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Late Eocene benthic foraminiferal fauna from clastic sequence of the Socka - Dobrna area and its chronostratigraphic importance (Slovenia)

Poznoeocenska bentična foraminiferna favna iz klastičnega zaporedja med Socko in Dobrno in njen kronostratigrafski pomen

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Ključne besede: bentične foraminifere, zgornji eocen, priabonij, soteške plasti, Socka, Dobrna, Slovenija

Abstract

We surveyed, sampled and described Late Eocene (Priabonian) benthic foraminiferal fauna from two sections in the type locality of the Socka beds, between Socka and Dobrna. We present a short history of research of these beds emphasising their dating, from the middle of 19th century on. We describe the lithological characteristics and lithostratigraphy of the sections. In total 118 taxa of benthic foraminifers were identified, and the Priabonian age of the Soca beds established.

Kratka vsebina

V članku obravnavamo pozno eocensko (priabonijsko) bentično foraminiferno favno iz dveh profilov, ki smo ju posneli in vzorčevali na tipičnem ozemlju soteških plasti med Socko in Dobrno. V uvodu je predstavljena kratka zgodovina raziskovanj soteških plasti, predvsem problem njihove starosti, od sredine 19. stoletja do danes. Opisane so litološke značilnosti in litostratigrafija obeh profilov. Skupno je bilo določenih 118 taksonov bentičnih foraminifer in ugotovljena priabonijska starost soteških plasti.

Introduction

This paper contains only a portion of a broader Geological Survey of Slovenia project, **Tertiary Tectofacies of the Southern Karavanke Mountains**. Its goal was to describe and evaluate the stratigraphy of the Southern Karavanke Tertiary, the type locality of the Socka beds between Socka and Dobrna (Fig. 1), and to compare it with the stratigraphy in other Slovenian Tertiary tectonostratigraphic units. The history section was written by Bogomir Jelen, the lithologic and lithostratigraphic description of

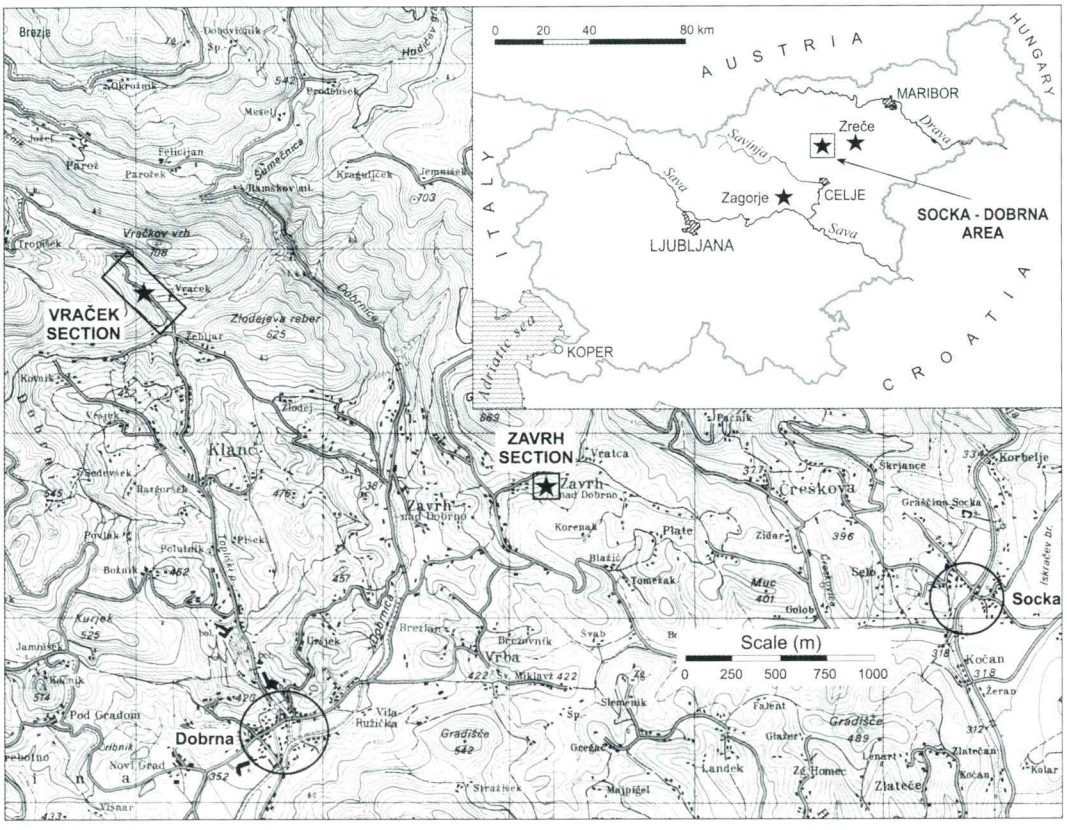


Fig. 1. Location map showing Socka-Dobrna area and detailed position of studied sections

sections by Dragomir Skaberne, and benthic foraminifers were described by Franc Cimerman.

Historical development of the problem

The problems associated with the stratigraphy of the Southern Karavanke Tertiary were recognized in the middle of the 19th century because of interest in the fast-growing coal industry. Coal exposures are not rare in basal Tertiary beds in central and eastern Slovenia, at that time a part of the Austrian-Hungarian Empire. These were targeted by geologists from the just established State Geological Survey in Vienna. Initially they distinguished between higher grade Glanzkohle (German term for bituminous and subbituminous coal in English terminology), which occurred in the northern coal belt between the Drava and Savinja rivers, and the lower grade brown coal from the southern belt between the Savinja and Sava rivers.

Morlot (1849a) was the first to assign an Eocene age to the basal coal-bearing strata at Socka and Dobrna in the northern coal belt, and in 1850 the Miocene age of the southern, brown coal-bearing strata (note that the Oligocene Formation was established later, in 1854). Morlot's (1849a) statement was based on Unger's opinion (in Morlot, 1849b) of an Eocene age of the Socka macroflora. Influenced by the paleobotanist Buch (1851), Morlot in 1853 changed his mind, and accepted a Miocene age for the Socka flora. Thus he started the painful flip-flopping leaps from one age of the Socka beds to another and back, which lasted for a century and a half. Ettingshausen (1853) noted that the fossil macroflora from the Zagorje locality in the southern coal belt was like the Eocene flora with many Miocene species.

Rolle (1857, 1858) first tackled "this hard problem" in his own words, after the introduction of the Oligocene as a new epoch between the Eocene and the Miocene Formations. He was not very successful, but he was probably the first researcher who used the term *Socka beds* (in German, Sotzka-Schichten; Rolle, 1858) for the basal Tertiary fresh water coal-bearing strata of the middle and northern coal belts. Namely, he introduced in the former north coal belt the middle coal belt, based on lithological differences and fossil content, but without evidence for age differentiation (Rolle, 1857). He (Rolle, 1858) assumed the Socka beds were Eocene and/or Oligocene in age. Ettingshausen (1858) published an article which revised Unger's flora and proposed a Late Eocene age of the Socka beds. Zollikofer (1859) stated that the coal-bearing strata of the southern coal belt are Oligocene. In contrast, in his 1861/1862 work in which Zollikofer dealt with the area east of the Savinja river, he dismissed the Oligocene age and subdivided the coal-bearing strata in the southern coal belt between the Eocene to Oligocene and the earliest Neogene age.

Ettingshausen (1872, 1877, 1885) dealt with the fossil leaf assemblages from the southern coal belt in detail. The assemblage from the coal footwall indicated a tropical, or at least subtropical climate, whereas the assemblage from the hangingwall indicated it formed in the temperate one. It followed that the tropical/subtropical flora corresponded to the Eocene, and the temperate flora to the Aquitanian. Stur (1864, 1871) advanced the idea that Socka and Eibiswald (in Slovene: Ivnik) beds from the southern rim of the Graz basin are of the same age, i.e. of Early Neogene age. He (Stur, 1871) was the first to extend the term of Socka beds to the southern coal belt under the name *Eibiswald and Socka beds*. Bittner (1884) stated concisely that it was previously known that the Tertiary succession of the southern belt consists of two main rock units: the lower coal-bearing Socka beds unit, which is most probably of Oligocene age, and the upper unit which corresponds to the Neogene development of the Vienna basin in Austria. Hoernes (1876, 1892) temporarily solved the question of the age of the coal-bearing strata at the base of the Tertiary system. In 1892 he formulated the following conclusions (paraphrased): 1) Socka beds, fresh water coal-bearing strata of the northern and middle coal belt belong to a much older stage than the coal-bearing strata of the southern belt. In the northern coal belt they partly belong to the Cretaceous Formation, which is more or less proved, while the age of the other part of northern and middle coal belt is still problematic. With regard to the underlying Cretaceous coal-bearing strata of the northern coal belt, they are not considerably younger, but Eocene in age. 2) The Oligocene coal-bearing strata in the southern coal belt have less in common with the Socka beds than they do with the Lower Miocene Eibiswald coal-bearing strata. Teller (1889,1896, 1898, 1907), expressed the opinion that Eocene deposits are completely missing. Tertiary deposits are divided into the Oligocene and the Miocene "lithostratigraphic" units. The coal-bearing strata comprise the youngest unit of the Oligocene succession in the northern, middle and southern coal belts.

Petrascheck (1926/1929) summarized existing stratigraphic ideas. He considered all coal-bearing strata at the base of the Tertiary System to be Socka beds and accepted their Oligocene age. Papp (1954, 1955) inferred the Chattian (Upper Oligocene) age from the *Miogypsina (Miogypsinoides)* cf. *formosensis* Jabe & Hanzawa and *Lepidocyclina (Nephrolepidina) tournoueri* (Lemoine & Douvillé) found in the conformable marine marly clay, overlying the Socka beds of the southern coal-belt. Kuščer (1955) proposed the idea that the Chattian rocks were missing in the southern coal belt. Szöts (1956) reasoned that the Chattian stage was the equivalent of the Aquitanian stage, therefore, according to him, the Socka beds were of the Aquitanian, i.e. of Early Miocene age, with Oligocene layers completely missing. Rijavec (1958) followed Papp's view. Majzon (1958) argued for a Lattorfian (Lower Oligocene) age of the Socka beds. Thenius (1959) was convinced that *Anthracotherium illyricum* Teller and *Miogypsina (Miogypsinoides)* cf. *formosensis* Jabe & Hanzawa indicated the (late) Stampian (late Chattian) age of the Socka beds in the southern coal belt.

Kuščer's (1967) stratigraphic positional relationship scheme was based on the Rupe-

lian (Middle Oligocene) age of the Socka beds and the conformable overlying marine marly clay in the southern and middle coal belts. Their age was determined by the characteristic benthic microforaminiferal taxa accompanying *Tritaxia szaboi* (Hantken) from the marine marly clay which exhibited a close similarity with the Middle Oligocene (at that time Rupelian) microforaminiferal fauna of Hungary and Transylvania (NW Rumania). Then, in 1975, Papp came forth with new taxonomic results: his *Miogypsina (Miogypsinoides) formosensis* Jabe & Hanzawa and *Miogypsina (Miogypsinoides) bantamensis* Tan Sin Hok from the marine marly clay overlying Socka beds in the southern coal belt indicated a late Early Egerian (= late Chattian, Late Oligocene) age. From the map of Mioč & Žnidarčič (1977), one can conclude that at the Socka site, the coal-bearing strata are Helvetian s.l. in age – equivalent to Ottnangian/Karpatian. Cimerman (1979) kept the Rupelian age for the "Socka" beds in the southern coal belt. He (ibid.) stated that the use of term *Socka beds* in the southern coal belt is not justified and proposed to write Socka in quotation marks – "Socka" beds. The same year saw revival of the idea of Eocene age deposits in central Slovenia. Mikuž (1979) advanced the thesis that the Socka beds of the western Southern Karavanke Mts. (middle coal belt) were not Rupelian, but Middle Eocene in age.

Drobne et al. (1979) published a Late Eocene age of a very small limestone patch in the eastern Southern Karavanke Mts. Mioč (1978) distinguished between the Middle Oligocene and the Helvetian s. l. Socka beds in the Socka-Dobrna type area. Buser (1979) and Premru (1983) retained the Middle Oligocene (Rupelian) age of the southern coal belt Socka beds, while Buser allowed their Eocene age in the middle coal belt, though not naming them as such. Aničić & Juriša (1985a) avoided the term *Socka beds*. In the southern coal belt Aničić & Juriša (1985a, b) recognized both, the Middle Oligocene (Rupelian) and the Late Oligocene (Chattian) coal-bearing strata. In the middle coal belt, Aničić & Juriša (1985a, b) assigned the Helvetian s.l. age to the basal coal-bearing strata, remarking that an older age was possible. Baldi (1984) correlated the Socka beds with the nanoplakton zone NP 23, (Rupelian). Drobne et al. (1985) correlated the Socka beds of the western Southern Karavanke Mts. (middle coal belt) with the late Middle Eocene, and the Socka beds of the southern coal belt with the Early Oligocene NP 21/22.

Hamrla (1987) presented a detailed stratigraphy of the Zreče area in the northern coal belt. He distinguished between the Late Cretaceous, older Paleogene and Helvetian s.l. coal-bearing beds. However, Brezigar (in Brezigar et al. 1988) was the first to speculate about the Eocene age of the Socka beds in the whole Southern Karavanke geotectonic unit, and thought that the Tertiary stratigraphy might be different within the Southern Karavanke and Savinja Alps geotectonic units. Royden & Baldi (1988) once again correlated the Socka beds of the middle and southern coal belt with the NP 23 zone. In the same year Mihajlović & Jungwirth (1988) also placed the Socka beds of the southern coal belt into the NP 23 zone, as did Pavšič and Jelen (in Jelen et al., 1990). Csontos et al. (1992) considered the lithothamnium limestone at the base of the Tertiary succession in the southern coal belt to be Late Eocene, followed by a gap between it and the overlying "Socka" beds of the NP 23 zone. In 1992, our working group, dedicated to solving the problem of this high stratigraphic inconsistency, published the first note on its work (Jelen et al., 1992).

The above summary shows how confusing and instable the position of the basal Tertiary coal-bearing strata was. Since each change in their age attribution resulted into changes in age upsection, and accordingly a revision of their stratigraphical relationships, we can understand how critical the drastic age inconsistency of the basal coal-bearing strata was.

The problem was to find a solution to the issue or, how to get the key to go to the root of the problem that had been baffling so many past workers.

The first palynological inspection of the coal-bearing strata at the base of the Tertiary successions showed great differences in the composition of palynological assemblages from the northern, the middle, and the southern coal belts (Jelen, unpublished). After palynological analysis we applied a structural-stratigraphic modelling to

establish an as much as possible flawless lithochronology of the middle coal belt, in which the Socka-Dobrna type area is situated. Luckily, in the type area the lithochronology could be satisfactorily established. Sampling was first performed in successions where the lithochronology was considered to be well established. Foraminiferal samples were collected from one metre long trenches in 1-metre intervals, if outcrop conditions were favourable, or at each metre, if considered necessary. In addition, we developed a new laboratory preparation method that allowed us to recover highly concentrated foraminifers (Jelen, unpublished).

Lithology and lithostratigraphy in the Vraček section area

The composite Vraček section (Vr/I and Vr/II) is situated north of Dobrna, south of Vračkov vrh (708m), along the way from the Žebljar farm north of the Klanec village toward the Trojnšek farm (Figs. 1, 2a). This area is more structuraly complex than was expected at the beginning of field work.

Tectonically disturbed limestones and pyroclastic rocks of Triassic age and older Eocene limestones are overlain by Upper Priabonian (Jelen et al., 2000), mostly clastic sedimentary rocks. The contact is partly tectonized. Eocene beds were folded together with basement rocks. All units are unconformably overlain by Miocene coarse-grained rocks with remains of ostrean valves of the Klanec beds and sandy marly rocks of the Dobrna marl.

Eocene beds are slightly bent into a syncline. The area is cut by several Dinaric (NW – SE), subvertical, sinistral faults into narrow, 20 to 60 m wide bands or wedges. Within the bands the Eocene marly beds are compressed, crushed and fissile. Fissility is steep and chiefly fault-parallel. In non-fissil parts, the rocks are predominantly massive, in places faintly laminated. The section comprises somewhat more than 200 m of the Eocene beds.

In the first, shorter segment of section, which is separated from the second main segment by a fault, Eocene rocks occur on tectonically disturbed green volcaniclastic rocks (tuffs, tuffites with thin intercalations of dark grey biomicritic limestones) of presumably Middle Triassic age.

The Eocene succession starts with a one meter thick, prevailingly light to medium grey fine-crystalline dolomite (unit **1** on Fig. 2a). The rock contains lenses, laminae and thin layers of xylitic coal, 2 mm to 5 cm thick in its lower half. In the upper part traces of plant root systems can be seen as well as limonitized, originally pyritic concretions.

The dolomitic bed is followed by a 1.7 m thick clayey coal interval (unit **2** on Fig. 2a). It consists of 5 to 30 cm thick layers of carbargillitic, detritic and xylitic coal and two 2 to 5 cm thick predominantly clayey beds with a lower content of organic, coaly components.

Above the coaly interval follows a dark yellowish brown, somewhat weathered, marly silty shale of weakly expressed parallel lamination (unit **3** on Fig. 2a) The rock can be compared to weathered yellowish grey marly silty shale at the beginning of the second, main part of the section. That rock is 14 m thick, it overlies the tectonized limestone with numerous calcitic veins, and is probably Triassic in age.

In the second part of the section, the yellow grey marly silty shale passes into brownish grey to dark brownish massive silty marlstone (unit **4** on Fig. 2a) approximately 20 m thick. It contains numerous ostracods and occasional bivalve and gastropod shells.

The dark brownish massive silty marlstone passes into yellowish grey, somewhat weathered marly silty shale (unit **5** on Fig. 2a) comprising a thickness of 7 m, up to the contact with a limestone lens.

The limestone lens (unit **6** on Fig. 2a) is 5.2 m thick and can be genetically divided in two parts. The lower part, 4.2 m thick, bordering along a sharp contact on the underlying yellowish grey marly silty shale, was macroscopically subdivided into three sequences. They start with up to 15 cm thick layers of calcirudite with angular clasts of intramicrite and biointramicrite up to 4 cm in size. On the lower side of these layers and within overlying macroscopically homogeneous, 0.7 to 2.4 m thick intervals of biomicritic limestone stylolites parallel to bedding are visible. In the upper part the lens is terminated with a 1.2 m thick normally graded carbonate turbiditic sequence.

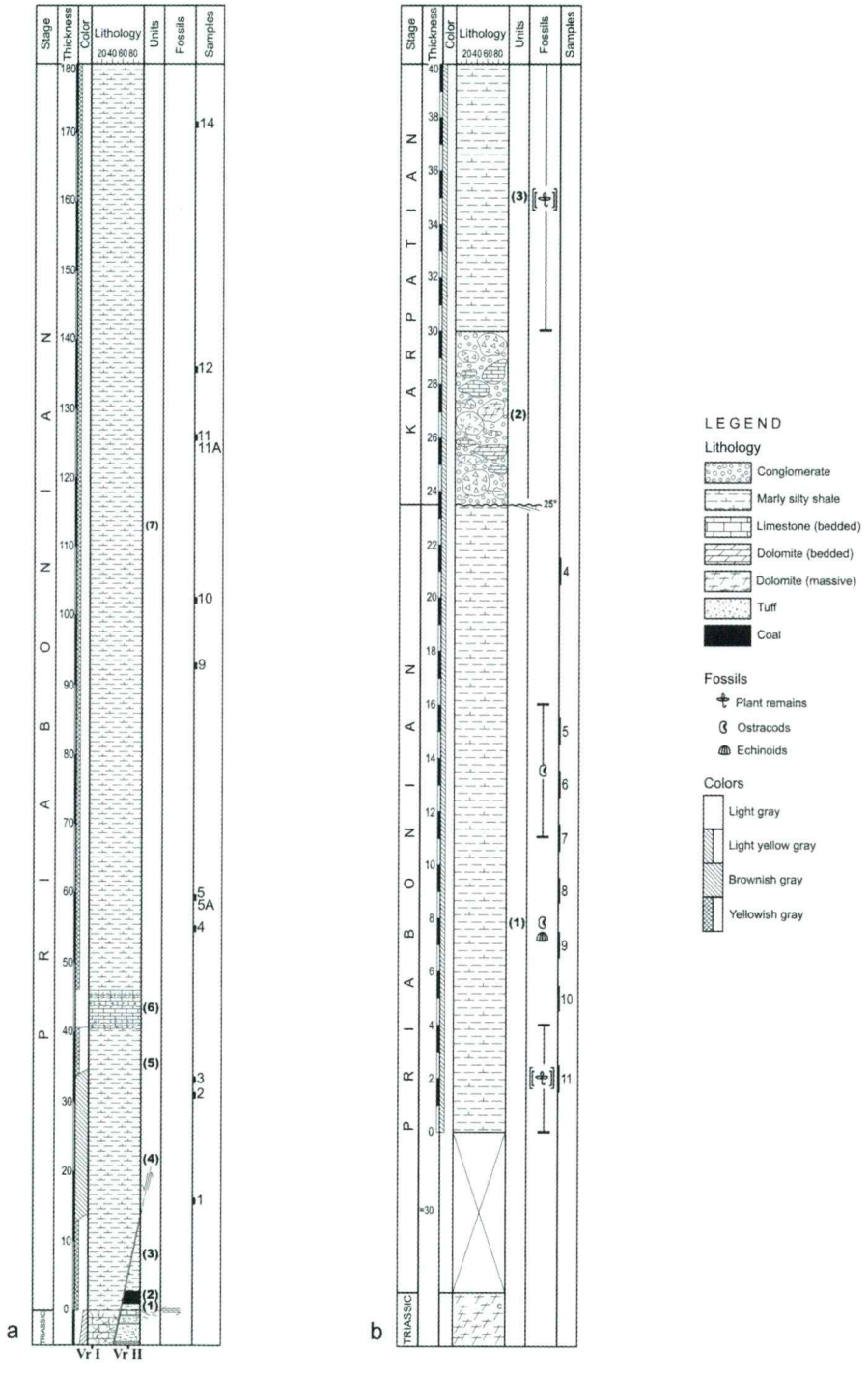


Fig. 2. Stratigraphic columns of:
a) Vraček section (Vr I and Vr II)
b) Zavrh section (Zv II). Karpatian part was also determined by foraminifers but this is not a topic of this article

Above the limestone lens lies a medium to light grey, partly weathered yellowish grey, tectonically disturbed marly silty shale (unit **7** on Fig. 2a). Macrofossils are rare. In places rare plant remains can be found. In the section above the limestone lens more than 150 m of real thickness of these rocks are comprised.

The lithostratigraphically highest part of marly rocks (of lithostratigraphic unit **7**) in the Vraček section is exposed in the Zavrh area, where it was covered with the Zavrh (Zv) section.

Lithology and lithostratigraphy in the Zavrh section area

The Zavrh (Zv) section is situated between Zavrh and Črešková in the area of the Vratca settlement (Figs. 1, 2b). The lower part of Tertiary beds to pre-Tertiary rocks is covered. Along the cartway leading to Črešková, however, they are abundantly exposed. Approximately parallel to the section a fault passes in the NW-SE direction. The horizontal component of the dextral displacement along the fault amounts to about 27 m.

The contact between the pre-Tertiary basement and Tertiary rocks is tectonical. In the basement a crystalline dolomite (dolosparite) occurs, on which erosional remains of red, probably weathered muddy rocks occur higher in the slope. The Tertiary sequence starts with a light grey silty clay. The thickness of the covered part of Tertiary rocks is an estimated 30 m. In rare outcrops, a grey massive to slightly laminated silty marlstone with rare plant remains occurs. The rock is brownish weathered and exhibits spheroidal parting. In the lower part occur rare, up to 0.1m thick layers of biodolomicrite with terrigenous admixture.

In the area of the carefully logged Zavrh (Zv/II) section there is a weathered light yelow grey silty marlstone with poorly expressed lamination in its lower part (unit **1** on Fig. 2b). Additionally, there are plant remains among the fossils, and in the middle part ostracods and rare echinoderm fragments. We found no fossils in the upper portion of Zv/II.

Following an angular discordance (25^0), a 6.5 m thick lenticular body of blocky conglomerate (unit **2** on Fig. 2b) overlies the silty marlstone. The blocky conglomerate is cut off in the SW by the aforementioned fault that passes parallel to the section. Toward the NE the conglomerate thins and becomes finer grained. It contains numerous fossil fragments: of red algae (lithothamnia), bivalves, bryozoans, echinoderms and of other organisms. The blocky conglomerate consists of approximately 75% blocks and pebbles and 25% of muddy matrix. Blocks and pebbles range in size from 1 to 100 cm, on an average 20 cm, and are very poorly sorted. The size distribution of pebbles and blocks is bimodal. The first mode is in the range from 1 to 20 cm, and the second one in the 30 to 100 cm range. Nineteen blocks, 20 cm or more in size, and 4 smaller pebbles were examined microscopically. In these we recognized 11 lithofacies, represented in 1 to 4 blocks or pebbles: dolomitic breccia with limonitized dolomicritic cement, dolomicrosparite with brecciated structure, crystalline dolosparite, dolomitized biomicrite, altered crystallolithic (andesitic) volcaniclastic rock, calcareous dolomite breccia, calcitic micaceous quartzy very fine-grained sandstone, partly recrystallized volcanic glass with microliths, recrystallized intrabiomicrite, intrabiomicrite with admixture of terrigenous components, and biopeldolomicrite. Blocks and pebbles are of Triassic to inclusively Eocene age, and are derived in part directly from the underlying rocks.

The blocky conglomerate is followed at the end of the section by monotonous parallelly laminated, slightly micaceous marly silty shale (unit **3** on Fig. 2b) with rare up to 1mm thick lenses of very fine-grained sandstone. Along with rare plant remains, visibile with naked eye, there is also a foraminiferal fauna.

Benthic foraminiferal fauna from the Socka beds

Eocene benthic foraminifers from Vraček II (Vr/II-) and Zavrh II (Zv/II-) sections were studied. In the two sections a total of 118 taxa were determined, belonging to 85 genera and 53 families.

Vraček II

From the VRAČEK II section (Fig. 2a) 12 samples (Vr/II-001, 002, 003, 004, 005, 005A,

009, 010, 011, 011A, 012, 014) were analyzed. In the section occur 107 taxa, out of them 49 only here. The highest number of taxa, 53, were found in sample Vr-005A, 39 in sample Vr-005, and in the remaining samples from 2 to 29 taxa.

Zavrh II

From the ZAVRH II section (Fig. 2b) 8 samples were analyzed, (Zv/II-011, 010, 009, 008, 007, 006, 005, 004, samples in sections are numbered in stratigraphic order, from the bottom upwards). In the section occur 75 taxa, of them 12 only here. The maximum taxa number was found in Zv/II-6, 37, and the smallest in the uppermost collected sample Zv/II-004, only 6; otherwise the number of taxa varies in a sample between 21 and 37.

Ecological interpretation of foraminiferal fauna

In samples Vr/II-001, 002 no foraminifers are present, only ostracods. The first foraminifers appear in sample Vr/II-003 as individual hauerinids: *Quinqueloculina* sp. 3 and *Pyrgo subsphaerica* (d'Orbigny). This part of the Vraček II section represents the passage from fresh water or brackish environment into a marine setting. Foraminifers become more numerous in sample Vr/II-004, which is entirely marine. The Zv II section is wholly marine. In samples Vr/II-004, 005, 005A the following large foraminiferal genera occur: *Heterostegina* sp., *Operculina* cf. *gomezi* (two juvenile forms), *Discocyclina trabayensis vicenzensis* (this species was determined by Vlasta Ćosović), *Asterocyclina* sp., *Eoannularia eocenica*, and the large miliolid *Borelis vonderschmitti*. The species *Calcarina lecalvezae* was established in both sections (Vr-014, Zv-009). These are shallow marine species, and are, according to their ecological characteristics, in contradiction with the remaining foraminiferal fauna in the same samples. Therefore we presume that the fauna was transported, washed out from shallower areas into the deeper sea. In the Vraček II section appears in marl a limestone lens with discocyclinas (the foraminiferal fauna has not yet been determined and interpreted). In Fig. 2a the lens is marked with number 6. Also at the Povlak farm, about 1km NW of Dobrna, an Eocene limestone with nummulites, discocyclinas, *Borelis*, and corals is exposed. The limestone at Povlak and the limestone lens at the Vraček II section may represent remains of sediments of the shallow sea from which the large foraminifers were redeposited. For some more frequent genera, Murray (1991, 288-290 and 323-326) reports ecological data from recent environments. Among them appear 20 genera that are identical to genera from our sections. For each of these genera the habitat extends from the shelf (either internal or external) to the bathyal. The shelf is indicated also by the miliolids (*Quinqueloculina*). The upper slope (200-2000 m) is indicated by genera *Ammobaculites, Bathysiphon, Karreriella, Repmanina, Textularia, Bulimina, Globocassidulina, Hoeglundina, Pullenia, Reussella, Trifarina and Uvigerina.* The genus *Laticarinina* that was found in both sections is an indicator of even greater bathyal depths. However, the observation of a relatively small number of planktonic forms is consistent with deposition of the sediments in the bathyal domain, but rather on the exernal shelf with a passage to the bathyal. According to the bathymetric interpretation of sediments at Biarritz (Gruenig & Herb, 1984) they were deposited in the realm extending from neritic to bathyal.

Comparison with Late Eocene faunas in Europe

By comparisons of the occurrence of the species in Vraček II and Zavrh II sections with those in other European localities of the Eocene (Possagno in north Italy, Buda marl in Hungary and Upper Eocene beds with *Tritaxia szaboi* in Hungary and Biarritz in France) we want to demonstrate the degree of similarity of our fauna with them.

In north Italy, Braga et al. (1975) established in Paleocene, and Lower and Middle Eocene at **Possagno** 99 benthic species, of which 10 (=8%) are also our species. From the Upper Eocene 126 benthic species were determined. Among these 13 (=11%) are found in our sections.

In the **Buda marl** Sztràkos (1982) established 471 forms of foraminifers, out of these 416 were determined to the species or subspecies level. 42 (=35%) of our species

are identical to those. From the Bartonian and Priabonian beds with *Tritaxia szaboi*, Sztràkos (1987) determined 429 species. Of these, 45 (=38%) are also our species.

The fauna from the **Biarritz** locality was investigated by Halkyard (1919), Gruenig & Herb (1984), Gruenig (1985) and Sztràkos (In: Mathelin & Sztràkos, 1993). Halkyard (1919) established the presence of 345 foraminiferal species. Gruenig (1985) determined 87 species. By far the most complete review was performed by Sztràkos (In: Mathelin & Sztràkos, 1993) who recorded 557 species. With the species from Biarritz 77 (=65%) species are identical, or two thirds of species from the Vraček II and Zavrh II sections are found in Biarritz. Outstanding among them is *Marginulina globosa* Halkyard. It was previously known only from Biarritz, and Halkyard's specimen was the only one of this species until Sztràkos found additional three individuals in the Aquitanian basin in beds of the zone with *Turborotalia cerroazulensis* s. l. (Middle Priabonian) (Sztràkos, 1993, 44. In: Mathelin & Sztràkos). The species is obviously very rare. Our find is from the third and easternmost locality. The species is interesting and important as an indicator of the connection of our Late Eocene sea toward the west.

Dating of the Socka beds

For dating the species of benthic foraminifers that are restricted to Eocene and that do not survive the Eocene-Oligocene boundary are critical. There are 22 such species (*Heterostegina* sp. does not belong to them) in our two sections:

Pavonitina biarritzensis
Dorothia fallax
Karrerotextularia olianensis
Sigmoilopsis bartoniensis
Borelis vonderschmitti
Reticulopalmula arborescens
Marginulina globosa
Spirolingulina acutimargo
Ceratocancris crassa
Lamarckina cristellaroides
Sporobulimina eocaena
Sagrinopsis aspera
Tubulogenerina tubulifera
Uvigerina chirana
Schlosserina asterites
Laticarinina altocamerata
Halkyardia minima
Melonis halkyardi
Eoannularia eocenica
Calcarina lecalvezae
Operculina cf. gomezi
Discocyclina trabayensis vicenzensis

Serra-Kiel et al. (1998) proposed the biozoning of the Paleocene and Eocene on the basis of shallow marine benthic foraminifers in 20 SB (shallow benthic) biozones. The last two biozones, SB 19 and SB 20, comprise the Priabonian (upper part of NP 18 to lowermost part of NP 21 or upper part of P 15 to P 17. After Serra-Kiel et al. 1998) Several species extend vertically through biozones, in our sections. These are:

- *Borelis vonderschmitti* which comprises the top part of SB 18, the whole SB 19 and lower part of SB 20
- *Operculina gomezi* covers the upper part of SB 18, entire SB 19 and entire SB20
- *Halkyardia minima* comprises the zones SB 15 to the end of SB 20
- *Discocyclina trabajensis vicenzensis* comprises SB 20
- *Calcarina lecalvezae* comprises the zones SB 17 and SB 18.

The authors of *Calcarina lecalvezae,* Boulanger & Poignant (1971, 96), report the for Upper Eocene for its range, but they also found it in the Upper Lutetian. *Heterostegina* is also stratigraphically important and is represented by a few individuals in the Vraček II section; it does not appear before the Priabonian (Hottinger, 1977, 142; Loeblich & Tappan, 1987, 684).

The most data for detailed dating could be obtained from planktic foraminifers. However, they are rare relative to benthic foraminifers. From samples Vr/II-005, 010, 011, 011A, 014 and Zv/II-009 Monique Toumarkine determined 15 planktic species belonging to four genera and three families. In a written communication she qualified them as species without great stratigraphic value, as for example *Catapsidrax dissimilis* (Cushman & Bermudez), *Globorotalia suteri* Bolli, the range of which extends from the Eocene into the Miocene. The other ones are globigerinas from the Eocene-Oligocene boundary. Only species*Turborotalia cerro-*

azulensis cerroazulensis (Cole) indicates a Late Eocene age. Foraminifers are not very well preserved, they are often deformed and their apertures filled with sediment.

The benthic and planktic foraminifers permit us to conclude that the beds in the Vraček II and Zavrh II sections are Priabonian in age, which also confirms the Priabonian age of the Socka beds.

Systematics

Order **FORAMINIFERIDA Eichwald, 1830**
Family: **Bathysiphonidae Avnimelech, 1952**

***Bathysiphon taurinensis* Sacco, 1893**
Pl. 1, Fig. 1

1893 *Bathysiphon taurinensis* - Sacco, p. 168, pl. 11, fig. 2 (Fide Ellis & Messina 1940)

1975 *Bathysiphon taurinense* Sacco - Popescu, p. 32, pl. 1, fig. 2

Locality: Vr-005, Vr-005A, Zv-008, Zv-009, Zv-011

Family: **Ammodiscidae Reuss, 1862**

***Repmanina charoides* (Jones & Parker), 1860**

1860 *Trochammina squamata* Jones & Parker var. *charoides* - Jones & Parker, p. 304 (Fide Ellis & Messina 1940)

1982 *Glomospira charoides* (Jones & Parker) - Foraminiferi padani, pl. 1, fig. 3

1975 *Glomospira charoides* (Jones & Parker) - Braga et. al., p. 102

Locality: Zv-010

Family: **Lituolidae de Blaiville, 1827**

***Ammobaculites agglutinans* (d'Orbigny), 1846**
Pl. 1, Figs. 2-3

1846 *Spirolina agglutinans* - d'Orbigny, p. 137, pl. 7, figs. 10-12

1985 *Ammobaculites agglutinans* (d'Orbigny) - Papp & Schmid, p. 196, pl. 45, figs. 6-9

1985 *Haplophragmoides - Ammobaculites* sp. - Grünig, p. 255, pl. 1, figs. 10-12

1993 *Ammobaculites agglutinans* (d'Orbigny) - Sztràkos (In: Mathelin & Sztràkos), p. 73, pl. 1, fig. 15

Locality: Vr-012

Family: **Spiroplectamminidae Cushman, 1927**

***Spiroplectinella dalmatina* (de Witt Puyt), 1941**
Pl. 1, Fig. 4

1941 *Textularia dalmatina* - de Witt Puyt, p. 45, pl. 1, figs. 4-5

1975 *Spiroplectammina dalmatina* (de Witt Puyt) - Braga et al., p. 102

1985 *Spiroplectammina dalmatina* (de Witt Puyt) - Grünig, p. 256, pl. 2, figs. 1-4

Locality: Vr-010, Zv-008, Zv-009

***Vulvulina haeringensis* (Gümbel), 1868**
Pl. 1, Fig. 6

1868 *Venilina haeringensis* - Gümbel, p. 71, pl. 2, fig. 84

1975 *Vulvulina haeringensis* (Gümbel) - Braga et al., p 91, pl. 1, figs. 4, 23; p. 102

1985 *Vulvulina haeringensis* (Gümbel) - Grünig, p. 256, pl. 2, figs. 10-12

1993 *Vulvulina haeringensis* (Gümbel) - Sztràkos (In: Mathelin & Sztràkos), p. 73, pl. 2, fig. 12

Locality: Vr-004, Vr-005, Vr-005A, Vr-009, Vr-011, Vr-012, Zv-006, Zv-008

Family: **Pavonitinidae Loeblich & Tappan, 1961**

***Pavonitina biarritzensis* Sztràkos, 1987**
Pl. 1, Figs. 7-8

1987b *Pavonitina biarritzensis* - Sztràkos, p. 129, pl. 1, figs. 1-3, pl. 3, figs. 1-3, textfig. 1

1993 *Pavonitina biarritzensis* Sztràkos - Sztràkos (In: Mathelin & Sztràkos), p. 73, pl. 24, fig. 5

Locality: Vr-005A, Zv-005, Zv-006, Zv-008, Zv-010, Zv-011

Family: **Prolixoplectidae Loeblich & Tappan, 1985**

***Plectina dalmatina* (Schubert), 1811**
Pl. 1, Figs. 9-10

1911 *Gaudryina dalmatina* Schubert - Liebus, p. 75, pl. 3, fig. 5

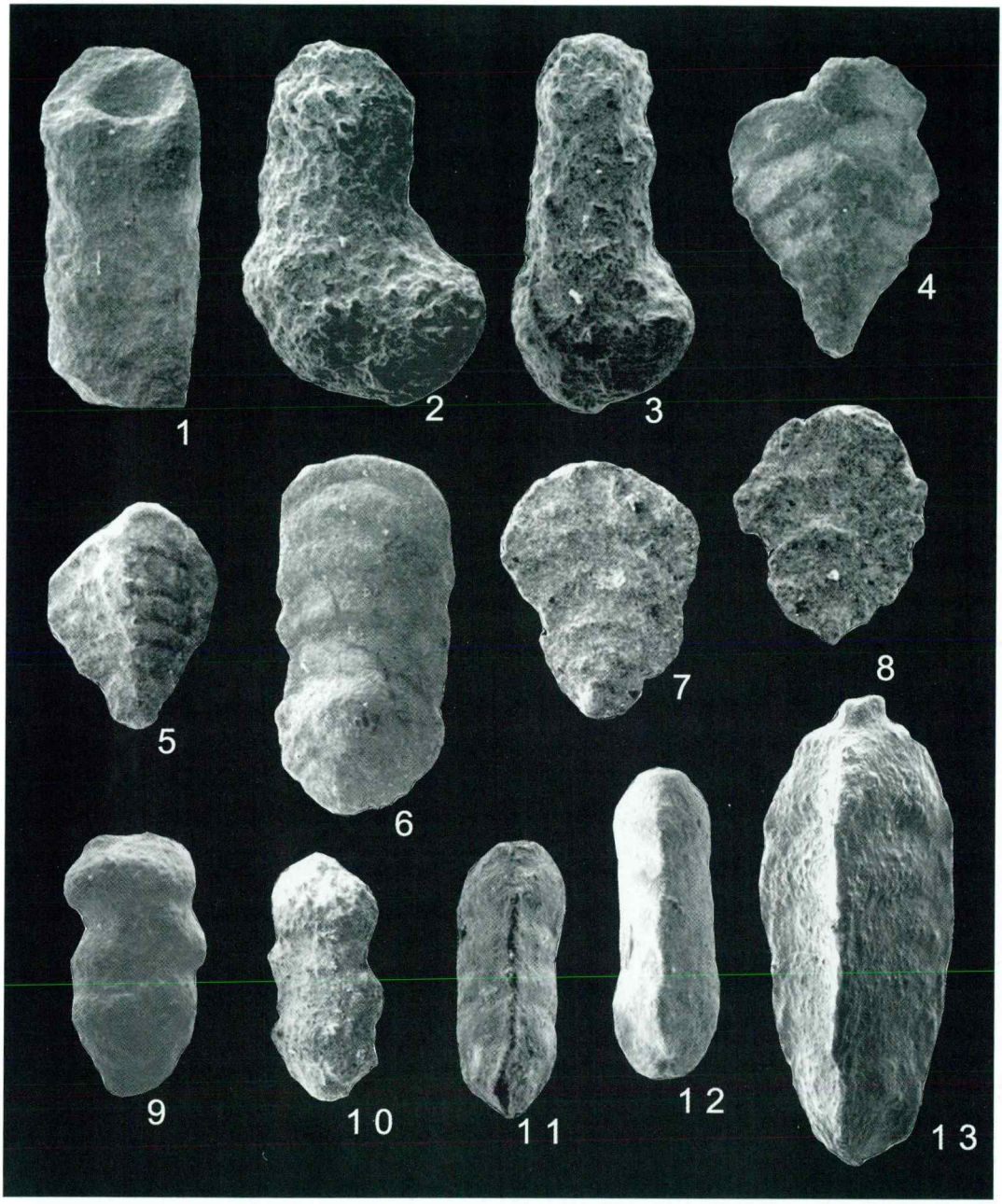
1919 *Clavulina gaudryinoises* Halkyard non Fornasini - Halkyard, p. 46, pl. 3, figs. 1-3

1937a *Plectina dalmatina* (Schubert) - Cushman, p. 107, pl. 12, fig. 8

1985 *Plectina dalmatina* (Schubert) - Grünig, p. 158, pl. 3, figs. 1-6

Locality: Vr-004, Vr-005, Vr-009, Vr-010, Vr-012, Zv-006, Zv-007, Zv-009, Zv-010, Zv-011

PLATE 1



1 *Bathisyphon taurinensis* Sacco, Vr-009, x28. **2-3** *Ammobaculites agglutinans* (d'Orbigny). **2** Vr-012, x40. **3** Vr-012, x40. **4** *Spiroplectinella dalmatina* (de Witt Puyt), Vr-009, x60. **5** *Spiroplectinella pectinata* (Hantken), Vr-010, x40. **6** *Vulvulina haeringensis* (Gümbel), Vr-009, x40. **7-8** *Pavonitina biarritzensis* Sztràkos. **7** Zv/II-006, x40. **8** Zv/II-006, x40. **9-10** *Plectina dalmatina* (Schubert). **9** Vr-009, x40, **10** Vr-009, x40. **11-12** *Tritaxia kruhelensis* (Woicik). **11** Vr-012, x40. **12** Vr-012, x40. **13** *Tritaxia szaboi* (Hantken), Vr-009, x40.

Family: **Tritaxiidae Plotnikova, 1979**

***Tritaxia kruhelensis* (Woicik), 1903**
Pl. 1, Figs. 11-12

1903 *Clavulina szaboi* var. *kruhelensis* - Woicik, p. 498, pl. 6, fig. 21 (Fide Ellis & Messina 1940)

1956 *Clavulinoides kruhelensis* (Woicik) - Hagn, p. 117, pl. 10, figs. 2-4, 8-9

1993 *Clavulinoides kruhelensis* (Woicik) - Sztràkos (In: Mathelin & Sztràkos), p. 73, pl. 3, fig. 19

Locality: Vr-012, Zv-004

***Tritaxia szaboi* (Hantken), 1868**
Pl. 1, Fig. 13

1868 *Clavulina Szaboi* - Hantken, p. 83, pl. 1, figs. 4, 6, 7

1868 *Rhabdogonium Szaboi* - Hantken, p. 90, pl. 1, fig. 18

1956 *Clavulinoides Szaboi* (Hantken) - Hagn, p. 116, pl. 10, fig. 1

1975 *Tritaxia szaboi* (Hantken) - Braga et al. p. 103, pl. 4, figs. 1-2

1993 *Clavulinoides szaboi* (Hantken) - Sztràkos (In: Mathelin & Sztràkos), p. 73, pl. 4, fig. 1; pl. 25, fig. 5

Locality: Vr-004, Vr-005A, Zv-005, Zv-006, Zv-008, Zv-010, Zv-011

Family: **Eggerellidae Cushman, 1937**

***Dorothia fallax* Hagn, 1956**
Pl. 2, Figs. 1-2

1956 *Dorothia fallax* - Hagn, p. 119, pl. 9, figs. 18-19; pl. 18, fig. 10

1975 *Dorothia fallax* Hagn - Braga et al., p. 92, pl. 1, fig. 25

1993 *Dorothia fallax* Hagn - Sztràkos (In: Mathelin & Sztràkos), p. 39, pl. 24, fig. 8

Locality: Zv-010, Zv-011

***Karreriella halkyardi* Cushman, 1936**
Pl. 2, figs. 3-4

1936 *Karreriella halkyardi* - Cushman, p. 36, pl. 5, fig. 16

1985 *Karreriella halkyardi* Cushman - Grünig, p. 258, pl. 3, figs. 21-22

1993 *Karreriella halkyardi* Cushman - Sztràkos (In: Mathelin & Sztràkos), p. 39, pl. 24, fig. 9

Locality: Vr-004, Vr-005, Vr-005A, Vr-010, Zv-004, Zv-006, Zv-008, Zv-009, Zv-010

Martinottiella sp.
Pl. 2, Fig. 5

Locality: Vr-004

Family: **Textulariidae Ehrenberg, 1838**

***Semivulvulina pectinata* (Hantken), 1875**
Pl. 1, Fig. 5

1875 *Vulvulina pectinata* - Hantken, p. 68, pl. 7, fig. 10

1975 *Vulvulina* aff. *pectinata* Hantken - Braga et al. p. 102. pl. 4, fig. 3

1985 *Spiroplectammina* aff. *pectinata* (Hantken) - Grünig, p. 256, pl. 2, figs. 5-8

1993 "*Semivulvulina*" cf. *pectinata* (Reuss) - Sztràkos (In: Mathelin & Sztràkos), p. 40, pl. 2, fig. 11

Locality: Vr-005A, Vr-009, Vr-010, Vr-011, Vr-012, Vr-014, Zv-005, Zv-006, Zv-008, Zv-010

***Textularia adalta* Cushman, 1926**
Pl. 2, Fig. 6

1926 *Textularia adalta* - Cushman, p. 29, pl. 4, fig. 2 (Fide Ellis & Messina 1940)

1950 *Textularia adalta* Cushman - Ruiz de Gaona & Colom, p. 416, figs. 5/22-26

1985 *Textularia adalta* Cushman - Grünig, p. 257, pl. 3, figs. 16-17

1993 *Textularia adalta* Cushman - Sztràkos (In: Mathelin & Sztràkos), p. 73, pl. 3, fig. 9

Locality: Vr-005, Vr-005A, Vr-009, Zv-010

***Karrerotextularia olianensis* (Ruiz de Gaona & Colom), 1950**
Pl. 2, Figs. 7-8

1950 *Siphotextularia olianensis* - Ruiz de Gaona & Colom, p. 413, figs. 16/1-9

1985 *Siphotextularia concava* (Karrer) - Grünig, p. 257, pl. 2, figs. 18-19

1991 *Siphotextularia olianensis* Ruiz de Gaona & Colom - Barbin & Keller-Grünig, p. 241, pl. 1, figs. 3-4

1993 *Karrerotextularia olianensis* (Ruiz de Gaona & Colom) - Sztràkos (In: Mathelin & Sztràkos), p. 40, pl. 3, figs. 17-18; pl. 25, figs. 3-4

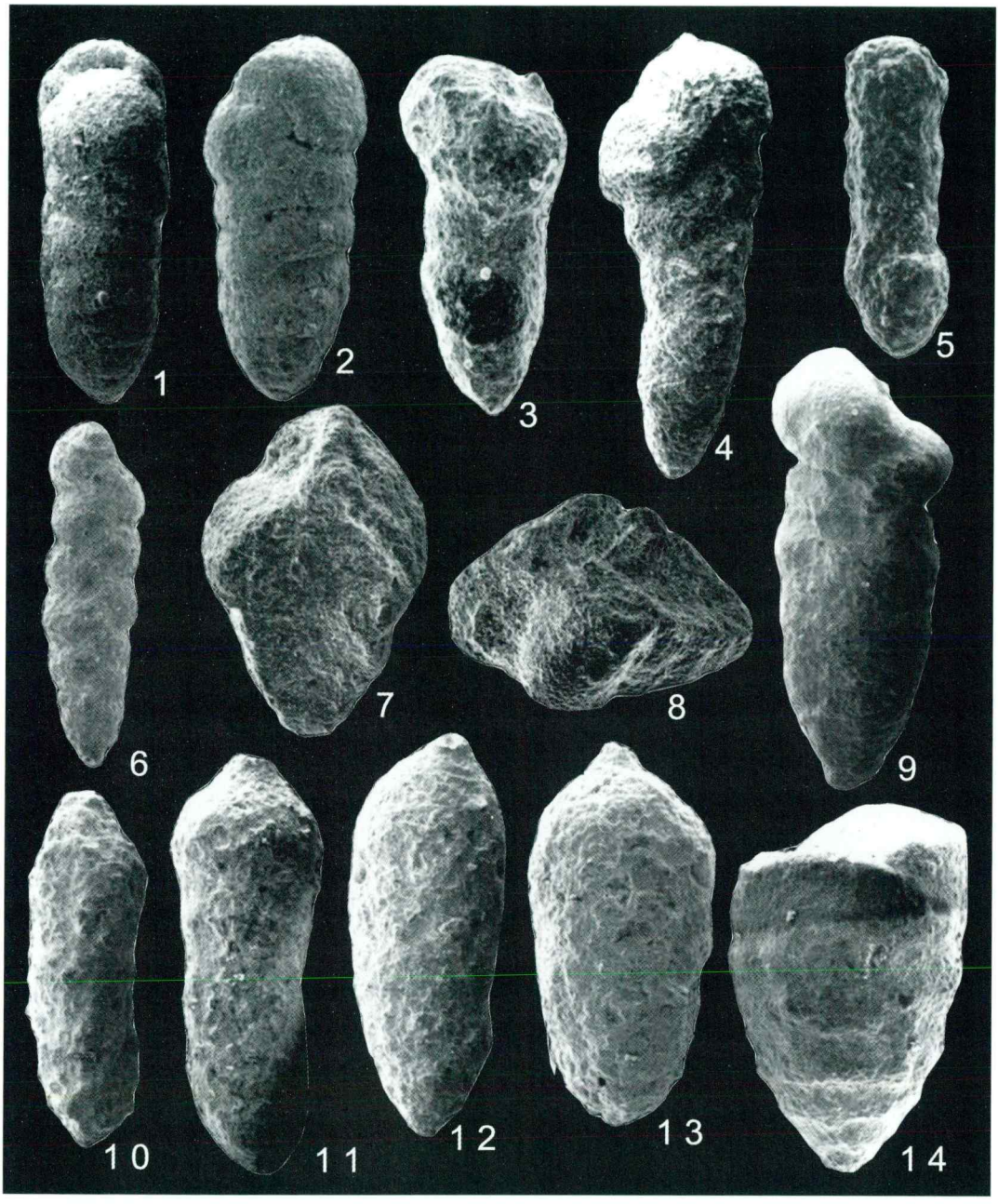
Locality: Vr-009

Family: **Pseudogaudryinidae Loeblich & Tappan, 1985**

***Pseudogaudryina textilaroides* (Hantken), 1875**
Pl. 2, Fig. 9

1875 *Gaudryina textilaroides* - Hantken, p. 15, pl. 1, fig. 6

PLATE 2



1-2 *Dorothia fallax* Hagn. **1** Zv/II-011, x40. **2** Zv/II-011, x40. **3-4** *Karreriella halkyardi* Cushman. **3** Vr-010, x80. **4** Zv/II-006, x60. **5** *Martinottiella* sp., Vr-004, x80. **6** *Textularia adalta* Cushman, Vr-009, x40. **7-8** *Karrerotextularia olianensis* (Ruiz de Gaona & Colom). **7** Vr-009, x120. **8** Vr-009, x120. **9** *Pseudogaudryina textilaroides* (Hantken), Vr-009, x28. **10-11** *Cylindroclavulina colomi* Hagn. **10** Vr-009, x40. **11** Vr-012, x40. **12-13** *Cylindroclavulina rudislosta* (Hantken). **12** Vr-009, x28. **13** Vr-009, x28. **14** *Tritaxilina pupa* (Gümbel), Vr-005A, x60.

1993 *Pseudogaudryina ? textilaroides* Hantken - Sztràkos (In: Mathelin & Sztràkos), p. 41, pl. 4, fig. 5
Locality: Vr-009

Family: **Valvulinidae Berthelin, 1880**

***Cylindroclavulina colomi* Hagn, 1956**
Pl. 2, Figs. 10-11

1956 *Cylindroclavulina colomi* - Hagn, p. 123, pl. 10, figs. 6-7; pl. 18, figs. 8. 9

1975 *Cylindroclavulina colomi* Hagn - Braga & al. p. 103, pl. 4, fig. 6

1985 *Cylindroclavulina colomi* Hagn - Grünig, p. 258, pl. 4, fig. 5

1993 *Cylindroclavulina colomi* Hagn - Sztràkos (In: Mathelin & Sztràkos), p. 73, pl. 4, fig. 2
Locality: Vr-004, Vr-005A, Vr-009, Vr-012, Vr-014, Zv-006, Zv-007

***Cylindroclavulina rudislosta* (Hantken), 1889**
Pl. 2, Figs. 12-13

1889 *Clavulina rudislosta* - Hantken, p. 383

1875 *Clavulina cylindrica* Hantken (non d'Orbigny 1825) - Hantken, p. 18, pl. 1, fig. 8

1956 *Cylindroclavulina rudislosta* (Hantken) - Hagn, p. 122, pl. 10, fig. 5

1991 *Cylindroclavulina rudislosta* (Hantken) - Barbin & Keller-Grünig, p. 240

1993 *Cylindroclavulina rudislosta* (Hantken) - Sztràkos (In: Mathelin & Sztràkos), p. 73, pl. 4, fig. 4
Locality: Vr-004, Vr-005, Vr-005A, Vr-009, Vr-012, Vr-014, Zv-004, Zv-005, Zv-007

***Tritaxilina pupa* (Gümbel), 1868**
Pl. 2, Fig. 14

1868 *Gaudryina pupa* - Gümbel, p. 602, pl. 1, fig. 3

1950 *Tritaxilina pupa* (Gümbel) - Ruiz de Gaona & Colom, p. 421, fig. 14/23

1975 *Tritaxilina pupa* (Gümbel) - Braga et al., p. 93, pl. 1, figs. 24, 27

1987a *Tritaxilina pupa* (Gümbel) - Sztràkos, p. 35, pl. 3, figs. 11-12
Locality: Vr-005A, Vr-011, Vr-014, Zv-008, Zv-009, Zv-010, Zv-011

Family: **CornusPiridae Schultze, 1854**

***Cornuspira angigyra* (Reuss), 1850**
Pl. 3, Fig. 1

1850 *Operculina angigyra* - Reuss, p. 370, pl. 46, fig. 19

1993 *Cornuspira angigyra* (Reuss) - Sztràkos (In: Mathelin & Sztràkos), p. 74, pl. 4, fig. 13
Locality: Zv-006

Family: **Spiroloculinidae Wiesner, 1920**

***Spiroloculina dorsata* Reuss, 1866**

1866 *Spiroloculina dorsata* - Reuss, p. 123

1855 *Spiroloculina limbata* - Bornemann, p. 348, pl. 19, fig. 1

1961 *Spiroloculina canaliculata* d'Orbigny - Kaasschieter, p. 154, pl. 3, figs. 20-23
Locality: Vr-004, Vr-005A

***Spiroloculina* sp. 1**
Pl. 3, Figs. 2-3
Locality: Vr-004, Vr-005, Vr-005A, Zv-005, Zv-010, Zv-011

***Spiroloculina* sp. 2**
Pl. 3, Fig. 4
Locality: Vr-005, Vr-011, Zv-006, Zv-007, Zv-008, Zv-009, Zv-010, Zv-011

Family: **Hauerinidae Schwager, 1876**

***Quinqueloculina depressa* d'Orbigny, 1826**
Pl. 3, Fig. 5

1826 *Quinqueloculina depressa* - d'Orbigny, p. 302, no. 38

1878 *Triloculina depressa* d'Orbigny - Terquem, pl. 8, figs. 1-11

1904 *Quinqueloculina depressa* d'Orbigny - Fornasini, p. 68, pl. 4, fig. 8

1993 *Quinqueloculina depressa* d'Orbigny - Sztràkos (In: Mathelin & Sztràkos), p. 74, pl. 5, fig. 4
Locality: Vr-005A, Zv-006, Zv-009, Zv-010, Zv-011

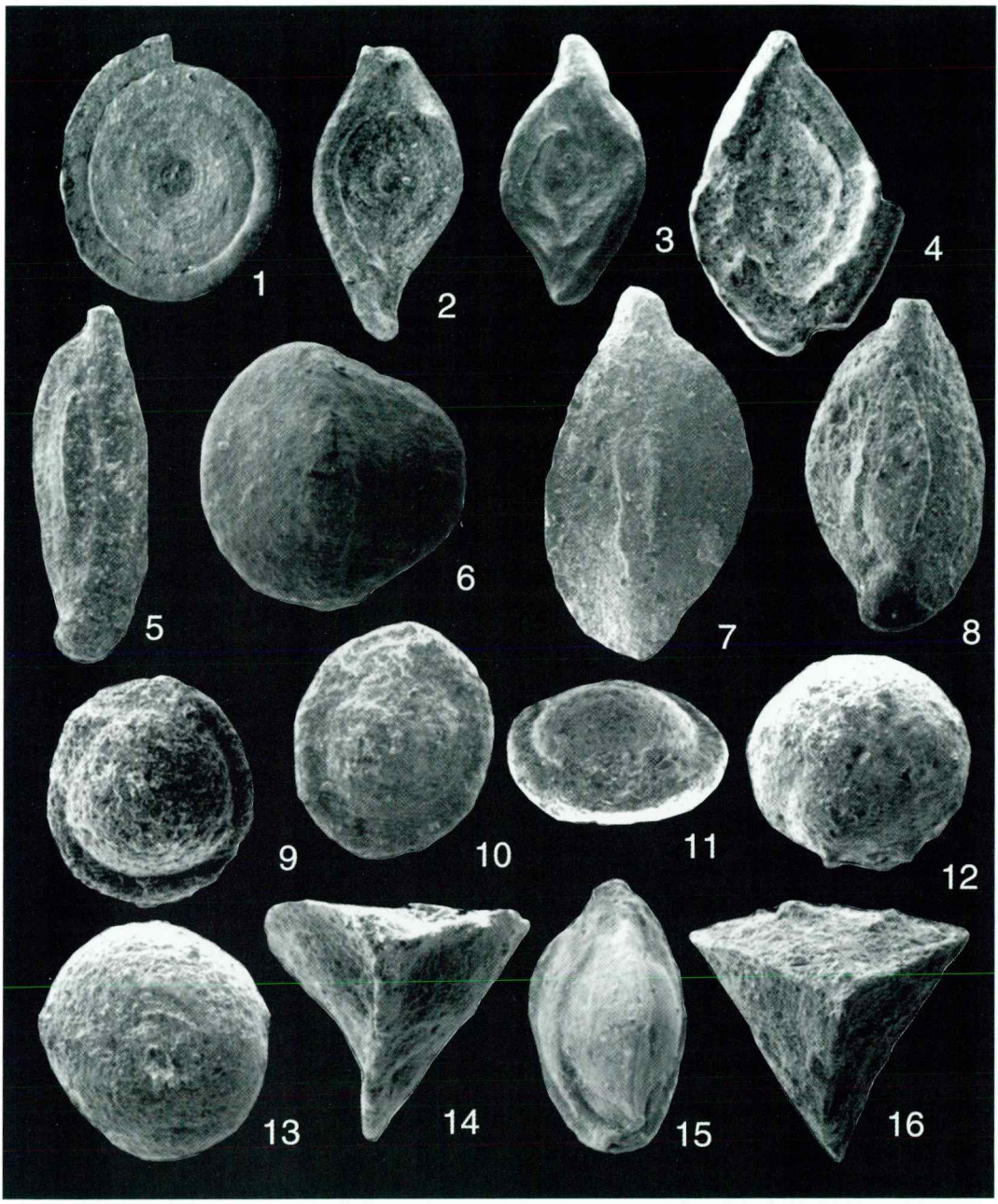
***Quinqueloculina impressa* Reuss, 1851**
Pl. 3, Fig. 6

1851 *Quinqueloculina impressa* - Reuss, p. 87, pl. 7, fig. 59

1993 *Quinqueloculina impressa* Reuss - Sztràkos (In: Mathelin & Sztràkos), p. 74, pl. 5, fig. 6
Locality: Vr-004, Vr-005, Vr-005A, Vr-009, Vr-010, Vr-011, Vr-011A, Vr-014, Zv-004, Zv-005, Zv-006, Zv-007, Zv-008, Zv-009, Zv-010, Zv-011

***Quinqueloculina* sp. 1**
Pl. 3, Figs. 7-8
Locality: Vr-004, Vr-011, Vr-011A, Zv-006, Zv-007, Zv-009, Zv-010, Zv-011

PLATE 3



1 *Cornuspira angigyra* (Reuss), Zv/II-006, x40. **2-3** *Spiroloculina* sp. 1. **2** Zv/II-011, x40. **3** Zv/II-011, x40. **4** *Spiroloculina* sp. 2. Vr-010, x60 **5** *Quinqueloculina depressa* d'Orbigny, Zv/II-010, x60. **6** *Quinqueloculina impressa* Reuss, Vr-009, x60. **7-8** *Quinqueloculina* sp. 1. **7** Zv/II-009, x60. **8** Zv/II-009, x60. **9** *Pyrgo simplex* (d'Orbigny), Zv/II-006, x80. **10-11** *Pyrgo* sp. 1. **10** Zv/II-005, x80. **11** Zv/II-006, x80. **12-13** *Pyrgo* sp. 2. **12** Zv/II-009, x80. **13** *Pyrgo* sp. 2, Zv/II-009, x80. **14-16** Nov. gen. sp. 1. **14** Zv/II-005, x120. **15** Zv/II-010, x60. **16** Zv/II-007, x80.

***Quinqueloculina* sp. 2**
Locality: Vr-011A, Zv-006, Zv-007, Zv-009, Zv-010, Zv-011

***Quinqueloculina* sp. 3**
Pl. 4, Fig. 5
Locality: Vr-003

***Pyrgo simplex* (d'Orbigny), 1846**
Pl. 3, Fig. 9

1846 *Biloculina simplex* - d'Orbigny, p. 264, pl. 15, figs. 25-27

1975 *Pyrgo simplex* (d'Orbigny) - Braga et al., p. 104

1985 *Pyrgo simplex* (d'Orbigny) - Grünig, p. 260 fig. 9

1993 *Pyrgo simplex* (d'Orbigny) – Sztràkos (In: Mathelin & Sztràkos), p. 74, pl. 5, fig. 9
Locality: Vr-012, Zv-005, Zv-006, Zv-008

***Pyrgo subsphaerica* (d'Orbigny), 1839**
Pl. 4, Fig.6

1839 *Biloculina subsphaerica* - d'Orbigny, p. 162, pl. 8, figs. 25-27

1949 *Pyrgo subsphaerica* (d'Orbigny) - Cuvillier & Szakall, p. 45, pl. 20, fig. 2

1985 *Pyrgo subsphaerica* (d'Orbigny) - Grünig, p. 260
Locality: Vr-003

***Pyrgo* sp. 1**
Pl. 3, Figs. 10-11

Locality: Zv-005, Zv-006

***Pyrgo* sp. 2**
Pl. 3, Figs. 12-13

Locality: Zv-009, Zv-010, Zv-011

Nov. gen. sp. 1
Pl. 3, Figs. 14-16
Locality: Vr-004, Vr-005A, Zv-005, Zv-006, Zv-007, Zv-008, Zv-010, Zv-011

***Sigmoilopsis bartoniensis* (Ruiz de Gaona & Colom), 1950**
Pl. 4, Figs. 1-2

1951 *Sigmoilina bartoniensis* - Ruiz de Gaona & Colom, p. 410, figs. 17/1-16

1985 *Sigmoilopsis* sp. - Grünig, p. 260, pl. 4, figs. 14-16

1993 *Sigmoilopsis bartoniensis* Ruiz de Gaona & Colom - Sztràkos (In: Mathelin & Sztràkos), p. 74, pl. 5, fig. 12
Locality: Vr-011, Vr-011A, Zv-005, Zv-006, Zv-007, Zv-008, Zv-009, Zv-010, Zv-011

Family: **Alveolinidae Ehrenberg, 1839**

***Borelis vonderschmitti* (Schweighauser), 1951**
Pl. 4, Figs. 3-4

1951 *Neoalveolina vonderschmitti* - Schweighauser, p. 468, figs. 1-4

1979 *Borelis* aff. *vonderschmitti* (Schweighauser) - Drobne K. et al., p. 160, pl. 4, figs. 1-2

1990 *Borelis vonderschmitti* (Schweighauser) - Pavlovec et al., p. 442, pl.1, figs. 1-3
Locality: Vr-005, Vr-005A

Family: **Nodosariidae Ehrenberg, 1838**

***Nodosaria latejugata* Gümbel, 1868**
Pl. 4, Fig. 11

1868 *Nodosaria latejugata* - Gümbel, p. 41, pl. 1, fig. 32

1956 *Nodosaria latejugata* Gümbel - Hagn, p. 137, pl. 12, fig. 11; pl. 13, fig. 1

1987a *Nodosaria latejugata* Gümbel - Sztràkos, p 33

1991 *Nodosaria latejugata* Gümbel - Barbin & Keller-Grünig, p. 240
Locality: Vr-004, Vr-005 Vr-010, Vr-011, Vr-012, Zv-008

***Pyramidulina bactridium* (Reuss), 1866**
Pl. 4, Figs. 8-9

1866 *Nodosaria bactridium* - Reuss, p. 130, pl. 1, figs. 24-25

1993 *Pyramidulina bactridium* (Reuss) - Sztràkos (In: Mathelin & Sztràkos). p. 75, pl. 7, figs. 15-16
Locality: Vr-005A

Family: **Vaginulinidae Reuss, 1860**

***Lenticulina arcuatostriata* (Hantken), 1868**
Pl. 4, Fig. 13

1868 *Cristellaria (Robulina) arcuato striata* - Hantken, p. 93, pl. 2, fig. 30

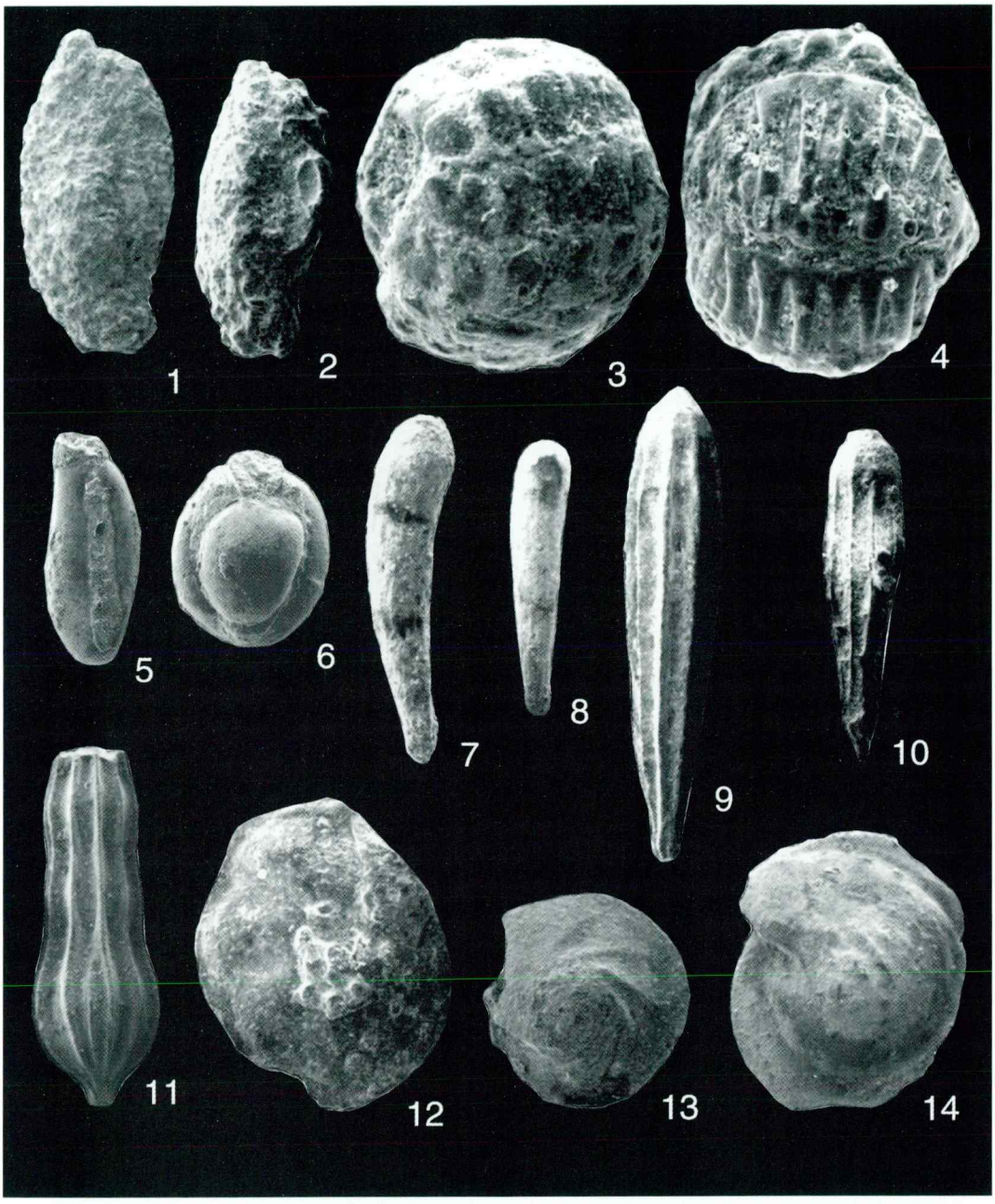
1950 *Robulus arcuatostriatus* (Hantken) - Ruiz de Gaona & Colom, p. 402, figs. 6/1-9

1956 *Robulus arcuato-striatus* (Hantken) - Hagn, p. 127, pl. 11, fig. 4

1975 *Lenticulina arcuatostriata* (Hantken) - Braga et al., p. 104

1985 *Lenticulina arcuato-striata* (Hantken) - Grünig, p. 261, pl. 4, fig. 19
Locality: Vr-005A, Vr-010, Vr-011, Zv-005, Zv-010

PLATE 4



1-2 *Sigmoilopsis bartoniensis* (Ruiz de Gaona & Colom). **1** Zv/II-010, x40. **2** Vr-011A, x40. **3-4** *Borelis vonderschmitti* (Schweighauser). **3** Vr-005A, x160. **4** Vr-005A, x120. **5** *Quinqueloculina* sp. 3, Vr/II-003, x40 **6** *Pyrgo subsphaerica* (d'Orbigny), Vr/II-003, x80. **7-8** *Rectobolivina zsigmondyi* (Hantken). **7** Zv/II-009, x60. **8** Zv/II-009, x40. **9-10** *Pyramidulina bactridium* (Reuss). **9** Vr-005A, x28. **10** Vr-005A, x40. **11** *Nodosaria latejugata* Gümbel, Zv/II-006, x28. **12** *Lenticulina budensis* (Hantken), Vr-012, x40. **13** *Lenticulina arcuatostriata* (Hantken), Vr-011, x28. **14** *Lenticulina limbosa* (Reuss), Zv/II-008, x28.

***Lenticulina budensis* (Hantken), 1875**
Pl. 4, Fig. 12

1875 *Robulina budensis* - Hantken, p. 58, pl. 7, fig. 1

1950 *Robulus budensis* (Hantken) - Ruiz de Gaona & Colom, p. 403, figs. 7/7-8

Locality: Vr-010, Vr-012

***Lenticulina limbosa* (Reuss), 1863**
Pl. 4, Fig. 14

1863 *Robulina limbosa* - Reuss, p. 55, pl. 6, fig. 69a-b

1875 *Robulina limbosa* Reuss - Hantken, p. 57, pl. 6, fig. 11

1950 *Rubulus limbosus* (Reuss) - Ruiz de Gaona & Colom, p. 405, fig. 5/1-14

1956 *Robulus limbosus* (Reuss) - Hagn, p. 127, pl. 11, fig. 2

1993 *Lenticulina limbosa* (Reuss) - Sztràkos (In: Mathelin & Sztràkos), p. 75, pl. 8, fig. 6

Locality: Zv-008

***Marginulinopsis behmi* (Reuss), 1866**
Pl. 5, Fig. 1

1866 *Cristellaria behmi* - Reuss, p. 22, pl. 2, fig. 37

1868 *Cristellaria behmi* Reuss - Gümbel, s. 55, pl. 1, fig. 61

1875 *Marginulina behmi* (Reuss) - Hantken, p. 48, pl. 5, figs. 1-2

1950 *Marginulina behmi* (Reuss) - Ruiz de Gaona & Colom, p. 384, fig. 11/18-26

1956 *Marginulina behmi* (Reuss) - Hagn, p. 131, pl. 11, fig. 11

1975 *Marginulina behmi* (Reuss) - Braga et al., p. 105, pl. 4, fig. 13

1985 *Marginulina behmi* (Reuss) - Grünig, p. 262, pl. 5, figs. 17-19

1993 *Marginulina behmi* (Reuss) - Sztràkos (In: Mathelin & Sztràkos), p. 43, pl. 26, figs. 14-16

Locality: Vr-004, Vr-005, Vr-009, Vr-010, Vr-011, Vr-012, Vr-014, Zv-006, Zv-008, Zv-009, Zv-010, Zv-011

***Marginulinopsis porvaensis* (Hantken), 1875**
Pl. 5, Figs. 2-3

1875 *Cristellaria porvaensis* - Hantken, p. 50, pl. 14, fig. 1

1950 *Marginulina porvaensis* (Hatken) - Ruiz de Gaona & Colom, p. 387, fig. 11/1-14

1987a *Marginulinopsis porvaensis* (Hantken) - Sztràkos, p. 32, pl. 5, fig. 20

1993 *Astacolus porvaensis* (Hantken) - Sztràkos (In: Mathelin & Sztràkos), p. 76, pl. 26, fig. 13

Locality: Vr-010, Vr-011, Zv-005, Zv-007, Zv-008, Zv-009, Zv-010

***Percultazonaria fragaria* (Gümbel), 1868**
Pl. 5, figs. 4-5

1868 *Marginulina fragaria* - Gümbel, p. 57, pl. 1, figs. 58a-c

1950 *Marginulina fragaria* - Ruiz de Gaona & Colom, p. 386, figs. 11/15-17

1956 *Marginulinopsis fragaria* (Gümbel) - Hagn, p. 134, pl. 12, figs. 3, 8, 10

1975 *Marginulinopsis fragaria* (Gümbel) - Braga et al., p. 105

1985 *Marginulinopsis fragaria* (Gümbel) - Grünig, p. 161, pl. 5, figs. 24-28

1991 *Marginulinopsis fragaria* (Gümbel) - Barbin & Keller-Grünig, p. 240, pl. 2, figs. 6-12

1993 *Percultazonaria fragaria* (Gümbel) - Sztràkos (In: Mathelin & Sztràkos), p. 76, pl. 9, figs. 1-2

Locality: Vr-014, Zv-004, Zv-006, Zv-007, Zv-009

***Saracenaria hantkeni* Cushman, 1933**
Pl. 5, Fig. 6

1933 *Saracenaria arcuata* d'Orbigny var. *hantkeni* - Cushman, p. 4, pl. 1, figs. 11-12 (Fide Ellis & Messina 1940)

1956 *Saracenaria hantkeni* Cushman - Hagn, p. 138, pl. 13, fig. 4

1993 *Saracenaria hantkeni* Cushman - Sztràkos (In: Mathelin & Sztràkos), p. 76, pl. 9, fig. 6

Locality: Vr-004, Vr-009, Vr-010, Zv-005, Zv-006, Zv-007, Zv-010, Zv-011

***Palmula budensis* (Hantken), 1875**
Pl. 5, Fig. 7

1875 *Flabellina budensis* - Hantken, p. 44, pl. 4, fig. 17

1984 *Frondicularia budensis* (Hantken) - Grünig & Herb, p. 263

1985 *Frondicularia budensis* (Hantken) - Grünig, p. 261, pl. 4, fig. 21

1993 *Palmula budensis* (Hantken) - Sztràkos (In: Mathelin & Sztràkos), p. 76, pl. 9, fig. 10

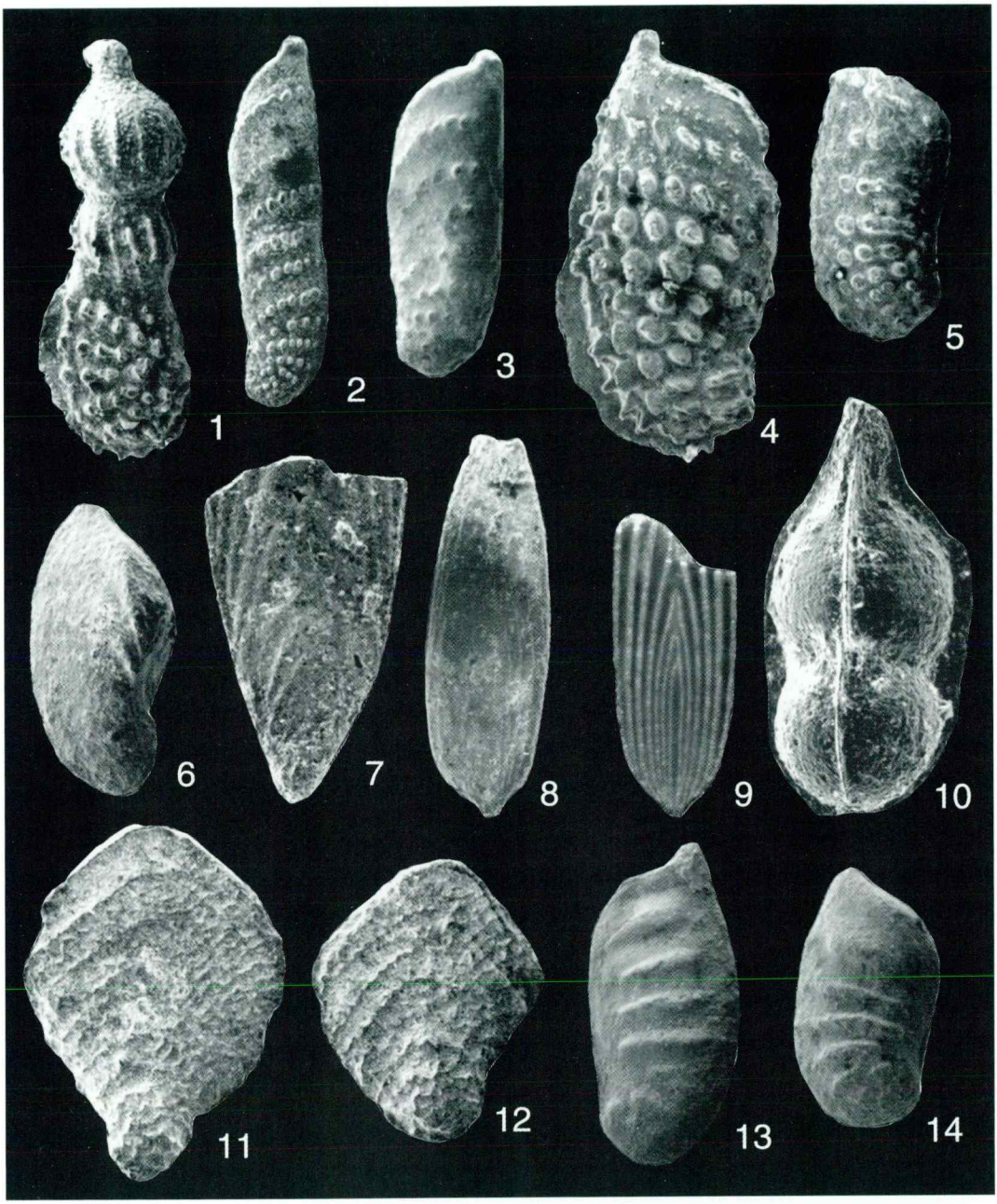
Locality: Vr-011, Zv-005, Zv-006, Zv-007, Zv-008

***Palmula tenuissima* (Hantken), 1875**
Pl. 5, Figs. 8-9

1875 *Frondicularia tenuissima* - Hantken, p. 43, pl. 13, fig. 11

1950 *Frondicularia tenuissima* Hantken - Ruiz de Gaona & Colom, p. 377

PLATE 5



1 *Marginulinopsis behmi* (Reuss), Zv/II-006, x60. **2-3** *Marginulinopsis porvaensis* (Hantken). **2** Zv/II-006, x28. **3** Zv/II-010, x40. **4-5** *Percultazonaria fragaria* (Gümbel). **4** Zv/II-006, x40. **5** Vr-012, x28. **6** *Saracenaria hantkeni* (Cushman), Vr-010, x40. **7** *Palmula budensis* (Hantken), Zv/II-006, x80. **8-9** *Palmula tenuissima* (Hantken). **8** Zv/II-008, x80. **9** Zv/II-005, x60. **10** *Marginulina globosa* (Halkyard), Zv/II-006, x120. **11-12** *Reticulopalmula arborescens* (Halkyard). **11** Vr-005, x40. **12** Vr-005, x40. **13-14** *Vaginulinopsis cumulicostata* (Gümbel). **13** Vr-004, x28. **14** Vr-004, x28.

1993 *Frondovaginulina tenuissima* (Hantken) - Sztràkos (In: Mathelin & Sztràkos), p. 76, pl. 9, fig. 8

Locality: Vr-005A, Zv-008

***Reticulopalmula arborescens* (Halkyard), 1919**

Pl. 5, Figs. 11-12

1919 *Frondicularia arborescens* - Halkyard, p. 88, pl. 5, figs. 8-9

1981 *Coleites arborescens* (Halkyard) - Hagn et al., p. 91

1985 *Coleites arborescens* (Halkyard) - Grünig, p. 275, pl. 6, figs. 14-15

1993 *Reticulopalmula arborescens* (Halkyard) - Sztràkos (In: Mathelin & Sztràkos), p. 43, pl. 26, figs. 8-9

Locality: Vr-005, Vr-009, Vr-010, Vr-011, Vr-012, Zv-005, Zv-006, Zv-008 Zv-010, Zv-011

***Marginulina globosa* Halkyard, 1919**

Pl. 5, Fig. 10

1919 *Marginulina pyramidale* Karrer var. *globosa* - Halkyard, p. 85, pl. 5, fig. 2

1993 *Marginulina globosa* Halkyard - Sztràkos (In: Mathelin & Sztràkos), p. 44, pl. 23, fig. 15; pl. 48, figs. 20-22

Locality: Vr-011, Zv-006

***Vagunulinopsis cumulicostata* (Gümbel), 1868**

Pl. 5, Figs. 13-14

1868 *Cristellaria cumulicostata* - Gümbel, p. 60, pl. 1, fig. 67

1956 *Vaginulinopsis cumulicostata* (Gümbel) - Hagn, p. 135, pl. 13, fig. 3

1975 *Vaginulinopsis cumulicostata* (Gümbel) - Braga et al. p. 105, pl. 4, fig. 8

1985 *Vaginulinopsis cumulicostata* (Gümbel) - Grünig, p. 263, pl. 6, fig. 6

1993 *Vaginulinopsis cumulicostatus* (Gümbel) - Sztràkos (In: Mathelin & Sztràkos), p. 76, pl. 10, fig. 12

Locality: Vr-004, Vr-005, Vr-010, Vr-012, Zv-005

***Spirolingulina acutimargo* (Halkyard), 1919**

Pl. 6, Fig. 1

1919 *Lingulinopsis acutimargo* - Halkyard, p. 81, pl. 5, fig. 1

1949 *Lingulina acutimargo* (Halkyard) - Cuvillier & Szakall, p. 81, pl. 29, fig. 11

1950 *Lingulina acutimargo* (Halkyard) - Ruiz de Gaona & Colom, p. 384, fig. 11/31-3

1993 *Spirolingulina acutimargo* (Halkyard) - Sztràkos (In: Mathelin & Sztràkos), p. 44, pl. 27, fig. 2

Locality: Vr-004, Zv-009

Family: **Ceratobuliminidae Cushman, 1927**

***Ceratocancris crassa* (Halkyard), 1919**

Pl. 6, Figs. 2-4

1919 *Pulvinulina haueri* d'Orbigny var. *crassa* - Halkyard, p. 125, pl. 7, fig. 6

1957 *Ceretobulimina haueri* d'Orbigny var. *crassa* (Halkyard) - Sacal & Debourle, p. 46, pl. 20, fig. 1

1993 *Ceratocancris crassa* (Halkyard) - Sztràkos (In: Mathelin & Sztràkos), p. 45, pl. 11, fig. 17

Locality: Vr-014

***Lamarckina cristellaroides* (Terquem), 1882**

Pl. 6, Fig. 7

1882 *Rotalina cristellaroides* - Terquem, p. 57, pl. 3, fig. 15a-c

1961 *Lamarckina cristellaroides* (Terquem) - Kaasschieter, p. 231, pl. 15, figs. 3-4

1970 *Lamarckina cristellaroides* (Terquem) - Le Calvez, p. 203, pl. 37, fig. 4

1993 *Lamarckina cristellaroides* (Terquem) - Sztràkos (In: Mathelin & Sztràkos), p. 77, pl. 11, fig. 19; pl. 29, fig. 6

Locality: Vr-005A

Family: **Epistominidae Wedekind, 1937**

***Hoeglundina eocenica* (Cushman & Hanna), 1927**

Pl. 6, Figs. 5-6

1927 *Epistomina eocenica* - Cushman & Hanna, p. 53, pl. 5, figs. 4-5

1975 *Hoeglundina eocenica* (Cushman & Hanna) - Braga et al., p. 110

1981 *Hoeglundina eocenica* (Cushman & Hanna) - Lindenberg et al., p. 148

1985 *Hoeglundina eocenica* (Cushman & Hanna) - Grünig, p. 277, pl. 11, figs. 22-24

1987a *Hoeglundina eocenica* (Cushman & Hanna) - Sztràkos, p. 31, pl. 15, fig. 9

Locality: Vr-005, Vr-010, Vr-011A, Vr-012, Zv-010

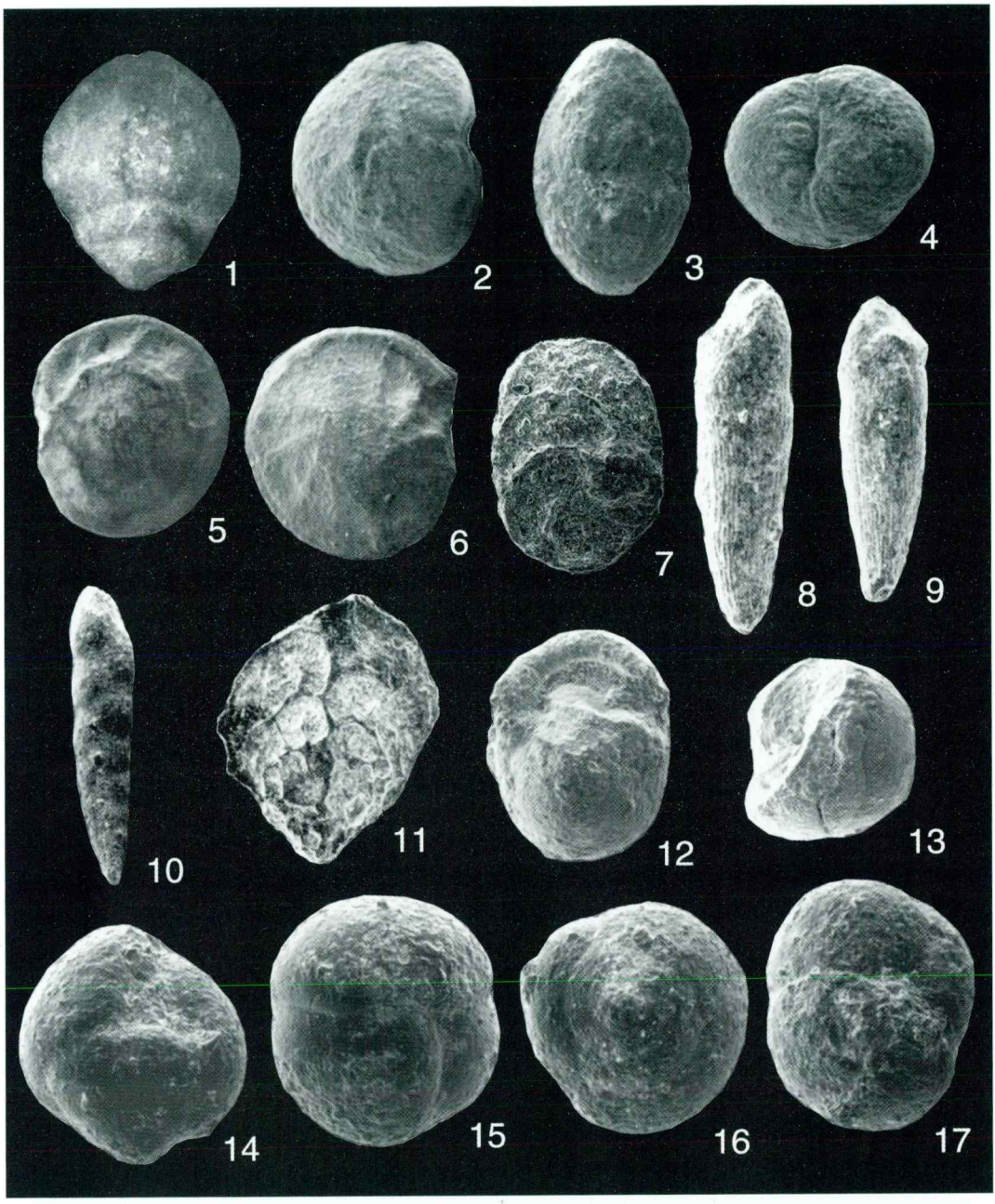
Family: **Bolivinidae Glaesner, 1937**

***Bolivina nobilis* Hantken, 1875**

Pl. 6, Figs. 9-10

1875 *Bolivina nobilis* - Hantken, p. 65, pl. 15, fig. 4a-b

PLATE 6



1 *Spirolingulina acutimargo* (Halkyard), Vr-004, x40. **2-4** *Ceratocancris crassa* (Halkyard). **2** spiral view, Vr-014, x40. **3** edge view, Vr-014, x40. **4** umbilical view, Vr-014, x40. **5-6** *Hoeglundina eocenica* (Cushman & Hanna). **5** spiral view, Vr-010, x28. **6** umbilical view, Vr-010, x28. **7** *Lamarckina cristellaroides* (Terquem), Vr-005A. **8-9** *Bolivina nobilis* Hantken. **8** Vr-010, x80. **9** Vr-010, x80. **10** *Bolivina semistriata* Hantken, Vr-005A, x40. **11** *Aragonia janoscheki* Gohrbandt, Vr-010, x120. **12-13** *Globocassidulina globosa* (Hantken). **12** Vr.011, x80. **13** Vr-009, x80. **14-17** *Sporobulimina eocaena* Bykova. **14** side view, Vr-008, x120. **15** apertural view, Vr-005A, x120. **16** apical view, Zv/II-008, x120. **17** apertural view, Zv/II-008, x120.

1950 *Bolivina nobilis* Hantken - Ruiz de Gaona & Colom, p. 364

1956 *Bolivina nobilis* Hantken - Hagn, p. 147

1975 *Bolivina nobilis* Hantken - Braga et al., p. 106, pl. 5, figs. 1-2

1985 *Bolivina nobilis* Hantken - Grünig, p. 265, pl. 5, figs. 12-14

1991 *Bolivina nobilis* Hantken - Barbin & Keller-Grünig, p. 240

1993 *Bolivina nobilis* Hantken - Sztràkos (In: Mathelin & Sztràkos), p. 78, pl. 32, fig. 9

Locality: Vr-004, Vr-005, Vr-009, Zv-007, Zv-008, Zv-009

***Bolivina semistriata* Hantken, 1875**

Pl. 6, Fig. 10

1875 *Bolivina semistriata* - Hantken, p. 65, pl. 7, fig. 13

1956 *Bolivina semistriata* Hantken - Hagn, p. 147

1993 *Bolivina semistriata* Hantken - Sztràkos (In: Mathelin & Sztràkos), p. 78, pl. 32, fig. 10

Locality: Vr-011, Vr-012, Zv-005, Zv-006, Zv-010

***Bolivina* pl. sp.**

Locality: Vr-005, Vr-009, Vr-011, Vr-012, Zv-005, Zv-007, Zv-008, Zv-009, Zv-010, Zv-011

Family: **Loxostomatidae Loeblich & Tappan, 1962**

***Aragonia janoscheki* Gohrbandt, 1962**

Pl. 6, Fig. 11

1962 *Aragonia janoscheki* - Gohrbandt, p. 81, pl. 3, figs. 5a-b

1975 *Aragonia janoscheki* Gohrbandt - Braga et al., p. 106, pl. 5, fig. 7

Locality: Vr-010, Vr-012

Family: **Cassidulinidae d'Orbigny, 1839**

***Globocassidulina globosa* (Hantken), 1875**

Pl. 6, Figs. 12-13

1875 *Cassidulina globosa* - Hantken, p. 64, pl. 16, figs. 2a-b

1956 *Cassidulina globosa* Hantken - Hagn, p. 167, pl. 14, figs. 9-10

1975 *Globocassidulina globosa* (Hantken) - Braga et al., p. 108, pl. 6, fig. 4

1985 *Globocassidulina globosa* (Hantken) - Grünig, p. 273, pl. 10, fig. 3

1987a *Globocassidulina globosa* Hantken - Sztràkos, p. 31, pl. 11, fig. 22

1993 *Globocassidulina globosa* (Hantken) - Sztràkos (In: Mathelin & Sztràkos), p. 79

Locality: Vr-004, Vr-005, Vr-005A, Vr-009, Vr-011, Vr-011A

Family: **Turrilinidae Cushman, 1927**

***Sporobulimina eocaena* Bykova, 1959**

Pl. 6, Figs. 14-17

1959 *Sporobulimina eocaena* - Bykova, p. 76, pl. 12, fig. 6a-b (Fide Ellis & Messina 1940)

1993 *Sporobulimina eocaena* Bykova - Sztràkos (In: Mathelin & Sztràkos), p. 46, pl. 33, figs. 11-12

Locality: Vr-005A, Zv/II-008

Family: **Siphogenerinoididae Saidova, 1981**

***Rectobolivina zsigmondyi* (Hantken), 1868**

Pl. 4, Figs. 7-8

1868 *Nodosaria (Dentalina) zsigmondyi* - Hantken, p. 87, pl. 1, fig. 12

1982 *Rectobolivina zsigmondyi* (Hantken) - Sztràkos, pl. 15, fig. 14

1987 *Rectobolivina zsigmondyi* (Hantken) - Reiser, p. 91, pl. 9, figs. 13, 19

Locality: Zv-005, Zv-008, Zv-009, Zv-010

***Sagrinopsis aspera* (Terquem), 1882**

Pl. 7, Figs. 1-3

1882 *Textilaria aspera* - Terquem, p. 147, pl. 15, fig. 14 (Fide Ellis & Messina 1940)

1919 *Siphogenerina hexagona* Halkyard - Halkyard, p. 41, pl. 6, fig. 5a-b

1975 *Bifarina* aff. *selseyensis* (Heron-Allen & Earland) - Braga et al., p. 108, pl. 5, fig. 9

1985 *Rectobolivina* sp. - Grünig, p. 266, pl. 8, fig. 22

1993 *Sagrinopsis aspera* (Terquem) - Sztràkos (In: Mathelin & Sztràkos), p. 47, pl. 33, fig. 15

Locality: Vr-005, Vr-005A

***Tubulogenerina tubulifera* (Parker & Jones), 1863**

Pl. 7, Figs. 4-5

1863 *Textularia tubulifera* - Parker & Jones, p. 94, fig. 2 (Fide Ellis & Messina 1940)

1837 *Tubulogenerina tubulifera* (Parker & Jones) - Cushman, p. 215, pl. 24, figs. 14-16

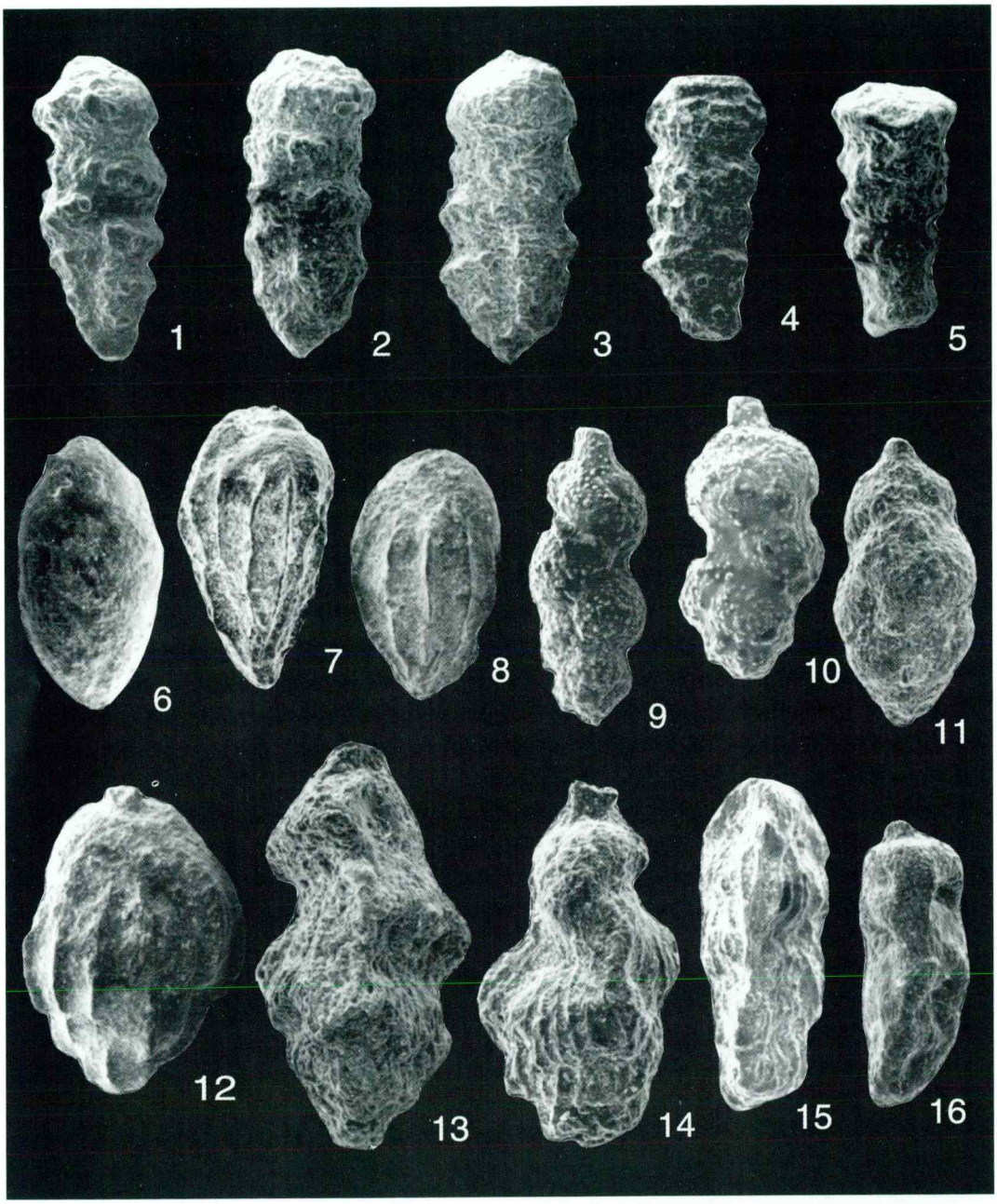
1970 *Tubulogenerina tubulifera* (Parker & Jones) - Le Calvez, p. 122, pl. 26, fig. 7

1987a *Tubulogenerina tubulifera* (Parker & Jones) - Sztràkos, p. 35, pl. 7, fig. 20; pl. 18, fig. 2

1991 *Tubulogenerina tubulifera* (Parker & Jones) - Gibson et al., p. 307, pl. 1, figs. 1-11; pl. 3, figs. 6-8

Locality: Vr-005, Vr-005A

PLATE 7



1-3 *Sagrinopsis aspera* (Terquem). **1** Vr-005, x80. **2** Vr-005, x120. **3** Vr-005A, x120. **4-5** *Tubulogenerina* cf. *tubulifera* (Parker & Jones). **4** Vr-005A, x120. **5** Vr-005, x120. **6** *Bulimina ovata* d'Orbigny, Vr-010, x60. **7** *Bulimina subtruncana* Hagn, Vr-010, x160. **8** *Bulimina truncana* Gümbel, Vr-005, x80. **9-10** *Uvigerina gracilis* Reuss. **9** Vr-005, x160. **10** Vr-005, x160. **11** *Uvigerina chirana* Cushman & Stone, Vr-005, x120. **12** *Uvigerina eocaena* Gümbel, Vr-010, x80. **13** *Angulogerina muralis* (Terquem), Zv/II-008, x160. **14** *Angulogerina pulchella* Cushman & Edwards, Vr-005, x160. **15** *Angulogerina globosa* (Stoltz), Vr-014, x120. **16** *Koleshnikovella elongata* (Halkyard), Zv/II-010, x120.

Family: **Buliminidae Jones, 1875**

***Bulimina ovata* d'Orbigny, 1846**
Pl. 7, Fig. 6

1846 *Bulimina ovata* - d'Orbigny, p. 185, pl. 11, figs. 13-14

1961 *Bulimina ovata* d'Orbigny - Kaasschieter, p. 191, pl. 9, fig. 6

1985 *Bulimina ovata* d'Orbigny - Grünig, p. 266, pl. 6, fig. 22
Locality: Vr-010

***Bulimina subtruncana* Hagn, 1956**
Pl. 7, Fig. 7

1954 *Bulimina subtruncana* - Hagn, p. 17, pl. 3, fig. 19; pl. 4, fig. 9

1985 *Bulimina subtruncana* Hagn - Grünig, p. 266, pl. 6, fig. 23
Locality: Vr-010

***Bulimina truncana* Gümbel, 1868**
Pl. 7, Fig. 8

1868 *Bulimina truncana* - Gümbel, p. 66, pl. 2, fig. 77a-b

1975 *Bulimina truncana* Gümbel - Hantken, p. 61, pl. 7, fig. 5

1975 *Bulimina truncana* Gümbel - Braga et al., p. 106, pl. 4, figs. 15-16

1985 *Bulimina truncana* Gümbel - Grünig, p. 267, pl. 7, figs. 26-27
Locality: Vr-005, Vr-005A, Vr-010, Vr-011A, Zv-009

Family: **Uvigerinidae Haeckel, 1894**

***Uvigerina chirana* Cushman & Stone, 1947**
Pl. 7, Fig. 11

1947 *Uvigerina chirana* - Cushman & Stone, p. 17, pl. 2, fig. 25 (Fide Ellis & Messina 1940)

1977 *Uvigerina chirana* Cushman & Stone - Braga et al., p. 95, pl. 5, fig. 10

1985 *Uvigerina chirana* Cushman & Stone - Grünig, p. 267, pl. 7, figs. 3-5
Locality: Vr-005, Zv-004, Zv-005

***Uvigerina eocaena* Gümbel, 1868**
Pl. 7, Fig. 12

1868 *Uvigerina eocaena* - Gümbel, p. 645, pl. 2, fig. 78

1975 *Uvigerina eocaena* Gümbel - Braga et al., p. 107, pl. 5, fig. 17

1985 *Uvigerina eocaena* Gümbel - Grünig, p. 267, pl. 7, figs. 8-10

1993 *Uvigerina eocaena* Gümbel - Sztràkos (In: Mathelin & Sztràkos), p. 79, pl. 34, figs. 9-10
Locality: Vr-004, Vr-010, Vr-011 Zv-005, Zv-006, Zv-008, Zv-010, Zv-011

***Uvigerina gracilis* Reuss, 1851**
Pl. 7, Figs. 9-10

1851 *Uvigerina gracilis* - Reuss, p. 77, pl. 5, fig. 39

1993 *Uvigerina gracilis* Reuss - Sztràkos (In: Mathelin & Sztràkos), p. 79, pl. 34, fig. 13
Locality: Vr-005

***Angulogerina globosa* (Stoltz), 1925**
Pl. 7, Fig. 15

1925 *Uvigerina tenuistriata* var. *globosa* – Stoltz, p. 130 (Fide Ellis & Messina 1940)

1993 *Angulogerina globosa* (Stoltz) - Sztràkos (In: Mathelin & Sztràkos), p. 48, pl. 34, fig. 20
Locality: Vr-014

***Angulogerina muralis* (Terquem), 1882**
Pl. 7, Fig. 13

1882 *Uvigerina muralis* - Terquem, p. 119, pl. 12, figs. 26-29 (Fide Ellis & Messina 1940)

1919 *Tritaxia dehiscens* - Halkyard, p. 44, pl. 3, fig. 8

1985 *Trifarina muralis* (Terquem) - Grünig, p. 268, pl. 7, fig. 26

1993 *Angulogerina muralis* (Terquem) - Sztràkos (In: Mathelin & Sztràkos), p. 79, pl. 43, fig. 18
Locality: Zv/II-008

***Angulogerina pulchella* Cushman & Edwards, 1937**
Pl. 7, Fig. 14

1937 *Angulogerina pulchella* - Cushman & Edwards, p. 61, pl. 8, fig. 19 (Fide Ellis & Messina 1940)

1993 *Angulogerina pulchella* Cushman & Edwards - Sztràkos (In: Mathelin & Sztràkos), p. 48, pl. 34, fig. 17
Locality: Vr-005

***Trifarina* sp. 1**
Locality: Vr-012

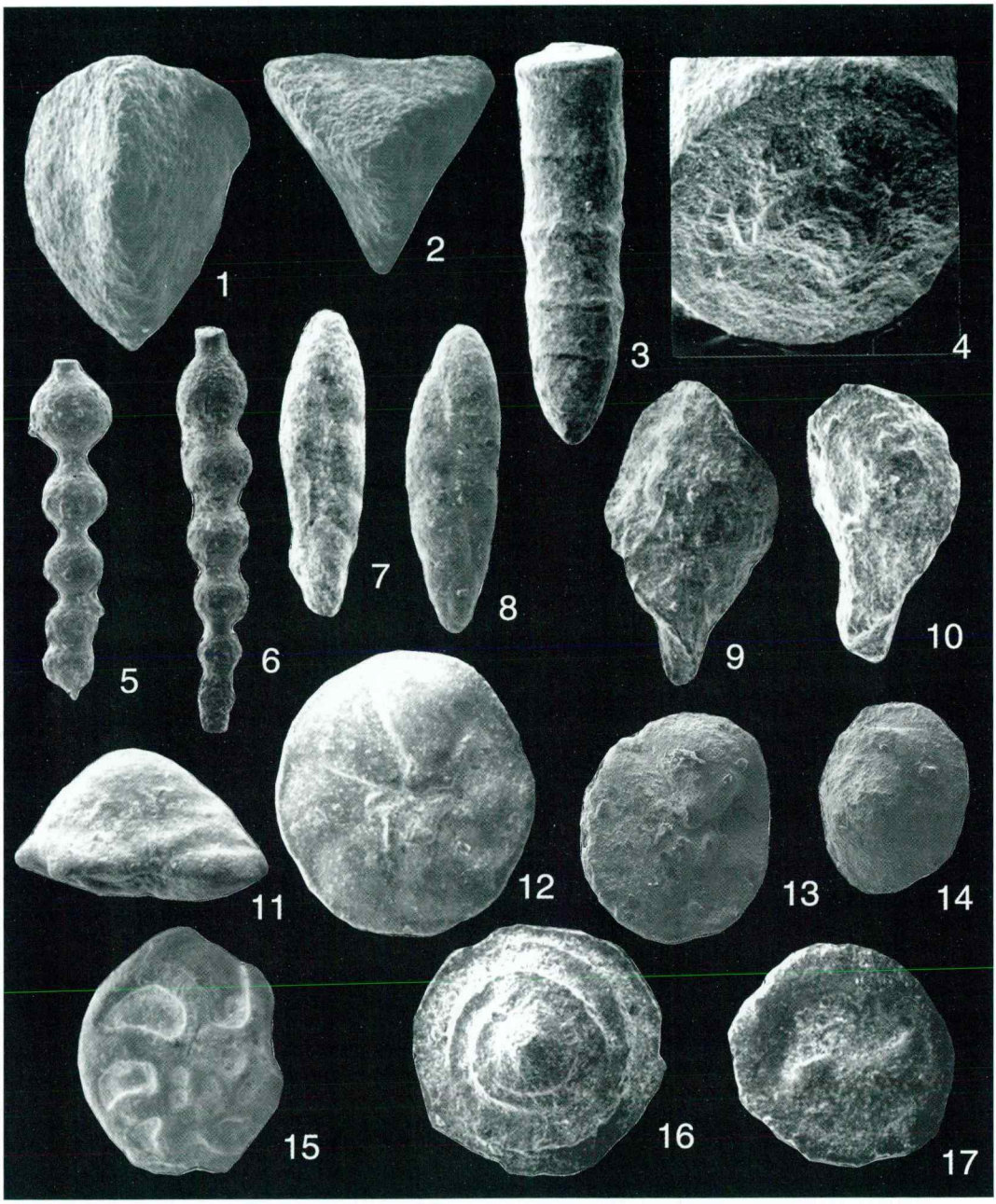
***Koleshnikovella elongata* (Halkyard), 1919**
Pl. 7, Fig. 16

1919 *Tritaxia elongata* - Halkyard, p. 45, pl. 3, fig. 9

1987a *Uvigerinella elongata* (Halkyard) - Sztràkos, p. 36, pl. 18, fig. 5

1993 *Koleshnikovella elongata* (Halkyard) - Sztràkos (In: Mathelin & Sztràkos). p. 48, pl. 34, fig. 16

PLATE 8



1-2 *Reussella oberburgensis* (Reuss). **1** Vr-005A, x120. **2** Vr-005A, x120. **3-4** *Siphonodosaria crassisepta* (Halkyard). **4** Vr-010, x40. **4** Vr-010, x40. **5-6** *Nodogenerina atlantisae* Cushman. **5** Zv/II-006, x80. **6** Zv/II-008, x80. **7-8** *Fursenkoina halkyardi* (Cushman). **7** Vr-012, x60. **8** Zv/II-008, x60. **9-10** *Sigmavirgulina tortuosa* (Brady). **9** Vr-005, x80. **10** Vr-010, x120. **11-12** *Neoeponides schreibersii* (d'Orbigny). **11** Zv/II-005, x40. **12**, Zv/II-005, x40. **13-14** *Eponides ouachitaensis* Howe & Wallace. **13** Vr-011A, x60. **14** Vr-011A, x60. **15** *Schlosserina asterites* (Gümbel), Vr-014, x28. **16-17** *Neoconorbina* sp. **16** spiral view, Vr-005A, x80. **17** umbilical view Vr-005A, x80.

Locality: Zv-010

Family: **Reussellidae Cushman, 1933**

***Reussella oberburgensis* (Reuss), 1864**

Pl. 8, Figs. 1-2

1864 *Verneuilina oberburgensis* Frey. in litt. - Reuss, p. 6, pl. 1, fig. 2

1962 *Reussella oberburgensis* (Freyer) - Gohrbandt, p. 82, pl. 3, fig. 6a-c

1985 *Reussella oberburgensis* (Freyer) - Grünig, p. 267

1993 *Reussella oberburgensis* (Freyer) - Sztràkos (In: Mathelin & Sztràkos), p. 79, pl. 34, fig. 26

Locality: Vr-004, Vr-005, Vr-005A, Vr-011

Family: **Fursenkoinidae Loeblich & TaPpan, 1961**

***Fursenkoina halkyardi* (Cushman), 1936**

Pl. 8, Figs. 7-8

1936 *Virgulina halkyardi* - Cushman, p. 47, pl. 7, fig. 5

1937b *Virgulina halkyardi* Cushman - Cushman, p. 11, pl. 1, figs. 26-27

1985 *Fursenkoina halkyardi* (Cushman) - Grünig, p. 273, pl. 9, figs. 25-27

1993 *Fursenkoina halkyardi* (Cushman) - Sztràkos (In: Mathelin & Sztràkos), p. 49, pl. 35, fig. 6

Locality: Vr-005, Vr-012, Zv-007, Zv-009, Zv-010, Zv-011

***Sigmavirgulina tortuosa* (Brady), 1881**

Pl. 8, Figs. 9-10

1881 *Bolivina tortuosa* - Brady, p. 57 (Fide Ellis & Messina 1940)

1960 *Sigmavirgulina tortuosa* (Brady) - Barker, pl. 52, figs. 31-32

Locality: Vr-005, Vr-005A, Vr-010, Vr-011, Vr-011A, Vr-012, Zv-005

Family: **Stilostomellidae Finlay, 1947**

***Siphonodosaria crassisepta* (Halkyard), 1919**

Pl. 8, Figs. 3-4

1919 *Nodosaria pauperata* d'Orbigny var. *crassisepta* - Halkyard, p. 72, pl. 4, figs. 12-13

1941 *Dentalina annulata* (Reuss) - de Witt Puyt, p. 51, pl. 1, figs. 23-25

1957 *Nodogenerina crassisepta* (Halkyard) - Sacal & Debourle, p. 16, pl. 4, fig. 8

1993 *Siphonodosaria crassisepta* (Halkyard) - Sztràkos (In: Mathelin & Sztràkos), p. 51, pl. 14, figs. 3-11

Locality: Vr-004, Vr-005A, Vr-009, Vr-010, Vr-014, Zv-005, Zv-006, Zv-007, Zv-008, Zv-009, Zv-010

Family: **Eponididae Hofker, 1951**

***Eponides ouachitaensis* Howe & Wallace, 1932**

Pl. 8, Figs. 13-14

1932 *Eponides ouachitaensis* - Howe & Wallace, p. 69, pl. 13, fig. 8 (Fide Ellis & Messina 1940)

1950 *Eponides ouachitaensis* Howe & Wallace - Ruiz de Gaona & Colom, p. 378, fig. 13/36-44

Locality: Vr-004

***"Eponides" dalmatinus* (de Witt Puyt), 1941**

Pl. 11, Figs. 14-15

1941 *Eponides carolinensis* Cushman var. *dalmatina* - de Witt Puyt, p. 66, pl. 1, figs. 52, 57; pl. 2, fig. 2

1950 *Eponides carolinensis* Cushman var. *navarraensis* - Ruiz de Gaona & Colom, p. 377, fig. 14/5-10

1956 *Rotalia dalmatina* (de Witt Puyt) - Hagn, p. 165, pl. 15, figs. 2-3

1993 *Neoeponides navaransis* (Ruiz de Gaona & Colom) - Sztràkos (In: Mathelin & Sztràkos), p. 52, figs. 6-7

Locality: Vr-005A, Vr-010, Vr-011, Zv/II-006, Zv/II-010

Family: **Mississippinidae Saidova, 1981**

***Schlosserina asterites* (Gümbel), 1868**

Pl. 8, Fig. 15

1868 *Rosalina asterites* - Gümbel, p. 658, pl. 2, fig. 101a-c

1981 *Schlosserina asterites* (Gümbel) - Lindenberg et al., p. 148

1991 *Schlosserina asterites* (Gümbel) - Barbin & Keller-Grünig, p. 241, pl. 1, figs. 13-15

1981 *Schlosserina asterites* (Gümbel) - Hagn et al., p. 91

1983 *Schlosserina asterites* (Gümbel) - Setiawan, p. 134, pl. 15, fig. 1

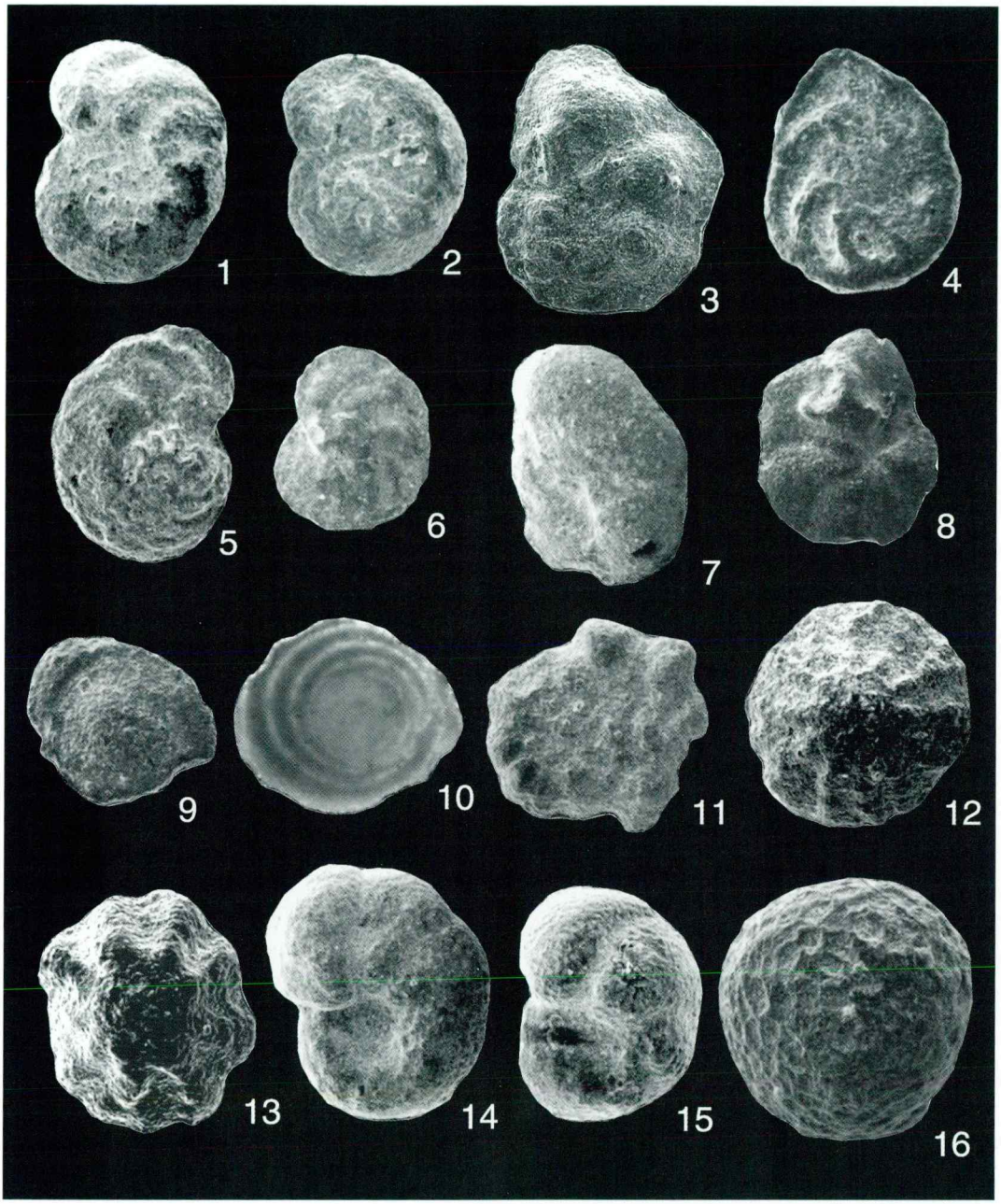
1993 *Schlosserina asterites* Hagn - Sztràkos (In: Mathelin & Sztràkos), p. 80, pl. 15, fig. 2

Locality: Vr-014

Family: **Discorbidae Ehrenberg, 1838**

***Neoeponides schreibersii* (d'Orbigny), 1846**

PLATE 9



1-2 *Cibicidoides ungerianus* (d'Orbigny). **1** spiral view, Vr-010, x60. **2** spiral view, Zv/II-008, x60. **3** *Laticarinina altocamerata* (Heron-Allen & Earland), umbilical view, Zv/II-008, x80. **4** *Planulina compressa* (Hantken), Vr-005A, x80. **5-6** *Planulina costata* (Hantken). **5** spiral view, Vr-012, x40. **6** umbilical view, Vr-010, x40. **7-8** *Lobatula lobatula* (Walker & Jacob). **7** umbilical view, Vr-012, x40. **8** umbilical view, Vr-005, x28. **9-10** *Cycloloculina eocenica* (Terquem). **9** Vr-005A, x80. **10** Vr-005A, x64. **11** *Planorbulina difformis* Roemer, Vr-005A, x60. **12** *Halkyardia minima* (Liebus), Vr-011, x80. **13** *Halkyardia* sp., Vr-011A, x120. **14-15** *Korobkovella grosserugosa* (Gümbel). **14** Vr-010, x60. **15** Vr-010, x60. **16** *Sphaerogypsina globula* (Reuss), Vr-005A, x120.

Pl. 8, Figs. 11-12

1846 *Rotalina schreibersii* - d'Orbigny, p. 154, pl. 8, figs. 4-6

1993 *Neoeponides schreibersii* (d'Orbigny) - Sztràkos (In: Mathelin & Sztràkos), p. 81, pl. 15, fig. 8

Locality: Zv-005, Zv-006, Zv-009, Zv-010

Family: **Rosalinidae Reiss, 1963**

***Neoconorbina* sp. 1**

Pl. 8, Figs. 16-17

Locality: Vr-005, Vr-005A

Family: **Parrelloididae Hofker, 1956**

***Cibicidoides ungerianus* (d'Orbigny), 1846**

Pl. 9, Figs. 1-2

1846 *Rotalina ungeriana* - d'Orbigny, p. 157, pl. 8, figs. 16-18

1950 *Cibicides granosus* (Reuss) - Ruiz de Gaona & Colom, p. 368, fig. 13/21-27

1956 *Cibicides ungerianus* (d'Orbigny) - Hagn, p. 181, pl. 17, figs. 10-11

1975 *Heterolepa ungeriana* (d'Orbigny) - Braga et al., p. 98

1991 *Cibicidoides ungerianus* (d'Orbigny) - Barbin & Keller-Grünig, p. 24

1993 *Cibicidoides ungerianus* (d'Orbigny) - Sztràkos (In: Mathelin & Sztràkos), p. 81, pl. 16, fig. 11

Locality: Vr-004, Vr-010, Vr-011, Zv-004, Zv-006, Zv-008

Family: **Discorbinellidae Sigal, 1952**

***Laticarinina altocamerata* (Heron-Allen & Earland), 1922**

Pl. 9, Fig. 3

1922 *Truncatulina tenuimargo* Brady var. altocamerata - Heron-Allen & Earland, p. 209, pl. 7, figs. 24-27 (Fide Ellis & Messina 1940)

1964 *Laticarinina altocamerata* (Heron-Allen & Earland) - Loeblich & Tappan, p. C580, fig. 457, 4

1983 *Laticarinina altocamerata* (Heron-Allen & Earland) - Setiawan, p. 116. pl. 5, fig. 4

1991 *Laticarinina altocamerata* (Heron-Allen & Earland) - Barbin & Keller-Grünig, p. 242

Locality: Vr-005A, Zv-008

Family: **Planulinidae Bermudez, 1952**

***Planulina compressa* (Hantken), 1875**

Pl. 9, Fig. 4

1875 *Truncatulina compressa* - Hantken, p. 72, pl. 8, fig. 8a-b

1956 *Planulina compressa* (Hantken) - Hagn, p. 179, pl. 17, fig. 5a-b

1975 *Planulina compressa* (Hantken) - Braga et al., p. 95, pl. 2, fig. 13a-c

1993 *Planulina compressa* (Hantken) - Sztràkos (In: Mathelin & Sztràkos), p. 81, pl. 17, fig. 1

Locality: Vr-005A

***Planulina costata* (Hantken), 1875**

Pl. 9, Figs. 5-6

1875 *Truncatulina costata* - Hantken, p. 73, pl. 9, fig. 2

1956 *Planulina costata* Hantken – Hagn, p. 178, pl. 17, figs. 3a-b, 4a-b

1984 *Planulina costata* (Hantken) - Grünig & Herb, p. 262

1993 *Planulina costata* (Hantken) - Sztràkos (In: Mathelin & Sztràkos), p. 81, pl. 16, fig. 13; pl. 38, fig. 9

Locality: Vr-004, Vr-005, Vr-005A, Vr-010, Vr-011, Vr-012, Zv-005, Zv-006, Zv-007, Zv-008, Zv-009, Zv-010

Family: **Cibicididae Cushman, 1927**

***Lobatula lobatula* (Walker & Jacob), 1798**

Pl. 9, Figs. 7-8

1798 *Nautilus lobatulus* - Walker & Jacob (in Kanmacher), p. 642, pl. 14, fig. 36 (Fide Ellis & Messina 1940))

1957 *Cibicides lobatulus* (Walker & Jacob) - Sacal & Debourle, p. 68, pl. 33, fig. 1

1962 *Cibicides lobatulus* (Walker & Jacob) - Gohrbandt, p. 113

1991 *Cibicides lobatulus* (Walker & Jacob) - Barbin & Keller-Grünig, p. 240, pl. 1, figs. 17-18

1993 *Lobatula lobatula* (Walker & Jacob) - Sztràkos (In: Mathelin & Sztràkos), p. 81, pl. 17, fig. 9

Locality: Vr-005, Vr-005A, Zv-005, Zv-010

***Cycloloculina eocenica* (Terquem), 1882**

Pl. 9, Figs. 9-10

1882 *Planorbulina eocenica* - Terquem, p. 90, pl. 9, fig. 15a-b

1970 *Cycloloculina eocenica* (Terquem) - Le Calvez, p. 186, pl. 35, fig. 4

1993 *Cycloloculina eocenica* (Terquem) - Sztràkos (In: Mathelin & Sztràkos), p. 81, pl. 19, fig. 1; pl. 43, fig. 6

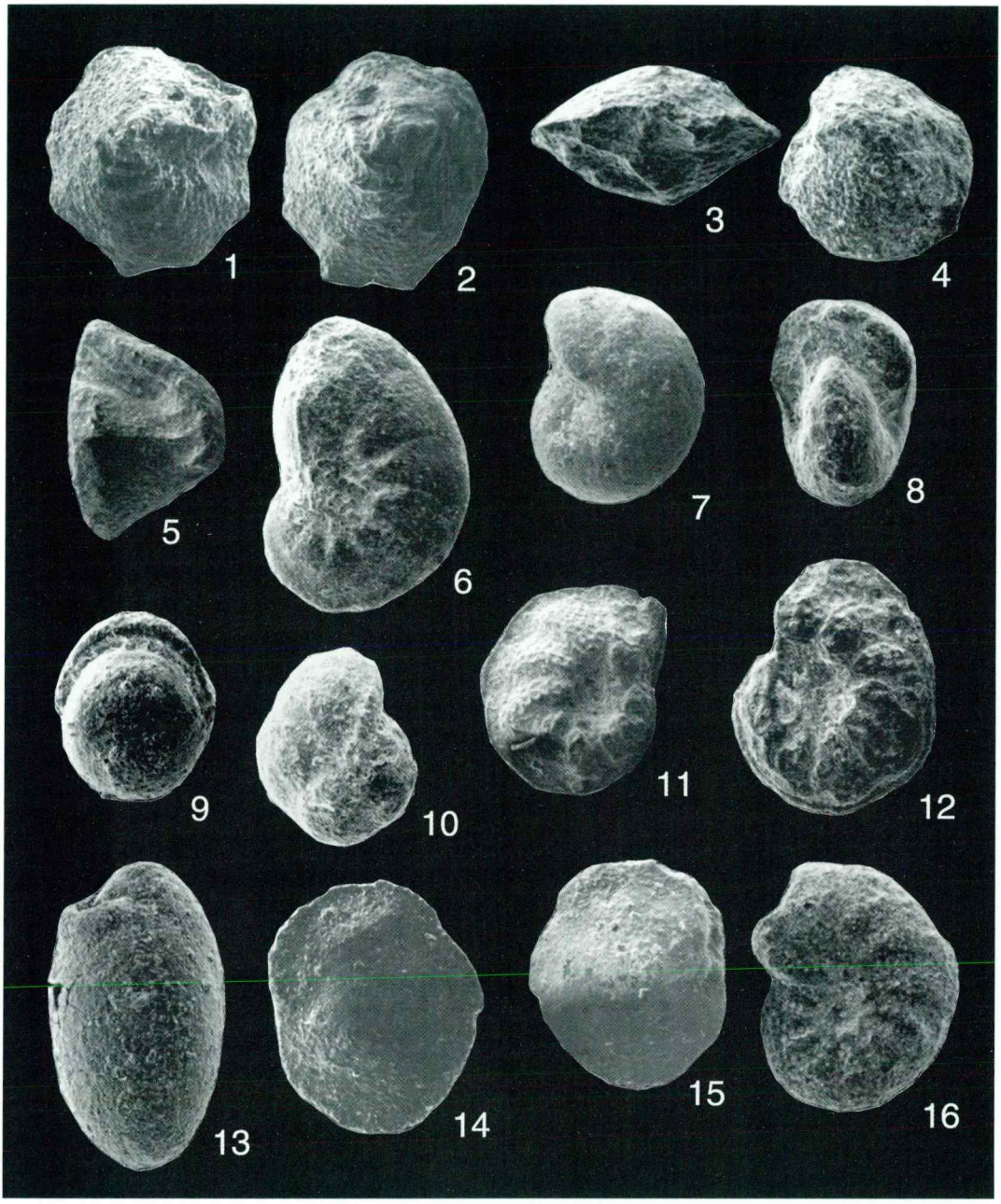
Locality: Vr-004, Vr-005A

Family: **Planorbulinidae Schwager, 1877**

***Planorbulina difformis* Roemer, 1838**

Pl. 9, Fig. 11

PLATE 10



1-2 *Asterigerina brencei* Haque. **1** umbilical view, Vr-005A, x120. **2** umbilical view, Vr-005A, x120. **3-4** *Asterigerina* sp. **3** edge view, Vr-005, x80. **4** umbilical view, Vr-004, x80. **5** *Asterigerina rotula* (Kaufmann), edge view, Vr-009, x40. **6** *Nonion scaphum* (Fichtel & Moll), side view, Vr-005, x80. **7-8** *Melonis halkyardi* (Cushman). **7** side view, Zv/II-008, x80. **8** apertural view, Vr-005, x80. **9** *Pullenia bulloides* (d'Orbigny), apertural view, Zv/II-011, x80. **10** *Pullenia quinqueloba* (Reuss), side view, Vr-010, x80. **11-12** *Queraltina epistominoides* Marie. **11** Vr-005A, x60. **12** Marie, Vr-005A, x60. **13** *Chilostomella ovoidea* Reuss, Zv/II-011, x60. **14-15** *Charltonina budensis* (Hantken). **14** spiral view, Vr-005A, x60. **15** umbilical view, Vr-005A, x60. **16** *Anomalinoides affinis* (Hantken), Vr-005, x80.

1993 *Planorbulina difformis* Roemer - Sztràkos (In: Mathelin & Sztràkos), p. 81, pl. 38, figs. 5-6

Locality: Vr-005A

Family: **Cymbaloporidae Cushman, 1927**

***Halkyardia minima* (Liebus), 1911**

Pl. 9, Fig. 12

1911 *Cymbalopora radiata* Hagenow var. *minima* - Liebus, p. 952, pl. 3, fig. 7a-c

1969 *Halkyardia minima* (Liebus) - Cimerman, p. 298, pl. 58, figs. 1-6

1976 *Halkyardia minima* (Liebus) - Šikić et al., p. 195, pl. 6, fig. 1

1979 *Halkyardia minima* (Liebus) - Drobne et al., p. 158

1985 *Halkyardia minima* (Liebus) - Grünig, p. 272, pl. 9, figs. 16-17

1991 *Halkyardia minima* (Liebus) - Barbin & Keller-Grünig, p. 241

1993 *Halkyardia minima* (Liebus) - Sztràkos (In: Mathelin & Sztràkos), p. 54, pl. 38, fig. 12

Locality: Vr-005A, Vr-011, Vr-011A, Vr-014

***Halkyardia* sp.**

Pl. 9, Fig. 13

Locality: Vr-011A

Family: **Stilostomellidae Finlay, 1947**

***Nodogenerina atlantisae* (Cushman), 1939**

Pl. 8, Figs. 5-6

1939 *Ellipsonodosaria atlantisae* - Cushman, p. 70, pl. 12, figs. 3-4 (Fide Ellis & Messina 1940)

1993 *Nodogenerina atlantisae* (Cushman) - Sztràkos (In: Mathelin & Sztràkos), p. 80, pl. 13, figs. 16-18; pl. 34, figs. 18-19

Locality: Zv-006, Zv-008

Family: **Victoriellidae Chapman & Crespin, 1930**

***Korobkovella grosserugosa* (Gümbel), 1868**

Pl. 9, Figs. 14-15

1868 *Truncatulina grosserugosa* - Gümbel, p. 82, pl. 2, fig. 104

1950 *Anomalina grosserugosa* (Gümbel) - Ruiz de Gaona & Colom, p. 362

1957 *Anomalina grosserugosa* (Gümbel) - Sacal & Debourle, p. 66, pl. 33, fig. 6

1970 *Anomalina grosserugosa* (Gümbel) - Le Calvez, p. 198, pl. 40, fig. 2

1983 *Anomalina grosserugosa* (Gümbel) - Setiawan, p. 132, pl. 14, fig. 1

1993 *Korobkovella grosserugosa* (Gümbel) - Sztràkos (In: Mathelin & Sztràkos), p. 82, pl. 19. Fig. 2

Locality: Vr-004, Vr-005A, Vr-009, Vr-010, Vr-012, Vr-014, Zv-006, Zv-007

Family: **Acervulinidae Schultze, 1854**

***Sphaerogypsina globula* (Reuss), 1848**

Pl. 9, Fig. 16

1848 *Ceriopora globulus* - Reuss, p. 33, pl. 5, fig. 7

1950 *Gypsina globula* (Reuss) - Ruiz de Gaona & Colom, p. 380

1979 *Sphaerogypsina globula* (Reuss) - Drobne et al., p. 158, pl. 3, fig. 1; pl. 4, figs. 3-4

1985 *Sphaerogypsina globula* (Reuss) - Grünig, p. 272, pl. 9, figs. 14-15

1993 *Sphaerogypsina globula* (Reuss) - Sztràkos (In: Mathelin & Sztràkos), p. 82, pl. 38, fig. 13

Locality: Vr-004, Vr-005, Vr-005A

Family: **Asterigerinidae d'Orbigny, 1839**

***Asterigerina brencei* Haque, 1960**

Pl. 10, Figs. 1-2

1960 *Asterigerina brencei* Haque - Setiawan, p. 118, pl. 9, fig. 3

Locality: Vr-005, Vr-009, Vr-010

***Asterigerina rotula* (Kaufmann), 1867**

Pl. 10, Fig. 5

1867 *Hemistegina rotula* - Kaufmann, p. 150, pl. 8, fig. 19 (Fide Ellis & Messina 1940)

1886 *Pulvinulina rotula* (Kaufmann) - Uhlig, p. 193, pl. 3, figs. 5-6; pl. 5, figs. 6-7

1979 *Asterigerina rotula* (Kaufmann) - Drobne et al., p. 158, pl. 3, fig. 2; pl. 4, fig. 5

1993 *Asterigerina rotula* (Kaufmann) - Sztràkos (In: Mathelin & Sztràkos), p. 82, pl. 19, fig. 7

Locality: Vr-010, Vr-011

***Asterigerina* sp. 1**

Pl. 10, Figs. 3-4

Locality: Vr-005, Vr-005A

Family: **Nonionidae Schultze, 1854**

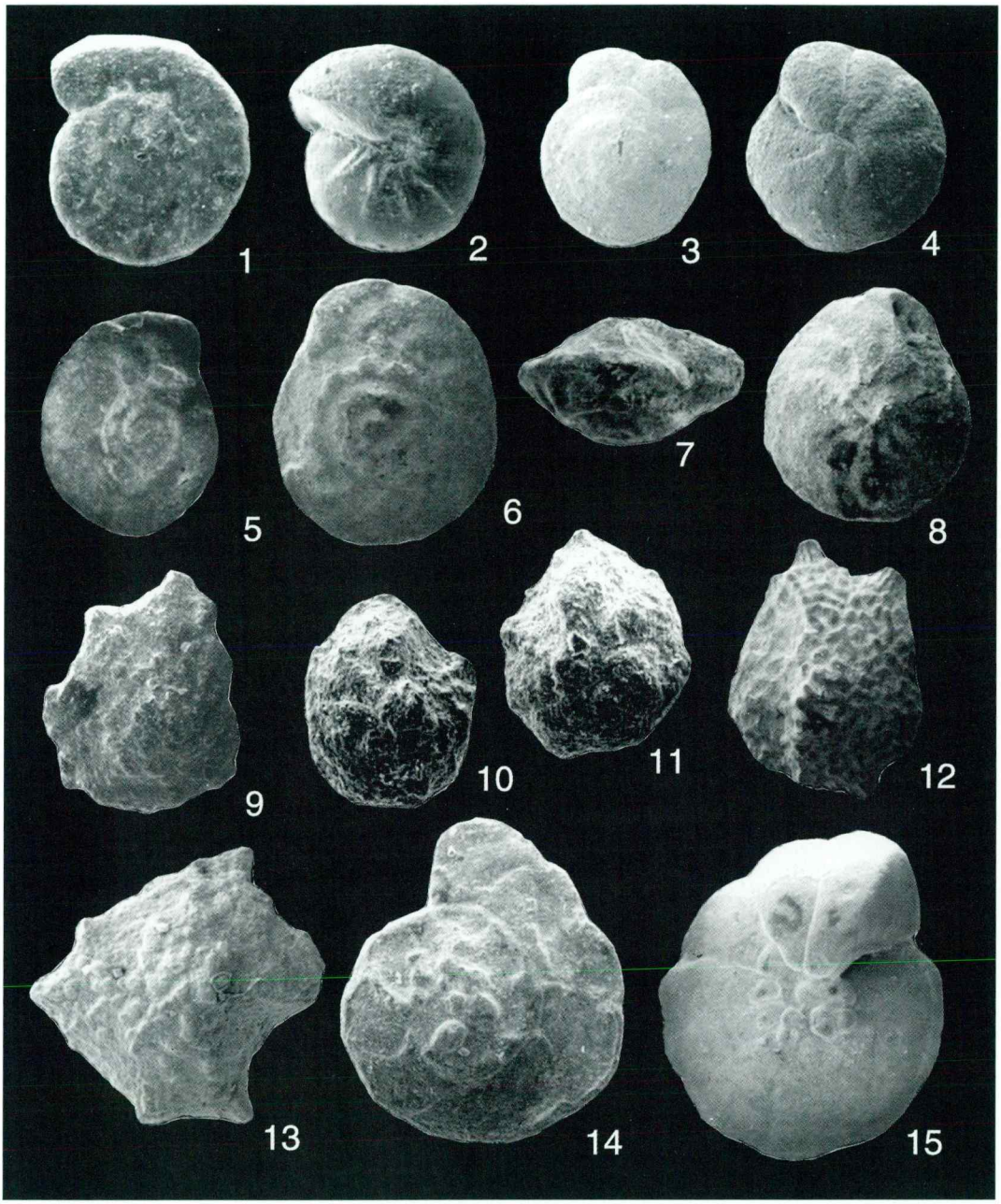
***Nonion scaphum* (Fichtel et Moll), 1798**

Pl. 10, Fig. 6

1798 *Nautilus scapha* - Fichtel & Moll, p. 105, pl. 19, figs. d-f (Fide Ellis & Messina 1940)

1846 *Nonionina communis* d'Orbigny - d'Orbigny, p. 106, pl. 5, fig. 7

PLATE 11



1-2 *Gyroidinoides girardanus* (Reuss). **1** spiral view, Zv/II-006, x40. **2** umbilical view, Zv/II-006, x40. **3-4** *Heterolepa eocaena* (Gümbel). **3** spiral view, Zv/II-006, x28. **4** umbilical view, Zv/II-011, x35. **5** *Heterolepa reussi* (Silvestri), spiral view, Vr-012, x50. **6-8** *Gavelinella acuta* (Plummer). **6** spiral view, Vr-009, x40. **7** edge view, Vr-009, x400. **8** spiral view, Vr-009, x40. **9** *Pararotalia armata* (d'Orbigny), spiral view, Vr-011, x60. **10-11** *Pararotalia audouini* (d'Orbigny). **10** spiral view, Vr-011, x80. **11** spiral view, Vr-011, x80. **12-13** *Calcarina lecalvezae* Boulanger & Poignant. **12** Vr-014, x28. **13** Zv/II-009, x28. **14-15** *"Eponides" dalmatinus* (de Witt Puyt). **14** spiral view, Vr-009, x28, **15** umbilical view, Zv/II-010, x28.

1961 *Nonion scaphum* (Fichtel & Moll) - Kaasschieter, p. 204, pl. 10, fig. 5

1993 *Nonion commune* (d'Orbigny) - Sztràkos (In: Mathelin & Sztràkos), p. 82, pl. 19, fig. 11

Locality: Vr-005

***Melonis halkyardi* (Cushman), 1936**

Pl. 10, Figs. 7-8

1936 *Nonion halkyardi* - Cushman, p. 63, pl. 12, fig. 1 (Fide Ellis & Messina 1940)

1987a *Melonis halkyardi* (Cushman) - Sztràkos, p. 32, pl. 15, fig. 6

Locality: Vr-005, Vr-012, Zv/II-008, Zv/II-011

***Pullenia bulloides* (d'Orbigny), 1846**

Pl. 10, Fig. 9

1846 *Nonionina bulloides* - d'Orbigny, p. 107, pl. 5, fig. 9-10

1875 *Pullenia bulloides* (d'Orbigny) - Hantken, p. 59, pl. 10, fig. 9

1987a *Pullenia bulloides* (d'Orbigny) - Sztràkos, p. 34

Locality: Vr-005A, Vr-011, Vr-011A, Zv-006, Zv-010, Zv-011

***Pullenia quinqueloba* (Reuss), 1851**

Pl. 10, Fig. 10

1851 *Nonionina quinqueloba* - Reuss, p. 71, pl. 5, fig. 31

1987 *Pullenia quinqueloba* (Reuss) - Wenger, p. 299, pl. 13, figs. 16, 20

1991 *Pullenia quinqueloba* (Reuss) - Barbin & Keller-Grünig, p. 240

1993 *Pullenia quinqueloba* (Reuss) - Sztràkos (In: Mathelin & Sztràkos), p. 82, pl. 19, fig. 17

Locality: Vr-005A, Zv-005, Zv-006

Family: **Almaenidae Myatlyuk, 1959**

***Queraltina epistominoides* Marie, 1950**

Pl. 10, Figs. 11-12

1950 *Queraltina epistominoides* - Marie, p. 74, figs. 1-3, 8-9 (Fide Ellis & Messina 1940)

1983 *Queraltina epistominoides* Marie - Setiawan, p. 133, pl. 14, figs. 2-3

1985 *Almaena epistominoides* (Marie) - Grünig, p. 276

1987a *Queraltina epistominoides* Marie - Sztràkos, p. 34

1991 *Queraltina epistominoides* Marie - Barbin & Keller-Grünig, p. 241, pl. 2, fig. 16

1993 *Queraltina epistominoides* Marie - Sztràkos (In: Mathelin & Sztràkos), p. 56, pl. 39, fig. 20

Locality: Vr-004, Vr-005A, Vr-012, Vr-014

Family: **Chilostomellidae Brady, 1881**

***Chilostomella ovoidea* Reuss, 1850**

Pl. 10, Fig. 13

1850 *Chilostomella ovoidea* - Reuss, p. 380, pl. 48, fig. 12

1993 *Chilostomella* cf. *ovoidea* Reuss - Sztràkos (In: Mathelin & Sztràkos), p. 82, pl. 20. fig. 1

Locality: Zv-005, Zv-006, Zv-009, Zv-010, Zv-011

Family: **Osangulariidae Loeblich & Tappan, 1964**

***Charltonina budensis* (Hantken), 1875**

Pl. 10, Figs. 14-15

1875 *Truncatulina budensis* - Hantken, p. 75, pl. 8, fig. 6

1919 *Pulvinulina acutimargo* - Halkyard, p. 120, pl. 7, fig. 4

1985 *Alabamina acutimargo* (Halkyard) - Grünig, p. 274, pl. 10. fig. 9-11

1987a *Alabamina budensis* (Hantken) - Sztràkos, p. 32, pl. 12, fig. 8

1993 *Charltonina budensis* (Hantken) - Sztràkos (In: Mathelin & Sztràkos), p. 57, pl. 20, fig. 4

Locality: Vr-005A, Vr-009, Vr-010, Vr-011, Vr-012

Family: **Heterolepidae Gonzales-Donoso, 1969**

***Anomalinoides affinis* (Hantken), 1875**

Pl. 10, Fig. 16

1875 *Pulvinulina affinis* - Hantken, p. 78, pl. 10, fig. 6

1941 *Anomalina dalmatina* nov. sp. - van Bellen, p. 1001, fig. 26a-c

1956 *Anomalinoides dalmatinus* (van Bellen) - Hagn, p. 177, pl. 17, fig. 1a-b

1993 *Anomalinoides affinis* (Hantken) - Sztràkos (In: Mathelin & Sztràkos), p. 82, pl. 20, fig. 8

Locality: Vr-004, Vr-005A, Zv-006, Zv-007, Zv-009, Zv-010, Zv-011

***Heterolepa eocaena* (Gümbel), 1868**

Pl. 11, Fig. 3-4

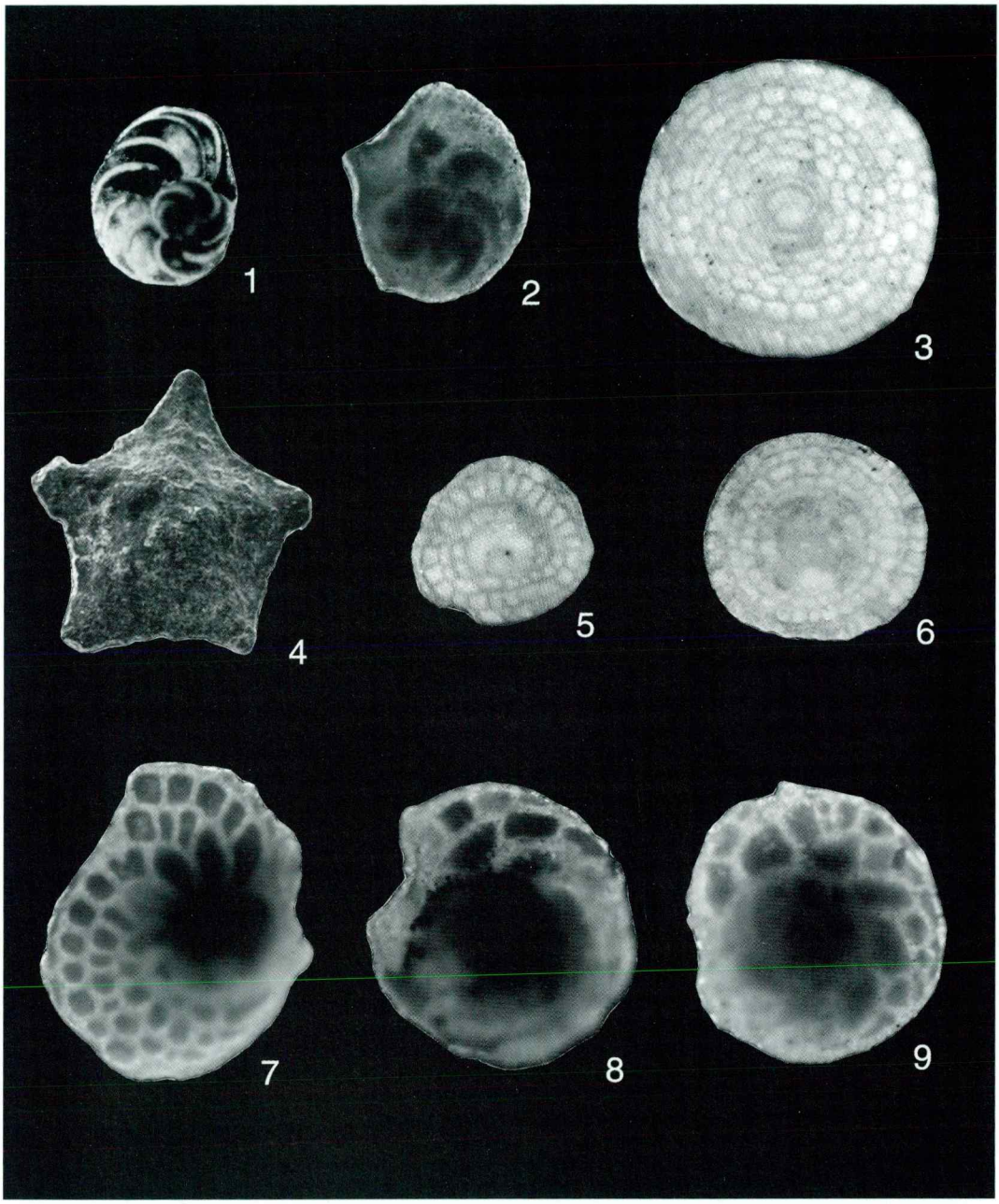
1868 *Rotalia eocaena* - Gümbel, p. 72, pl. 2, fig. 87a-b

1956 *Cibicides eocaenus* (Gümbel) - Hagn, p. 180, pl. 17, figs. 8-9

1985 *Heterolepa eocaena* (Gümbel) - Grünig, p. 275, pl. 11, figs. 1-3

Locality: Vr-004, Vr-005, Vr-005A, Vr-

PLATE 12



1-2 *Operculina* cf. *gomezi* Colom & Bauza. **1** Vr-005A, x32. **2** Vr-005A, x32. **3** *Eoannularia eoceniva* Cole & Bermudez, Vr-005A, x64. **4** *Asterocyclina* sp. Vr-005A, x80. **5** *Discocyclina trabayensis vicenzensis* Less, Vr-005A, x64. **6** *Discocyclina* s. l., Vr-005A, x64. **7-9***Heterostegoina* sp. 1. **7** Vr-005A, x64 . **8** Vr-005A, x64. **9** Vr-005A, x64.

012, Zv-005, Zv-011

***Heterolepa reussi* (Silvestri), 1906**
Pl. 11, Fig. 5

1906 *Truncatulina dutemplei* (d'Orbigny) var. reussi - Silvestri, p. 33 (Fide Ellis & Messina 1940)

1956 *Cibicides dalmatinus* van Bellen - Hagn, p. 180, pl. 18, fig. 5a-b

1985 *Heterolepa reussi* (Silvestri) - Grünig, p. 76, pl. 11, figs. 7-9
Locality: Vr-011, Vr-012

Family: **Gavelinellidae Hofker, 1956**

***Gyroidinoides girardanus* (Reuss), 1851**
Pl. 11, Figs. 1-2

1851 *Rotalina girardana* - Reuss, p. 73, pl. 5, fig. 34

1993 *Gyroidinoides girardanus* (Reuss) - Sztràkos (In: Mathelin & Sztràkos), p. 83, pl. 21, fig. 3
Locality: Vr-004, Vr-005A, Vr-010, Vr-012, Zv-006, Zv-007, Zv-009, Zv-011

***Gavelinella acuta* (Plummer), 1926**
Pl. 11, Figs. 6-8

1926 *Anomalina ammonoides* (Reuss) var. *acuta* n. var. - Plummer, p. 149, pl. 10, fig. 2a-c

1983 *Anomalina acuta* Plummer - Setiawan, p. 131, pl. 14, fig. 3

1987a *Gavelinella acuta* (Plummer) - Sztràkos, p. 31, pl. 13, figs. 12, 13

Locality: Vr-009

Family: **Linderinidae Loeblich & Tappan, 1984**

***Eoannularia eocenica* Cole & Bermudez, 1944**
Pl. 12, Fig. 3

1944 *Eoannularia eocenica* - Cole & Bermudez, p. 12, pl. 1, figs. 11-16 (Fide Ellis & Messina 1940)

1976 *Eoannularia eocenica* Cole & Bermudez – Sirel, p. 80, pl. 1. figs. 1-3; pl. 2, figs. 1, 2, 4, 5, 8, 9
Locality: Vr-005A, Vr-011

Family: **Rotaliidae Ehrenberg, 1839**

***Pararotalia armata* (d'Orbigny), 1826**
Pl. 11, Fig. 9

1826 *Rotalia armata* - d'Orbigny, p. 273, pl. 8, fig. no. 22

1970 *Pararotalia armata* (d'Orbigny) - Le Calvez, p. 161, pl. 39, fig. 1

1985 *Pararotalia armata* (d'Orbigny) - Grünig, p. 270, pl. 8, fig. 9

1993 *Pararotalia armata* (d'Orbigny) - Sztràkos (In: Mathelin & Sztràkos), p. 83, pl. 42, fig. 11
Locality: Vr-011

***Pararotalia audouini* (d'Orbigny), 1826**
Pl. 11, Figs. 10-11

1826 *Rotalia audouini* - d'Orbigny, p. 273, no. 19

1970 *Pararotalia audouini* (d'Orbigny) - Le Calvez, p. 162, pl. 34, fig. 8

1975 *Pararotalia audouini* (d'Orbigny) - Braga et al., p. 107, pl. 6, figs. 8-9

1983 *Pararotalia audouini* (d'Orbigny) - Setiawan, p. 120

1993 *Pararotalia audouini* (d'Orbigny) - Sztràkos (In: Mathelin & Sztràkos), p. 83, pl. 42, fig. 12
Locality: Vr-011

Family: **Calcarinidae Schwager, 1876**

***Calcarina lecalvezae* Boulanger & Poignant, 1971**
Pl. 11, Figs. 12-13

1971 *Calcarina le calvezae* - Boulanger & Poignant, p. 96, pl. 1, figs. 1-10

1991 *Calcarina lecalvezae* Boulanger & Poignant - Barbin & Keller-Grünig, p. 242, pl. 1, fig. 22

1993 *Calcarina lecalvezae* Boulanger & Poignant - Sztràkos (In: Mathelin & Sztràkos), p. 83, pl. 22, figs. 7-9
Locality: Vr-014, Zv-009

Family: **Nummulitidae de Blainville, 1827**

***Heterostegina* sp. 1**
Pl. 12, Figs. 7-9
Locality: Vr-005, Vr-005A

***Operculina* cf. *gomezi* Colom & Bauza, 1950**
Pl. 12, Figs. 1-2

1950 *Operculina canalifera gomezi* - Colom & Bauza, p. 217, pl. 16, figs. 1-3; texte, figs. 1-2. (Fide Ellis & Messina 1940)

1971 *Operculina canalifera gomezi* Colom & Bauza - Ferrer, p. 35, fig. 19

1977 *Operculina gomezi* Colom & Bauza - Hottinger, p. 98, figs. 38 A-F

1993 *Operculina gomezi* Colom & Bauza - Mathelin (In: Mathelin & Sztràkos), p. 62, pl. 44, fig. 4

Locality: Vr-005A

Family: **Discocyclinidae Galloway, 1928**

***Discocyclina trabayensis vicenzensis* Less, 1987**

Pl. 12, Fig. 5

1987 *Discocyclina trabayensis* Neumann, 1955 *vicenzensis* n. ssp. - Less, p. 172, pl. 18, figs. 3-5, textfig. 27y

Locality: Vr-005A

***Discocyclina* s. l.**

Pl. 12, Fig. 6

Locality: Vr-004, Vr-005, Vr-005A, VR-009

***Asterocyclina* sp. 1**

Pl. 12, Fig. 4

Locality: Vr-004, Vr-005, Vr-005A

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