

Data to revision and distribution of small Foraminifera species described by  
HANTKEN (1868, 1875)

Part II. Nodosariidae and Vaginulinidae

by  
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**Abstract** — In this part, the systematic position, diagnosis, stratigraphical range and scanning electron microscope photos of 50 species, designated by HANTKEN, are given. These species belong to the Nodosariidae (*Dentalina bacilloides*, *D. crassa*, *D. budensis*, *D. acuminata*, *D. contorta*, *D. guembeli*, *D. semilaevis*, “*Dentalina*” *sublaxa*, *Grigelis coarctata*, *Laevidentalina intermedia*, *L. debilis*, *L. budensis*, *Nodosaria karreri*, *N. reitzji*, *N. simplex*, *N. gigantea*, *N. setosa*, *Pyramidulina mino*, *Lingulina glabra*, *L. seminuda*, *Plectofrondicularia striata*) and to the Vaginulinidae (*Lenticulina arcuatostrata*, *L. granulata*, *L. bullata*, *L. budensis*, *L. baconica*, *L. porvaensis*, *Percultazonaria schwageri*, *Saracenaria minima*, *S. propinqua*, *Frondevaginulina superba*, *F. tenuissima*, *Planula budensis*, *Amphicoryna tunicata*, *A. (?) globosa*, *Astacolus complanatus*, *A. indifferens*, *A. budensis*, *A. irregularis*, *A. porvaensis*, *Hemirobulina hantkeni*, *H. recta*, *H. pauciloculata*, *H. ornata*, *H. splendens*, *Vaginulinopsis subregularis*, *V. elegans*, *V. minutus*, *Planularia karolyi*, *P. kubinyii*).

**Key words** — HANTKEN’s small foraminifers, “*Clavulina Szabói*” layers, diagnoses, types, stratigraphy, ecology, Eocene, Oligocene.

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Introduction

Subject of this work, the second part of a taxonomical series, is re-examination and re-figuration of the nodosariid and vaginulinid species that were described by HANTKEN (1868, 1875a–b). These publications are fundamental in the foraminiferal research and this fact has given reason to search for the original specimens in order to collect data for a revision of HANTKEN’s species. Unfortunately, most of the original specimens have already lost and, because many localities have become inaccessible, they frequently cannot be substituted by topotypic neotypes.

Detailed information about the material, methods, localities and geological formations is provided in the first part (HORVÁTH 2002) as well as about the taxonomy of 13 species of Textulariidae and Miliolidae.

Inventory numbers indicate Dept. of Geology and Palaeontology of the Hungarian Natural History Museum as depository. Original specimens of several species were found in two additional collections as indicated in Table 1.

The classification of benthic foraminifera, applied in this paper, follows that of LOEBLICH & TAPPAN (1988).

Table 1 — The available original material out of the Hungarian Natural History Museum. — Number of specimens.

Localities:	Várhegy	Kis-Sváb-hegy	Újlak	Józsefhegy	Szápár	Porva	Kiscell	All available
<b>University Eötvös Loránd, Department of Physical and Historical Geology</b>								
<i>Cristellaria Schwageri</i>	1							1
<i>Dentalina contorta</i>		2						2
<i>Dentalina gigantea</i>	1							1
<i>Dentalina semilaevis</i>			1					1
<i>Robulina arcuato-striata</i>			18	3				21
<i>Robulina budensis</i>							2	2
<i>Robulina granulata</i>						1		1
<i>Robulina Kubinyii</i>	3	29	3					35
<b>University Eötvös Loránd, Department of Palaeontology</b>								
<i>Robulina arcuato-striata</i>					9			9
<i>Robulina Kubinyii</i>			50					50

Taxonomy

Classis Foraminifera EICHWALD, 1830  
Order Lagenida DELAGE & HÉROUARD, 1896  
Superfamily Nodosariacea EHRENBERG, 1838  
Family Nodosariidae EHRENBERG, 1838  
Subfamily Nodosariinae EHRENBERG, 1838  
Genus *Dentalina* RISSO, 1826

Table 2 — HANTKEN's nodosariid and vaginulinid species from the *Clavulina Szabói* layers and their current valid names (reversed comma indicate nomina dubia).

Names given by HANTKEN (1868, 1875)	Valid name
<i>Nodosaria karreri</i>	<i>Nodosaria karreri</i> HANTKEN, 1868
<i>Nodosaria coarctata</i>	<i>Grigelis coarctata</i> (HANTKEN, 1875)
<i>Nodosaria bacillum</i> D'ORBIGNY var. <i>minor</i>	<i>Pyramidulina minor</i> (HANTKEN, 1875)
<i>Nodosaria bacilloides</i>	<i>Dentalina bacilloides</i> (HANTKEN, 1868)
<i>Nodosaria crassa</i>	<i>Dentalina crassa</i> (HANTKEN, 1868)
<i>Nodosaria budensis</i>	<i>Dentalina budensis</i> (HANTKEN, 1875)
<i>Nodosaria acuminata</i>	<i>Dentalina acuminata</i> (HANTKEN, 1875)
<i>Dentalina sublaesa</i>	" <i>Dentalina</i> " <i>sublaesa</i> HANTKEN, 1875
<i>Dentalina intermedia</i>	<i>Laedentalina intermedia</i> (HANTKEN, 1875)
<i>Dentalina Reitzji</i>	<i>Nodosaria reitzji</i> (HANTKEN, 1868)
<i>Dentalina simplex</i>	<i>Laedentalina simplex</i> (HANTKEN, 1868)
<i>Dentalina debilis</i>	<i>Laedentalina debilis</i> (HANTKEN, 1868)
<i>Dentalina budensis</i>	<i>Laedentalina budensis</i> (HANTKEN, 1875)
<i>Dentalina gigantea</i>	<i>Nodosaria gigantea</i> (HANTKEN, 1875)
<i>Dentalina contorta</i>	<i>Dentalina contorta</i> (HANTKEN, 1868)
<i>Dentalina Gumbeli</i>	<i>Dentalina guembeli</i> HANTKEN, 1875
<i>Dentalina semilaevis</i>	<i>Dentalina semilaevis</i> HANTKEN, 1875
<i>Dentalina setosa</i>	<i>Nodosaria setosa</i> (HANTKEN, 1875)
<i>Lingulina glabra</i>	<i>Lingulina glabra</i> HANTKEN, 1875
<i>Lingulina costata</i> D'ORBIGNY var. <i>seminuda</i>	<i>Lingulina seminuda</i> HANTKEN, 1875
<i>Frondocularia superba</i>	<i>Frondocularia superba</i> (HANTKEN, 1875)
<i>Frondocularia tenuissima</i>	<i>Frondocularia tenuissima</i> (HANTKEN, 1875)
<i>Flabellina striata</i>	<i>Plectofrondocularia striata</i> (HANTKEN, 1875)
<i>Flabellina budensis</i>	<i>Planularia budensis</i> (HANTKEN, 1875)
<i>Marginulina complanata</i>	<i>Astaculus complanatus</i> (HANTKEN, 1868)
<i>Marginulina subregularis</i>	<i>Vaginulinopsis subregularis</i> (HANTKEN, 1868)
<i>Marginulina subbullata</i>	<i>Hemirobulina hantkeni</i> (BANDY, 1949)
<i>Marginulina globosa</i>	<i>Amphicoryna</i> (?) <i>globosa</i> (HANTKEN, 1868)
<i>Marginulina recta</i>	<i>Hemirobulina recta</i> (HANTKEN, 1875)
<i>Marginulina indifferens</i>	<i>Astaculus indifferens</i> (HANTKEN, 1875)
<i>Marginulina budensis</i>	<i>Astaculus budensis</i> (HANTKEN, 1875)
<i>Marginulina pauciloculata</i>	<i>Hemirobulina pauciloculata</i> (HANTKEN, 1875)
<i>Marginulina tunicata</i>	<i>Amphicoryna tunicata</i> (HANTKEN, 1868)
<i>Cristellaria Schwageri</i>	<i>Percultazonaria schwageri</i> (HANTKEN, 1875)
<i>Cristellaria irregularis</i>	<i>Astaculus irregularis</i> (HANTKEN, 1875)
<i>Cristellaria porvaensis</i>	<i>Astaculus porvaensis</i> (HANTKEN, 1875)
<i>Cristellaria minuta</i>	<i>Vaginulinopsis minutus</i> (HANTKEN, 1875)
<i>Cristellaria nummulitica</i> GÜMBEL var.	<i>Planularia karolyi</i> CICHÁ & RÖGL, 1998
<i>Cristellaria minima</i>	<i>Saracenaria minima</i> (HANTKEN, 1875)
<i>Cristellaria ornata</i>	<i>Hemirobulina ornata</i> (HANTKEN, 1875)
<i>Cristellaria propinqua</i>	<i>Saracenaria propinqua</i> (HANTKEN, 1875)
<i>Cristellaria elegans</i>	<i>Vaginulinopsis elegans</i> (HANTKEN, 1875)
<i>Robulina Kubinyii</i>	<i>Planularia kubinyii</i> (HANTKEN, 1868)
<i>Robulina arcuato-striata</i>	<i>Lenticulina arcuato-striata</i> (HANTKEN, 1868)
<i>Robulina granulata</i>	<i>Lenticulina granulata</i> (HANTKEN, 1875)
<i>Robulina bullata</i>	<i>Lenticulina bullata</i> (HANTKEN, 1875)
<i>Robulina budensis</i>	<i>Lenticulina budensis</i> (HANTKEN, 1875)
<i>Robulina baconica</i>	<i>Lenticulina baconica</i> (HANTKEN, 1875)
<i>Robulina porvaensis</i>	<i>Lenticulina porvaensis</i> (HANTKEN, 1875)
<i>Marginulina splendens</i>	<i>Hemirobulina splendens</i> (HANTKEN, 1875)

*Dentalina acuminata* (HANTKEN, 1875)

(Plate I: 1, Plate II: 1)

- 1875a *Nodosaria acuminata* n. sp. — HANTKEN, S. 28, Taf. II, Fig. 9; Taf. XIII, Fig. 5.  
 1875b *Nodosaria acuminata* — HANTKEN, p. 23, pl. II, fig. 9; pl. XIII, fig. 5.  
 1961 *Nodosaria "acuminata"* (HANTKEN) — PAPP, S. 218, Abb. 6, Fig. 10,11.  
 1962 *Nodosaria acuminata* HANTKEN — MAJZON, pl. XXX(II), fig. 9.  
 1973 *Nodosaria acuminata* HANTKEN — NAGYNÉ GELLAI, p. 457.  
 1978 *Nodosaria acuminata* HANTKEN — SZTRÁKOS, p. 72, pl. 9, fig. 1.  
 non part 1979 *Nodosaria acuminata* HANTKEN — SZTRÁKOS, pl. 9, fig. 2.  
 1982 *Nodosaria acuminata* HANTKEN — SZTRÁKOS, pl. 5, fig. 5.  
 1982 *Nodosaria acuminata* HANTKEN — FORAMINIFERI PADANI, Tav. XIII., fig. 7.  
 1985 *Nodosaria acuminata* HANTKEN — SIKIĆ, pl. III, fig. 2.



- 1987 *Nodosaria* cf. *acuminata* HANTKEN — REISER, S. 71, Taf. 5, Fig. 2, 8.  
 1999 *Nodosaria acuminata* (HANTKEN) — DARAKCHIEVA, p. 30.

**Neotype** — M.99.50.

**Type locality** — Eger, Kiséged-hegy, road cut.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — One specimen.

**Dimensions** — Length 8–15 mm, width 0.5–1.5 mm.

**Diagnosis** — Test is elongate, uniserial; the proloculus is apiculate. The chambers are ovate, enlarging gradually. Sutures are horizontal and distinct. Wall is calcareous, hyaline. The aperture is terminal and radiate. Test is ornamented by 6–8 longitudinal ribs.

**Remarks** — The figured specimen in SZTRÁKOS (1979) differs from original one with number and height of chambers. Complete specimens are rare.

**Stratigraphical range** — This species is not rare in

the *Clavulina Szabói* layers (HANTKEN 1875a–b). Recently, few specimens are known from the Kiscell Clay (Dorog, Eger, Kiscell-Óbuda) (NAGYNÉ GELLAI 1973; HORVÁTH 1985; SZTRÁKOS 1978).

*Dentalina acuminata* can be found in the Michelstetter layers in the Bavarian molasse, Lower Egerian (REISER 1987). In Croatia it occurs in Oligocene (Rupelian) (CIMERMAN & PAVŠIĆ 1979; SIKIĆ 1985). In North Bulgaria it ranges from Upper Eocene to Lower Oligocene and occurs in Middle Miocene, too (DARAKCHIEVA, 1999).

**Ecology** — There are no significant data on the distribution and ecological parameters of *Dentalina*. This species may occur from the neritic to the bathyal zone.

### *Dentalina bacilloides* (HANTKEN, 1868)

(Plate I: 2, Plate II: 2)

- 1868 *Nodosaria bacilloides* n. sp. — HANTKEN, p. 86, pl. I, fig. 9.  
 1875a *Nodosaria bacilloides* HANTKEN — HANTKEN, S. 27, Taf. II, Fig. 8.  
 1875b *Nodosaria bacilloides* HANTKEN — HANTKEN, p. 22, pl. II, fig. 8.  
 1949 *Nodosaria bacilloides* HANTKEN — CUVILLIER & SZAKALL, p. 74, pl. 27, fig. 32.  
 1962 *Nodosaria bacilloides* HANTKEN — MAJZON, pl. XXX(II), fig. 8.  
 1978 *Nodosaria bacilloides* HANTKEN — SZTRÁKOS, pl. 9, fig. 6.  
 1979 *Nodosaria bacilloides* HANTKEN — CIMERMAN & PAVŠIĆ, p. 256 (in list)  
 1979 *Nodosaria bacilloides* HANTKEN — SZTRÁKOS, pl. 8, fig. 12.  
 1985 *Nodosaria bacilloides* HANTKEN — KORECZNÉ LAKY & NAGYNÉ GELLAI, p. 110, pl. XXXV, fig. 4, pl. XCIX, fig. 13.

**Neotype** — M.99.51.

**Type locality** — Pilisborosjenő, brickyard.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — One specimen.

**Dimension** — Length 1.8 mm, width 0.3–0.4 mm.

**Diagnosis** — Test is elongate, uniserial and has a nearly cylindrical proloculus with a long bristle. Size of the chambers decreases gradually as added. Number of chambers is three or four, their sutures are horizontal, distinct. Wall is calcareous, hyaline. Its surface is ornamented by four to six longitudinal costae. Aperture is terminal, and radiate.

**Remarks** — *Dentalina bacilloides* (HANTKEN 1868) differs from *Nodosaria latejugata* (GÜMBEL 1868) in having

a slightly spherical proloculus and long-shaped chambers, and from *Nodosaria raphanistrum* (LINNÉ, 1758) in the form of proloculus and subsequent chambers.

**Stratigraphical range** — HANTKEN (1875a–b) determined this species from Buda (Újlak) and Óbuda (Kiscell), upper part of the *Clavulina Szabói* layers.

In the Central Paratethys, this rare species occurs in the Kiscellian and the Lower Badenian (CIMERMAN & PAVŠIĆ 1979; SZTRÁKOS 1979; KORECZNÉ LAKY & NAGYNÉ GELLAI 1985). In the Aquitanian basin it is known in the Miocene sediments (CUVIER & SZAKALL 1949).

**Ecology** — *Dentalina bacilloides* ranges from the neritic to the bathyal zone.

### *Dentalina budensis* (HANTKEN, 1875)

(Plate I: 3, Plate II: 3)

- 1875a *Nodosaria budensis* n. sp. — HANTKEN, S. 28, Taf. II, Fig. 10.  
 1875b *Nodosaria budensis* — HANTKEN, p. 23, pl. II, fig. 10.  
 1933 *Dentalina Hantkeni* — CUSHMAN, p. 9, pl. 1, figs. 18–19.  
 1935 *Dentalina Hantkeni* CUSHMAN — CUSHMAN, p. 20, pl. 8, figs. 5–6.  
 1962 *Nodosaria budensis* HANTKEN — MAJZON, pl. XXX(II), fig. 10.  
 1978 *Nodosaria budensis* HANTKEN — SZTRÁKOS, pl. 8, fig. 1  
 1979 *Nodosaria budensis* HANTKEN — SZTRÁKOS, pl. 8, fig. 15.

**Neotype** — M.99.52.

**Type locality** — Pilisborosjenő, brickyard.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — One specimen.

**Dimensions** — Length 2 mm, width 0.3 mm.

**Diagnosis** — Test is elongate, uniserial. Its proloculus

is spherical with a short bristle. Chambers are slightly cylindrical. Proloculus and the last chamber are the largest. Sutures are distinct, horizontal and slightly depressed. Wall is calcareous, perforate, and twelve longitudinal costae ornament the surface. The costae are dentalina-type, broken at the sutures. Aperture is terminal, radiate.

**Remarks** — No specimen remained in the Hantken collections in Hungary.

**Stratigraphical range** — In Hungary, the species occurred in the Kiscell Clay Formation (HANTKEN 1875a–b;

SZTRÁKOS 1979; BÁLDI et al. 1973). It the Carpathians, it occurs in the Menilitic beds, Kiscellian (OLSZEWSKA 1985).

**Ecology** — The species may range from the neritic to the bathyal zone.

*Dentalina contorta* (HANTKEN, 1868)

(Plate I: 4, Plate II: 4)

- 1868 *Nodosaria (Dentalina) contorta* n. sp. — HANTKEN, p. 89, pl. I, fig. 16.  
 1875a *Dentalina contorta* HANTKEN — HANTKEN, S. 36, Taf. IV, Fig. 5.  
 1875b *Dentalina contorta* HANTKEN — HANTKEN, p. 30, pl. IV, fig. 5.  
 1962 *Dentalina contorta* HANTKEN — MAJZON, pl. XXXII(IV), fig. 5.  
 part 1978 *Dentalina contorta* HANTKEN — SZTRÁKOS, pl. 10, fig. 10.  
 part 1979 *Dentalina contorta* HANTKEN — SZTRÁKOS, pl. 10, fig. 16.  
 part 1985 *Dentalina contorta* HANTKEN — KORECZNÉ LAKY & NAGYNÉ GELLAI, pl. XI, figs. 3–4.  
 1988 *Dentalina contorta* HANTKEN — GELLAI–NAGY, pl. V, figs. 1–2.  
 1998 *Dentalina contorta* HANTKEN — CICHA et al., p. 93, pl. 21, fig. 1.

**Lectotype** — GELLAI–NAGY (1988), pl. V, figs. 1–2.

**Paralectotype** — M.01.11. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.

**Type locality** — Budapest, Újlak.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — Two specimens remained in the Hantken collections in Hungary (Table 1).

**Dimension** — length 2–4 mm, width 0.6–0.8 mm.

**Diagnosis** — Test is elongate, slightly curved, uniserial, circular in cross-section. Chambers are cylindrical, enlarging gradually and quickly as added. The first chamber has a short bristle. Sutures are horizontal. Wall is calcareous,

perforate, and ornamented by oblique, longitudinal ribs. The aperture is terminal, radiate.

**Remarks** — The figures in SZTRÁKOS (1978, 1979) and KORECZNÉ LAKY & NAGYNÉ GELLAI (1985) differ from the original ones with the slightly oblique costae.

**Stratigraphical range** — In Hungary, this rare species was found only in the Kiscell Clay, Upper Kiscellian (HANTKEN 1868, 1875a–b). In other parts of the Central Paratethys, it ranges from the Lower Kiscellian to the Ottomangian (CICHA et al. 1998).

**Ecology** — The species may occur from the neritic to the bathyal zone.

*Dentalina crassa* (HANTKEN, 1868)

(Plate V: 1)

- 1868 *Nodosaria crassa* n. sp. — HANTKEN, p. 86, pl. I, fig. 15.  
 1875a *Nodosaria crassa* HANTKEN — HANTKEN, S. 28, Taf. XIII, Fig. 4.  
 1875b *Nodosaria crassa* HANTKEN — HANTKEN, p. 23, pl. XIII, fig. 4.  
 1962 *Nodosaria crassa* HANTKEN — MAJZON, pl. XLI(XIII), fig. 4.  
 1973 *Nodosaria crassa* HANTKEN HANTKEN — NAGYNÉ GELLAI, p. 457, pl. IV, fig. 2.  
 1978 *Amphicoryna crassa* (HANTKEN) — SZTRÁKOS, p. 73, pl. 36, fig. 5.  
 1979 *Amphicoryna crassa* (HANTKEN) — SZTRÁKOS, p. 63, pl. 10, figs. 1,2.  
 1985 *Nodosaria crassa* HANTKEN — KORECZNÉ LAKY & NAGYNÉ GELLAI, pl. XXXV, fig. 3; pl. XXXVI, figs. 1–6.

**Dimension** — Length 0.8 mm (by HANTKEN 1875a–b).

**Diagnosis** — The uniserial test consists of two chambers only. Suture is distinct, elongate and horizontal. Wall is calcareous, hyaline and finely perforate. Surface is ornamented with eight to ten longitudinal costae. Aperture is terminal, radiate.

**Remarks** — No specimen has been preserved in the

Hantken collections, and no specimen has been found in the Kiscell Clay recently.

**Stratigraphical range** — The species is rare in the upper part of the *Clavulina Szabóii* layers (HANTKEN 1868, 1875a–b). It is known only from the Kiscell Clay, Upper Kiscellian (SZTRÁKOS 1978, 1979; KORECZNÉ LAKY & NAGYNÉ GELLAI 1985).

*Dentalina guembeli* HANTKEN, 1875

(Plate I: 5, Plate II: 5)

- 1875a *Dentalina Gümbeli* n. sp. — HANTKEN, S. 38, Taf. IV, Fig. 1.  
 1875b *Dentalina Gümbeli* — HANTKEN, p. 32, pl. IV, fig. 1.  
 1962 *Dentalina gümbeli* HANTKEN — MAJZON, pl. XXXII(IV), fig. 1.

**Neotype** — M.01.12.

**Type locality** — Budapest, Újlak.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — One specimen (broken).

**Dimensions** — Length 3–4 mm, height of chambers is 0.5–0.8 mm.

**Diagnosis** — The uniserial test is elongate, gradually increasing. Proloculus is small, apiculate, the last chamber is large, spherical. Number of chambers is more than ten. The sutures are distinct, horizontal and depressed. Wall is calcareous and ornamented by longitudinal costae. The aperture is terminal, radiate.



**Remarks** — One new (broken) specimen has been found in the Kiscell Clay recently.

**Stratigraphical range** — The species is rare “in the upper part of *Clavulina Szabói* layers, Buda (Újlak and

Kristinastadt Ziegelscläge)” (HANTKEN 1875a–b).

**Ecology** — *Dentalina guembeli* may range from the neritic to the bathyal zone.

*Dentalina semilaevis* HANTKEN, 1875

(Plate I: 6, Plate II: 6)

1875a *Dentalina semilaevis* n. sp. — HANTKEN, S. 39, Taf. IV, Fig. 6; Taf. XII, Fig. 13.

1875b *Dentalina semilaevis* — HANTKEN, p. 32, pl. IV, fig. 6; pl. XII, fig. 13.

1956 *Dentalina semilaevis* HANTKEN — HAGN, S. 136.

1962 *Dentalina semilaevis* HANTKEN — MAJZON, pl. XXXII(IV), fig. 6.

1962 *Dentalina semilaevis* HANTKEN — LÜHR, Taf.3, Fig.12.

1975 *Dentalina semilaevis* HANTKEN — BRAGA & GRÜNIG in BRAGA et al., p. 104.

1988 *Dentalina semilaevis* HANTKEN — GELLAI-NAGY, pl. V, figs. 3–4.

**Lectotype** — GELLAI-NAGY (1988), pl. V, figs. 3–4.

**Type locality** — Budapest, Újlak

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Paralectotype** — M.01.13. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.

**Material** — One specimen.

**Dimensions** — Length 1.5–1.8 mm, width 0.2–0.3 mm.

**Diagnosis** — Test is elongate, uniserial, slightly arcuate. It consists of eight-nine chambers that are broader than height and gradually enlarging. Wall is calcareous, hyaline, and perforate. All sutures are horizontal. The aperture is terminate, radiate. Surface of the test is ornamented with

12–16 longitudinal costae, excepting the last and the two first chambers that have no ornament.

**Remarks** — A single specimen has been found in the Hantken collections.

**Stratigraphical range** — The species is very rare in the upper part of the *Clavulina Szabói* layers, in the Kiscell Clay Formation, Upper Kiscellian (HANTKEN 1875a–b). In other localities, it has been found only in the Upper Eocene at Possagno (BRAGA et al. 1975) and the Oligocene of the Bavarian molasse (LÜHR 1962).

**Ecology** — *Dentalina semilaevis* may range from the neritic to the bathyal zone.

Genus *Grigelis* MIKHALEVICH, 1981

*Grigelis coarctata* (HANTKEN, 1875)

(Plate V: 2)

1875a *Nodosaria coarctata* — HANTKEN, S. 24, Taf. XII, Fig. 15.

1875b *Nodosaria coarctata* — HANTKEN, p. 19, pl. XII, fig. 15.

1962 *Nodosaria coarctata* HANTKEN — MAJZON, pl. XL(XII), fig. 15.

1975 *Dentalina coarctata* (HANTKEN) — BRAGA & GRÜNIG in BRAGA et al., p. 104.

non 1978 *Nodosaria coarctata* HANTKEN — SZTRÁKOS, pl. 11, fig. 10.

non 1979 *Nodosaria coarctata* HANTKEN — SZTRÁKOS, pl. 9, fig. 9.

non 1979 *Nodosaria coarctata* HANTKEN — SZTRÁKOS, pl. 9, fig. 8.

1982 *Nodosaria coarctata* HANTKEN — SZTRÁKOS, pl. 5, fig. 11.

**Material** — This species is not found in the Hantken Collections in Hungary.

**Dimensions** — Length 0.3 mm, width 0.1 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is elongate, its chambers are ovate, and long narrow necks separate them. The necks are nearly as long as the chambers. Position of the sutures is at the base of the succeeding chamber. Wall is calcareous, hyaline. Its surface is ornamented by longitudinal costae. Aperture is terminal, radiate at the end of a rather long last neck.

**Remarks** — The figure in SZTRÁKOS (1978, pl. 9, fig. 9) has shorter necks than the original one.

**Stratigraphical range** — This species is very rare, it has occurred only in the upper part of the *Clavulina Szabói* layers, Buda (Újlak) (HANTKEN 1875a–b; SZTRÁKOS 1979, 1982), and in the Kiscell Clay Formation, Upper Kiscellian.

In Possagno section and the Ardour basin (SW France) *Grigelis coarctata* occurs in the Upper Eocene sediments (BRAGA & GRÜNIG in BRAGA et al. 1975, SZTRÁKOS 2000).

Genus *Laevidentalina* LOEBLICH & TAPPAN, 1936

*Laevidentalina budensis* (HANTKEN, 1875)

(Plate V: 3)

1875a *Dentalina budensis* n. sp. — HANTKEN, S. 34, Taf. III, Fig. 12.

1875b *Dentalina budensis* — HANTKEN, p. 28, pl. III, fig. 12.

1933 *Dentalina Hantkeni* — CUSHMAN, p. 9, pl. 1, figs. 18–19.

1935 *Dentalina Hantkeni* CUSHMAN — CUSHMAN, p. 20, pl. 8, figs. 5–6.

1962 *Dentalina budensis* HANTKEN — MAJZON, pl. XXX(III), fig. 12.

non 1982 *Margulinula budensis* (HANTKEN) — SZTRÁKOS, pl. 6, figs. 7a–b.

non 1985 *Nodosaria budensis* HANTKEN — OLSZEWSKA, p. 225, pl. 1, fig. 4.

**Dimension** — Length 1 mm (HANTKEN 1875 a–b).

**Diagnosis** — Test is elongate and slightly arcuate. Its chambers are longer than wide. Their number is five only. Proloculus is fusiform, subsequent chambers are differently sized. Sutures are straight and horizontal. Wall of the test is smooth. Aperture is terminal, close to the

apex (after HANTKEN'S description).

**Remarks** — No specimen remained in the Hantken collections in Hungary.

**Stratigraphical range** — The species is very rare in the Kiscell Clay, only in the upper part of the *Clavulina Szabói* layers (HANTKEN 1875a–b).

*Laevidentalina debilis* (HANTKEN, 1868)

(Plate V: 4)

1868 *Dentalina debilis* n. sp. — HANTKEN, p. 88, pl. II, fig. 27.

1875a *Dentalina debilis* HANTKEN — HANTKEN, p. 28, pl. XIII, fig. 10.

1875b *Dentalina debilis* HANTKEN — HANTKEN, S. 33, Taf. XIII, Fig. 10.

1962 *Dentalina debilis* HANTKEN — MAJZON, pl. XLI (XIII), fig. 10.

part 1978 *Dentalina debilis* HANTKEN — SZTRÁKOS, pl. 10, fig. 11.

part 1979 *Dentalina debilis* HANTKEN — SZTRÁKOS, pl. 10, fig. 18.

1985 *Dentalina debilis* HANTKEN — KORECZNÉ LAKY & NAGYNÉ GELLAI, pl. XI, fig. 8.

**Dimension** — Length 0.5 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is small, elongate, arcuate and uniserial. Proloculus is rounded. Chambers increased gradually during ontogenesis. Wall is calcareous, hyaline and finely perforated. Sutures are oblique and slightly depressed. Aperture is terminal and consisting of several radial slits.

**Remarks** — No specimen remained in the Hantken Collections in Hungary.

**Stratigraphical range** — The species is very rare in the

upper part of the *Clavulina Szabói* layers, Budapest (Újlak) (HANTKEN 1875a–b). SZTRÁKOS (1978, 1979) found a specimen in the Lower Kiscellian of the Farkasrét Cemetery (Budapest). KORECZNÉ LAKY & NAGYNÉ GELLAI (1985) identified *L. debilis* also in the Oligocene sediments of the Börzsöny Mountains. This species ranges from Middle to Upper Eocene of the Adour basin (SW France, SZTRÁKOS 2000).

*Laevidentalina intermedia* (HANTKEN, 1875)

(Plate I: 7, Plate II: 7)

1875a *Dentalina intermedia* n. sp. — HANTKEN, S. 30, Taf. III, Fig. 4,8.

1875b *Dentalina intermedia* — HANTKEN, p. 25, pl. III, figs. 4,8.

1962b *Dentalina intermedia* HANTKEN — MAJZON, pl. XXXI(III), figs. 4,8.

1973 *Dentalina intermedia* HANTKEN — NAGYNÉ GELLAI, p. 455.

1979 *Dentalina intermedia* HANTKEN — SZTRÁKOS, pl. 11, fig. 2.

part 1982 *Dentalina intermedia* (HANTKEN) — SZTRÁKOS, pl. 7, fig. 21.

**Neotype** — M.99.56.

**Type locality** — Noszvaj, Síkfőlkút.

**Type level** — Upper part of the Buda Marl Formation, Lower Kiscellian.

**Material** — One specimen.

**Dimension** — Length 2–3 mm.

**Diagnosis** — Test is elongate, uniserial, slightly arcuate and it has a rounded proloculus. Sutures are straight and horizontal. Wall is calcareous, hyaline and extreme

finely perforate. Aperture is terminal, it consists of a series of radial slits close to the apex.

**Remarks** — SZTRÁKOS (1982) figure differs from the original one in a fatter test and in the number of chambers.

**Stratigraphical range** — *L. intermedia* occurs only sporadically in the upper part of the *Clavulina Szabói* layers (HANTKEN 1875a–b) in the Kiscellian (SZTRÁKOS 1979).

**Ecology** — The species ranges from the neritic to the bathyal zone.

*Laevidentalina simplex* (HANTKEN, 1868)

(Plate I: 8, Plate II: 8)

1868 *Dentalina simplex* n. sp. — HANTKEN, p. 87, pl. I, fig. 11.

1875a *Dentalina simplex* HANTKEN — HANTKEN, S. 33, Taf. XIII, Fig. 7.

1875b *Dentalina simplex* HANTKEN — HANTKEN, p. 27, pl. XIII, fig. 7.

1962 *Dentalina simplex* HANTKEN — MAJZON, pl. XLI(XIII), fig. 7.

1982 *Dentalina simplex* HANTKEN — SZTRÁKOS, pl. 8, fig. 1.

**Neotype** — M.01.14.

**Type locality** — Pilisborosjenő, brickyard.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — One specimen.

**Dimension** — Length 0.8 mm.

**Diagnosis** — Test is elongate, slightly arcuate with

rounded proloculus. Younger chambers are uniserial, equal in size. Sutures are straight and slightly oblique. Wall is calcareous, hyaline and finely perforate. Aperture is composed of a series of radial slits nearby the apex.

**Remarks** — No original specimen has been found.

**Stratigraphical range** — *L. simplex* is very rare in



the upper part of the *Clavulina Szabói* beds of Budapest (HANTKEN 1875a–b) in the Kiscell Clay, Upper Kiscellian. It is mentioned also from the Adour basin (SW

France) in Middle and Upper Eocene (SZTRÁKOS 2000).

**Ecology** — The species may range from the neritic to the bathyal zone.

Genus *Nodosaria* LAMARCK, 1812  
*Nodosaria gigantea* (HANTKEN, 1875)  
 (Plate I: 9, Plate II: 9)

1875a *Dentalina gigantea* n. sp. — HANTKEN, S. 34, Taf. III, Fig. 15.

1875b *Dentalina gigantea* — HANTKEN, p. 29, pl. III, fig. 15.

1962b *Dentalina gigantea* HANTKEN — MAJZON, pl. XXXI(III), fig. 15.

**Lectotype** — M.01.15.

**Type locality** — Budapest, Kis-Sváb-hegy.

**Type level** — Buda Marl Formation, Upper Priabonian.

**Material** — One specimen.

**Dimensions** — Length 2.6 mm, width (on the last chamber) 0.8 mm (broken).

**Diagnosis** — Test is large elongate, and uniserial. Chambers are cylindrical, the proloculus is followed by chambers, slightly increasing but gradually. The sutures can be seen, horizontal, depressed. The wall is calcareous,

hyaline, unornamented. The aperture is terminal, radiate.

**Remarks** — The species differs from *Dentalina herculea* GÜMBEL, 1868 (S. 43, Taf. 1, Fig. 34) in the width and height of the chambers. A single broken specimen remained in the Hantken collections in Hungary.

**Stratigraphical range** — *Nodosaria gigantea* is rare in the lower part of the *Clavulina Szabói* layers (HANTKEN, 1875a–b) at Buda (Buda Marl Formation), Upper Eocene.

**Ecology** — The species may range from neritic to bathyal zone.

*Nodosaria karrieri* HANTKEN, 1868  
 (Plate V: 5)

1868 *Nodosaria Karrieri* n. sp. — HANTKEN, p. 85, pl. I, fig. 8.

1875a *Nodosaria Karrieri* HANTKEN — HANTKEN, S. 23.

1875b *Nodosaria Karrieri* HANTKEN — HANTKEN, p. 19.

1949 *Nodosaria karrieri* HANTKEN — CUVILLIER & SZAKALL, p. 73, pl. 27, fig. 24.

part 1978 *Dentalina karrieri* (HANTKEN) — SZTRÁKOS, pl. 36, fig. 10

part 1979 *Dentalina karrieri* (HANTKEN) — SZTRÁKOS, pl. 11, fig. 3.

**Dimension** — Length: ca. 1 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is elongate, rounded in section. It consists of four or five chambers, only. Its spherical proloculus is followed by ovate chambers. Sutures are horizontal, distinct. Wall is calcareous, hyaline, finely perforate, unsculptured. Aperture is rounded and it can be found on a short neck.

**Remarks** — No specimen remained in the Hantken

collections in Hungary and no specimen has been found recently. SZTRÁKOS (1978, 1979) figures differ from the original in absence of the neck.

**Stratigraphical range** — *N. karrieri* is rare in the upper part of the *Clavulina Szabói* layers (HANTKEN 1875a, 1868, Budapest, Újtlak). It occurs in the Middle Eocene – Aquitainian in the Aquitaine basin (CUVILLIER & SZAKALL 1949).

*Nodosaria reitzi* (HANTKEN, 1868)  
 (Plate I: 10, Plate II: 10)

1868 *Nodosaria (Dentalina) Reitzi* n. sp. — HANTKEN, p. 88, pl. I, fig. 13.

1875a *Dentalina Reitzi* HANTKEN — HANTKEN, S. 33, Taf. XIII, Fig. 6.

1875b *Dentalina Reitzi* HANTKEN — HANTKEN, p. 27, pl. XIII, fig. 6.

1962 *Dentalina reitzi* (HANTKEN) — MAJZON, pl. XLI(XIII), fig. 6.

**Neotype** — M.01.16.

**Type locality** — Budapest, Újtlak.

**Type level** — Kiscell Clay Formation, late Kiscellian.

**Material** — One specimen.

**Dimension** — Length 0.8 mm, width 0.2–0.3 mm.

**Diagnosis** — Test is uniserial, early portion arcuate, succeeding part rectilinear. Chambers are ovate, their dimensions increasing during the ontogenesis. Wall is calcareous, perforate, unsculptured. The aperture is terminal

in HANTKEN's figure but not visible on the available specimen

**Remarks** — No original specimen has been found.

**Stratigraphical range** — *N. reitzi* is very rare in the upper *Clavulina Szabói* layers, Buda (Újtlak) (HANTKEN 1868, 1875a–b) in the Kiscell Clay Formation, Upper Kiscellian.

**Ecology** — *Nodosaria reitzi* may range from the neritic to the bathyal zone.

*Nodosaria setosa* (HANTKEN, 1875)  
(Plate I: 11, Plate II: 11)

- 1875a *Dentalina setosa* n. sp. — HANTKEN, S. 39, Taf. XIII, Fig. 9.  
1875b *Dentalina setosa* — HANTKEN, p. 33, pl. XIII, fig. 9.  
1962 *Dentalina setosa* HANTKEN — MAJZON, pl. XLI(XIII), fig. 9.  
1979 *Dentalina setosa* HANTKEN — SZTRÁKOS, pl. 11, fig. 10.

**Neotype** — M.01.17.

**Type locality** — Budapest, Újlak.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — One specimen.

**Dimension** — Length 0.6 mm, width 0.1 mm.

**Diagnosis** — The elongate, uniserial test consists of only a few chambers. Proloculus is small and spherical, gradually increasing four or five chambers follow it. Short and wide neck connects the neighbouring chambers. The calcareous wall is ornamented by fine granulae. Aperture is terminal, rounded and developed on a neck.

**Remarks** — HANTKEN described this species on the basis of a single specimen from the upper part of the *Clavulina Szabói* layers in the Kiscell Clay, Upper Kiscellian, Óbuda–Újlak (HANTKEN 1875 a–b). No specimen is preserved in the Hantken collections in Hungary.

**Stratigraphical range** — In Hungary, this species occurs in the Kiscell Clay, Upper Kiscellian SZTRÁKOS (1979). SZTRÁKOS (2000) found a questionable form in the Upper Eocene in Aquitaine (France).

**Ecology** — *Nodosaria setosa* may range from neritic to bathyal zone.

Genus *Pyramidulina* FORNASINI, 1894

*Pyramidulina minor* (HANTKEN, 1875)

(Plate V: 6)

- 1866b *Nodosaria bacillum* — HANTKEN, p.235 (in list)  
1875a *Nodosaria bacillum* DEFR. var. *minor* — HANTKEN, S. 26.  
1875a *Nodosaria latejugata* DEFR. var. *minor* — HANTKEN, S. 21. Taf. II, Fig. 7.  
1875b *Nodosaria bacillum* DEFR. var. *minor* — HANTKEN, p. 21, pl. II, fig. 7.  
1961 *Nodosaria minor* HANTKEN — KAASSCHIETER, p. 177, pl. VII, fig. 21.  
1962 *Nodosaria bacillum* HANTKEN — MAJZON, pl. XXX(II), fig. 7.  
1970 *Nodosaria bacilla minor* HANTKEN — KIESEL, S. 219, Taf. VII, Fig. 15.  
1978 *Nodosaria minor* HANTKEN — SZTRÁKOS, pl. 9, fig. 5.  
1979 *Nodosaria minor* HANTKEN — SZTRÁKOS, pl. 9, fig. 3.  
1982 *Nodosaria minor* HANTKEN — SZTRÁKOS, pl. 5, fig. 13.

**Dimension** — Length 4–6 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is elongate, uniserial. Chambers are globular and regularly increasing; orizontal sutures separate them. Wall is calcareous and perforate, 7–9 distinct, longitudinal ribs ornament it. Aperture is terminal and rounded.

**Remarks** — *P. minor* differs from *P. latejugata* (GÜMBEL,

1868; S.619, Taf. I, Fig. 32.) in inflation of the chambers.

No specimen remained in the Hantken collections.

**Stratigraphical range** — In Hungary this species is rare, it has been found in the Oligocene HANTKEN (1875 a–b), SZTRÁKOS (1979, 1982). In other parts of Europe, KAASSCHIETER (1961) and KIESEL (1970) recognised it in the Eocene.

Subfamily Lingulininae LOEBLICH & TAPPAN, 1961

Genus *Lingulina* D'ORBIGNY, 1826.

*Lingulina glabra* HANTKEN, 1875

(Plate I: 12, Plate II: 12)

- 1875b *Lingulina glabra* n. sp. — HANTKEN, S. 42. Taf. XIII, Fig. 14.  
1875a *Lingulina glabra* — HANTKEN, p. 35, pl. XIII, fig. 14.  
1956 *Lingulina glabra* HANTKEN — HAGN, S. 139, Taf. 13, Fig. 2.  
1962 *Lingulina glabra* HANTKEN — MAJZON, pl. XLI(XII), fig. 14.  
1971 *Lingulina* aff. *glabra* HANTKEN — POPESCU & IVA, pl. V, fig. 3

**Lectotype** — M.99.59.

**Type locality** — Budapest, Vár-hegy.

**Type level** — Buda Marl Formation, Upper Eocene.

**Material** — One specimen (broken).

**Dimensions** — Length 1.2 mm, width 0.8 mm.

**Diagnosis** — Test is elongate, compressed and lenticular. The uniserially arranged, overlapping chambers are rectilinear, their numbers are 5 to 7. Sutures are horizontal and slightly depressed. Wall is calcareous, perforate,

its surface is smooth. Aperture is a terminal slit in the plane of compression.

**Remarks** — A single specimen has been preserved in the Hantken Collections in Hungary.

**Stratigraphical range** — This species is known from the Eocene and Oligocene (HANTKEN 1875a–b HAGN 1956; POPESCU & IVA 1971).

**Ecology** — There are no data on the distribution of *Lingulina* species.



*Lingulina seminuda* HANTKEN, 1875

(Plate I: 13, Plate II: 13)

- 1875a *Lingulina costata* d'ORB. var. *seminuda* — HANTKEN, S. 41.  
 1875a *Lingulina costata* d'ORB. var. *subglabra* — HANTKEN, Taf. IV, Fig. 8a–b.  
 1875b *Lingulina costata* d'ORB. var. *seminuda* — HANTKEN, p. 35.  
 1876b *Lingulina costata* d'ORB. var. *subglabra* — HANTKEN, pl. IV, figs. 8a–b.  
 1962 *Lingulina seminuda* HANTKEN — MAJZON, pl. XXXII(IV), fig. 8.  
 1979 *Lingulina seminuda* HANTKEN — SZTRÁKOS, pl. 16, fig. 2.  
 1982 *Lingulina seminuda* HANTKEN — FORAMINIFERI PADANI, Tav. XV, Fig. 4.  
 1998 *Lingulina seminuda* HANTKEN — CÍCHA et al., p. 111, pl. 22, fig. 2.

**Neotype** — M.99.60.**Type locality** — Budapest, Újlak.**Type level** — Kiscell Clay Formation, late Kiscellian.**Material** — Two specimens.**Dimensions** — Length 1.5–2 mm, width 1.2–1.6 mm.

**Diagnosis** — Test is elongate, robust and lenticular. Chambers are uniserial, rectilinear, strongly overlapping; the final one almost reaches one-third of the test length. Number of the chambers is 3 or 4. Sutures are distinct, horizontal, slightly depressed. Wall calcareous and finely perforate. Its surface is almost smooth, two or three longitudinal costae are visible on the peripheral side. Aperture

is an oval, terminal slit.

**Remarks** — No specimen remained in the Hantken collections in Hungary.

**Stratigraphical range** — *Lingulina seminuda* is rare, it occurs from the Upper Priabonian to the Upper Kiscellian in Hungary (HANTKEN 1875a–b, SZTRÁKOS 1979). It is known from the Lower Kiscellian to the Upper Eggenburgian in other areas of the Central Paratethys (CÍCHA et al. 1998) and in Burdigalian in Aquitaine (CAHUZAC & POIGNANT 2002).

**Ecology** — There are no data on the distribution of *Lingulina* species.

## Subfamily Plectofrondiculariinae CUSHMAN, 1955

Genus *Plectofrondicularia* LIEBUS, 1902*Plectofrondicularia striata* (HANTKEN, 1875)

(Plate I: 14, Plate II: 14)

- 1875a *Flabellina striata* n. sp. — HANTKEN, S. 43, Taf. XIII, Fig. 13.  
 1875b *Flabellina striata* — HANTKEN, p. 36, pl. XIII, fig. 13.  
 1956 *Plectofrondicularia* aff. *striata* (HANTKEN) — HAGN, S. 144.  
 1962 *Plectofrondicularia striata* (HANTKEN) — MAJZON, pl. XLI(XIII), fig. 13.  
 1971 *Plectofrondicularia striata* (HANTKEN) — POPESCU & IVA, p. 42, pl. V, figs. 2a–b.  
 1973 *Plectofrondicularia striata* (HANTKEN) — NAGYNÉ GELLAI, p. 467, pl. V, fig. 12.  
 1978 *Plectofrondicularia striata* (HANTKEN) — SZTRÁKOS, pl. 11, fig. 8.  
 1979 *Plectofrondicularia striata* (HANTKEN) — SZTRÁKOS, pl. 15, fig. 14.  
 1982 *Plectofrondicularia striata* (HANTKEN) — SZTRÁKOS, pl. 14, fig. 4.  
 1987 *Plectofrondicularia striata* (HANTKEN) — REISSER, S. 72, Taf. 5, Fig. 25, 27.  
 1998 *Plectofrondicularia striata* (HANTKEN) — CÍCHA et al., p. 118, pl. 22, figs. 13–15.

**Neotype** — M.99.61.**Type locality** — Noszvaj, Síkfőkút quarry.**Type level** — Buda Marl Formation, Upper Priabonian.**Material** — Two specimens.**Dimensions** — Length 1.1–1.4 mm, width 0.2–0.3 mm.

**Diagnosis** — Test is straight, lanceolate, flattened, and ovate in section. The early chambers are biserial, succeeding ones are uniserial, chevron shaped. Sutures are distinct, slightly depressed and U-shaped. Wall is calcareous, finely perforate and ornamented by 10–12 fine, longitudinal costellae. The aperture is terminal and radiate.

**Remarks** — REISSER (1987) discussed how to distinguish *P. striata* from *Fronidularia digitalis* NEUGEBOREN, 1850, *P. multilimeata* CUSHMAN & SIMONSON, 1944, *P. incompleta* FRANZENAU, 1888 and *F. semiornata* KARRER, 1877.

No specimen remained in the Hantken collections in

Hungary.

**Stratigraphical range** — A few specimens occurred in the Kiscell Clay Formation in Hungary (HANTKEN 1875a–b; NAGYNÉ GELLAI 1973; SZTRÁKOS 1978, 1979, 1982).

In futher parts of the Central Paratethys *Plectofrondicularia striata* ranges from the end of Eocene to the Late Egerian (CÍCHA et al. 1975; LINDENBERG et al. in HAGN, 1981, CÍCHA et al. 1998). In Aquitaine (SW France) it can be found also in Eocene (SZTRÁKOS 2000) and Chattian sediments (CAHUZAC & POIGNANT 2002).

**Ecology** — There are no data on the distributions of the *Plectofrondicularia* species. Some specimens occur in the uppermost part of Buda Marl, and lower part of Tard Clay, where the O<sub>2</sub> content has been low.

Family Vaginulinidae REUSS, 1860  
 Subfamily Lenticulininae CHAPMAN, PARR, & COLLINS, 1934  
 Genus *Lenticulina* LAMARCK, 1804  
*Lenticulina arcuatostrata* (HANTKEN, 1868)  
 (Plate III: 1, Plate IV: 1)

- 1868 *Cristellaria (Robulina) arcuato striata* n. sp. — HANTKEN, p. 93, pl. II, figs. 30a–b.  
 1871 *Robulina arcuatostrata* (HANTKEN) — HANTKEN, p. 126. (in list)  
 1875a *Robulina arcuato-striata* HANTKEN — HANTKEN, S. 56, Taf. VII, Fig. 2.  
 1875b *Robulina arcuato-striata* HANTKEN — HANTKEN, p. 48, pl. VII, fig. 2.  
 1935 *Robulus arcuato-striatus* (HANTKEN) var. *carolinianus* — CUSHMAN, p. 17, pl. 6, figs. 6a–b.  
 part 1949 *Robulus arcuatostratus* (HANTKEN) — CUVILLIER & SZAKALL, p. 51, pl.23. fig. 9.  
 1956 *Robulus arcuato-striatus* (HANTKEN) — HAGN, S. 127, Taf. 11, Fig. 4.  
 1962 *Robulus arcuatostratus* (HANTKEN) — MAJZON, pl. XXXV(VII), pl. 2.  
 1962 *Robulus arcuatostratus* (HANTKEN) — LÜHR, Taf. 2, Fig. 13.  
 1973 *Robulus arcuatostratus* (HANTKEN) — NAGYNÉ GELLAI, p. 449, pl. III, fig. 1.  
 1975 *Lenticulina arcuatostrata* (HANTKEN) — BRAGA & GRÜNIG in BRAGA et al., p. 104.  
 part 1978 *Lenticulina arcuatostrata* (HANTKEN) — SZTRÁKOS, pl. 11, figs. 11a–b.  
 part 1979 *Lenticulina arcuatostrata* (HANTKEN) — SZTRÁKOS, pl. 12, figs. 8a–b.  
 1982 *Lenticulina arcuatostrata* (HANTKEN) — SZTRÁKOS, pl. 9, figs. 2a–b.  
 1985 *Lenticulina arcuatostrata* (HANTKEN) — SIKIĆ, Pl. II, figs. 6–7.  
 1988 *Robulina arcuatostrata* HANTKEN — GELLAI–NAGY, pl. VIII, figs. 1–3.  
 1998 *Lenticulina arcuatostrata* (HANTKEN) — CÍCHA et al., p. 109, pl. 24, figs. 1–2.

**Lectotype** — GELLAI–NAGY (1988) pl. VIII, figs.1–3.

**Type locality** — Budapest, Újlak.

**Type level** — Kiscell Clay Formation, Late Kiscellian.

**Paralectotype** — M.01.18. Budapest, Újlak, Kiscell Clay Formation, Late Kiscellian.

**Material** — 30 specimens remained in the Hantken collections in Hungary.

**Dimension** — Diameter 2.5–4 mm.

**Diagnosis** — Test is enrolled, planispiral, lenticular, biumbonate and having an umbonal boss. Periphery is angular and bears a keel. Chambers are rather broad and low, their dimensions increase with low rate. Sutures incline to the proloculus. Wall is calcareous, hyaline and perforate. Aperture is radiate.

**Remarks** — There is no significant difference between *L. arcuata* and *L. cultrata* in the figures of SZTRÁKOS (1978, 1979).

**Stratigraphical range** — *Lenticulina arcuatostrata* ranges

from the Middle Eocene to the Lower Miocene in Hungary (HANTKEN 1868, 1975a–b; NAGYNÉ GELLAI 1973; SZTRÁKOS 1978, 1979, 1982; HORVÁTH 1980), and from the Middle Eocene to end of the Eggenburgian elsewhere in the Central Paratethys (BRESTENSKA & LEHOTAYOVÁ 1983, CÍCHA et al. 1998).

It is frequent also in other parts of Europe [for example Middle Eocene in Aquitanian basin (CUVILLIER & SZAKALL 1949); Priabonian in North Italy (HAGN 1956; BRAGA & GRÜNIG in BRAGA et al. 1975); Oligocene (Rupelian) in Croatia (SIKIĆ 1985, CIMERMAN & PAVSIĆ 1979), in Bavaria (HAGN in HAGN & MARTINI, 1981); Lower Oligocene in Lower Inn valley (SCHERBACHER et al. 2001)].

**Ecology** — This species is an epifaunal, probably detritivore, normal, cold marine, bathyal taxon. It is a typical and frequent element of the bathyal sediments in Upper Eocene and Oligocene.

*Lenticulina baconica* (HANTKEN, 1875)

(Plate V: 7)

- 1875a *Robulina baconica* n. sp. — HANTKEN, S. 58, Taf. XIV, Fig. 9.  
 1875b *Robulina baconica* — HANTKEN, p. 49, pl.XIV, fig. 9.  
 1949 *Robulus baconicus* (HANTKEN) — CUVILLIER & SZAKALL, p. 57, pl. 21, fig. 22.  
 1962 *Robulus baconicus* (HANTKEN) — MAJZON, pl. XLII(XIV), fig. 9.

**Dimension** — Diameter is about 1 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is planispirally coiled, lenticular and biumbonate. The broad and low chambers increase in low rate, the final ones are stretched. The number of the chambers is eight in the last whorl. Sutures are distinct, curved, elevated, and narrowing toward the margin. Wall is calcareous, perforate and smooth. Umbos are covered and orna-

mented by nodes. Aperture is radiate at the peripheral angle.

**Remarks** — No specimen were preserved in the Hantken collections in Hungary.

**Stratigraphical range** — This species is very rare in the lower part of the *Clavulina Szabói* layers, at Porva (= Padrag Marl Formation) (HANTKEN 1875a, b).

CUVILLIER & SZAKALL (1949) had written the species in the Aquitaine basin, from Lutetian to Miocene.

*Lenticulina budensis* (HANTKEN, 1875)

(Plate III: 2, Plate IV: 2)

- 1875a *Robulina budensis* n. sp. — HANTKEN, S. 58. Taf. VII, Fig. 1.



- 1875b *Robulina budensis* — HANTKEN, p. 49, pl. VII, fig. 1.  
 1949 *Robulus budensis* (HANTKEN) — CUVILLIER & SZAKALL, p. 52, pl. 22, fig. 18.  
 1961 *Planularia budensis* (HANTKEN) — PAPP, S. 217, Abb. 4, Fig. 3.  
 1962 *Robulus budensis* (HANTKEN) — MAJZON, pl. XXXV(VII), fig. 1.  
 1962 *Robulus budensis* (HANTKEN) — LÜHR, Taf. 2, Fig. 18.  
 1973 *Robulus budensis* (HANTKEN) — NAGYNÉ GELLAI, p. 449, pl. III, fig. 15.  
 1978 *Lenticulina budensis* (HANTKEN) — SZTRÁKOS, pl. 11, figs. 12a–b.  
 1979 *Lenticulina budensis* (HANTKEN) — SZTRÁKOS, pl. 12, figs. 9a–b.  
 1982 *Lenticulina budensis* (HANTKEN) — SZTRÁKOS, pl. 9, fig. 3.  
 1985 *Lenticulina budensis* (HANTKEN) — KORECZNÉ LAKY & NAGYNÉ GELLAI, pl. XII, fig. 1.  
 1987 *Planularia budensis* (HANTKEN) — REISER, S. 64, Taf. 3, Fig. 20, 25.  
 1988 *Robulina budensis* HANTKEN — GELLAI–NAGY, pl. VIII, figs. 4–5.  
 1998 *Lenticulina budensis* (HANTKEN) — CÍCHA et al., p. 110, pl. 24, figs. 4–5.

**Lectotype** — GELLAI–NAGY (1988), pl. VIII, figs. 4–5.

**Type locality** — Budapest, Óbuda–Újlak.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Paralectotype** — M.99.63. Budapest, Újlak, Kiscell Clay Formation, Late Kiscellian.

**Material** — Two specimens are kept in the Hantken collections in Hungary.

**Dimension** — Diameter 1.2–1.5 mm.

**Diagnosis** — The rather large test is planispirally enrolled, lenticular but not involute and biumbonate. Size of the succeeding chambers increase rapidly. Their number is seven to eight in the last whorl. Sutures are distinct, backwards curved to the proloculus. Its has a peripheral keel. Wall is calcareous, hyaline and perforate, its surface is smooth. The radiate aperture lays at the peripheral angle.

**Remarks** — Figure of *Lenticulina budensis* in KORECZ-

NÉ LAKY & NAGYNÉ GELLAI (1985) differs from the original one in the numbers of the chambers.

**Stratigraphical range** — *L. budensis* is frequent in the Buda Marl and Kiscell Clay Formations in Hungary (HANTKEN 1875a–b; SZTRÁKOS 1978, 1979, 1982; KORECZNÉ LAKY & NAGYNÉ GELLAI 1985, CÍCHA et al. 1975; HORVÁTH 1980). It ranges from Upper Eocene to Upper Oligocene in Hungary.

This species is known from the Upper Eocene to the Kiscellian in the Central Paratethys, but it is characteristic only in Upper Kiscellian (CÍCHA et al. 1998). In other parts of Europe, it occurs from the Upper Eocene to Oligocene (CUVILLIER & SZAKALL 1949; LÜHR 1962; REISER 1987).

**Ecology** — *L. budensis* is an epifaunal, normal marine and cold-water species, typical in bathyal sediments.

### *Lenticulina bullata* (HANTKEN, 1875)

(Plate V: 8)

- 1875a *Robulina bullata* n. sp. — HANTKEN, S. 58, Taf. XIV, Fig. 13.  
 1875b *Robulina bullata* — HANTKEN, p. 49, pl. XIV, fig. 13.  
 part 1949 *Robulus bullatus* (HANTKEN) — CUVILLIER & SZAKALL, p. 58, pl.22, fig. 24.  
 1962 *Robulus bullatus* (HANTKEN) — MAJZON, pl. XLII(XIV), fig. 13.  
 1982 *Lenticulina bullata* (HANTKEN) — SZTRÁKOS, pl. 9, fig. 4.

**Dimensions** — Diameter 0.7 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is enrolled, planispiral, biumbonate and spherical with rounded periphery. The two or three chambers are broad and low, their size slightly increases; obscure sutures separate them. Wall is calcareous, perforate, its surface is smooth. Radiate aperture developed at the peripheral angle.

**Remarks** — No specimen remained in the Hantken

collections in Hungary.

The figure in CUVILLIER & SZAKALL (1949, pl. 22, fig. 24) has more chamber than the original one.

**Stratigraphical range** — It is very rare. HANTKEN (1875a–b) found only one specimen in the upper part of the *Clavulina Szabói* layers, Buda (Újlak). SZTRÁKOS (2000) identified this species as *L. cf. bullata* from Middle Eocene beds in Adour basin (SW France).

### *Lenticulina granulata* (HANTKEN, 1875)

(Plate III: 3, Plate IV: 3)

- 1875a *Robulina granulata* n. sp. — HANTKEN, S. 57, Taf. XIV, Fig. 15.  
 1875b *Robulina granulata* — HANTKEN, p. 49, pl. XIV, fig. 15.  
 1956 *Robulus granulatus* (HANTKEN) — HAGN, S. 126, Taf. 11, Fig. 6.  
 1962 *Robulus granulatus* (HANTKEN) — MAJZON, p. 49, pl. XLII(XIV), fig. 15.  
 1988 *Robulina granulata* HANTKEN — GELLAI–NAGY, pl. IX, figs. 4–5.  
 1999 *Lenticulina granulata* (HANTKEN) — DARAKCHIEVA, p. 32.

**Lectotype** — GELLAI–NAGY (1988) pl. IX, figs. 4–5.

**Type locality** — Porva, Transdanubian Mountains.

**Type level** — Padrag Marl Formation, middle Eocene.

**Paralectotype** — M.99.64. (broken). Porva, Transdanubian Mountains, Padrag Marl Formation, Middle

Eocene.

**Material** — A single specimen remained in Hantken Collections in Hungary.

**Dimension** — Diameter 1.5 mm.

**Diagnosis** — Test is coiled, planispiral, lenticular, biumbonate.

bonate and compressed. The relatively broad and low chambers increase slowly in size as added. Sutures are oblique. Wall is calcareous, perforate, but small nodes cover the perforation. Aperture is radiate at the peripheral angle. The periphery itself is angular with a wide rim.

**Remarks** — It is not rare in the lowermost part of the *Clavulina Szabói* layers, on the south-western part of

the Transdanubian Central Range (HANTKEN 1875a–b).

**Stratigraphical range** — *Lenticulina granulata* ranges from the Upper Eocene to the Lower Oligocene in North Bulgaria (DARAKCHIEVA 1999) and from the Middle to the Upper Eocene in Aquitaine (France) (SZTRÁKOS 2000).

**Ecology** — The species is epifaunal, normal marine, cold water dweller, and bathyal species, typical in clay facies.

*Lenticulina porvaensis* (HANTKEN, 1875)

(Plate V: 9)

- 1875a *Robulina porvaensis* n. sp. — HANTKEN H, S. 58, Taf. XIV, Fig. 11.  
 1875b *Robulina porvaensis* — HANTKEN, p. 50, pl. XIV, fig. 11.  
 1962 *Robulus porvaensis* (HANTKEN) — MAJZON, pl. XLII(XIV), fig. 11.  
 1956 *Robulus porvaensis* (HANTKEN) — HAGN, S. 126.  
 1982 *Lenticulina* cf. *porvaensis* (HANTKEN) — SZTRÁKOS, pl. 10, figs. 1a–b.

**Dimension** — Diameter is about 1 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is planispirally coiled, only the last ten to twelve chambers can be seen. The test is stretched and lenticular. The younger chambers are more stretched than the older ones. On both sides small bosses cover the umbilicus. The dorsal periphery is angled. The chambers are broad and low, their size increase slowly as

following each other. Sutures are distinct and radial. Wall is calcareous, perforate and has no ornamentation. Aperture is radiate and lying at the peripheral angle.

**Stratigraphical range** — It is very rare, only in the lower part of the *Clavulina Szabói* layers (HANTKEN 1875a–b), in the Padrag Marl Formation, Middle Eocene.

There are few data about its occurrence from the Upper Eocene (HAGN 1956; SZTRÁKOS 1982).

Genus *Percultazonaria* LOEBLICH & TAPPAN, 1986

*Percultazonaria schwageri* (HANTKEN, 1875)

(Plate III: 4, Plate IV: 4)

- 1875a *Cristellaria Schwageri* n. sp. — HANTKEN, S. 49, Taf. V, Fig. 11.  
 1875b *Cristellaria Schwageri* — HANTKEN, p. 42, pl. V, fig. 11.  
 1919 *Cristellaria robusta* HALKYARD — HALKYARD, p. 90, pl. 6, fig. 1.  
 1962 *Marginulina (Marginulinopsis) schwageri* (HANTKEN) — MAJZON, pl. XXXIII(V), fig. 11.  
 1962 *Vaginulinopsis schwageri* (HANTKEN) — LÜHR, Taf. 3, Fig. 6a–b.  
 1973 *Marginulina schwageri* (HANTKEN) — NAGYNÉ GELLAI, p. 453.  
 1982 *Vaginulinopsis schwageri* (HANTKEN) — SZTRÁKOS, pl. 13, figs. 15a–b, not fig. 14  
 1988 *Cristellaria schwageri* HANTKEN — GELLAI–NAGY, pl. II, figs. 5–6.  
 1993 *Vaginulinopsis robustus* (HALKYARD) — SZTRÁKOS in MATHELIN & SZTRÁKOS, p. 44, pl. 10, figs. 13–15; pl. 26, fig. 19.

**Lectotype** — GELLAI–NAGY (1988), pl. VII, figs. 5–6.

**Type locality** — The top of the Kis-Sváb-hegy.

**Type level** — Buda Marl Formation, Upper Eocene.

**Paralectotype** — M.99.65 (broken). Kis-Sváb-hegy, Buda Marl Formation, Upper Eocene.

**Material** — One specimen (broken).

**Dimension** — Length 2–4 mm, width 1–1.2 mm.

**Diagnosis** — Test is elongate, somewhat flattened, early part coiled. Chambers are broad and low. Sutures are distinct, depressed, oblique and curved. Wall is calcareous, hyaline and perforate, without any ornament. Aperture is radiate,

terminal at the dorsal angle, proceed on a small neck.

**Remarks** — In the Hantken Collections, one specimen has been preserved. It differs from *Vaginulinopsis* species in the smooth wall and peripheral keel.

**Stratigraphical range** — *Percultazonaria schwageri* occurs mainly in Buda Marl and Kiscell Clay, in Hungary, from the Upper Eocene to the Oligocene (HANTKEN 1875a–b; SZTRÁKOS 1982; NAGYNÉ GELLAI 1973). In other parts of Europe this species is known also in the Eocene (MATHELIN & SZTRÁKOS 1993) and in the Oligocene (LÜHR 1962).

**Ecology** — There are no data about the distribution.

Genus *Saracenaria* DEFRANCE, 1824

*Saracenaria minima* (HANTKEN, 1875)

(Plate V: 10)

- 1875a *Cristellaria minima* n. sp. — HANTKEN, S. 54, Taf. XIII, Fig. 21.  
 1875b *Cristellaria minima* — HANTKEN, p. 77, pl. XIII, fig. 21.  
 1962 *Marginulina (Marginulinopsis) minima* (HANTKEN) — MAJZON, pl. XLI (XIII), fig. 21.  
 1973 *Marginulina minima* (HANTKEN) — NAGYNÉ GELLAI, p. 453, pl. III, fig. 12.  
 1978 *Astacolus minima* (HANTKEN) — SZTRÁKOS, pl. 10, figs. 3a–b.  
 1979 *Astacolus minima* (HANTKEN) — SZTRÁKOS, pl. 10, figs. 6a–b.  
 1982 *Astacolus minimus* (HANTKEN) — SZTRÁKOS, pl. 6, figs. 10a–b.  
 1987 *Astacolus minimus* (HANTKEN) — REISER, S. 66, Taf. 4, Fig. 3, 8.



**Dimension** — Length maximum 0.4 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is planispirally coiled in the early growth stage. Subsequent chambers are tending to become rectilinear, uniserial, triangular in section. The dorsal side is angular, but it has only a rudimentary keel. Chambers are broad and low, the apertural face of the last chamber is smooth and broad. Sutures are curved in the early growth stage, then they become slightly curved and depressed. Wall is calcareous, its surface is smooth. Aperture developed at the dorsal angle and radiate.

**Remarks** — REISER (1987) discussed distinction of this species from *Vaginulinopsis bauerina* (D'ORBIGNY 1846),

*Astacolus crepidulus* (FICHTEL & MOLL 1803), *Vaginulinopsis mirabilis* (REUSS 1856). It differs from *Hemirobulina* and *Astacolus* in its triangular section, planispirally coiling in the early ontogenetic stage, and the angular dorsal periphery. It differs from *Marginulinopsis* in smooth wall.

No specimen has been preserved in the Hantken collections in Hungary.

**Stratigraphical range** — The species is very rare in the Kiscell Clay Formation, Upper Kiscellian (HANTKEN 1875a–b; SZTRÁKOS 1982). In the Bavarian molasse it occurred from the Upper Rupelian to the Lower Egerian (REISER 1987).

***Saracenaria propinqua*** (HANTKEN, 1875)

(Plate III: 5, Plate IV: 5)

- 1875a *Cristellaria propinqua* n. sp. — HANTKEN, S. 52, Taf. V, Fig. 4.  
 1875b *Cristellaria propinqua* — HANTKEN, p. 45, pl. V, fig. 4.  
 1935 *Robulus propinquus* (HANTKEN) — CUSHMAN, p. 16, pl. 5, fig. 1.  
 1962 *Saracenaria propinqua* (HANTKEN) — MAJZON, pl. XXXIII(V), fig. 4.  
 1978 *Saracenaria propinqua* (HANTKEN) — SZTRÁKOS, pl. 13, figs. 16a–b.  
 1979 *Saracenaria propinqua* (HANTKEN) — SZTRÁKOS, pl. 15, figs. 4a–b.  
 1981 *Marginulinopsis propinqua* (HANTKEN) — HAGN in HAGN et al., p. 96 (in list)  
 1982 *Saracenaria propinqua* (HANTKEN) — SZTRÁKOS, pl. 13, figs. 3a–b.  
 1985 *Saracenaria propinqua* (HANTKEN) — KORECZNÉ LAKY & NAGYNÉ GELLAI, pl. XIII, fig. 16; pl. XXIV, figs. 1–3.  
 1987 *Saracenaria propinqua* (HANTKEN) — REISER, S. 67, Taf. 4, Fig. 13,17.  
 1998 *Saracenaria propinqua* (HANTKEN) — CICHA et al., p. 125, pl. 24, fig. 9.

**Neotype** — M.99.66.

**Type locality** — Novaj, Nyárjas.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — One specimen.

**Dimensions** — Length 0.7 mm, width 0.5 mm.

**Diagnosis** — Test is planispirally enrolled in early growth stage, later flaring and tending to become rectilinear. Its section is triangular. Number of the chambers is 6–7. The dorsal margin is angular. Sutures are curved, slightly depressed. Wall is calcareous, perforate and smooth. Aperture is radiate, at the dorsal angle.

**Remarks** — It differs from *Saracenaria minima* (HANTKEN, 1875) in a wide apertural face and the order of two final chambers. No specimen remained in the Hantken collections in Hungary.

**Stratigraphical range** — In Hungary *Saracenaria propinqua* occurs in the upper part of the *Clavulina Szabói* layers (Kiscell Clay Formation), Upper Kiscellian (HANTKEN 1875a–b; SZTRÁKOS 1978, 1979, 1982; KORECZNÉ LAKY & NAGYNÉ GELLAI 1985). Rare.

The species ranges from the Upper Eocene to the Middle Egerian in the Central Paratethys (CICHA et al. 1998). In the Bavarian molasse it occurs in the Upper Kiscellian. (Late Rupelian) (REISER 1987). CUSHMAN (1935) indicated this species from the Jackson Formation, Upper Eocene.

**Ecology** — The species probable ranges from the sublittoral to the bathyal zone in normal marine environments.

Subfamily Palmulinae SAIDOVA, 1981

Genus *Frondivaginulina* SCHUBERT, 1912

***Frondivaginulina superba*** (HANTKEN, 1875)

(Plate III: 6, Plate IV: 6)

- 1875a *Frondivaginulina superba* n. sp. — HANTKEN, S. 42, Taf. IV, Fig. 16.  
 1875b *Frondivaginulina superba* — HANTKEN, p. 36, pl. IV, fig. 16.  
 1962 *Frondivaginulina superba* HANTKEN — MAJZON, pl. XXXII(IV), fig. 16.  
 1978 *Frondivaginulina superba* HANTKEN — SZTRÁKOS, pl. 11, fig. 6.  
 1979 *Frondivaginulina superba* HANTKEN — SZTRÁKOS, pl. 11, fig. 15.  
 1982 *Frondivaginulina superba* HANTKEN — SZTRÁKOS, pl. 8, fig. 8.  
 1985 *Frondivaginulina superba* HANTKEN — KORECZNÉ LAKY & NAGYNÉ GELLAI, pl. XI, fig. 23.  
 1998 *Frondivaginulina superba* HANTKEN — CICHA et al., p. 97, pl. 22, figs. 4–5.

**Neotype** — M.99.68.

**Type locality** — Budapest, Újlak.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — One specimen.

**Dimensions** — Length 1.7 (broken)–2.5 mm, width 1.8 mm, thickness 0.2 mm.

**Diagnosis** — Test is palmate, flattened. Proloculus is spherical, subsequent chambers are low, broad, they form so-called V-shape. Sutures are arched, slightly depressed. Wall is calcareous with smooth surface. Aperture is terminal and radiate.

**Remarks** — This species belongs to *Frondivaginulina* as it is indicated by order of chambers.

**Stratigraphical range** — *Frondivaginulina superba* is not rare in the Kiscellian in Hungary (HANTKEN 1875a–b; SZTRÁKOS 1978, 1979, 1982; KORECZNÉ LAKY & NAGYNÉ GELLAI 1985). In other parts of the Central Paratethys, it occurs in the Kiscellian (CICHA et al. 1998).

**Ecology** — The species may range from the neritic to the bathyal zone, in silty sediments.

*Frondivaginulina tenuissima* (HANTKEN, 1875)

(Plate III: 7, Plate IV: 7)

- 1875a *Frondivaginulina tenuissima* n. sp. — HANTKEN, S. 43, Taf. XIII, Fig. 11a–b.  
 1875b *Frondivaginulina tenuissima* — HANTKEN, p. 36, pl. XIII, fig. 11.  
 1949 *Frondivaginulina tenuissima* (HANTKEN) — CUVILLIER & SZAKALL, p. 85, pl. 30, figs. 11, 15.  
 1956 *Flabellina tenuissima* (HANTKEN) — HAGN, S. 139.  
 1962 *Frondivaginulina tenuissima* HANTKEN — MAJZON, pl. XLI(XIII), fig. 11.  
 1962 *Flabellina tenuissima* (HANTKEN) — LÜHR, S. 118, Taf. 4, Fig. 12.  
 1969 *Frondivaginulina tenuissima* HANTKEN — KRAEVA & ZERNECKIJ, p. 52, pl. 17, figs. 3a–b.  
 1973 *Frondivaginulina tenuissima* HANTKEN — NAGYNÉ GELLAI, p. 460, pl. V, fig. 1.  
 1978 *Frondivaginulina tenuissima* HANTKEN — SZTRÁKOS, pl. 11, fig. 7.  
 1979 *Frondivaginulina tenuissima* HANTKEN — SZTRÁKOS, pl. 12, fig. 1.  
 1982 *Plectofrondivaginulina tenuissima* (HANTKEN) — Foraminiferi padani, Tav. XXIV, fig. 8.  
 1985 *Frondivaginulina tenuissima* HANTKEN — KORECZNÉ LAKY & NAGYNÉ GELLAI, pl. XI, fig. 25; pl. XXV, fig. 3.  
 1987 *Flabellina tenuissima* — REISER, S. 72, Taf. 5, Fig. 29–30.  
 1988 *Frondivaginulina tenuissima* HANTKEN — GELLAI–NAGY, pl. VI, figs. 1–2.  
 1998 *Frondivaginulina tenuissima* (HANTKEN) — CICHA et al., p. 97, pl. 24, figs. 12–13.

**Lectotype** — GELLAI–NAGY (1988), pl. VI, figs. 1–2.

**Type locality** — Budapest, Újlak.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Topotype** — M.99.67. Noszvaj, Síkfőkút, Buda Marl Formation, Upper Priabonian.

**Material** — Two specimens.

**Dimensions** — Length 1.3–2 mm, width 0.3–0.5 mm.

**Diagnosis** — Test is lanceolate, strongly flattened. The fusiform proloculus is followed by a few astacoline chambers. Subsequent chambers are low, broad and medially elevated. Sutures are strongly arched and slightly depressed. Wall is calcareous and smooth. Aperture is terminal, radiate.

**Remarks** — One specimen has been found in the Hantken collections (GELLAI–NAGY 1988, pl. VI, figs. 1–2).

**Stratigraphical range** — In Hungary the species

sporadically occurs mainly in the Kiscell Clay (Upper Kiscellian) but it ranges from the Upper Eocene to the Kiscellian (HANTKEN 1875a–b; NAGYNÉ GELLAI 1973, SZTRÁKOS 1978, 1979; KORECZNÉ LAKY & NAGYNÉ GELLAI 1985).

It ranges from the Upper Eocene to the Egerian in the Central Paratethys (CIMERMAN & PAVŠIČ 1979; CICHA et al. 1998). In the Western and Eastern Paratethys *Frondivaginulina tenuissima* occurs from the Middle Eocene (KRAEVA & ZERNECKIJ 1969) to the Lower Miocene (HAGN 1956; LÜHR 1962; CUVILLIER & SZAKALL 1949; LINDENBERG et al. 1981; REISER 1987; SZTRÁKOS & CASTELLTORT 2001; CAHUZAC & POIGNANT 2002).

**Ecology** — This species may range from the neritic to the bathyal zone, in fine silty sediments.

Genus *Palmula* LEA, 1833

*Palmula budensis* (HANTKEN, 1875)

(Plate III: 8, Plate IV: 8)

- 1875a *Flabellina budensis* n. sp. — HANTKEN, S. 44, Taf. IV, Fig. 17.  
 1875b *Flabellina budensis* — HANTKEN, p. 37, pl. IV, fig. 17.  
 1949 *Frondivaginulina budensis* (HANTKEN) — CUVILLIER & SZAKALL, p. 84, pl. 30, fig. 14.  
 1953 *Frondivaginulina budensis* (HANTKEN) — SUBBOTINA, pl. VII, figs. 6–7.  
 1962 *Palmula budensis* (HANTKEN) — MAJZON, pl. XXXII(IV), fig. 17.  
 1962 *Flabellina budensis* (HANTKEN) — LÜHR, S. 118, Taf. 4, Fig. 11.  
 1969 *Frondivaginulina budensis* (HANTKEN) — KRAEVA & ZERNECKIJ, p. 52, pl. 17, figs. 1, 2a–b.  
 1970 *Flabellina budensis* (HANTKEN) — KIESEL, S. 242, Taf. X, Fig. 23.  
 1973 *Palmula budensis* (HANTKEN) — NAGYNÉ GELLAI, p. 460, pl. V, fig. 3.  
 1975 *Frondivaginulina budensis* (HANTKEN) — BRAGA & GRÜNIG in BRAGA et al., p. 104.  
 1978 *Frondivaginulina budensis* (HANTKEN) — SZTRÁKOS, pl. 11, fig. 4.  
 1979 *Palmula budensis* (HANTKEN) — SZTRÁKOS, p. 65, pl. 14, fig. 10; pl. 33, figs. 9a–b, 10.  
 1982 *Palmula budensis* (HANTKEN) — SZTRÁKOS, pl. 12, fig. 11.  
 1985 *Frondivaginulina budensis* HANTKEN — KORECZNÉ LAKY & NAGYNÉ GELLAI, pl. XI, fig. 24; pl. XXV, figs. 1–2.  
 1987 *Palmula cf. budensis* (HANTKEN) — REISER, S. 72, Taf. 5, Fig. 13, 16, 21.  
 1992 *Palmula budensis* (HANTKEN) — DARAKCHIEVA & JURANOV, p. 12, pl. I, fig. 9. not fig. 10.  
 1998 *Palmula budensis* (HANTKEN) — CICHA et al., p. 114, pl. 24, figs. 15–16.  
 1999 *Palmula budensis* (HANTKEN) — DARAKCHIEVA, p. 34.



**Neotype** — M.99.69.

**Type locality** — Pilisborosjenő, brickyard.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — Two specimens.

**Dimensions** — Length 0.9–1.2 mm, width 0.4 mm, and thickness 0.1 mm.

**Diagnosis** — Test is elongate, flattened, its early stage is planispirally coiled (microspheric generation) but astacoline in megalospheric generation. Later the arrangement of the chambers becomes uncoiled, rectilinear. The chambers are broad, low and arched. The number of chambers is 12–15. Sutures are flush. Wall is calcareous, perforate with smooth surface. Aperture is terminal, radiate.

**Remarks** — No specimen remained in the Hantken Collections in Hungary.

**Stratigraphical range** — In Hungary this species occurs mainly in Kiscellian (HANTKEN 1875a–b; NAGYNÉ GELLAI 1973, SZTRÁKOS 1978, 1979, 1982; KÖRECNÉ LAKY & NAGYNÉ GELLAI 1985). It ranges from the Upper Eocene to and Lower Egerian in the Central Paratethys (CIMERMAN & PAVŠIČ 1979; CÍCHA et al. 1998). Rare.

In Europe this species is known from Middle Eocene (CUVILLIER & SZAKALL 1949; SZTRÁKOS 2000) and late Eocene (BRAGA & GRÜNIG in BRAGA et al. 1975; SUBBOTINA 1953) to Lower Egerian (REISER 1987). In North Bulgaria it ranges from the end of Middle Eocene to Lower Oligocene (DARAKCHIEVA & JURANOV 1992; DARALCHIEVA 1999).

**Ecology** — There are no ecological data. The species may range from neritic to bathyal zone, in silty sediments.

Subfamily Marginulininae WEDEKIND, 1937  
Genus *Amphicoryna* SCHLUMBERGER, 1881  
*Amphicoryna* (?) *globosa* (HANTKEN, 1868)  
(Plate V: 11)

- 1868 *Cristellaria* (*Marginulina*) *globosa* n. sp. — HANTKEN, p. 91, pl. II, figs. 22a–b.  
1875a *Marginulina globosa* HANTKEN — HANTKEN, S. 46.  
1875b *Marginulina globosa* HANTKEN — HANTKEN, p. 39.

**Remarks** — Test consists of only two spherical chambers. It seems to belong to genus *Amphicoryna*, because its dorsal periphery is angular, and the chambers are opened in the ventral side.

No specimen remained in the Hantken collections.

**Stratigraphical range** — The species is very rare in the upper part of the *Clavulina Szabói* layers, Buda (Újlak) (HANTKEN 1875a–b).

*Amphicoryna tunicata* (HANTKEN, 1868)  
(Plate III: 9, Plate IV: 9)

- 1868 *Cristellaria* (*Marginulina*) *tunicata* n. sp. — HANTKEN, p. 91, pl. I, figs. 24a–c.  
1875a *Marginulina tunicata* HANTKEN — HANTKEN N, S. 48, Taf. XIV, Fig. 8a.  
1875b *Marginulina tunicata* HANTKEN — HANTKEN, p. 40, pl. XIV, fig. 8.  
1962 *Amphicoryne tunicata* (HANTKEN) — MAJZON, pl. XLII(XIV), fig. 8.  
1971 *Amphicoryne tunicata* (HANTKEN) — POPESCU & IVA, pl. III, figs. 4a–b.  
1973 *Amphicoryne tunicata* (HANTKEN) — NAGYNÉ GELLAI, p. 459, pl. IV, figs. 12–14.  
1978 *Amphicoryna spinicosta* (D'ORBIGNY) forma B — SZTRÁKOS, p. 73, pl. 9, fig. 17.  
1979 *Amphicoryna spinicosta* (D'ORBIGNY) — SZTRÁKOS, p. 63, pl. 10, fig. 3.  
1985 *Amphicoryna tunicata* (HANTKEN) — KÖRECNÉ LAKY & NAGYNÉ GELLAI, pl. X, fig. 7.  
1987 *Amphicoryna badensis* (D'ORBIGNY) — REISER, S. 69.  
1987 *Amphicoryna badensis* (D'ORBIGNY) — REISER, Taf. 4, Fig. 10  
1998. *Amphicoryna tunicata* (HANTKEN) — CÍCHA et al., p. 80, pl. 25, figs. 2–3.

**Neotype** — M.99.70.

**Type locality** — Budapest, Újlak.

**Type level** — Kiscell Clay, Upper Kiscellian.

**Material** — Two specimens.

**Dimensions** — Length 0.9 mm, width 0.2–0.3 mm.

**Diagnosis** — Test is elongate, the juvenile chambers are in a compressed whorl in the microspheric generation. The globular final chambers are rectilinear. Sutures are straight and constricted in the rectilinear portion. Wall is calcareous, perforate and commonly ornamented with longitudinal striae or fine ribs. The number of riblets changes between 5 and 8. The terminal, radiate aperture

is at the end of a neck with some collar like processes.

**Remarks** — No specimen remained in the Hantken collections.

**Stratigraphical range** — The species is very rare in the upper part of the *Clavulina Szabói* layers, Buda (Újlak) (HANTKEN 1868, 1875a–b). It ranges from the Kiscellian to the Egerian in the Central Paratethys (CÍCHA et al. 1998) and in the Bavaria (REISER 1987).

**Ecology** — This ecological characters of this species are similar to that of *Nodosaria*, therefore it ranges from neritic to bathyal zone, in normal marine waters.

Genus *Astacolus* de MONFORT, 1808  
*Astacolus budensis* (HANTKEN, 1875)  
 (Plate III: 10, Plate IV: 10)

- 1875a *Marginulina budensis* n. sp. — HANTKEN, S. 47, Taf. XIV, Fig. 5.  
 1875b *Marginulina budensis* — HANTKEN, p. 40, pl. XIV, fig. 5.  
 1962 *Marginulina budensis* — MAJZON, pl. XLII(XIV), fig. 5.  
 1982 *Marginulina budensis* (HANTKEN) — SZTRÁKOS, pl. 6, figs. 7a–b.

**Neotype** — M.01.19.

**Type locality** — Budapest, Újlak.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — A single specimen.

**Dimensions** — Length 2.3 mm, width 0.5 mm.

**Diagnosis** — Test is elongate, ovate in section, flattened in both sides. Chambers are broad and low, they are arranged along a slightly curved axis in the early growth stage. Sutures are distinct, strongly oblique to proloculus. The dorsal periphery is narrowed, the ventral one is rounded. Wall is calcareous, perforate, its surface is smooth. Aperture is radiate, its position is at the dorsal angle.

**Remarks** — The morphology of this species suggests belonging to genus *Astacolus* (elongate test, ovate outline, slightly curved axis in early growth phase, strongly oblique sutures, radiate aperture at the dorsal angle).

No specimen was found in the Hantken collections in Hungary.

**Stratigraphical range** — HANTKEN had found only one specimen in the lower part of the *Clavulina Szabói* layers, Buda (Kis-Sváb-hegy) (HANTKEN 1875a–b), in the Buda Marl, Upper Eocene.

**Ecology** — There are no data on its ecological characters.

*Astacolus complanatus* (HANTKEN, 1868)  
 (Plate V: 12)

- 1868 *Cristellaria (Marginulina) complanata* — HANTKEN H, p. 90, pl. II, fig. 28.  
 1875a *Marginulina complanata* HANTKEN — HANTKEN, S. 45.  
 1875b *Marginulina complanata* HANTKEN — HANTKEN, p. 38.

**Dimension** — About 0.4 mm (HANTKEN 1875a–b).

**Diagnosis** — The very small test is flattened, ovate in section. The number of chambers is about eight, they are broad, low and arranged along a slightly curved line, the last chambers are uncoiled. Periphery is rounded. Sutures are slightly curved. Wall is calcareous, perforate and smooth. Aperture is at the dorsal angle, it is not radiate (HANTKEN 1875).

**Remarks** — The species belongs to *Astacolus* on the basis of the chamber arrangement and the slightly curved

axis of the early growth stage. It differs from *Marginulina* because the test is flattened, ovate in section and the longitudinal costae are lacking.

No specimen remained in the Hantken collections in Hungary.

**Stratigraphical range** — This species is very rare in the upper part of the *Clavulina Szabói* layers (HANTKEN 1868, 1875a–b), Buda (Újlak), Kiscell Clay Formation, Upper Kiscellian.

*Astacolus indifferens* (HANTKEN, 1875)  
 (Plate III: 11, Plate IV: 11)

- 1875a *Marginulina indifferens* n. sp. — HANTKEN, S. 47, Taf. IV, Fig. 14.  
 1875b *Marginulina indifferens* — HANTKEN, p. 40, pl. IV, fig. 14.  
 1962 *Marginulina indifferens* HANTKEN — MAJZON, pl. XXXII(IV), fig. 14.  
 1973 *Marginulina indifferens* HANTKEN — NAGYNÉ GELLAI, p. 452.  
 1978 *Marginulina indifferens* HANTKEN — SZTRÁKOS, pl. 36, figs. 12a–b.  
 1979 *Marginulina indifferens* HANTKEN — SZTRÁKOS, pl. 13, figs. 12a–b.

**Neotype** — M.99.71.

**Type locality** — Budapest, on the left side of Danube, VIII/1. borehole, 25 m.

**Type level** — Kiscell Clay Formation, *Cassidulina vitalisi* zone, Upper Kiscellian.

**Material** — One specimen.

**Dimensions** — Length 1.2 mm, width 0.3 mm.

**Diagnosis** — Test is elongate, ovate in section, laterally slightly flattened. Chambers are ordered along a slightly curved axis, they are broad and low, gradually increasing. Sutures are distinct, slightly curved. Periph-

eries are rounded. Wall is calcareous, finely perforate, not ornamented. Aperture is terminal, radiate, lying at the dorsal angle.

**Remarks** — HANTKEN described this species on the base of a single specimen, having been not found in the Hantken Collections in Hungary.

**Stratigraphical range** — This species is known from the Kiscellian in Hungary (HANTKEN 1875a–b, SZTRÁKOS 1978, 1979). Very rare.

**Ecology** — The species may range from neritic to bathyal zone, in fine silty sediments.



*Astacolus irregularis* (HANTKEN, 1875)

(Plate V: 13)

- 1875a *Cristellaria irregularis* n. sp. — HANTKEN, S. 50, Taf. XIV, Fig. 2,3.  
 1875b *Cristellaria irregularis* — HANTKEN, p. 42, pl. XIV, figs. 2,3.  
 1962 *Marginulina irregularis* (HANTKEN) — MAJZON, pl. XLII(XIV), fig. 2,3.  
 1982 *Marginulina irregularis* (HANTKEN) — SZTRÁKOS, pl. 11, figs. 9a–b, 10.

**Diagnosis** — Test is elongate, ovate in section and flattened. Chambers are broader than height. They are arranged along a slightly curved axis in the early growth stage, later uncoiling by HANTKEN'S diagnosis. The early sutures are strongly oblique, later ones slightly. The dorsal periphery less, the ventral one is more strongly rounded. Wall is calcareous, perforate and smooth. Aperture is

terminal, placed at the dorsal angle.

**Remarks** — No specimen remained in the Hantken collections in Hungary.

**Stratigraphical range** — *A. irregularis* is very rare in the lower part of the *Clavulina Szabói* beds (two specimens), Buda (Kis-Sváb-hegy) (HANTKEN 1875a–b). SZTRÁKOS (1982) mentioned this species without data of occurrence.

*Astacolus porvaensis* (HANTKEN, 1875)

(Plate V: 14)

- 1875a *Cristellaria porvaensis* n. sp. — HANTKEN, S. 50, Taf. XIV, Fig. 1.  
 1875b *Cristellaria porvaensis* — HANTKEN, p. 42, pl. XIV, fig. 1.  
 1962 *Marginulina (Marginulinopsis) porvaensis* (HANTKEN) — MAJZON, pl. XLII(XIV), fig. 1.

**Dimensions** — Length is about 0.8 mm, width 0.2 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is elongate, ovate in outline and flattened. The six to ten chambers are broad and low, added along a slightly curved axis in the very early stage, later uncoiling. Sutures are slightly oblique in the early stage, later straight. Wall is calcareous, perforate, and smooth. Small granulae cover the sutures. Periphery is angular. Aperture is radiate, its position is at the dorsal

angle.

**Remarks** — No specimen remained in the Hantken collections in Hungary.

**Stratigraphical range** — *Astacolus porvaensis* is not rare in the lowermost part of the *Clavulina Szabói* layers, Porva Marl (HANTKEN 1875a–b), recently is equivalent to the Padrag Marl Formation, Middle Eocene. In Croatia this species is known from the Eocene (DROBNE 1979).

Genus *Hemirobulina* STACHE, 1864*Hemirobulina hantkeni* (BANDY, 1949)

(Plate V: 15)

- 1875a *Marginulina subbullata* n. sp. — HANTKEN, S. 46, Taf. IV, Fig. 9–10; Taf. V, Fig. 9.  
 1875b *Marginulina subbullata* — HANTKEN, p. 39, pl. IV, figs. 9–10; pl. V, fig. 9.  
 1949 *Marginulina hantkeni* n. sp. — BANDY, p. 46, pl. 6, fig. 9.  
 part 1956 *Marginulina hantkeni* BANDY — HAGN, S. 132, Taf. 11, Fig. 14.  
 1962 *Marginulina subbullata* HANTKEN — MAJZON, pl. XXXII(V), figs. 9–10; pl. XXXIII(V), fig. 9.  
 1973 *Marginulina subbullata* HANTKEN — NAGYNÉ GELLAI, p. 453, pl. III, figs. 5, 11.  
 1979 *Marginulina subbullata* HANTKEN — DROBNE et al., p. 183 (in list)  
 1981 *Marginulina subbullata* (HANTKEN) — HAGN in HAGN & MARTINI, p. 82 (in list)  
 1982 *Marginulina hantkeni* BANDY — SZTRÁKOS, pl. 11, fig. 6.  
 1982 *Marginulina subbullata* HANTKEN — FORAMINIFERI PADANI, Tav. XIII, Fig. 1.  
 1985 *Marginulina subbullata* HANTKEN — SIKIĆ, pl. IV, figs. 2–3.  
 1985 *Marginulina subbullata* HANTKEN — KORECZNÉ LAKY & NAGYNÉ GELLAI, pl. XIII, fig. 13.  
 1987 *Marginulina hantkeni* BANDY — REISER, S. 68, Taf. 4, Fig. 14, 22.  
 1988 *Marginulina subbullata* HANTKEN — GELLAI-NAGY, pl. VI, figs. 5–6.  
 1998 *Hemirobulina hantkeni* (BANDY) — CÍCHA et al., p. 107, pl. 25, figs. 9–10.  
 1999 *Hemirobulina hantkeni* (BANDY) — DARAKCHIEVA, p. 34.

**Dimensions** — Length 1.0 mm, width 0.5 mm.

**Diagnosis** — Test is elongate, circular in section. Four or six chambers are added along a slight curve. Rapidly increasing chambers become rectilinear later. Sutures are oblique, they may be slightly depressed. Wall is calcareous, hyaline, perforate and smooth. Aperture is terminal, radial, placed at the dorsal angle.

**Remarks** — “*Marginulina hantkeni* BANDY” was introduced as new name for *Marginulina subbullata* HANTKEN (1875) non *Marginulina subbullata* GÜMBEL (1868) —

RÖGL in CÍCHA et al. (1998).

No original specimen was found in Hungary.

**Stratigraphical range** — This species occurs in the Kiscell Clay Formation, Kiscellian in Hungary (HANTKEN 1875a–b; NAGYNÉ GELLAI 1973; SZTRÁKOS 1982; KORECZNÉ LAKY & NAGYNÉ GELLAI 1985). Rare.

*Hemirobulina hantkeni* ranges from the Upper Eocene to the Egerian in the Central Paratethys (CÍCHA et al. 1998). In the Bavarian molasse it ranges from the Upper Rupelian (Upper Kiscellian) to the Lower Egerian (REI-

SER 1987). In Croatia and in Italy it occurs in the Oligocene (Rupelian) (SIKIĆ 1985; FORAMINIFERI PADANI 1982). It was found in the Eocene in the Adour basin

(SW France) (SZTRÁKOS 2000) and the Lower Oligocene in the Lower Inn valley (SCHERBACHER et al. 2001).

*Hemirobulina ornata* (HANTKEN, 1875)

(Plate V: 16)

- 1875a *Cristellaria ornata* n. sp. — HANTKEN, S. 54, Taf. XIII, Fig. 19.  
 1875b *Cristellaria ornata* — HANTKEN, p. 77, pl. XIII, fig. 19.  
 non 1949 *Marginulina* aff. *ornata* (HANTKEN) — CUVILLIER & SZAKALL, p. 65, pl. 25, figs. 22–23.  
 1962 *Marginulina* (*Marginulinopsis*) *ornata* (HANTKEN) — MAJZON, pl. XLI(XIII), fig. 19.  
 1985 *Marginulina ornata* HANTKEN — KORECZNÉ LAKY & NAGYNÉ GELLAI, pl. XCVIII, figs. 6, 12.

**Dimension** — About 0.5 mm (HANTKEN 1875a–b).

**Diagnosis** — The small test is flattened, elongate lenticular in section. The six chambers are added along a slight curve. The chambers are broad and low, slightly increase as added. Suture is oblique, depressed, distinct. The dorsal periphery is angular. Wall is calcareous, perforate. Aperture is terminal, radiate, its position is at the dorsal angle.

**Remarks** — This species differs from *Vaginulinopsis* because the early part of the test is not coiled. It differs

from *Marginulina* in lack of the longitudinal costae and the ovate section. It is similar to *Astacolus*, but differs in the arrangement of the chambers.

**Stratigraphical range** — *Hemirobulina ornata* is rare, some specimens have occurred in the *Clavulina Szabói* layers (HANTKEN 1875a–b) at Buda. KORECZNÉ LAKY & NAGYNÉ GELLAI (1985) mentioned this species also from the Lower Badenian, Börzsöny Mountains (North Hungary).

*Hemirobulina pauciloculata* (HANTKEN, 1875)

(Plate V: 17)

- 1875a *Marginulina pauciloculata* n. sp. — HANTKEN, S. 47, Taf. XIV, Fig. 10.  
 1875b *Marginulina pauci-loculata* — HANTKEN, p. 76, pl. XIV, fig. 10.  
 1949 *Marginulina pauciloculata* HANTKEN — CUVILLIER & SZAKALL, p. 67, pl. 25, fig. 36.  
 1962 *Marginulina pauciloculata* HANTKEN — MAJZON, pl. XLII(XIV), fig. 10.  
 1982 *Marginulina pauciloculata* HANTKEN — SZTRÁKOS, pl. 11, figs. 11a–b.

**Dimensions** — Length 1.5 mm, width 0.6 mm.

**Diagnosis** — Test is elongate, flattened, and lenticular in section. The six chambers are added in a slight curve. The chambers are as wide as high, slightly increase, as added. Sutures are oblique, depressed, distinct. The dorsal periphery is angular. Wall is calcareous, perforate. Aperture is terminal, radiate, placed at the dorsal angle.

**Remarks** — HANTKEN described this species on the basis of a single specimen but no specimen was found in the Hantken collections in Hungary.

**Stratigraphical range** — This species occurred in the upper part of the *Clavulina Szabói* layers, Buda (Újlak) (HANTKEN, 1875a–b). CUVILLIER & SZAKALL (1949) identified it also from the Aquitaine basin, Middle Eocene.

*Hemirobulina recta* (HANTKEN, 1875)

(Plate V: 18)

- 1875a *Marginulina recta* n. sp. — HANTKEN, S. 47, Taf. IV, Fig. 15.  
 1875b *Marginulina recta* — HANTKEN, p. 39, pl. IV, fig. 15.  
 1962 *Marginulina recta* HANTKEN — MAJZON, pl. XXXII(IV), fig. 15.  
 1973 *Marginulina recta* HANTKEN — NAGYNÉ GELLAI, p. 453.

**Dimensions** — Length 1 mm, width 0.3 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is elongate, circular in section. The four chambers are inflated, added along a slight curve at the base, later becoming rectilinear. Sutures are slightly curved, and depressed. Wall is calcareous, finely perforate, smooth. Aperture is terminal and placed at the dorsal angle.

**Remarks** — No specimen remained in the Hantken collections in Hungary. HANTKEN established this species on a single specimen from Buda (Újlak), from the upper part of the *Clavulina Szabói* layers.

**Stratigraphical range** — The species occurs in the Kiscell Clay Formation, Upper Kiscellian, only. Rare.

*Hemirobulina splendens* (HANTKEN, 1875)

(Plate III: 12, Plate IV: 12)

- 1875a *Marginulina splendens* n. sp. — HANTKEN, S. 87, Taf. IV, Fig. 11.  
 1875b *Marginulina splendens* — HANTKEN, p. 40, pl. IV, fig. 11.  
 1949 *Marginulina* aff. *splendens* HANTKEN — CIVILLIER & SZAKALL, p. 67, pl. 25, fig. 33.  
 1962 *Marginulina splendens* HANTKEN — MAJZON, pl. XXXII(IV), fig. 11.  
 part 1978 *Marginulina splendens* HANTKEN — SZTRÁKOS, pl. 12, fig. 11.



- part 1979 *Marginulina splendens* HANTKEN — SZTRÁKOS, pl. 14, fig. 1.  
 part 1982 *Marginulina splendens* HANTKEN — SZTRÁKOS, pl. 12, fig. 1.

**Neotype** — M.99.75.

**Type locality** — Pilisborosjenő, brickyard.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — One specimen (damaged).

**Dimensions** — Length 1.6 mm, width 0.5 mm.

**Diagnosis** — Test is elongate, circular in section. Chambers are arranged in a slight arch at the base, subsequently becomes rectilinear, and uniserial. Chambers gradually increase, generally they are broad and low, flatness gradually decreases. Sutures are distinct, oblique in the early stage, later they become nearly horizontal. Wall is calcareous, perforate, not ornamented. Aperture is terminal, radiate, its position is at the dorsal angle.

terminal, radiate, its position is at the dorsal angle.

**Remarks** — HANTKEN established this species on a single specimen. SZTRÁKOS (1978, 1979, 1982) figured variable forms as *Marginulina splendens*, which differ from the original in the number of chambers and the shape of test.

**Stratigraphical range** — This species is very rare in the upper part of the *Clavulina Szabói* layers, Buda (Újlak) (HANTKEN 1875a–b). In Europe this species is rare, it occurs in the Middle and Upper Eocene in the Adour basin (SW France) only (SZTRÁKOS 2000).

**Ecology** — *Hemirobulina splendens* is rare, it may range from neritic to bathyal zone.

Genus *Vaginulinopsis* SILVESTRI, 1904  
*Vaginulinopsis elegans* (HANTKEN, 1875)  
 (Plate V: 19)

- 1875a *Cristellaria elegans* n. sp. — HANTKEN, S. 88, Taf. XIV, Fig. 4.  
 1875b *Cristellaria elegans* — HANTKEN, p. 43, pl. XIV, fig. 4.  
 1961 *Vaginulinopsis elegans* (HANTKEN) — PAPP, S. 218.  
 1961 *Marginulinopsis elegans* (HANTKEN) — PAPP, Abb. 6, Fig. 7.  
 1962 *Marginulina* (*Marginulinopsis*) *elegans* (HANTKEN) — MAJZON, pl. XLII(XIV), fig. 4.  
 1987 *Vaginulinopsis elegans* (HANTKEN) — WENGER, S. 257, Taf. 4, Fig. 11, 12.

**Dimensions** — Length about 1 mm, width about 0.2 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is elongate, earliest four or five chambers are planispirally coiled. The subsequent ones are uncoiled and uniserial, rectilinear. The test is laterally compressed, lenticular in section. Dorsal and ventral periphery is angled. Sutures are radial in the early stage, later they become nearly straight and horizontal. Wall is perforate, calcareous. Aperture is

terminal, radiate, it is developed at the dorsal angle.

**Remarks** — HANTKEN had described this species on the basis of only one specimen from the upper part of the *Clavulina Szabói* layers, Buda (Újlak) (HANTKEN 1875a–b).

**Stratigraphical range** — The *Vaginulinopsis elegans* occurs in the Bavarian molasse (WENGER 1987) in the Michelstettener Formation, Lower Egerian, and one specimen in the Middle Ottnangian.

*Vaginulinopsis minutus* (HANTKEN, 1875)  
 (Plate III: 13, Plate IV: 13)

- 1875a *Cristellaria minuta* n. sp. — HANTKEN, S. 50, Taf. XIV, Fig. 7.  
 1875a *Cristellaria minuta* — HANTKEN, p. 43, pl. XIV, fig. 7.  
 1962 *Marginulina minuta* HANTKEN — MAJZON, pl. XLII(XIV), fig. 7.  
 1978 *Vaginulinopsis minuta* (HANTKEN) — SZTRÁKOS, pl. 37, fig. 2.  
 1979 *Vaginulinopsis minuta* (HANTKEN) — SZTRÁKOS, pl. 15, fig. 8.  
 1982 *Vaginulinopsis minutus* (HANTKEN) — SZTRÁKOS, pl. 13, figs. 11a–b, 12a–b.  
 1998 *Vaginulinopsis minutus* (HANTKEN) — CÍCHA et al., p. 135, pl. 26, fig. 5.

**Neotype** — M.99.76.

**Type locality** — Pilisborosjenő, brickyard.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Material** — One specimen.

**Dimensions** — length 0.6 mm, width 0.1 mm.

**Diagnosis** — The small test is elongate, planispirally coiled in the early growth stage, involute. Later it is uncoiled, uniserial, and rectilinear. Size of the chambers gradually increases during the growth of the test. The last chamber is the largest and slightly inflated. The complete test is laterally compressed, lenticular in section. Sutures are radial in early stage, later straight and nearly horizontal. The smooth wall is calcareous and perforate. Aperture is terminal, radiate, its position is at the dorsal angle.

terminal, radiate, its position is at the dorsal angle.

**Remarks** — HANTKEN described this species on the basis of one specimen from Porva Marl (that is equivalent of the Padrag Marl Formation, Middle Eocene). No specimen remained in the Hantken collections in Hungary.

**Stratigraphical range** — The species is known from the Middle Eocene to the Kiscellian in Hungary (HANTKEN 1875a–b; SZTRÁKOS 1978, 1979, 1982). In the Central Paratethys it occurs in the Kiscellian (CÍCHA et al. 1998). This species is known in the Middle Eocene in Aquitaine (SZTRÁKOS & CASTELLTORT 2001).

**Ecology** — The species is rare, it may range from the neritic to the bathyal depth.

*Vaginulinopsis subregularis* (HANTKEN, 1868)  
(Plate V: 20)

- 1868 *Cristellaria (Marginulina) subregularis* n. sp. — HANTKEN, p. 90, pl. I, fig. 20.  
1875a *Marginulina subregularis* HANTKEN — HANTKEN, S. 45.  
1875b *Marginulina subregularis* HANTKEN — HANTKEN, p. 38.  
part 1979 *Marginulina subregularis* HANTKEN — SZTRÁKOS, pl. 14, fig. 2.  
part 1982 *Marginulina subregularis* HANTKEN — SZTRÁKOS, pl. 11, figs. 17a–b.

**Dimension** — Length 0.6 mm (HANTKEN 1875a–b).

**Diagnosis** — Test is elongate, the early chambers are planispirally coiled. Later chambers are uncoiled and rectilinear. Test is laterally compressed, ovate in section. Chambers are broad low, and slightly convex. Sutures are curved in the early stage, oblique in the uncoiled part of the test. Wall is calcareous, finely perforate and smooth. Aperture is terminal, radiate, its position is at the dorsal angle.

**Remarks** — SZTRÁKOS (1979, 1982) specimens differ from HANTKEN's figure in the position of aperture and the numbers of the chambers.

No specimen remained in the Hantken collections in Hungary.

**Stratigraphical range** — This species is very rare in the upper part of the *Clavulina Szabói* layers, Buda (Újlak) (HANTKEN 1868, 1875a–b).

Subfamily Vaginulininae REUSS, 1860  
Genus *Planularia* DEFRANCE, 1826  
*Planularia karolyi* CICHA & RÖGL, 1998  
(Plate III: 14, Plate IV: 14)

- non 1868 *Cristellaria nummulitica* n. sp. — GÜMBEL, S. 58, Taf. 1, Fig. 63a–b.  
1875a *Cristellaria nummulitica* GÜMBEL var. — HANTKEN, S. 51, Taf. VI, Fig. 4a–b.  
1875b *Cristellaria nummulitica* GÜMBEL — HANTKEN, p. 44, pl. VI, fig. 4.  
non 1956 *Astacolus nummuliticus* (GÜMBEL) — HAGN, S. 131, Taf. 11, Fig. 17.  
1962b *Planularia nummulitica* (GÜMBEL) — MAJZON, pl. XXXIV(VI), fig. 4.  
1979 *Planularia nummulitica* (HANTKEN non GÜMBEL) — SZTRÁKOS, in list (p.81), pl. 14, fig. 11.  
1982 *Planularia nummulitica* (HANTKEN non GÜMBEL) — SZTRÁKOS, pl. 12, fig. 13.  
1985 *Planularia nummulitica* (HANTKEN) — KORECZNÉ LAKY & NAGYNÉ GELLAI, p.76, pl.12, figs.10–11.  
1998 *Planularia karolyi* n. sp. — CICHA & RÖGL in CICHA et al., p. 73, pl. 26, fig. 14.

**Topotype** — M.01.20. Budapest, Újlak, Kiscell Clay Formation, Late Kiscellian.

**Material** — Two specimens.

**Dimensions** — Length 3–4 mm, width 0.9–1.4 mm.

**Diagnosis** — Test is large, broadly ovate and strongly compressed. The early stage is in a partial whorl, chambers increase rapidly in breadth, the latest chambers broad and low, wedgelike. Fifteen to twenty broad chambers can be seen. Sutures are curved in the beginning, the later ones become straight. Wall is calcareous, and perforate, its surface is smooth. Aperture is radiate, at the dorsal angle. Periphery is carinate.

**Remarks** — *Planularia nummulitica* (HANTKEN) is a junior homonym of *P. nummulitica* (GÜMBEL) (SZTRÁKOS 1979), therefore CICHA et al. (1998) proposed a new name.

**Stratigraphical range** — In Hungary *P. karolyi* occurs in the Oligocene (SZTRÁKOS 1979, 1982; KORECZNÉ LAKY & NAGYNÉ GELLAI 1985). It ranges from the Kiscellian to the Egerian in the Central Paratethys (CICHA et al. 1998).

**Ecology** — *Planularia karolyi* is an epifaunal, normal marine and cold-water taxon in the bathyal zone. It prefers the silty substrate.

*Planularia kubinyii* (HANTKEN, 1868)  
(Plate III: 15, Plate IV: 15)

- 1868 *Cristellaria (Robulina) Kubinyi* n. sp. — HANTKEN, p. 92, pl. II, fig. 29.  
1875a *Robulina Kubinyii* HANTKEN — HANTKEN, S. 56, Taf. VI, Fig. 7.  
1875b *Robulina Kubinyii* HANTKEN — HANTKEN, p. 47, pl. VI, fig. 7.  
1949 *Planularia kubinyii* (HANTKEN) — CUVILLIER & SZAKALL, p. 60, pl. 24, fig. 1.  
1956 *Planularia kubinyii* (HANTKEN) — HAGN, S. 130, Taf. 12, Fig. 7.  
1961 *Planularia* cf. *kubinyii* (HANTKEN) — PAPP, S. 217, Abb. 4, Fig. 1.  
1962 *Planularia kubinyii* HANTKEN — MAJZON, pl. XXXIV(VI), fig. 7.  
1962 *Robulus kubinyi* (HANTKEN) — LÜHR, S., Taf. 2, Fig. 24.  
1971 *Planularia kubinyii* — POPESCU & IVA, p. 41, pl. IV, figs. 5a–b.  
1973 *Planularia kubinyii* (HANTKEN) — NAGYNÉ GELLAI, p. 452, pl. II, fig. 8.  
1978 *Lenticulina kubinyii* (HANTKEN) — SZTRÁKOS, pl. 12, fig. 1.  
1979 *Lenticulina kubinyii* (HANTKEN) — SZTRÁKOS, pl. 13, fig. 1.  
1985 *Planularia kubinyii* (HANTKEN) — KORECZNÉ LAKY & NAGYNÉ GELLAI, pl. XII, figs. 9, 12.  
1987 *Planularia kubinyii* — REISER, S. 65, Taf. 3, Fig. 21–22.  
1988 *Robulina kubinyii* HANTKEN — GELLAI–NAGY, pl. IX, figs. 1–3.



1993 *Planularia kubinii* HANTKEN — RUSU et al., p. 32, Fig. 15/7–8.

1998 *Planularia kubinyi* (HANTKEN) — CÍCHA et al., p. 118, pl. 26, figs. 8–9.

**Lectotype** — GELLAI–NAGY (1988), pl. IX, figs. 1–3.

**Type locality** — Budapest, Újlak.

**Type level** — Kiscell Clay Formation, Upper Kiscellian.

**Paralectotype** — M.99.77. Budapest, Újlak, Kiscell Clay Formation, *Cassidulina vitalisi* zone, Upper Kiscellian.

**Material** — 85 specimens.

**Dimensions** — Larger diameter is 2–3 mm, width is 1.1–1.3 mm.

**Diagnosis** — The large test is broadly ovate, strongly compressed. Chambers increase rapidly in width. A large boss on both sides covers the early chambers, respectively. The number of chambers is sixteen to twenty; last chambers are broad and low, dorsally highest and ventrally extending back towards the early chambers. Sutures are distinct and curved. Periphery is carinate. Wall is calcareous,

perforate and smooth. Aperture is radiate, it can be found at the dorsal angle.

**Remarks** — “It is one of the most characteristic forms in the *Clavulina Szabói* layers,” wrote HANTKEN (1875a–b). Some specimens have remained in the Hantken collections.

**Stratigraphical range** — This species is very frequent in the *Clavulina Szabói* layers (HANTKEN 1868, 1875a–b). It ranges from the Kiscellian to the Eggenburgian in the Central Paratethys (CIMERMAN & PAVŠIĆ 1979; CÍCHA et al. 1998), and from the Middle Eocene to the Lower Miocene in Western Europe (CUVILLIER & SZAKALL 1949, LINDENBERG et al. 1981; REISER 1987; SZTRÁKOS 2000).

**Ecology** — This species is an epifaunal, normal marine, cold water, and bathyal taxon. It prefers the silty and/or clayey sediments.

## Appendix

### “*Dentalina*” *sublaxa* HANTKEN, 1875

1875a *Dentalina sublaxa* n. sp. — HANTKEN, S. 29.

1875b *Dentalina sublaxa* — HANTKEN, p. 24.

**Remarks** — HANTKEN (1875a–b) described this species without figures. On the basis of his description, this species can belong to *Nodosaria*, because it has no longitudinal ribs. It was recognised from the upper part of

the *Clavulina Szabói* layers (from Kiscell Clay) at Buda (Újlak) (HANTKEN 1875a–b). No specimen remained in the Hantken collections in Hungary.

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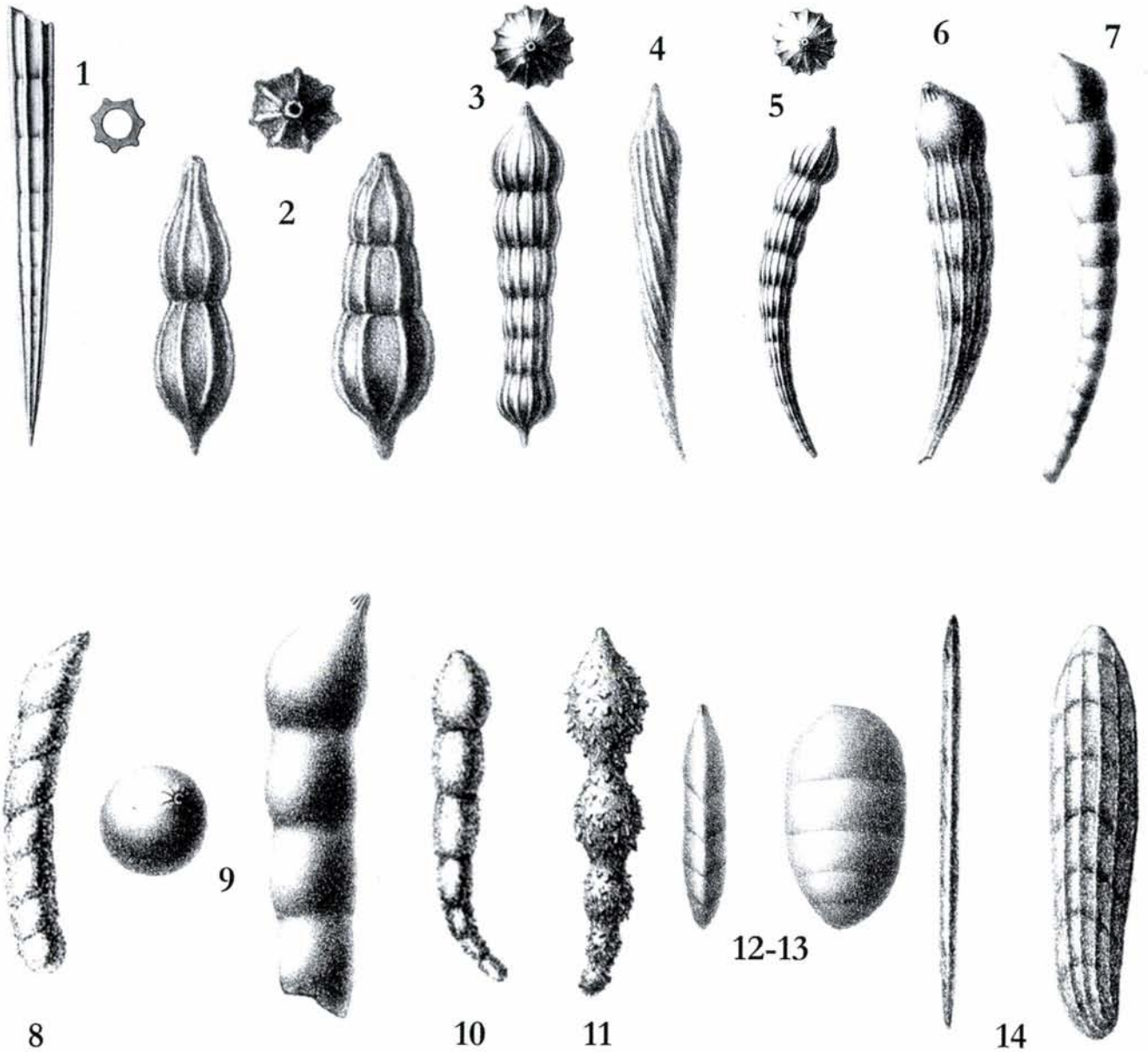
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## Plate I



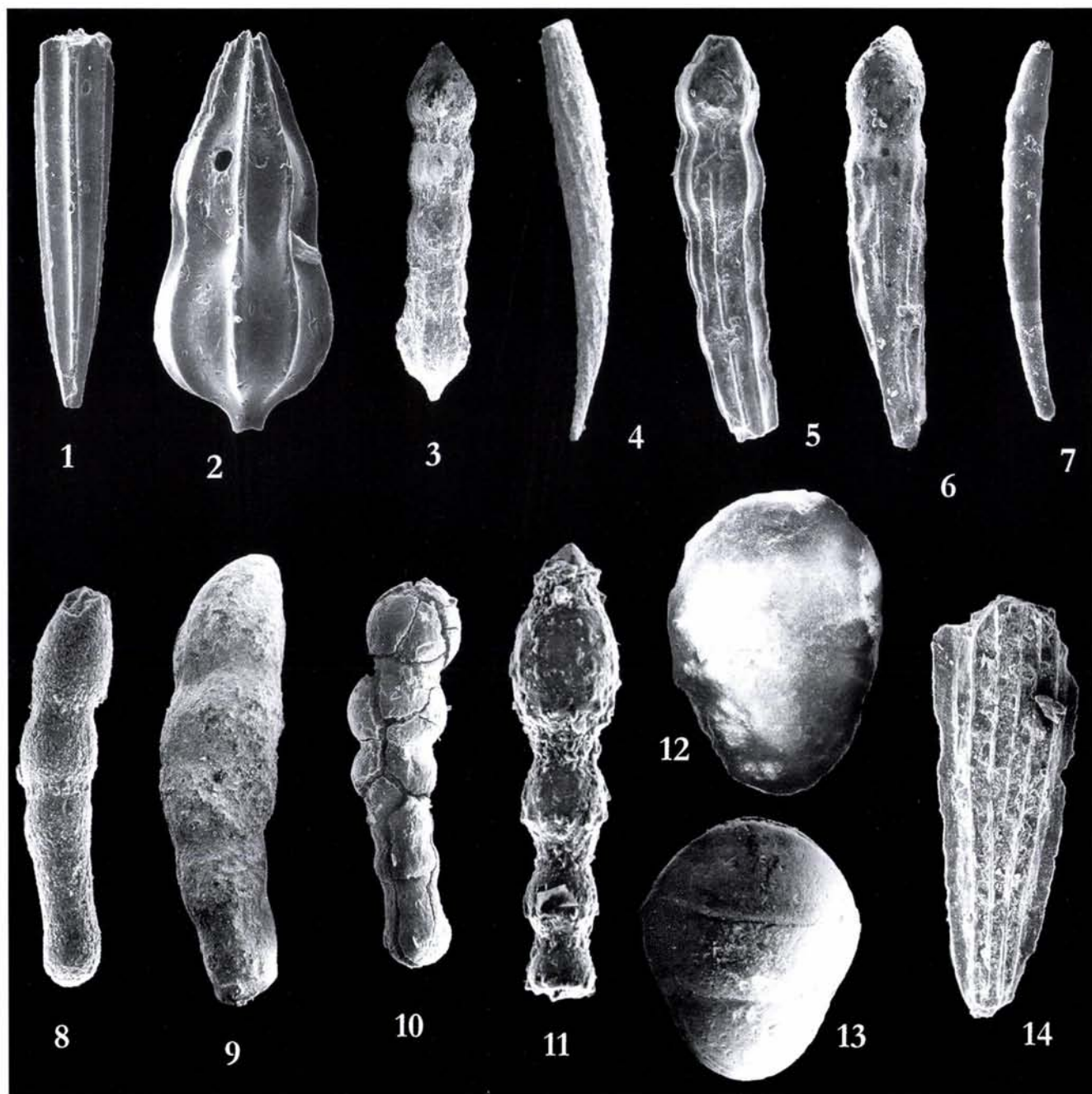
## Explanation to Plate I

- 1 *Nodosaria acuminata* HANTKEN, 1875. Taf. II, Fig. 9.
- 2 *Nodosaria bacilloides* HANTKEN, 1868. pl. I, fig. 9.
- 3 *Nodosaria budensis* HANTKEN, 1875. Taf. II, Fig. 10.
- 4 *Nodosaria (Dentalina) contorta* HANTKEN, 1868. pl. I, fig. 16.
- 5 *Dentalina Gumbeli* HANTKEN, 1875. Taf. IV, Fig. 1.
- 6 *Dentalina semilaevis* HANTKEN, 1875. Taf. IV, Fig. 6.
- 7 *Dentalina intermedia* HANTKEN, 1875. Taf. III, Fig. 4, 8.
- 8 *Dentalina simplex* HANTKEN, 1868. pl. I, fig. 11.
- 9 *Dentalina gigantea* HANTKEN, 1875. Taf. III, Fig. 15.
- 10 *Nodosaria (Dentalina) Reitzi* HANTKEN, 1868. pl. I, Fig. 13.
- 11 *Dentalina setosa* HANTKEN, 1875. Taf. XIII, Fig. 9.
- 12 *Lingulina glabra* HANTKEN, 1875. Taf. XIII, Fig. 14.
- 13 *Lingulina costata* D'ORBIGNY var. *seminuda* HANTKEN, 1875. Taf. IV, Fig. 8.
- 14 *Flabellina striata* HANTKEN, 1875. Taf. XIII, Fig. 13.

(All figures are copied from HANTKEN's original publications.)



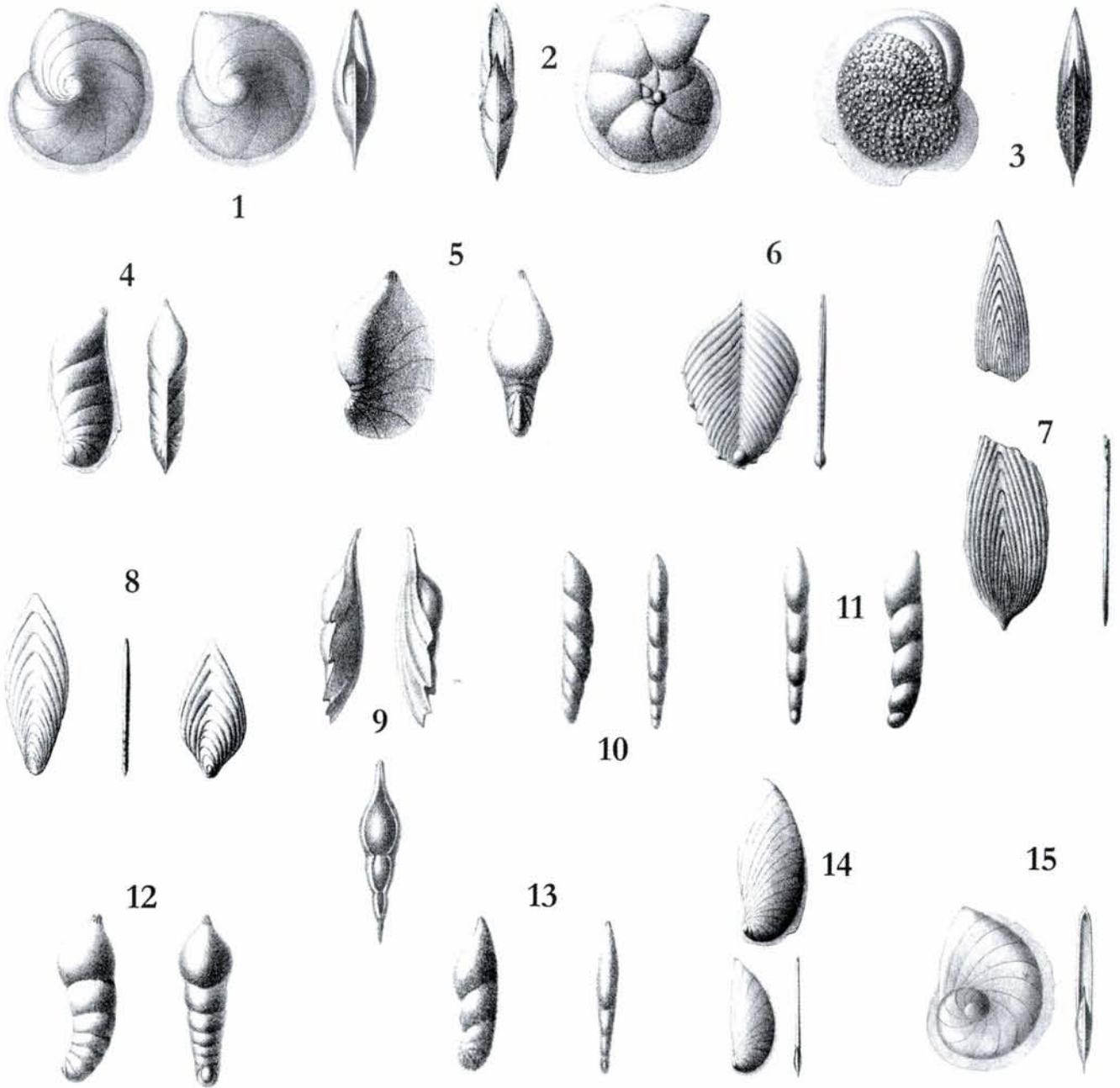
## Plate II



## Explanation to Plate II

- 1 *Dentalina acuminata* (HANTKEN) — ×33; Neotype. Eger, Kiséged-hill, Kiscell Clay, Upper Kiscellian.
- 2 *Dentalina bacilloides* (HANTKEN) — ×34; Neotype. Törökbálint, brickyard, Kiscell Clay Formation, Upper Kiscellian.
- 3 *Dentalina budensis* (HANTKEN) — ×30; Neotype. Pilisborosjenő, brickyard, Kiscell Clay Formation, Upper Kiscellian.
- 4 *Dentalina contorta* (HANTKEN) — ×36; Paralectotype. Pilisborosjenő, brickyard, Kiscell Clay Formation, Upper Kiscellian.
- 5 *Dentalina guembeli* (HANTKEN) — ×18; Neotype. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.
- 6 *Dentalina semilaevis* (HANTKEN) — ×38; Paralectotype. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.
- 7 *Laevidentalina intermedia* (HANTKEN) — ×37; Neotype. Noszvaj, Síkfőkút, upper part of Buda Marl Formation, Lower Kiscellian.
- 8 *Laevidentalina simplex* (HANTKEN) — ×80; Neotype. Pilisborosjenő, Kiscell Clay Formation, Upper Kiscellian.
- 9 *Nodosaria gigantea* (HANTKEN) — ×18; Lectotype. Budapest, Kis-Sváb-hegy, lower part of the Buda Marl Formation, Upper Eocene.
- 10 *Nodosaria reitzi* (HANTKEN) — ×79; Neotype. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.
- 11 *Nodosaria setosa* (HANTKEN) — ×120; Neotype. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.
- 12 *Lingulina glabra* HANTKEN — ×38; Lectotype. Budapest, Vár-hegy, Buda Marl Formation, Upper Eocene.
- 13 *Lingulina seminuda* HANTKEN — ×48; Neotype. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.
- 14 *Plectofrondicularia striata* (HANTKEN) — Neotype. Noszvaj, Síkfőkút, Buda Marl Formation, Upper Eocene.

## Plate III

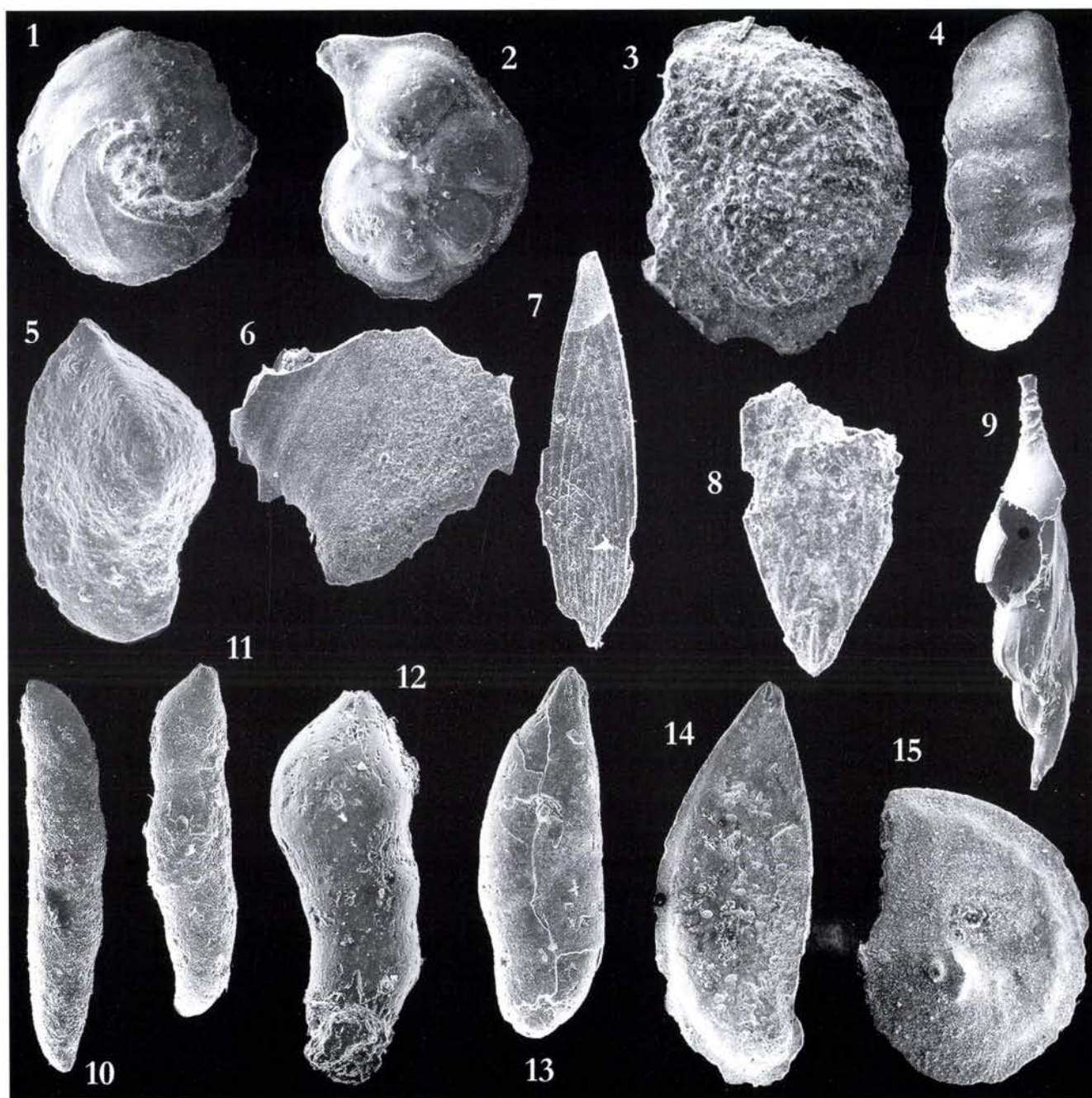


## Explanation to Plate III

- 1 *Cristellaria (Robulina) arcuato-striata* HANTKEN, 1868. pl. II, fig. 30.
  - 2 *Robulina budensis* HANTKEN, 1875. Taf. VII, Fig. 1.
  - 3 *Robulina granulata* HANTKEN, 1875. Taf. XIV, Fig. 15.
  - 4 *Cristellaria Schwageri* HANTKEN, 1875. Taf. V, Fig. 11.
  - 5 *Cristellaria propinqua* HANTKEN, 1875. Taf. V, Fig. 4.
  - 6 *Frondicularia superba* HANTKEN, 1875. Taf. IV, Fig. 16.
  - 7 *Frondicularia tenuissima* HANTKEN, 1875. Taf. XIII, Fig. 11
  - 8 *Flabellina budensis* HANTKEN, 1875. Taf. IV, Fig. 17.
  - 9 *Cristellaria (Marginulina) tunicata* HANTKEN, 1868. pl. I, fig. 24.
  - 10 *Marginulina budensis* HANTKEN, 1875. Taf. XIV, Fig. 5.
  - 11 *Marginulina indifferens* HANTKEN, 1875. Taf. IV, Fig. 14.
  - 12 *Marginulina splendens* HANTKEN, 1875. Taf. IV, Fig. 11.
  - 13 *Cristellaria minuta* HANTKEN, 1875. Taf. XIV, Fig. 7.
  - 14 *Cristellaria nummulitica* GÜMBEL var. HANTKEN, 1875. Taf. VI, Fig. 4.
  - 15 *Cristellaria (Robulina) Kubinyii* HANTKEN, 1868. pl. II, fig. 29.
- (All figures are copied from HANTKEN's original publications.)



## Plate IV

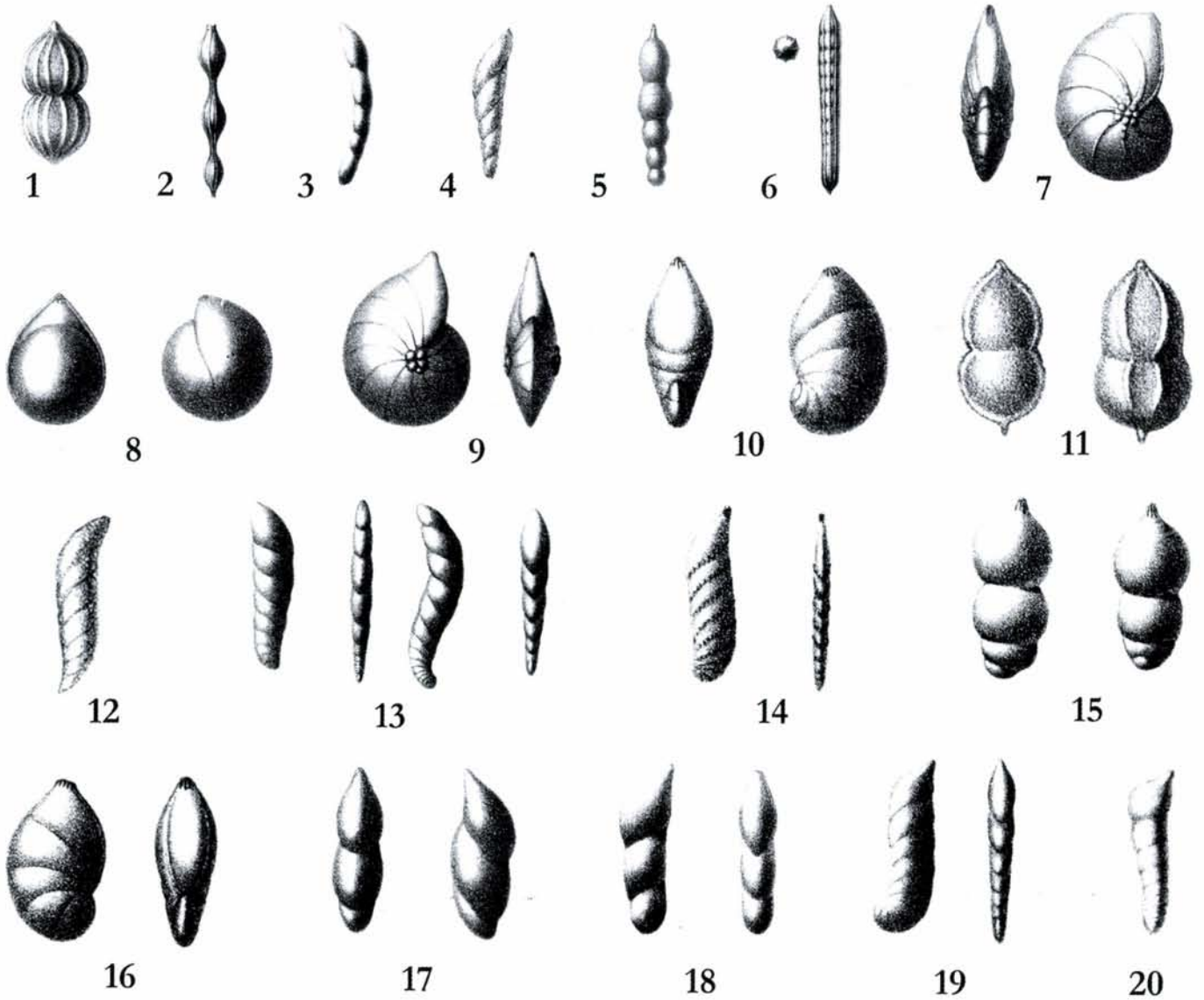


## Explanation to Plate IV

- 1 *Lenticulina arcuatostrata* (HANTKEN) — ×32; Paralectotype. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.
- 2 *Lenticulina budensis* (HANTKEN) — ×44; Paralectotype. Budapest, Újlak, Kiscell Clay, Upper Kiscellian.
- 3 *Lenticulina granulata* (HANTKEN) — ×36; Paralectotype. Porva, Padrag Marl Formation, Middle Eocene.
- 4 *Percultazonaria schwageri* (HANTKEN) — ×32; Paralectotype. Kis-Sváb-hegy, Buda Marl Formation, Upper Eocene.
- 5 *Saraceneria propinqua* (HANTKEN) — ×76; Neotype. Novaj, Nyárjas, Kiscell Clay Formation, Upper Kiscellian.
- 6 *Frondovaginulina superba* (HANTKEN) — ×38; Neotype. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.
- 7 *Frondovaginulina tenuissima* (HANTKEN) — ×106; Topotype. Noszvaj, Sikfökút, Buda Marl Formation, Upper Eocene
- 8 *Palmula budensis* (HANTKEN) — ×98; Neotype. Pilisborosjenő, brickyard, Kiscell Clay Formation, Upper Kiscellian.
- 9 *Amphicoryna tunicata* (HANTKEN) — ×138; Neotype. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.
- 10 *Astaculus budensis* (HANTKEN) — ×28; Neotype. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.
- 11 *Astaculus indifferens* (HANTKEN) — ×95; Neotype. Budapest, VIII/1 borehole, 25 m, Kiscell Clay Formation, Upper Kiscellian.
- 12 *Hemirobulina splendens* (HANTKEN) — ×88; Neotype. Pilisborosjenő, brickyard, Kiscell Clay Formation, Upper Kiscellian
- 13 *Vaginulinopsis minutus* (HANTKEN) — ×173; Neotype. Pilisborosjenő, brickyard, Kiscell Clay Formation, Upper Kiscellian.
- 14 *Planularia karolyi* CICHA & RÖGL — ×22; Budapest-Újlak, Kiscell Clay Formation, Upper Kiscellian.
- 15 *Planularia kubinyii* (HANTKEN) — ×22; Paralectotype. Budapest, Újlak, Kiscell Clay Formation, Upper Kiscellian.



## Plate V



## Explanation to Plate V

- 1 *Dentalina crassa* (HANTKEN, 1868) — HANTKEN, p. 86, pl. I, fig. 15.
  - 2 *Grigelis coarctata* (HANTKEN, 1875) — HANTKEN, S. 24, Taf. XII, Fig. 15.
  - 3 *Laevidentalina budensis* (HANTKEN, 1875) — HANTKEN, S. 34, Taf. III, Fig. 12.
  - 4 *Laevidentalina debilis* (HANTKEN, 1868) — HANTKEN, p. 88, pl. II, fig. 27.
  - 5 *Nodosaria karreri* HANTKEN, 1868 — HANTKEN, p. 85, pl. I, fig. 8.
  - 6 *Pyramidulina minor* (HANTKEN, 1875) — HANTKEN, p. 21, pl. II, fig. 7.
  - 7 *Lenticulina baconica* (HANTKEN, 1875) — HANTKEN, S. 58, Taf. XIV, Fig. 9.
  - 8 *Lenticulina bullata* (HANTKEN, 1875) — HANTKEN, S. 58, Taf. XIV, Fig. 13.
  - 9 *Lenticulina porvaensis* (HANTKEN, 1875) — HANTKEN H, S. 58, Taf. XIV, Fig. 11.
  - 10 *Saracenaria minima* (HANTKEN, 1875) — HANTKEN, S. 54, Taf. XIII, Fig. 21.
  - 11 *Amphicoryna (?) globosa* (HANTKEN, 1868) — HANTKEN, p. 91, pl. II, figs. 22a–b.
  - 12 *Astaculus complanatus* (HANTKEN, 1868) — HANTKEN H, p. 90, pl. II, fig. 28.
  - 13 *Astaculus irregularis* (HANTKEN, 1875) — HANTKEN, S. 50, Taf. XIV, Fig. 2, 3.
  - 14 *Astaculus porvaensis* (HANTKEN, 1875) — HANTKEN, S. 50, Taf. XIV, Fig. 1.
  - 15 *Hemirobulina hantkeni* (BANDY, 1949) — HANTKEN, S. 46, Taf. IV, Fig. 10.
  - 16 *Hemirobulina ornata* (HANTKEN, 1875) — HANTKEN, S. 54, Taf. XIII, Fig. 19.
  - 17 *Hemirobulina pauciloculata* (HANTKEN, 1875) — HANTKEN, S. 47, Taf. XIV, Fig. 10.
  - 18 *Hemirobulina recta* (HANTKEN, 1875) — HANTKEN, S. 47, Taf. IV, Fig. 15.
  - 19 *Vaginulinopsis elegans* (HANTKEN, 1875) — HANTKEN, S. 88, Taf. XIV, Fig. 4.
  - 20 *Vaginulinopsis subregularis* (HANTKEN, 1868) — HANTKEN, p. 90, pl. I, fig. 20.
- (All figures are copied from HANTKEN's original publications.)