

Carnian Foraminifera from the Kucler quarry at Lesno Brdo (Slovenia)

Karnijske foraminifere iz Kuclerjevega kamnoloma na Lesnem Brdu

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Ključne besede: Mikropaleontologija, foraminifere (luknjičarke), karnij, Lesno Brdo

Abstract

The Carnian platy limestone of the Kucler quarry at Lesno Brdo yields a rich assemblage of Foraminifera and other microfossils. Eight foraminiferan genera have been determined, of them the following three are the most abundant; *Lamelliconus*, *Aulotortus* and *Triadodiscus*. Genera *Gandinella*, ? *Meandrospira* and *Gsollbergella* are less abundant, but still frequent, while Foraminifera from genera *Trochammina* and *Nodosaria* occur sparsely.

Kratka vsebina

Karnijski ploščasti apnenec iz Kuclerjevega kamnoloma na Lesnem Brdu je s foraminiferami kot tudi z ostalimi mikrofosili zelo bogat. Določenih je osem luknjičarskih rodov, med katerimi so številčno najmočnejše zastopani trije; *Lamelliconus*, *Aulotortus* in *Triadodiscus*. Pogoste so še luknjičarke iz rodov *Gandinella*, ? *Meandrospira* in *Gsollbergella*, medtem ko so luknjičarke iz rodov *Trochammina* in *Nodosaria* maloštevilne.

Introduction

This paper presents Carnian (Julian) Foraminifera from the Kucler quarry by Lesno Brdo (Vrhnika, Slovenia; Fig.1). Lithologically, the Kucler quarry consists of dark grey to black micritic strata interbedded with thin strata of shaly and marly mudstone (Fig.2). Sedimentation of these beds occurred in a shallow lagoon. As the results of the geochemical analysis indicate, the water was brackish and warm (21–34°C) (Dolenec & Jelen, 1987).

The Kucler quarry is very interesting in a paleontological view due to its bivalve assemblage, which has been studied by many

paleontologists, such as Kosmat (1902), Waagen (1907), Rakovec (1955), Grad & Ferjančič (1976) and Jelen (1982).

To my knowledge, the microfossils have not been studied in detail until now. There are recorded microgastropods, bivalve debris, ostracoda shells, algae *Clypeina besici* and pellets of *Parafavrenia thoronetensis* (Crustacean) in Jelen (1982). Among Foraminifera, two genera were listed; *Involutina* and *Trocholina*. The presence of foraminiferan genera *Glomospira* and *Nodosaria* is also reported (Grad & Ferjančič, 1976).

For a more detailed study of foraminiferan assemblage I have sampled mudstone

and micritic strata I was able to reach. The stratimetric column of the collecting site VČK (Jelen, 1982, p. 24; note: named by author) was used for this purpose. From micritic samples, I prepared 45 slides that were studied later. On the other hand, isolated Foraminifera from mudstone remain unclassified due to their bed preservation.

Paleontological part

I found out that almost all of the sampled micritic strata yield a rich microfossils' assemblage (Fig. 2). According to slides, Foraminifera are numerous already in the lowest (3) stratum. They are even more abundant upward but become sparse in the highest (45) stratum. The reason could be a great recrystallization rate and subsequently, an obliteration of fossils in that stratum. Contrary to the high abundance, the foraminiferan diversity in the quarry is low. Some paleoecological parameters of lagoon could have influenced that; for instance, shallow brackish water, high nutrition and reducing condition within the fine-grained sediment.

Microgastropods are the most frequent between the (7) and (19) stratum. The shell debris is present with more or less constant density throughout the whole section while the ostracodes are more typical in the lower strata. A lot of their shells remained connected after their death. In slides of the (9) stratum, there are some holothurian sclerites of the genus *Theelia*. Among fossil algae, *Clypeina* is the most distinctive. It is numerous in (13) and (27) stratum, but occurs sparsely in slides of other strata. Algae that could belong to genera *Macroporella* and *Griphoporella* were also found (Oblak, 1999).

Taxonomy of Carnian Foraminifera from Lesno Brdo and their description (referring to Loeblich & Tappan, 1987)

Ordo FORAMINIFERA Eichwald, 1830
 Subordo TEXTULARIINA Delage & Herouard, 1896
 Superfamilia AMMODISCACEA
 Reuss, 1862
 Familia AMMODISCIDAE Reuss, 1862

Subfamilia AMMOVERTELLININAE

Saidova, 1981

Genus *Gandinella* Ciarapica and Zaninetti, 1985

Gandinella falsofriedli (Salaj, Borza & Samuel, 1983)
 (Pl. 2., fig. 1, 2)

1966 *Glomospirella friedli* Kristan-Tollmann - Broennimann & Page, pl.1, fig.9-12.

1970 *Glomospirella* aff. *G. friedli* Kristan-Tollmann - Jendrekova, pl.1, fig.5.

1983 *Glomospirella friedli* Ho - Gazdzicki, p. 133, pl.32, fig.1-6.

1983 *Pilamminella falsofriedli* n.sp. - Salaj et al., p. 67., pl.XV, fig.7-11.

1985 *Gandinella apenninica* n.sp. - Ciarapica & Zaninetti, p. 307, pl.I, fig.1-14.

1986 *Glomospirella friedli* Kristan-Tollmann - Sudar, pl.XXIV, fig.4, 5.

1987 *Gandinella apenninica* Ciarapica & Zaninetti - Loeblich & Tappan, p. 50, pl.61, fig.4-6.

1988 *Gandinella apenninica* Ciarapica & Zaninetti - Peybernes et al., pl.VI, fig.1-5.

1990 *Gandinella falsofriedli* (Salaj, Borza & Samuel) - Vachard et al., p. 526, pl.2, fig.15, pl.3, fig.1, 2, 10-14.

1995 *Gandinella falsofriedli* (Salaj, Borza & Samuel) - Zamparelli et al., p. 402, pl.1, fig.1-15.

Material: Frequent sections in slides.

Description: The test is made of a proloculus and of a tubular undivided second chamber. The earliest coils are streptospiral, the following three to five whorls are sigmoidal and the late stage is planispiral. The wall is agglutinated of fine particles.

Size: Diameters of the tests are up to 0.35 mm, mostly about 0.3mm.

Occurrence of the genus: Carnian - Rhaetian; Italy, Spain, Slovakia, Turkey, China. In Slovenia, Foraminifera of this genus have been found at least in two locations; in Log pod Mangartom and in Belca. They were classified into the species *Gandinella kuthani* (Salaj), (described as *Pilamminella kuthani*) (Oblak, 1998).

Superfamilia TROCHAMMINACEA

Schwager, 1877

Familia TROCHAMMINIDAE

Schwager, 1877

Subfamilia TROCHAMMININAE

Schwager, 1877

Genus *Trochammina* Parker & Jones,
1859***Trochammina cf. almtalensis*** Koehn -
Zaninetti, 1968
(Pl. 1, fig. 6)1971 *Trochammina cf. almtalensis*
Koehn - Zaninetti - Urošević, pl.8,
fig.4, 6.1983 *Trochammina almtalensis* Koehn -
Zaninetti - Salaj et al., p. 77., pl. XXII,
fig.1-12.1986 *Trochammina almtalensis* Koehn -
Zaninetti - Sudar, pl. XVIII, fig.1, 2,
pl. XXI, fig.3.1987 *Trochammina almtalensis* Koehn -
Zaninetti - Oravec - Scheffer,
pl. XLI, fig.9, 10, pl. LIV, fig.3.1994 *Trochammina almtalensis* Koehn -
Zaninetti - Flügel et al., pl.2, fig.12.

Material: Five sections in slides.

Description: Chambers are arranged trochospirally. They are rounded at the periphery and enlarge gradually. The agglutinated test is smooth. The aperture is interiomarginal.

Size: Diameters of the umbilical side of the tests are 0.12-0.14mm, the heights of the tests are about 0.7mm.

Occurrence of the genus: Carbon - Holocene; cosmopolitan. In Slovenia, the genus *Trochammina* has been found in the northern part of the Julian Alps (Oblak, 1998).

Subordo INVOLUTININA

Hohenegger & Piller, 1977

Familia INVOLUTINIDAE Buetschli,
1880

Subfamilia TRIADODISCINAE

Zaninetti, 1984

Genus *Lamelliconus* Piller, 1978***Lamelliconus procerus*** (Liebus, 1942)
(Pl. 1, fig. 1, 2a)1978 *Trocholina? procerus* Liebus -
Trifonova, pl.5, fig.7, 8.1983 *Lamelliconus procerus* (Liebus) -
Salaj et al., p. 148., pl. CXXV, fig.2-5.1988 *Lamelliconus procerus* (Liebus) -
Santorio & Venturini, p. 47.

Material: Numerous sections in slides.

Description: The elongate test consists of a globular proloculus and a tubular undivided second chamber that coils trochospirally. The tube might be complete or it lacks the part of the wall where it fits the previous whorl. When each new whorl is formed, the outer surface gets covered with one additional lamella on the spiral side and more additional lamellae on the umbilical side of the test. A circular aperture is terminal.

Size: Diameters of the umbilical side of the tests are 0.15-0.2, by two specimens 0.25. The heights of the tests are 0.6-0.9mm.

Occurrence of the genus: Ladinian - Carnian; Austria, Italy, Hungary, Bulgaria, Slovakia, Croatia. Five species have been already recorded in Slovenia; *Trocholina biconvexa* Oberhauser (= *Lamelliconus biconvexus* (Oberhauser)) in the Julian Alps area, Trebuša, Idrija, Logatec and Mežica, *T. procerus multispiroides* Djurdjanovic (= *L. procerus multispiroides* (Djurdjanovic)) in Trebuša, Idrija, Logatec and Mežica, *T. multispira* Oberhauser (= *L. multispirus* (Oberhauser)) in Trebuša, Idrija and Logatec, *T. cordevolica* Oberhauser (= *L. cordevolicus* (Oberhauser)) in Logatec and *T. permodiscoides* Oberhauser in the Idrija area (Oblak, 1998).Genus *Triadodiscus* Piller, 1983***Triadodiscus eomesozoicus***

(Oberhauser, 1957)

(Pl. 1, fig. 3, 4)

1983 *Permodiscus eomesozoicus* (Oberhauser) - Salaj et al., p. 138., pl. LXXXVII, fig.1-7, pl. LXXXVIII, fig.1-5, pl. LXXXIX, fig.1-8.1984 a *Triadodiscus eomesozoicus* (Oberhauser) - Ciarapica & Zaninetti, pl. III, fig.1-13,

1984 b *Triadodiscus eomesozoicus* (Oberhauser) - Ciarapica & Zaninetti, pl.I, fig.11,12.

1987 *Triadodiscus eomesozoicus* (Oberhauser) - Loeblich & Tappan, p.295, pl.309, fig.9.

1987 *Triadodiscus eomesozoicus* (Oberhauser) - Oravec-Scheffer, pl.XLIII, fig.2.

1989 *Triadodiscus eomesozoicus* (Oberhauser) - Martini et al., pl.2, fig.1,2.

1994 *Triadodiscus eomesozoicus* (Oberhauser) - di Bari & Laghi, p.116, pl.III, fig.4, pl.4, fig.1,2.

Material: Numerous sections in slides.

Description: The flattened test is made up of a globular proloculus and a tubular undivided second chamber. The latter coils planispirally to very low trochospirally and involutely.

Size: Diameters of the tests are 0.2-0.4mm, heights of the tests probably do not exceed 0.1mm.

Occurrence of the genus: Scythian - Carnian, ?Rhaetian; Austria, Bulgaria, Poland, ex -USSR, Iran, Turkey, Slovakia, Italy. In Slovenia, these Foraminifera have been found in the South Alps area. They were described as *Involutina eomesozoica* (Oberhauser) (Oblak, 1998).

Triadodiscus inceptus

di Bari & Laghi, 1994
(Pl. 1, fig. 5)

1994 *Triadodiscus inceptus* n.sp. - di Bari & Laghi, p.116, Pl.III, fig.3-8.

Material: Few sections in slides.

Description: A rounded proloculus is followed by a tubular undivided second chamber. The latter coils planispirally to very low trochospirally and involutely. The periphery is narrowed.

Size: Diameters of the tests are about 0.4mm, heights of the tests are about 0.15mm.

Occurrence of the genus: The same as *T. eomesozoicus*.

Subfamilia AULOTORTINAE
Zaninetti, 1984

Genus *Aulotortus* Weynschenk, 1956

Aulotortus sinuosus Weynschenk, 1956
(Pl. 1, fig. 2b)

1970 *Involutina sinuosa sinuosa* (Weynschenk) - Jendrejakova, pl.3, fig.3.

1971 *Involutina sinuosa sinuosa* (Weynschenk) - Hohenegger & Lobitzer, pl.3, fig.2.

1971 *Involutina pragsoides* (Oberhauser) - Hohenegger & Lobitzer, pl.3, fig.5.

1972 *Involutina sinuosa sinuosa* (Weynschenk) - Pantić, pl.5, fig.6.

1975 *Involutina (Aulotortus) sinuosa sinuosa* (Weynschenk) - Gušić, p.16, pl.3, fig.1-8.

1975 *Involutina (Aulotortus) sinuosa pragsoides* (Oberhauser) - Gušić, p.16, pl.4, fig.5.

1983 *Aulotortus cf. pragsoides* (Oberhauser) - Gazdzicki, pl.34, fig.1.

1983 *Aulotortus sinuosus* Weynschenk - Gazdzicki, pl.34, fig.2, 3, 5, 7-12.

1985 *Aulotortus sinuosus* Weynschenk - Ramovš, fig.27-2.

1986 *Aulotortus pragsoides* (Oberhauser) - Sudar, pl. XXI, fig.6.

1987 *Aulotortus cf. sinuosus* Weynschenk - Oravec-Scheffer, pl.LXII, fig.1-3.

1987 *Aulotortus sinuosus* Weynschenk - Oravec-Scheffer, pl.LXX, fig.10.

1988 *Aulotortus sinuosus* Weynschenk - Fazzuoli et al., pl.66, fig.13, 18.

1988 *Aulotortus gr. sinuosus* Weynschenk - Santorio & Venturini, p.48.

1989 *Aulotortus sinuosus* Weynschenk - Jadoul et al., pl.38, fig.4, 13.

Material: Numerous sections in slides.

Description: The flattened test consists of a globular proloculus and of a tubular undivided second chamber that coils usually oscillately. The aperture is at the end of the second chamber.

Size: Diameter of the tests is 0.3-0.5mm, the height of the tests is 0.2-0.35mm.

Occurrence of the genus: Anisian - M. Jurassic; Austria, Italy, Hungary, Slovakia, Serbia, Turkey, China, India and Nevada. Four species of this genus have been already listed in Slovenia. *Involutina pragsoides oscilens* Oberhauser (= *A. sinuosus* Weynschenk), *I communis* (Kristan) (= *A. communis* (Kristan)) and *I tumida* (Kristan-Tollmann) (= *A. tumidus* (Kristan-Tollmann)) were found in the Golica area, and *Involutina sinuosa pragsoides* (Weynschenk) (= *A. sinuosus* Weynschenk) in the Golica area and near Mežica. Foraminifera that were determined as *Involutina sp.*, have been also noticed at Idrija, Logatec and Vojsko. In view of their Carnian age they probably belong to the genus *Aulotortus* (Oblak, 1998).

Subordo MILIOLINA Delage & Herouard, 1896

Superfamilia CORNUSPIRACEA
Schultze, 1854

Familia CORNUSPIRIDAE
Schultze, 1854

Subfamilia MEANDROSPIRINAE
Saidova, 1981

Genus *Meandrospira* Loeblich & Tappan, 1946

? *Meandrospira sp.* Loeblich & Tappan, 1946
(Pl. 2, fig. 3)

1968 *Meandrospira iulia* (Premoli Silva) - Ramovš, pl.8, fig.1-4.

1971 *Meandrospira dinarica* Kochany-Devide & Pantic - Urošević, pl.4, fig.2-5.

1972 *Meandrospira dinarica* Kochany-Devide & Pantic - Ramovš, pl.1, fig.1.

1973 *Meandrospira pusilla* (Ho) - Bronnemann et al., p. 16, pl.4, fig.1-17.

1983 *Meandrospira dinarica* Kochany-Devide & Pantic - Salaj et al., p. 99, pl.LI, fig.1, 8, pl.LII, fig.1-8.

1983 *Meandrospira insolita* (Ho) - Salaj et al., p. 100, pl.LIV, fig.7-9.

1983 *Meandrospira pusilla* (Ho) - Salaj et al., p.101, pl.LV, fig.1-18.

1983 *Meandrospira cheni* (Ho) - Salaj et al., p. 99, pl.LVI, fig.1-19.

1985 *Meandrospira pusilla* (Ho) - Ramovš, fig.4-1.

1986 *Meandrospira dinarica* Kochany-Devide & Pantic - Sudar, pl.XIX, fig.1-5, pl.28, fig.4.

1990 *Meandrospira pusilla* (Ho) - Baroz et al., pl.4, fig.1-6, 11, 12.

1990 *Meandrospira cheni* (Ho) - Baroz et al., pl.4, fig.13-18.

1990 *Meandrospira dinarica* Kochany-Devide & Pantic - Baroz et al., pl.5, fig.4-9.

Material: Frequent indistinct sections in slides.

Description: The test is small and globular, made up of a globular proloculus and a tubular undivided second chamber. The latter coils planispirally in a zigzag pattern and involutely. The rounded aperture is terminal.

Size: Diameters of the tests are about 0.1mm.

Occurrence of the genus: L. Permian - Holocene; N. America, Europe, N. Africa, Australia. In Slovenia, the Carnian Foraminifera of the genus *Meandrospira* have been found in the Dinara Mountains (Oblak, 1998).

Remark: All microfossils sections that could belong to the genus *Meandrospira* are indistinct and thus, difficult to study. However, they are frequent and more or less uniform so I have decided to classify them into this genus.

Familia OPHTHALMIDIIDAE Wiesner, 1920

Genus *Gsollbergella* Zaninetti, 1979

Gsollbergella spiroloculiformis
(Oravec Scheffer, 1968)
(Pl. 2, fig. 4, 5)

1983 *Agathamminoides spiroloculiformis* (Oravec Scheffer) - Salaj et al., p. 113, pl.LXXII, fig.7-10

1987 *Gsollbergella spiroloculiformis* (Oravec Scheffer) - Oravec-Scheffer, p. 115, pl.XXXII, fig.4, 1-4, 7-10, pl.LII, fig.4.

Material: Frequent sections in slides.

Description: A globular proloculus, one coil long second chamber and half of coil

long further chambers make up the test. The latter chambers are arranged quinqueloculinely. Septa are not completely formed; there are only thickenings of the wall instead of them. The rounded aperture is terminal.

Size: Diameters of the tests are 0.25-0.4mm.

Occurrence of the genus: Carnian; Austria, Hungary, Italy, Czech Republic. To my knowledge, *Gsollbergella* has not been evidenced in Slovenia before.

Subordo LAGENINA Delage &
Herouard, 1896
Superfamilia NODOSARIACEA
Ehrenberg, 1838
Familia NODOSARIIDAE
Ehrenberg, 1838
Subfamilia NODOSARIINAE
Ehrenberg, 1838
Genus *Nodosaria* Lamarck, 1812

***Nodosaria* sp.**
(Pl. 2, fig. 6)

1978 *Nodosaria ordinata* Trifonova -
Trifonova, pl.4, fig.6.

1983 *Nodosaria schablensis* Trifonova -
Salaj et al., p 119, pl.CXLIV, fig.7.

1987 *Nodosaria ordinata* Trifonova -
Oravec-Scheffer, pl.XXXIX, fig.7,
pl.XL, fig.5, pl.LXXII, fig.1.

1987 *Nodosaria primitiva* Kuebler &

Zwingly - Oravec-Scheffer,
pl.XXXIV, fig.6.

1987 *Nodosaria guembeli* - Oravec-Scheffer,
pl.LIII, fig.3.

Material: Six sections in slides.

Description: Test is made of ovate proloculus and uniserially rectilinearly arranged later chambers. Surface is smooth. Radiate or rounded aperture is placed on a neck.

Size: The length of the test is about 0.35 mm, diameter of the last chamber is about 0.07 mm.

Occurrence of the genus: L. Jurassic - Holocene (Note: In the literature, this genus is reported for Carnian beds, too); cosmopolitan. Only one species is listed from Slovene Carnian beds; *N. ordinata* Trifonova from the Julian Alps and the Western Karavanke Mountains. Foraminifera of the genus *Nodosaria* have been found near Tolmin and Logatec (Oblak, 1998).

Conclusion

According to my slides, the association of three foraminiferan genera, *Lamelliconus*, *Aulotortus* and *Triadodiscus*, is characteristic for beds of the Kucler quarry. These Foraminifera are numerous in almost all sampled strata. Their tests are small, flat-

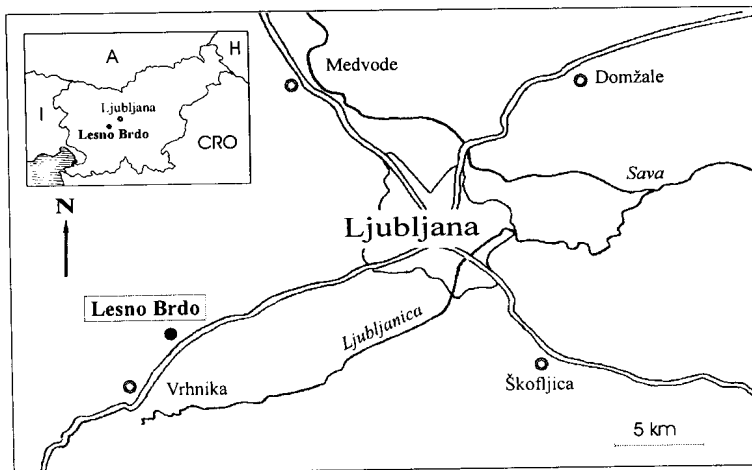


Fig. 1. The location map of Lesno Brdo in Slovene area
Sl. 1. Lega Lesnega Brda v slovenskem prostoru

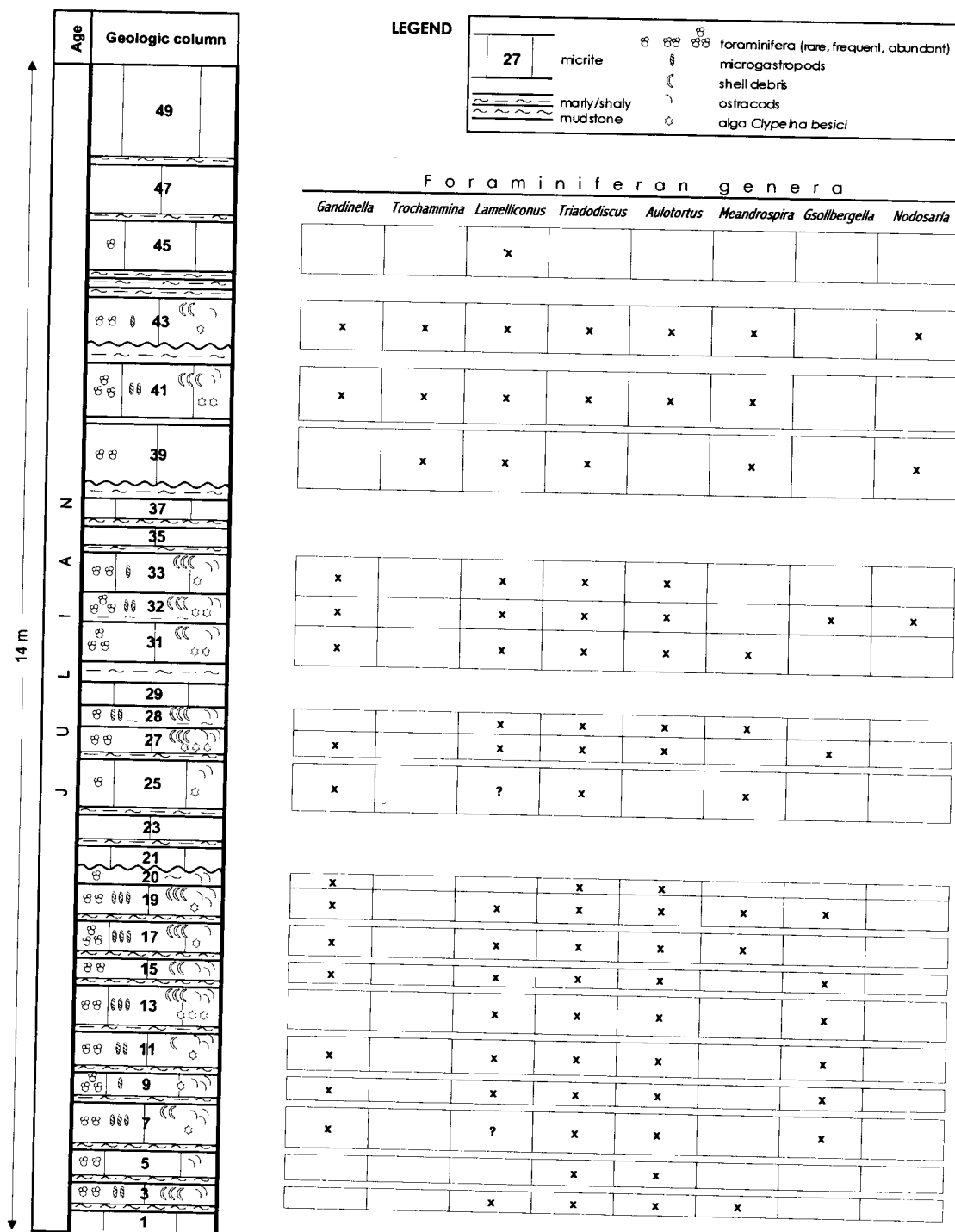


Fig. 2. Distribution of Foraminifera and other microfossils in the Kucler quarry section (The stratimetric column is modified after Jelen, 1990, p.24; strata are numbered on the field already)

Sl. 2. Pojavljanje luknjičark in ostalih mikrofosilov vzdolž profila Kuclerjevega kamnoloma (Stratimetrični stolpec je prirejen po Jeleni, 1990, str. 24; plasti so oštevilčene že na terenu)

tened (*Aulotortus*, *Triadodiscus*) or elongated (*Lamelliconus*) and smooth. Small size of tests was probably affected by brackish and eutrophic water of the former lagoon as well as by the fine sediment and low level of dissolved oxygen within the sediment. The fine sediment might also have selected for their flattened or elongated shape and absence of distinctive surface ornamentation. At the same time, genera *Lamelliconus* and *Aulotortus* are also the most frequently found foraminiferan genera in other Slovene outcrops of the same age and similar lithology. Mostly they are described with older synonyms within genera *Trocholina* (= *Lamelliconus*) and *Involutina* (= *Aulotortus*). In contrast to them, the genus *Triadodiscus* has been evidenced rarely in the Slovene territory.

Less abundant, but still frequent, are Foraminifera of genera *Gandinella*, (?) *Meandrospira* and *Gsollbergella*. The former two genera are disturbed through the

whole section of the quarry while the genus *Gsollbergella* has not been evidenced in the upper part of the section. Genera *Nodosaria* and *Trochammina* occur sparsely in slides of the uppermost beds only.

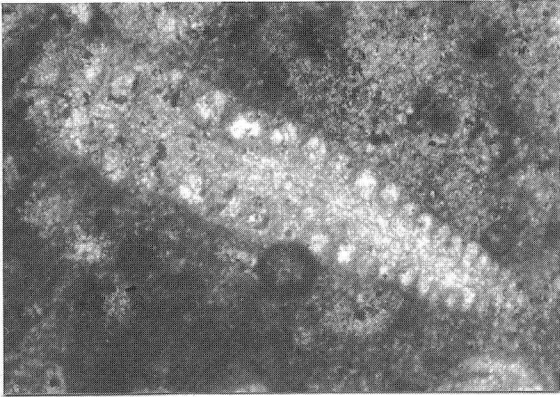
All of the studied foraminiferan genera (except the genus *Gsollbergella*) as well as other microfossils from the Kucler quarry, such as holothurian sclerites, shells of ostracods and dasycladacean algae, have already been reported as Carnian microfossils taken from Slovenian beds.

Acknowledgements

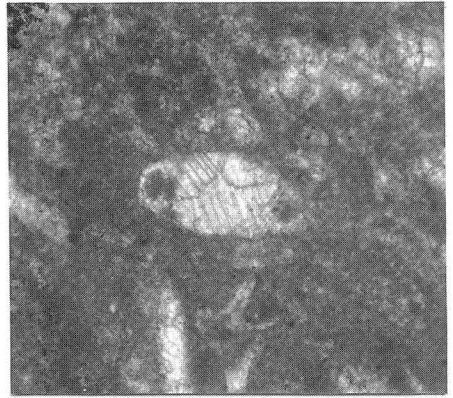
I am grateful to Dr. Jernej Pavšič for his mentorship and special thanks are due to Dr. Roberto Rettori, University of Perugia, for his generous and valuable comments about my determinations.

Plate 1 - Tabla 1

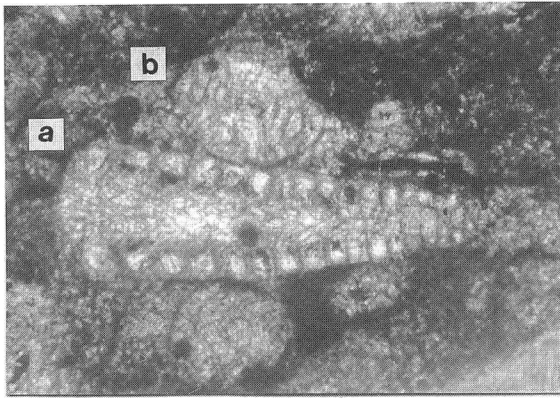
- 1 *Lamelliconus procerus* (Liebus); (31); ×100.
- 2 a) *Lamelliconus procerus* (Liebus); (31); ×100.
b) *Aulotortus sinuosus* Weynschenk; (31); ×100.
- 3 *Triadodiscus eomesozoicus* (Oberhauser); (17); ×100.
- 4 *Triadodiscus eomesozoicus* (Oberhauser); (32); ×100.
- 5 *Triadodiscus inceptus* Bari & Laghi; (32); ×100.
- 6 *Trochammina cf. almtalensis* Koehn-Zaninetti; (43); ×250.



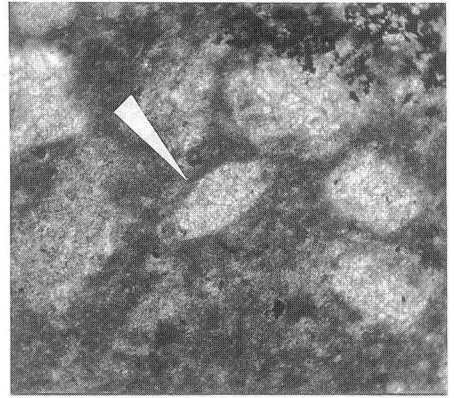
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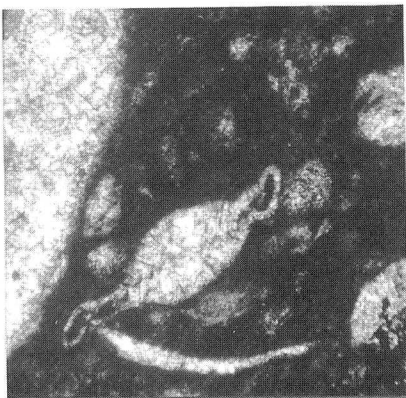
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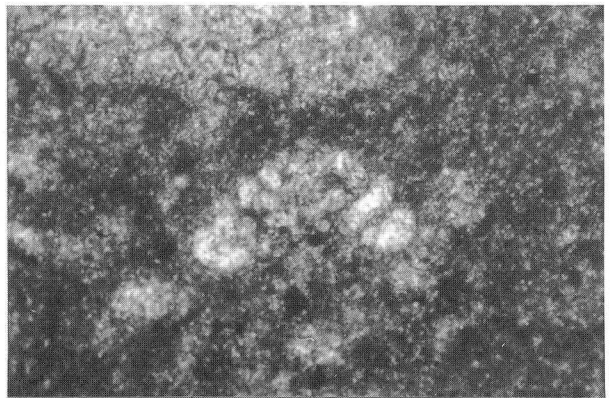
2



4



5



6

Karnijske foraminifere iz Kuclerjevlega kamnoloma na Lesnem Brdu

Povzetek

Raziskovala sem foraminifere (luknjičarke) iz Kuclerjevlega kamnoloma na Lesnem Brdu pri Vrhniku (Sl.1). V kamnolomu so razgaljene menjajoče se plasti temno sivega do črnega mikritnega apnenca ter tankoplastnatega skrilavega laporovca in muljevca. Sedimentacija je potekala v plitvem brakičnem morju v julu (karnij, zgornji trias). Kamnolom je poznan po bogati fosilni školjčni favni, ki so jo raziskovali že paleontologi 19. stoletja. Mikrofosili iz tega nahajališča so slabše raziskani. Za preučitev zastopanosti fosilnih foraminifer sem vzorčila vse dostopne apnenčeve plasti. Po analizi zbruskov sem ugotovila, da je večina raziskanih plasti zelo bogatih z mikrofosili (Sl.2). Številne foraminifere se pojavijo že v najnižji (3) plasti, njihova pogostnost višje še naraste, v najvišji (45) plasti pa znatno upade. Značilna je združba treh foraminifernih rodov; *Lamelliconus*, *Aulotortus* in *Triadodiscus*. Te luknjičarke se pojavljajo množično v večini vzorčenih plasti. Njihove hišice so majhne, sploščene (*Aulotortus*, *Triadodiscus*) ali podolgovate (*Lamelliconus*) in neornamentirane. Omenjena morfologija je verjetno rezultat delovanja večih ekoloških parametrov v nekdanji laguni, na primer, brakične in evtrofne vode, drobnozrnatega sedimenta ter redukcijskih pogojev v sedimentu. Rodova *Lamelliconus* in

Aulotortus se tudi sicer pojavljata v karnijskih skladih pri nas najpogosteje. Večinoma sta navedena s starejšimi sinonimi znotraj rodov *Trocholina* (= *Lamelliconus*) in *Involutina* (= *Aulotortus*). Foraminifere iz rodov *Gandinella*, (?) *Meandrospira* in *Gsollbergella* so v zbruskih precej pogoste. Gandinele in meandrospire se pojavljajo vzdolž celotnega profila, medtem ko gsollbergel v višjih plasteh nisem zasledila. Rodova *Trochammmina* in *Nodosaria* se pojavita le v zbruskih najvišjih plastih.

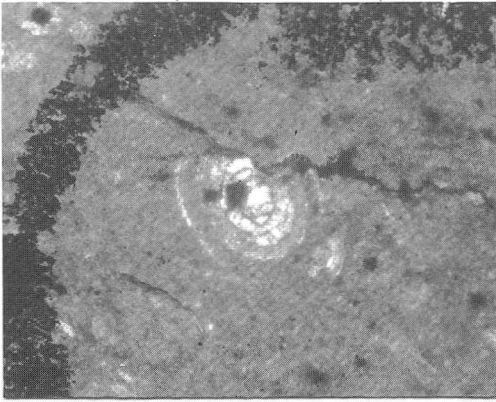
Poleg foraminifer so v zbruskih prisotni še mikrogastropodi, školjčni drobiri, lupinice ostrakodov, holoturijski skleriti in skletne alge. Med slednjimi je najznačilnejša *Clypeina* besici. Vsi foraminiferni rodovi (razen rodu *Gsollbergella*) kot tudi drugi mikrofosili, ki sem jih našla, so že bili odkriti v karnijskih plasteh po Sloveniji.

Reference

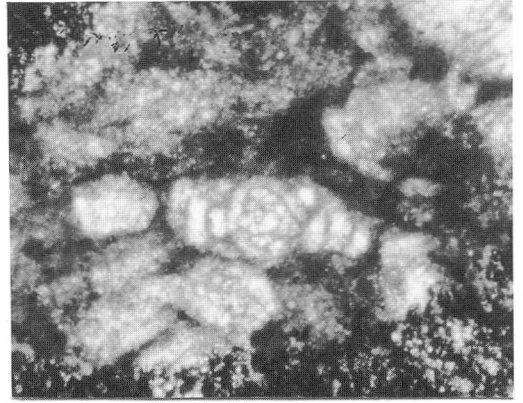
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Plate 2 - Tabla 2

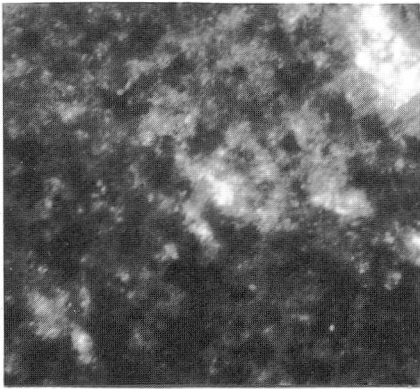
- 1 *Gandinella falsofriedli* (Salaj, Borza & Samuel); (11); ×100.
- 2 *Gandinella falsofriedli* (Salaj, Borza & Samuel); (31); ×80.
- 3 ? *Meandrospira* sp.; (19); ×140.
- 4 *Gsollbergella spiroloculiformis* (Oravec & Scheffer); (15); ×100.
- 5 *Gsollbergella spiroloculiformis* (Oravec & Scheffer); (15); ×100.
- 6 *Nodosaria* sp.; (39); ×100.



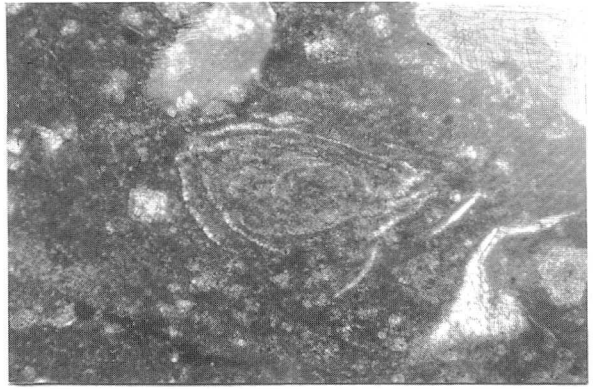
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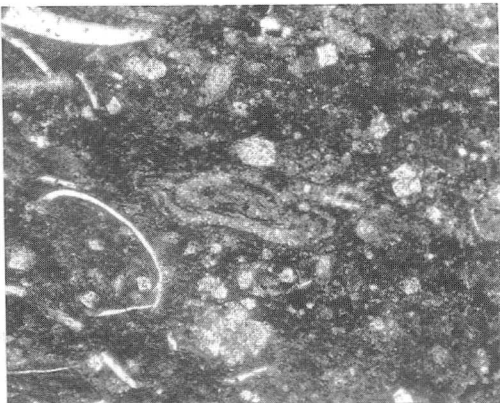
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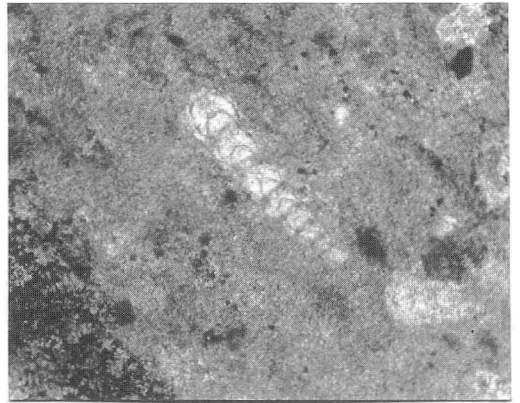
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