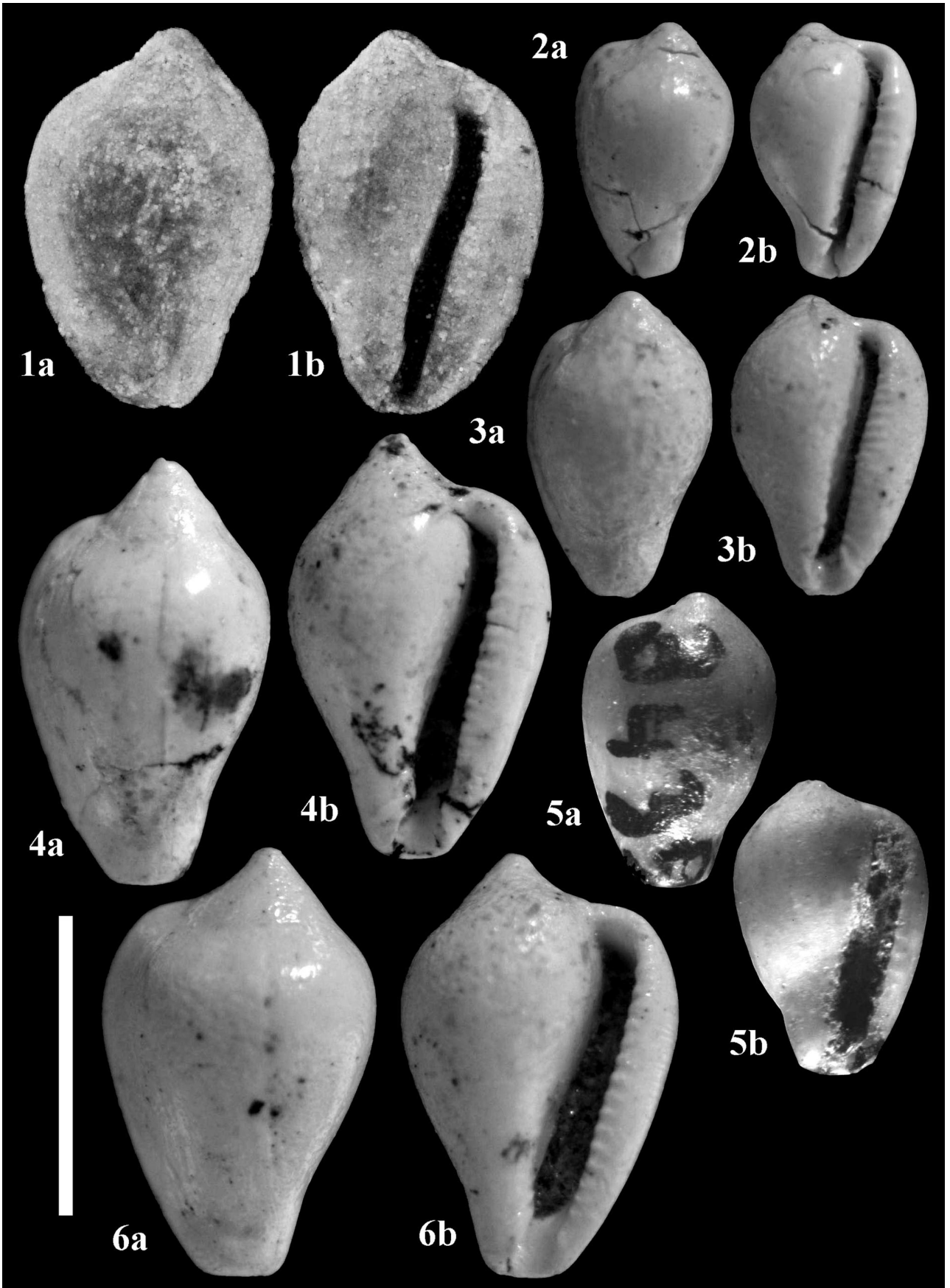


Plate 10.

Plate 11.

1. *Erato laevilabiata* Sacco, 1894, **lectotype** of *Erato hoernesii* Boettger, 1901; Lăpuşiu de Sus, Romania; Badenian, middle Miocene; SMF XII 2205a.
2. *Erato laevilabiata* Sacco, 1894, **lectotype**, Niederleis, Austria; Badenian, middle Miocene; NHMW 1863/0015/0612.
3. *Erato laevilabiata* Sacco, 1894; Marne di Stazzano, Italy; Langhian, middle Miocene; DFB 2858A.
4. *Erato laevilabiata* Sacco, 1894; Marne di Stazzano, Italy; Langhian, middle Miocene; DFB 2858B.
5. *Erato laevilabiata* Sacco, 1894; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 9367A.
6. *Erato laevilabiata* Sacco, 1894; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 9367B.
7. *Erato laevilabiata* Sacco, 1894; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 9367C.

a: dorsal views, b: apertural views. Bar represents 5 mm.

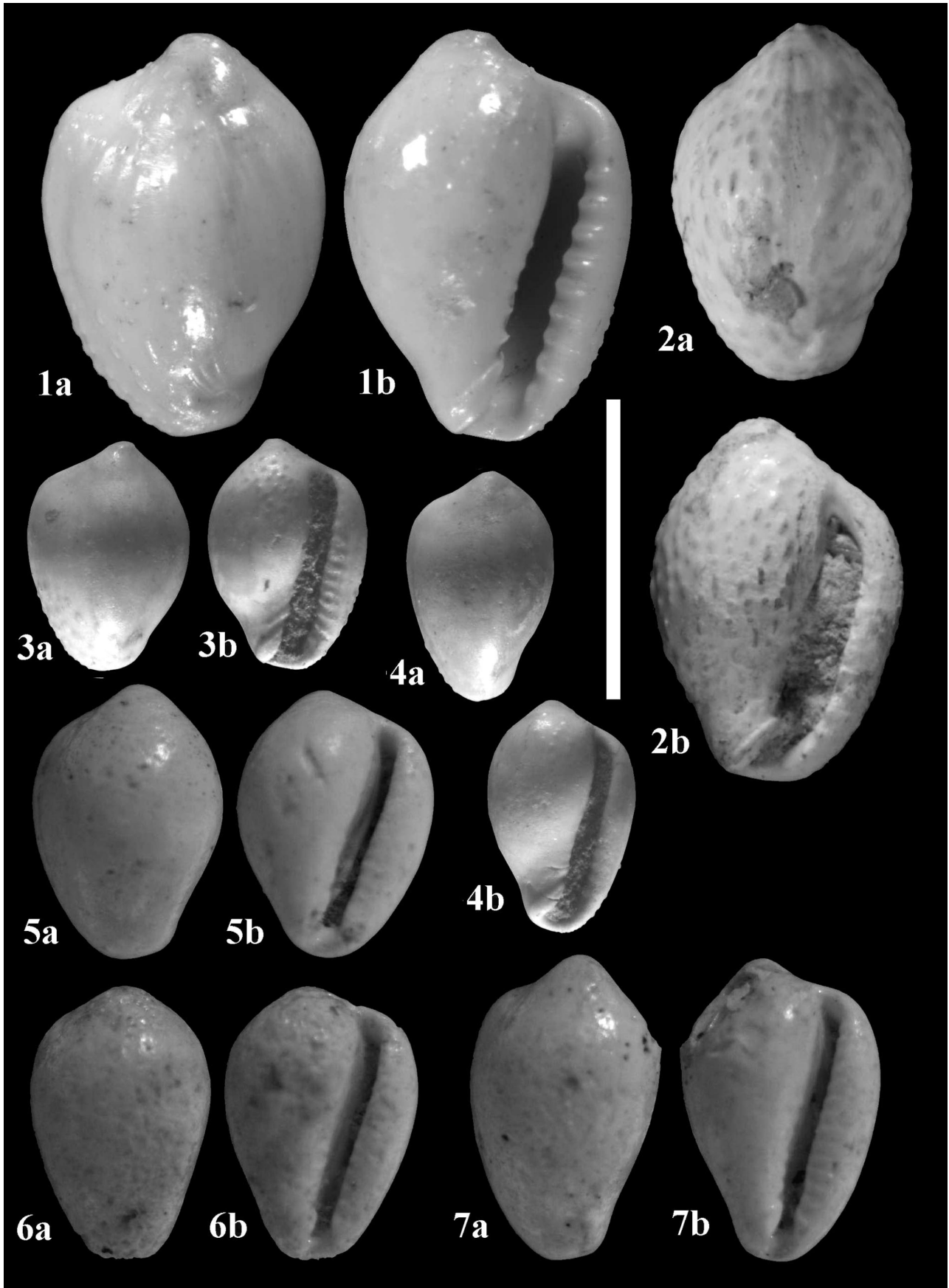


Plate 11.

Plate 12.

1. *Erato gallica* Schilder, 1932b, **holotype**; La Placette, France; Langhian, middle Miocene; CS 3638.
2. *Erato gallica* Schilder, 1932b; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8914A.
3. *Erato gallica* Schilder, 1932b; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8914B.
4. *Erato gallica* Schilder, 1932b; Steinabrunn, Austria; Badenian, middle Miocene; DFB 8658.
5. *Erato gallica* Schilder, 1932b; Paulmy, Pauvrelay, France; Serravallian, middle Miocene; DFB 5808.

a: dorsal views, b: apertural views. Bar represents 5 mm.

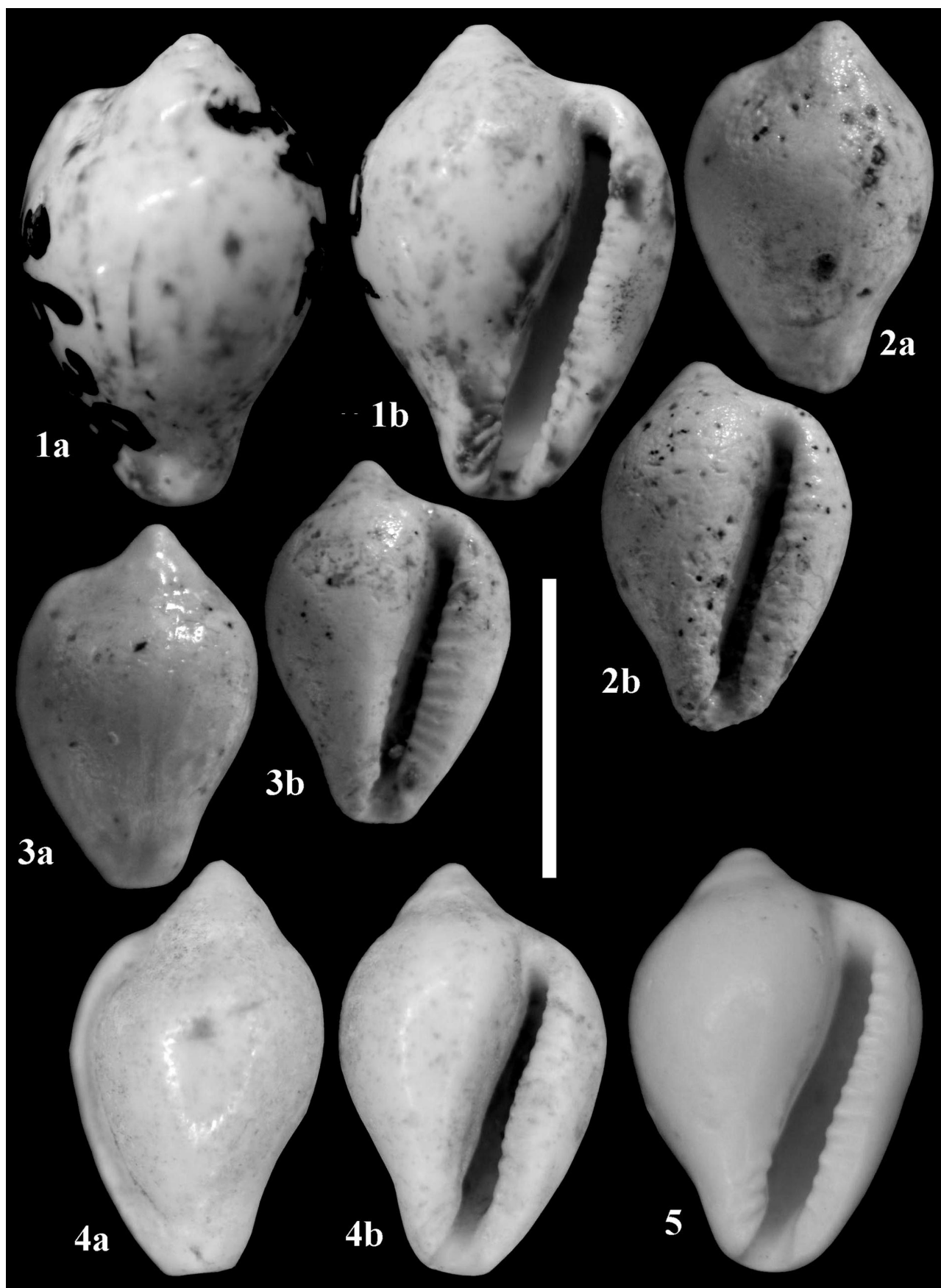


Plate 12.

Plate 13.

1. *Erato praecedens* Schilder, 1933, **holotype**; Montegibbio, Italy; Tortonian, late Miocene; CS 5088.
2. *Erato praecedens* Schilder, 1933; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8908A.
3. *Erato praecedens* Schilder, 1933; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8908B.
4. *Erato praecedens* Schilder, 1933; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8908C.
5. *Erato praecedens* Schilder, 1933; Lăpugiu de Sus, Romania; Badenian, middle Miocene; DFB 6947A.
6. *Erato praecedens* Schilder, 1933; Orthez, France; Serravallian, middle Miocene; DFB 6522A.
7. *Erato praecedens* Schilder, 1933; Lăpugiu de Sus, Romania; Badenian, middle Miocene; DFB 6947B.
8. *Erato praecedens* Schilder, 1933; Orthez, France; Serravallian, middle Miocene; DFB 6522B.

a: dorsal views, b: apertural views. Bar represents 5 mm.

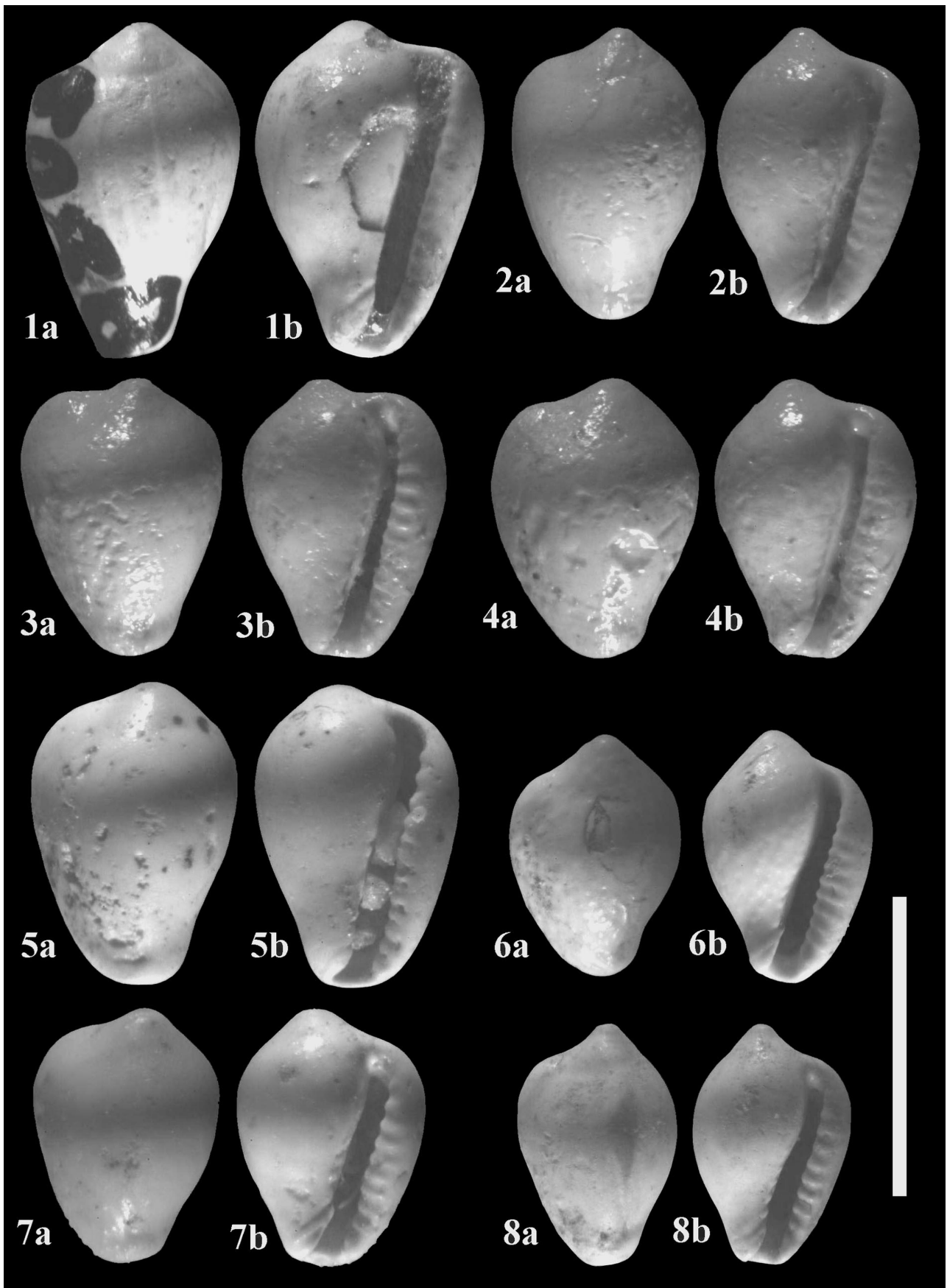


Plate 13.

Plate 14.

1. *Erato turonica* Schilder, 1933, **holotype**; Manthelan, France; Langhian, middle Miocene; CS 45.
2. *Erato turonica* Schilder, 1933; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8914A.
3. *Erato turonica* Schilder, 1933; Borsodbóta, Hungary; Badenian, middle Miocene; DFB 8914B.
4. *Erato turonica* Schilder, 1933; Orthez, France; Serravallian, middle Miocene; DFB 6527A.
5. *Erato turonica* Schilder, 1933; Orthez, France; Serravallian, middle Miocene; DFB 6527B.

a: dorsal views, b: apertural views. Bar represents 5 mm.

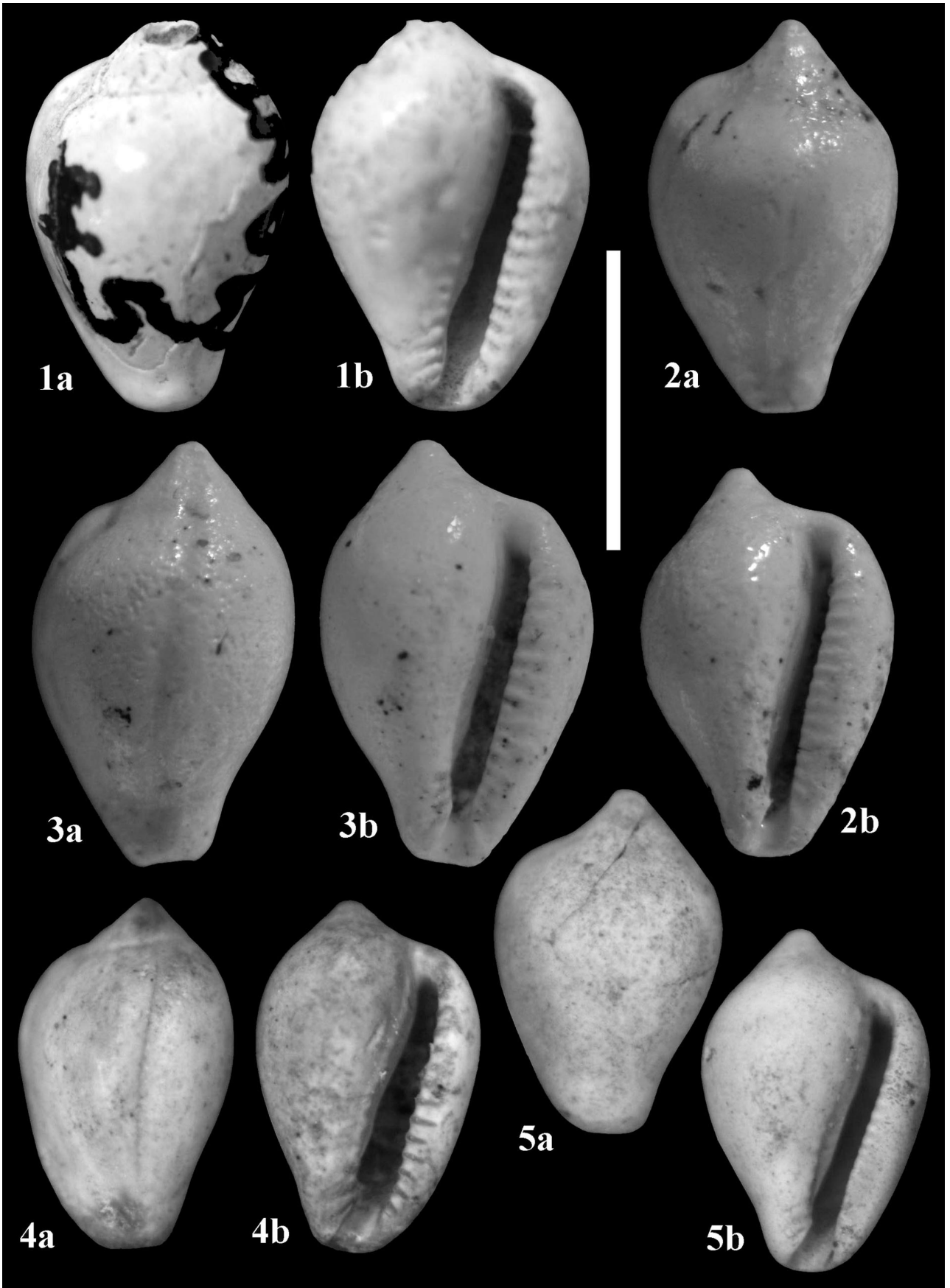


Plate 14.

Plate 15.

1. *Eratopsis barrandei* Hoernes & Auinger, 1879, **Lectotype**; Niederleis, Austria; Badanian, middle Miocene; NHMW 1863/0015/0612.
2. *Eratopsis barrandei* Hoernes & Auinger, 1879; Borsodbóta, Hungary; Badanian, middle Miocene; JGS.
3. *Eratopsis barrandei* Hoernes & Auinger, 1879; Orthez, France; Serravallian, middle Miocene; DFB 6521A.
4. *Eratopsis barrandei* Hoernes & Auinger, 1879; Orthez, France; Serravallian, middle Miocene; DFB 6521B.
5. *Erato laevilabiata* Sacco, 1894, **paralectotype** (= 'variety B' of Hoernes & Auinger, 1879, pl. 8, figs 10a-c); Niederleis, Austria; Badanian; middle Miocene; NHMW 1864/0001/0294.

a: dorsal views, b: apertural views. Bar represents 5 mm.

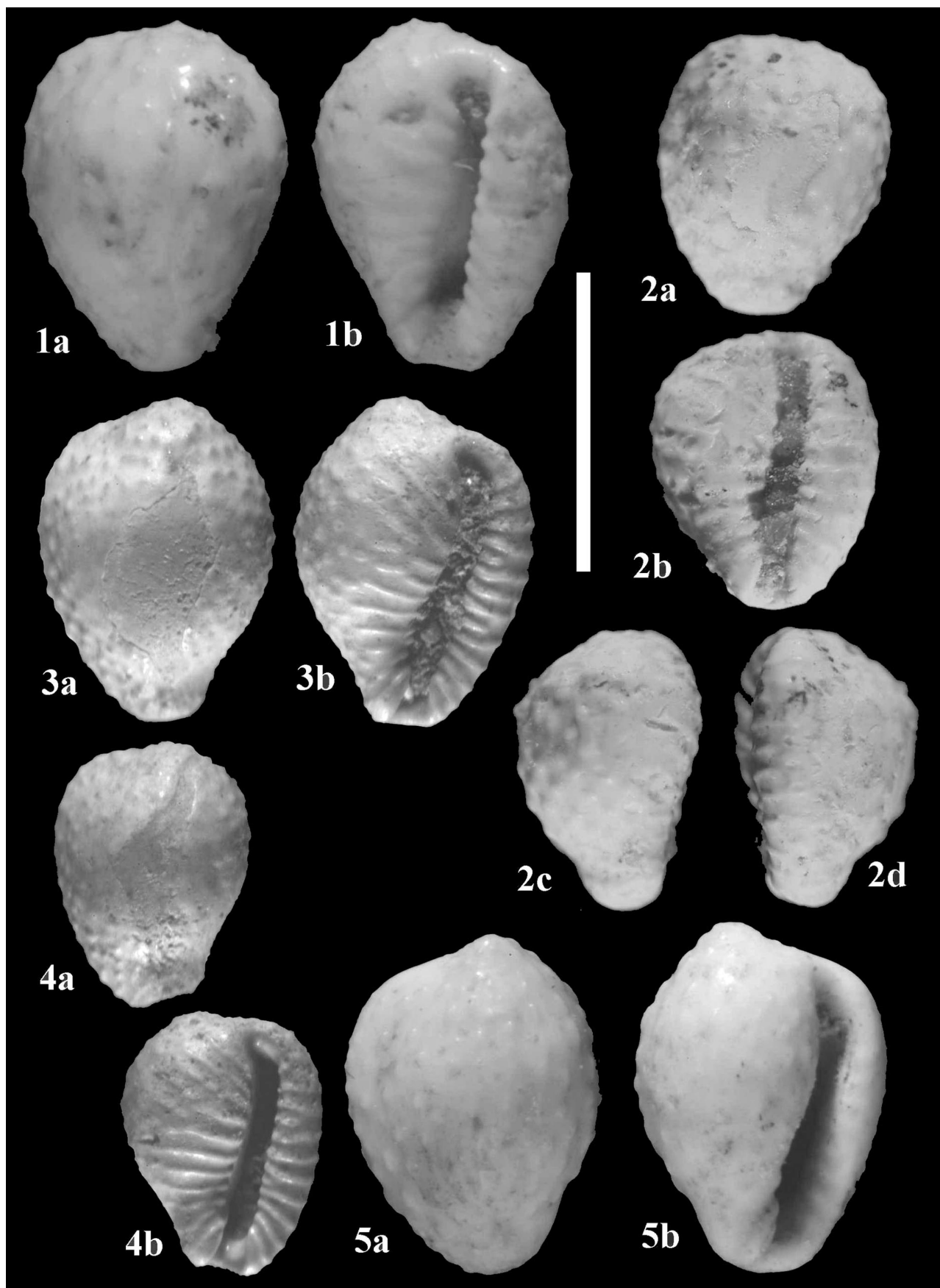


Plate 15.