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ZAPADNÉ KARPATY

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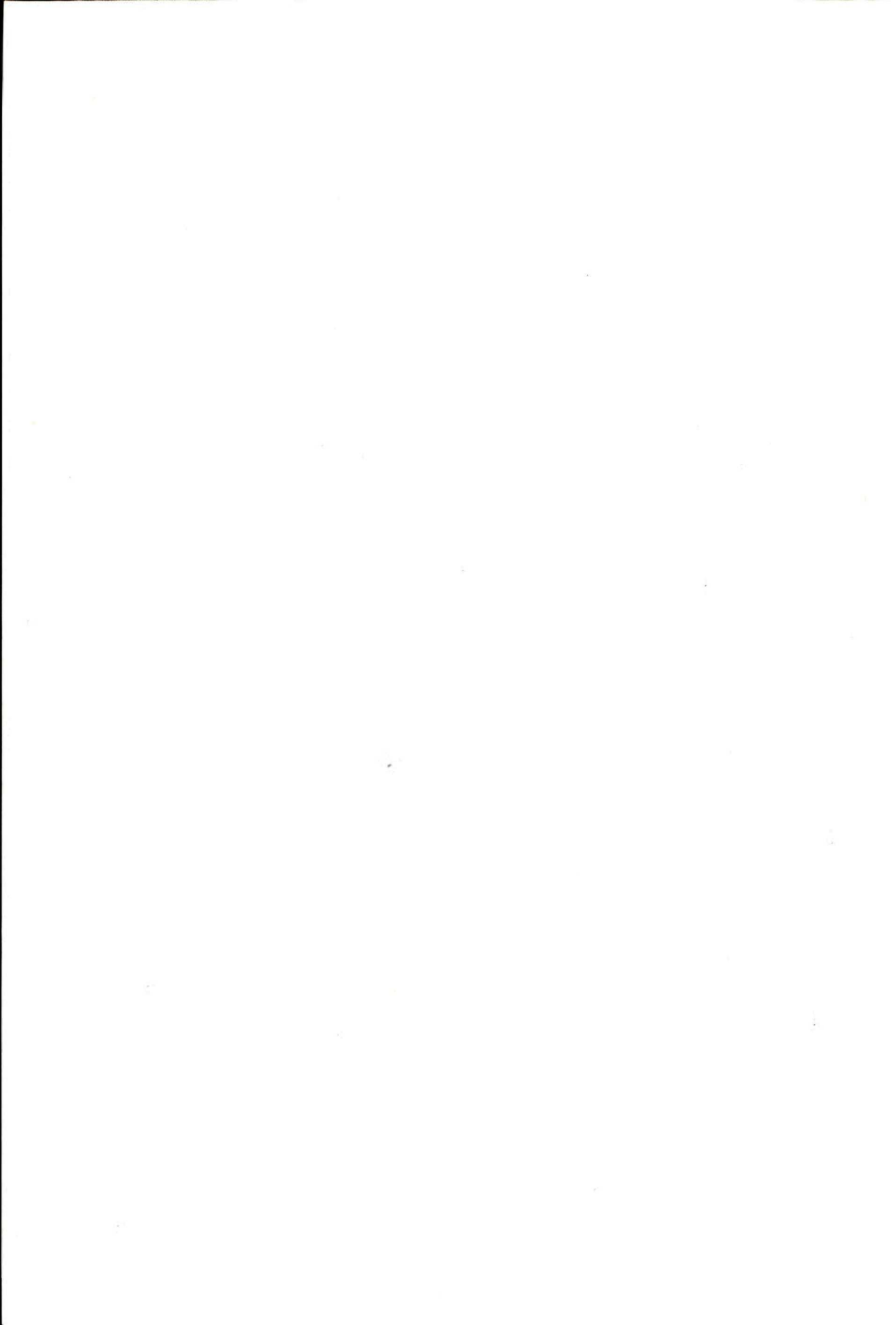
Paleontológia 15

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Obsah — Contents — Inhalt

SAMUEL, O.: Late Triassic foraminifers from profile Turík, well Závod-81 and locality Ráztoka (West Carpathians) — Vrchnotriasové foraminifery z oporného profilu Turík, vrtu Závod-81 a lokality Ráztoka (Západné Karpaty)	7
ELIÁŠOVÁ, H.: Quelques Scléractiniaires nouveaux de la Slovaquie (Crétacé et Paléogène. Tchécoslovaquie) — Několik nových korálů ze Slovenska	49
FORDINÁL, K.: Biometrical Evaluation of <i>Melanopsis pygmaea pygmaea</i> M. Hoernes. <i>Melanopsis lebedai</i> Lueger, and its Significance for Monitoring of Paleoeological Changes	57
FORDINÁL, K.: <i>Congeria dodereleini</i> Brusina from Pannonian sediments in a loam pit of the brick plant at Pezinok	71
PLIČKA, M.—NĚMCOVÁ, A.: <i>Solanichnium spinari</i> n. ichnogen. n. sp. and <i>Monomorphichnus lineatus</i> Crimes et al. 1977, New Trace Fossils in the Carpathian Flysch Sediments in Czechoslovakia — <i>Solanichnium spinari</i> n. ichnogen. n. sp. a <i>Monomorphichnus lineatus</i> Crimes et al. 1977, nové fosilní stopy v sedimentech karpatského flyše v Československu	79



ONDREJ SAMUEL

Late Triassic foraminifers from profile Turík, well Závod-81 and locality Ráztoka (West Carpathians)

4 text-fig., 54 pls. (I-LIV), slovak summary

Abstract. The author describes and depicts more than 50 Late Triassic taxa from the profile Turík (Reifling limestones, "Trachyceras" — and Reingraben beds), from Halstatt limestones from the well Závod-81) and from the locality Ráztoka (Reifling limestones).

Introduction

During the microbiostratigraphical investigations of deep structural wells in Miocene sediments of the Vienna Basin besement (cf. A. BUJNOVSKÝ — O. SAMUEL 1989; O. SAMUEL — A. BUJNOVSKÝ — P. SNOPOKOVÁ 1989; O. SAMUEL — A. BUJNOVSKÝ — P. SNOPOKOVÁ 1991; A. BUJNOVSKÝ — O. SAMUEL — P. SNOPOKOVÁ 1992) we have — besides foraminifers from thin sections of Halstatt limestones — also recovered "free" foraminifers from residuous sediments dissolved in acetic acid. In the same way have recovered foraminifers from Reifling limestones at the locality Ráztoka and from the profile Turík. "Free" foraminifers from the "Trachyceras" — and Reingraben beds of the Turík profile have been recovered by washing.

Lithology and stratigraphy of lithostratigraphic Units, based on microfauna

The profile Turík. It is in the northern part of the village Turík 6 km NE of Ružomberok (Fig. 1). Sediments in the profile belong to the Choč unit (nappe). They are exposed in three small quarries, situated above eachf other. A wider vicinity of the locality has been paid attention by several authors since the past century (D. ŠTÚR 1860; E. MOJSISOVICS 1867; B. DORNAY 1917). The Turík profile was mentioned for the first time by V. VOGEL (1917). It was later mentioned in the thirties (A. MATĚJKA 1927, 1935; D. ANDRUSOV 1935, a. o.).

Biostratigraphical problems of the Turík profile were discussed in the works by J. BYSTRICKÝ (1967); J. SALAJ — A. BIELY — J. BYSTRICKÝ (1967); J. SALAJ — O. JEN-

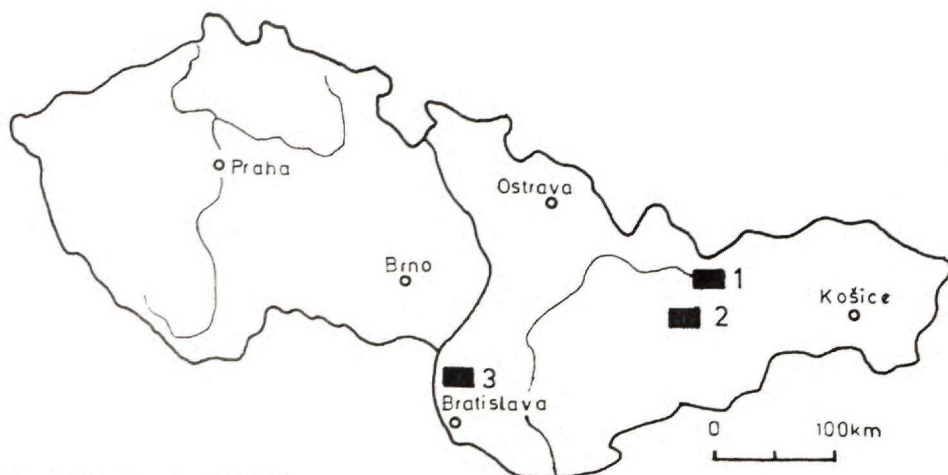


Fig. 1 Sketch map of locality
1 — Turík, 2 — Ráztoka, 3 — borehole Závod-81.

DREJÁKOVÁ [1967], H. KOZUR — R. MOCK (1974), M. KOCHANOVÁ (1979). The first detailed description of particular lithostratigraphic successions with respect to lithofacies was given by K. BORZA (1973).

For the purpose of detailed investigation of profiles in various tectonic units the Turík profile was recently treated by a collective of authors, supervised by M. Havrila. They summarized the former and present data in a report entitled "The profile of the Triassic of the Choč nappe at the locality Turík" (M. HAVRILA et al. 1988). Our description of successive lithostratigraphic units is based on this report.

The Reifling dolomites (dolomitized Reifling limestones) outcrop in the bottom part of the Quarry. The dolomites were discussed in several writings studied in detail by M. HAVRILA et al. (1988). According in the upper part ... they contain the alga *Physoporella dissita* (GÜMBEL) PIA". He ranged them to the Pelsonian. Any macro- or microfauna were not found in that part of the bends.

The Reifling limestones and the "Parnach shales" were gradually defeloping from the Reifling dolomites. According to J. BYSTRICKÝ (1985) grey-green ("Parnach") shales are overlying the Reifling dolomites alternating with the Reifling limestones. Shales predominate in the lower part of the complex and limestones in its upper part. No macrofauna was found in that part of the beds. Thin-sections contain relics of foraminifers, ostracods and algae of the genus *Acicularia* and other fossil remains (conodonts, fish teeth, crinoid segments, radiolarians, sponge spicules; cf. M. HAVRILA et al. 1988). The Middle-Late Longobardian to Cordevolian age of the bends has been determined according to conodonts studied by M. HAVRILA and J. PEVNÝ (in M. HAVRILA et al. l.c.).

The Reifling limestones (upper part). According to M. Havrila (in M. HAVRILA et al., l.c.) there are mostly platy and thick-bedded fine-crystalline limestone with layers and nodules of cherts and intercalations (1—2 cm thick) of shales. Besides conodonts and microfossil remains (mentioned above) the residue contained "free" foraminifers whose species composition is practically identic with the assemblage from the Reifling limestones on southern slopes of the Nízke Tatry Mts. (locality Ráztoka). The plates show foraminifers preserved at this locality: *Rhabdammina triassica* n.sp., *Hyperammina*

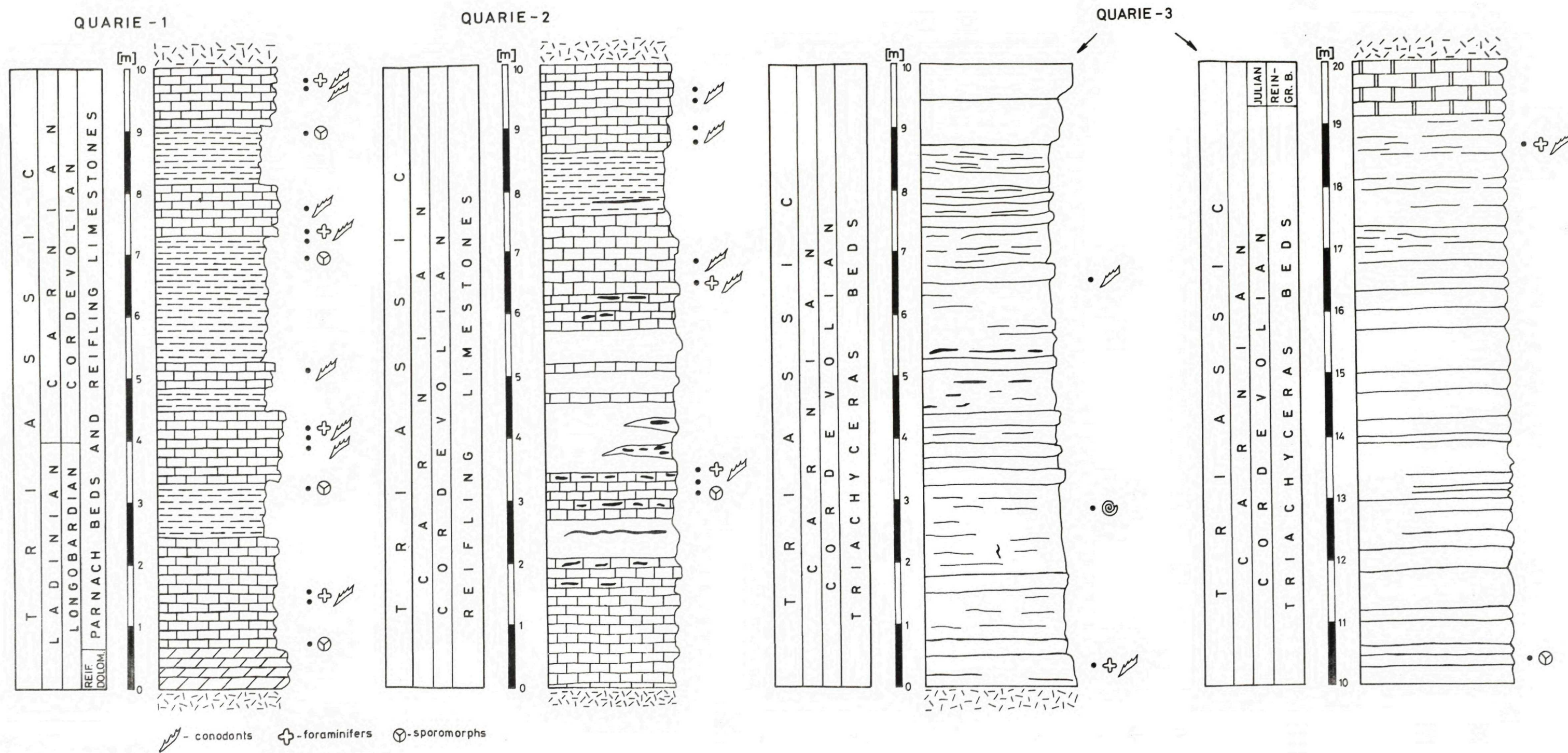


Fig. 3 Lithostratigraphical profile of locality Turik.

constricta n. sp., *Ammodiscus* cf. *inaequabilis* STYK, *Tolypammina discoides* TRIFONOVA, *T. milanis multiplex* UROŠEVIĆ, *T. biplaniformis* n. sp., *T. milanis salayi* n.ssp., "*Turritellevella*" *mesotriasica* KOEHN-ZANINETTI, *Gaudryina triassica* TRIFONOVA, *Ophthalmidium tricki* (Langer), *Pseudonodosaria obconica* (REUSS), *Pseudonodosaria* sp., *Conicospirillina mariae* KRISTAN-TOLLMANN, *Schmidia* cf. *cassiana* (GÜMBEL).

It is evident that "*Turritellevella*" *mesotriasica* KOEHN-ZANINETTI is one of the stratigraphically significant species. The existing literature concerning my researches in the West Carpathians show that this species and *Ophthalmidium tricki* (LANGER) as well as *Pseudonodosaria obconica* (REUSS) belong among the species characteristic of the Reifling limestones. "*Turritellevella*" *mesotriasica* was defined by L. KOEHN-ZANINETTI in 1969 from the Pelsonian part of the Reifling limestones from Almtal. F. HIRSCH (1976) — basing on conodonts — determined the Fasnian-Longobardian age range of the species, whereas D. UROŠEVIĆ (1977a) ranget it to the Ladinian. J. HOHENEGGER — W. LEIN (1977) describe the species "*Turritellevella*" *mesotriasica* KOEHN-ZANINETTI from the Reifling limestones in the easternmost part of the Alps (Schneeberg) in an assemblage with Illyrian-Fasnian conodonts. According to E. TRIFONOVA (1978) the age range of this species in the Balkan region is Ladinian — Early Carnian. L. ZANINETTI and Z. DAGER (1978) determined the Illyrian-Early Carnian age range of the species from the series Kocaeli (Turkey).

Other significant forms comprise *Pseudonodosaria obconica* (REUSS). E. MIRĂUTA — D. M. GHEORGHIAN (1977) denoted this taxon from the Romanian eastern Carpathians as *?Fronicularia* sp., where as O. JENDREJÁKOVÁ — J. MICHALÍK — J. PAPŠOVÁ (1981) as *Pseudonodosaria* aff. (or cf.) *obconica* (REUSS) — from the locality Zámstie-Štefánka, dated as Illyrian or Fasnian. The existing data indicate that it is a form with the same age range and bathymetric position as the specief "*Turritellevella*" *mesotriasica* KOEHN-ZANINETTI.

The age range of their forms is wider as well. Then it follows that on the basis of foraminifers the assenblage studied is ranged to the Late Ladinian.

This is also supported by the presence of the species *Halobia* cf. *zitteli* LINDSTÄN, characteristic of the Cordevolian (M. KOCHANOVÁ 1979). The opinion is further supported by stratigraphic position of *Trachyceras* beds overlying the upper parts of the Reifling limestones. Then the Reifling limestones in the profile Turík and at the locality Ráztočka are in a higher stratigraphic position than in the Slovak Karst (locality Gombasek) and in the Malé Karpaty Mts. (locality Hurlovec). The Early-Illyrian microfauna (Fig. 2) described by J. SALAJ — K. BORZA — O. SAMUEL (1983) comes from these areas. The age of the Reifling limestones is also evidenced by conodonts (MOCK 1971), algae (*Physo-porella dissita* (GÜMB.) STEINM. (J. BYSTRICKÝ 1985) and by macrofauna (V. KOLLÁROVÁ-ANDRUSOVÁ — J. BYSTRICKÝ 1974). Basing on these facts, J. BYSTRICKÝ (l.c. p. 177) postulates that the stratigraphic range of the Reifling limestones in the West Carpathians is Lower Illyrian-Cordevolian; in the Gemericum mostly Lower Illyrian.

Trachyceras beds in the profile Turík were formerly denoted as Aonian shales (A. MATĚJKA 1935, J. SALAJ — O. JENDREJÁKOVÁ 1967, K. BORZA 1973, R. MOCK — H. KOZUR 1974). According to M. HAVRILA et al. (1989) the dark-grey and black-gray laminated detrital limestones alternating with thick-bedded grey fine-crystalline limestones are lithofacially closer to the *Trachyceras* beds than to the Aonian.

This opinion is in accordance with M. RAKÚS (in M. HAVRILA et al. 1988). Basing on data by V. VOGEL (1917), M. KOCHANOVÁ (1979) and M. RAKÚS (l.c.) who studied *Trachyceratidae*, M. HAVRILA (l.c.) — considering the fauna of conodonts (M. HAVRILA — J. PEVNÝ 1988, P. STRAKA 1988) and of foraminifers, ranges the *Trachyceras* beds to the Cordevolian—Julian.

1 = Malé Karpaty Mts (Hurlovec)		
2 = Slovak karst (Gombasek; G - 3)	1	2
<i>Ammodiscus inaequibilis</i> STYK, 1975	+	-
„ <i>Turritella</i> ” <i>mesotriassica</i> KOEHN-ZANINETTI, 1968	+	-
<i>Lituotuba carpathica</i> SALAJ, BORZA et SAMUEL, 1983	+	-
<i>Erlandinita elongata</i> SALAJ, 1967	-	+
<i>Erlandinita oberhauseri</i> SALAJ, 1967	-	+
<i>Nodosinella libera</i> TRIFONOVA, 1967	-	+
<i>Nodosinella rostrata</i> TRIFONOVA, 1972	-	+
<i>Nodosinella siliqua</i> TRIFONOVA, 1972	-	+
<i>Pachyphloides klebelsbergi</i> (OBERHAUSER, 1960)	-	+
<i>Geinitzina taurica</i> SELLIER de CIVRIEUX et DESSAUVAGIE, 1965	-	+
<i>Geinitzina oberhauseri</i> SELLIER de CIVRIEUX et DESSAUVAGIE, 1965	-	+
<i>Geinitzinita pupoides</i> (NORVANG, 1957)	-	+
<i>Nodophthalmidium</i> sp.	+	-
<i>Ophthalmidium tricki</i> (LANGER, 1961)	+	-
<i>Ophthalmidium</i> sp.	+	-
<i>Nodobacularia cylindrififormis</i> SALAJ, BORZA et SAMUEL, 1983	+	-
<i>Nodobacularia vujici</i> UROŠEVIĆ et GAZDZICKI, 1977	+	-
<i>Calcitronella elongata</i> CUSHMAN et WATERS, 1928	+	-
<i>Nodosaria liratella</i> TAPPAN, 1951	+	+
<i>Nodosaria ordinata</i> TRIFONOVA, 1965	-	+
<i>Nodosaria prima</i> d'ORBOGNY, 1850	-	+
<i>Nodosaria shablensis</i> TRIFONOVA, 1978	-	+
<i>Nodosaria trifonova</i> SALAJ, BORZA et SAMUEL, 1983	-	+
<i>Dentalina curva</i> LABUS, 1944	-	+
<i>Dentalina</i> aff. <i>excellens</i> STYK, 1975	-	+
<i>Dentalina hoi</i> TRIFONOVA, 1967	-	+
<i>Dentalina subsiliqua</i> FRÄNKE, 1936	-	+
<i>Pseudonodosaria gemerica</i> SALAJ, BORZA et Samuel, 1983	-	+
<i>Pseudonodosaria gombasecki</i> SALAJ, BORZA et SAMUEL, 1983	-	+
<i>Pseudonodosaria liberta</i> TRIFONOVA,	-	+
<i>Pseudonodosaria primitiva</i> KUBLER et ZWINGLI, 1866	+	+
<i>Pseudonodosaria striatoclavata</i> (SPANGEL, 1901)	-	+
<i>Fronidina permica</i> SELLIER de CIVRIEUX et DESSAUVAGIE, 1965	-	+
<i>Fronidinosaria pyrula</i> SELLER de CIVRIEUX et DESSAUVAGIE, 1965	-	+
<i>Fronidinosaria semiornata</i> (REUSS, 1863)	-	+
<i>Protonodosaria globifronidina</i> SELLIER de CIVRIEUX et DESSAUVAGIE, 1965	-	+
<i>Ichtyoloria primitiva</i> SELLIER de CIVRIEUX et DESSAUVAGIE, 1965	-	+
<i>Austrocolomia cordevolica</i> OBERHAUSER, 1967	-	+
<i>Austrocolomia marshali</i> OBERHAUSER, 1960	-	+
<i>Austrocolomia ploechingeri</i> OBERHAUSER, 1960	-	+
<i>Austrocolomia primitiva</i> SALAJ, BORZA et SAMUEL, 1983	-	+

Fig. 2 Microfauna from the Reifling limestones of the locality Hurlovec (Malé Karpaty Mts) and Gombasek (Slovak karts).

J. SALAJ — O. JENDREFÁKOVÁ (1967, p. 311) found the following foraminifers in this lithostratigraphic unit: *Duostomina alta* (KRISTAN-TOLLMANN), *Trocholina multispira* OBERHAUSER, *T. ventroplana* OBERHAUSER, *Hyperammina* cf. *eulimbata* KRISTAN-TOLLMANN, *Nodosaria apheiloculata alabra* KRISTAN-TOLLMANN, *Neoendothyra keupperi* (OBERHAUSER), *Variostoma prolongense* KRISTAN-TOLLMANN.

The sample from the Trachyceras bends (according to STRAKA) contained fragments of significant species, evidently representing the genera *Tolypammina* div. sp., *Gaudryina triassica* TRIFONOVA, *Pseudonodosaria obconica* REUSS, *Dentalina* aff. *luperti* EFIMOVA and *Lamelliconus procerus* (LIEBUS).

As for their age diapason, no one of the foraminiferal species contradicts to the Cordevolian-Julian age of the Trachyceras beds. It is also evidenced by the representatives of the genus *Lamelliconus* [(*L. multispirus* OBERHAUSER), *L. procerus* (LIEBUS)] or *Trocholina* (*T. ventroplana* OBERHAUSER) occurring in the Cordevolian of the West Carpathians (J. SALAJ — K. BORZA — O. SAMUEL 1983) and some high-arched forms were found in the Longobardian of Bulgaria. So this stratigraphical interpretation is actually in accordance with the existing information about the age range of species of the genus *Lamelliconus* or *Trocholina* (cf. E. KRISTAN 1957, R. OBERHAUSER 1957).

The *Reingraben beds* (shales) have so far not been particularized. They were most frequently denoted as Aonian shales together with the Trachyceras beds. The beds described mostly consists of marly limestones and black-gray marly shales. They are overlain by the Lunz beds. They were subjected to detailed petrographic study by A. VOZÁROVÁ (in M. HAVRILA et al. 1989).

A rich foraminiferal assemblage was found in the sample Nr. 573 from the contact layer of the *Reingraben*- and the *Lunz beds*. On the basis of the stratigraphical position of the Trachyceras beds (Cordevolian-Julian) and microbiostratigraphic content of analyzed samples the *Reingraben beds* (shales) are ranged to the Lower Carnian (Julian).

In almost 40 taxa determined the representatives of the genera *Nodosaria*, *Pseudonodosaria*, *Dentalina* and *Pachypholoides* are predominant. Most species of these genera were described by E. KRISTAN-TOLLMANN (1964) from the Rhaetian Zlambach beds. The Rhaetian age of the *Reingraben beds* at the locality studied is denied by the presence of the species *Pseudonodosaria obconica* (REUSS) representing the mostly Ladinian and Carnian significant forms. The accessible literary data and the research in the West Carpathians prove that the species does not surpass the boundary of the Norian. The same is proved by the species "*Turritella*" *mesotriasica* KOEHN-ZANINETTI (Anisian-Carnian) from the *Reingraben beds* at the locality studied. The representatives of the genus *Pachypholoides* are stratigraphically significant. R. OBERHAUSER (1960) describe *P. dracosimilis*, *P. infirmis* and the species *P. oberhauseri* SELLIER de CIVRIEUX et DESSAUVAGIE from the adjacent Austrian Alps — from an analogous lithostratigraphic unit (Early Carnian *Reingraben beds*). The age range of this species is evidently wider. N. A. EFIMOVA (1974) found it in the Ladinian. The species described by O. STYK (1975) as *P. ?triangularis* is regarded as a synonym of the species *P. oberhauseri*. According to her the taxon occurs in the Middle Triassic. The same stratigraphic range is assigned to the species *Ophthalmidium tricki* (LAYER), *Spiroloculina praecursor* OBERHAUSER, *Sigmoilina triadica* LANGER and *Duostomina alta* KRISTAN-TOLLMANN.

Following is the composition of the assemblage from the *Reingraben beds* including the transitional layer between the *Reingraben* and the *Lunz beds*. The layer shows a closer affinity to the *Reingraben beds* than to the *Lunz beds*. And yet the deposition of the *Reingraben beds* terminated in the Lower Carnian (Julian) the deposition of the *Lunz beds* commenced at this stratigraphic level.

Rhizammina sp.
Hyperammina eulimbata KRISTAN-TOLLMANN
Hyperammina stabilis KRISTAN-TOLLMANN
Ammodiscus annulonoides KRISTAN-TOLLMANN
Ammodiscus sp.
"Turritellella" mesotriasica KOEHN-ZANINETTI
Tetrataxis sp.
Nodosinella rostrata TRIFONOVA
Ophthalmidium tori ZANINETTI et BROENNIMANN
Ophthalmidium triadicum KRISTAN
Ophthalmidium tricki (LANGER)
Paleomiliona sp.
Spiroloculina praecursor OBERHAUSER
Pachypholoides dracosimilis (OBERHAUSER)
Pachypholoides infirmis (OBERHAUSER)
Pachypholoides ex gr. oberhauseri SELLIER DE CIVRIEUX et DESSAUVAGIE
Pachypholoides reingrabensis n. sp.
Dentalina crenata SCHWAGER
Dentalina paucicurvata FRANKE
Dentalina pseudomonile TERQUEM
Nodosaria levifracta KRISTAN-TOLLMANN
Nodosaria nitidana BRAND
Nodosaria zlambachensis KRISTAN-TTOLLMANN
Pseudonodosaria obconica (REUSS)
Pseudonodosaria polyarta (KRISTAN-TOLLMANN)
Pseudonodosaria pseudovulgata n. sp.
Pseudonodosaria semisphaerica (KRISTAN-TOLLMANN)
Pseudonodosaria sphaerocephala (KRISTAN-TOLLMANN)
Pseudonodosaria vulgata multicamerata (KRISTAN-TOLLMANN)
Pseudonodosaria sp.
Lenticulina (A.) *matutina* (D'ORBIGNY)
Lenticulina (L.) *ex gr. nauphiolides* (BORNEMANN)
Lenticulina sp.
Duostomina alta KRISTAN-TOLLMANN
Nassellaria gen. et. sp. indent.

The author did not study the *Lunz beds* with respect to micropaleontology in the surroundings of the profile *Turik*. Microfauna was mentioned by J. SALAJ — O. JENDREJÁKOVÁ (1967). The author studied microfauna at the locality *Liptovský Hrádok* (road cut) where the species *Duostomina alta* KRISTAN-TOLLMANN and *Duostomina biconvexa* KRISTAN-TOLLMANN either form a monoassemblage or predominate. An analogous foraminiferal feral assemblage was found by J. SALAJ — O. JENDREJÁKOVÁ (l.c.) in the *Lunz beds* in the *Svätojánska dolina* valley. According to their position — like in the *Estern Alps* — the *Lunz beds* in the *West Carpathians* were generated as *Carnian* (D. ANDRUSOV 1935, 1959, 1964) or *Julian* (J. BYSTRICKÝ 1965, 1972; D. ANDRUSOV 1959, 1964). According to their position — overlying the *Svarin beds* (zone *Trachyceras aonoides*) they belong mainly to the upper part of the *Julian*.

The succession in the well *Závod-81* was also subjected to microfaunal study. According to A. BUJNOVSKÝ — O. SAMUEL (1989) the pre-Neogene basement was bored at the depth of 3610. From this level to 3650 m there are only grey dolomite fragments. Their

age is not evidenced biostratigraphically. Their lithofacies character and superposition are indicative of their Late Triassic age.

The Halstatt limestones were bored at the depth of 3700—3704 m (core No₁). The graph presentation of the composition of mud fragments and the bored core (1a) indicate that the Halstatt limestones extend to the depth of 3724 m. They consist of pink and yellow-brown nodular stylolitic limestones. Microscopical examination revealed biomicrite "mudstone" with predominant radiolarian microfacies. The biofacies component is represented by organic elements like radiolarians, coprolites, profiles of bivalvians, gastropods and ammonites, ostracods, foraminifers, detritus of crinoidal segments, echinoderm spines, fish scales, calcispheres, *Globochaeta alpina*, filaments, pellets and microstylolites.

A lithofacies analysis shows that the described Halstatt limestones are practically identical with the Halstatt limestones of the East Alps.

In the West Carpatians the Halstatt limestones occur in the Silica nappe; in the southwestern part of the Vienna Basin the Halstatt limestones occur at the localities "Hernstein" (cf. H. MOSTLER — R. OBERHAUSER — P. PLÖCHINGER 1967), in the "high Alpine nappe" (Hohe Wand Decke), in the surroundings of the "Fischauer Berge" (P. PLÖCHINGER 1967), in the area of "Hohe Wand" near Miesenbachtal, at Ödenhof-Fenster, Gösing and Priglitiz.

Seventeen thin sections of the Halstatt limestones contained foraminifers indicative of the Late Triassic age: *Ammodiscus* sp., *Ammodiscus* sp. (cf. *A. parapriscus* HO), *Ammodiscus* cf. *infinus* STRICHLAND, *Ammodiscus parapriscus* HO, *Permodiscus* sp., *Permodiscus planidiscoides* OBERHAUSER, *Trochammina* sp., *Tetrataxis inflata* KRISTAN, *Tetrataxis* sp. (cf. *T. nana* KRISTAN-TOLLMANN), *Dentalina* sp., *Dentalina* cf. *hoi* TRIFONOVA, *Fronicularia woodwardi* HOWCHIN, *Ophthalmidium lucidum* (TRIFONOVA), *Spiroloculina praecursor* OBERHAUSER, *Lenticulina acutiangulata* (TERQUEM), *Lenticulina* cf. *eulimbata* KRISTAN-TOLLMANN, ?*Valvulina* sp.

The residue of dissolved limestones contained free specimens: *Glomospira charoides* (JONES et PARKER), *Plagioraphe tornata* KRISTAN-TOLLMANN, *Textularia exigua* (SCHWAGER), *Gaudryna triassica* TRIFONOVA, *Pseudonodosaria obconica* (REUSS), *Endothyra keupperi* OBERHAUSER.

According to the vertical distribution of the species identified the Halstatt limestones are ranged to the Upper Triassic. On the basis of general regional data their age is determined as Norian or even Early-Rhaetian (Sevatian).

The next depth interval (3750—3754 m) from the basement of the Halstatt limestones is represented by anhydrites. The lithofacies study revealed breccia composed of grey and grey-black clasts of compressed and cleaved dolomites cemented by anhydrites in the depth of 3750 m, and anhydrite in the depth of 3751,2—3752,9 m was revealed by means of X-ray examination.

Samples for palynomorphic study were taken from this part of the well. According to P. SNOPOKOVÁ (in A. BUJNOVSKÝ et al. 1986) the samples were poor in palynomorphs and poorly preserved. Basing on species, she correlated the palynomorph assemblages with the Keuper, mainly "Gypskeuper" in Switzerland (B. W. SCHEURING 1970) roughly corresponding to the Carnian-Norian. The drilling revealed sandstones, dolomites, limestones in the depth of 3813 m (core No 3). Their stratigraphic position is not known exactly because they are only small rock fragments. The sandstones are fine-grained, grey-rose. Dolomites form dark-grey spotty dolomicrites and limestones are dark-grey and contain ostracods microfacies. They roughly resemble the Middle Triassic Gutenstein limestones.

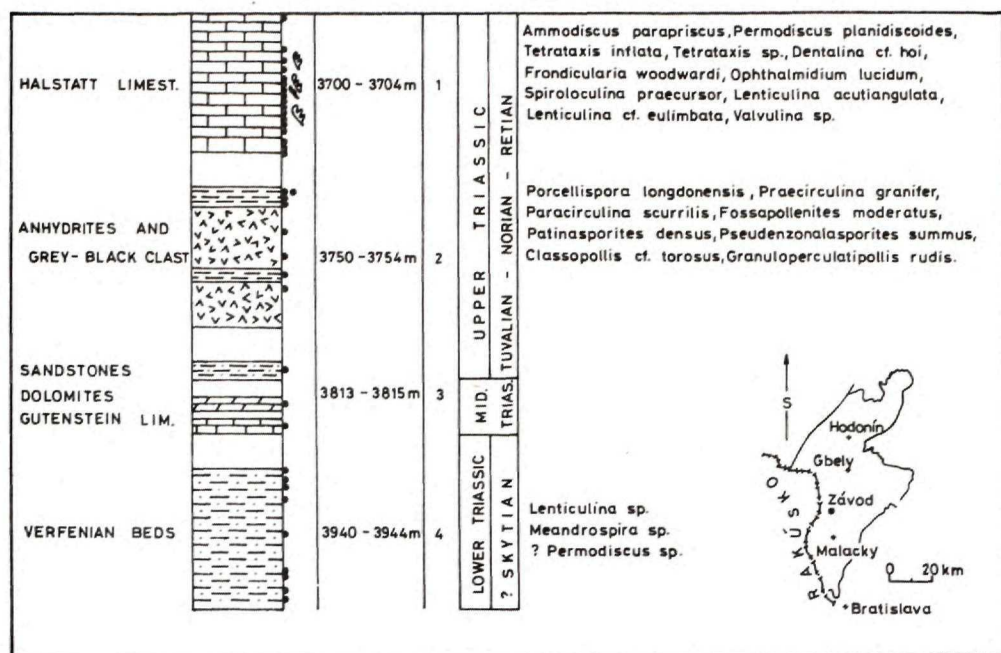


Fig. 4 Lithostratigraphical profile of borehole Závod-81 (compiled by A. BUJNOVSKÝ, in A. BUJNOVSKÝ — O. SAMUEL 1989) and sketch map of the borehole Závod-81.

Carbonate sandstones (? werfenian beds) were studied in the interval 3940,2-3944,0 m. They most likely represent a complex of Werfenian beds, usually rich in evaporites in their upper part.

Anhydrite breccia with dolomite fragments, probably Permian, represents the lowermost member below the Werfenian beds. According to superposition their position is analogous with the alpine "Haselgebirge".

PALEONTOLOGICAL DESCRIPTION

Rhabdammina Sars, 1869

Rhabdammina triassica n. sp.

Pl. I, Fig. 1—3

Type species: Pl. I, Fig. 2; in the depository of the D. Štúr Institute of Geology in Bratislava.

Denomination: According to the stratigraphic unit — Triassic.

Type level: Upper Ladinian — Reifling limestones.

Type locality: Ráztoka, Low Tatra.

Description: The test is tubular, straight; circular or subcircular in section. The test wall consists of angular and subangular quartz grains cemented by quartzose cement. The test surface is coarse; smooth on the inner side. The species differs from *Rhabdammina cylindrica* GLAESSNER, 1881 (Upper Cretaceous — Paleogene) in smaller quartz and thus in less coarse test-surface. It differs from *Rhabdammina discreta* BRADY 1881 in a coarser surface, in larger usually non-rouded quartz grains and in absence of constrictions.

Dimensions: length 0,3—0,5 mm; width 0,1—0,15 mm.

Stratigraphical and geographical range: In the West Carpathians the species is scarce in the Reifling limestones, "Trachyceras beds" and Reingraben beds.

Hyperammina BRADY, 1879

Hyperammina amplimuralis (PANTIĆ, 1972)

Pl. III, Fig. 2a-b

1972 *Aeolisaccus amplimuralis* n. sp. — S. PANTIĆ: *Aeolisaccus amplimuralis* n. sp. i *Aeolisaccus gracilis* n. sp. from the Middle Triassic etc., p. 227—228, Fig. 1—3.

1977 *Hyperammina amplimuralis* (PANTIĆ) — J. HOHENEGGER — R. LEIN: Die Reiflinger Schichten etc., p. 218—220, Taf. 15, Fig. 1, Taf. 17, Fig. 1 (cum syn.).

Description: Carpathian forms are most similar to the species described by J. HOHENEGGER — R. LEIN (l.c.) from Reifling formations.

Dimensions: length 0,45—0,65 mm; width 0,09—0,19 mm.

Stratigraphical and geographical range: The Upper Ladinian Reifling limestones of the Choč nappe in the West Carpathians.

Hyperammina constricta n. sp.

Pl. I; fig. 4a-b

Type species: Pl. I, fig. 4a-b; in the depository of the D. Štúr Institute of Geology in Bratislava.

Denomination: According to the Constriction.

Type level: Upper Ladinian — Reifling limestones.

Type locality: Ráztoka, Low Tatra.

Description: The test is tubular, usually slowly arcuate subcircular to circular in section. For the species various distinct constrictions, differently spaced are characteristic. The test wall consisting of regular finely quartz grains cemented by quartzose cement.

It differs from *Hyperammina eulimbata* KRISTAN-TOLLMANN, 1964 regular primary constrictions.

Dimensions: length 0,4—0,6 mm, width 0,15—0,2 mm.

Stratigraphical and geographical range: In the West Carpathians the species is scarce in the Reifling limestones and Reingraben beds.

Hyperammina eulimbata KRISTAN-TOLLMANN, 1964

Pl. II, Fig. 1-b, Pl. III, Fig. 1a-b

1964 *Hyperammina eulimbata* n. sp. — E. KRISTAN-TOLLMANN: Die Foraminiferen aus dem rhätischen Zillbachmergeln, etc., p. 26, Pl. 1, Fig. 3—5, 10—11.

Description: The Carpathian forms are most similar to the taxon described by E. KRISTAN-TOLLMANN (l.c.) from Zlambach beds (Rhaetian) of the Alps.

It differs from the species *Hyperammina stabilis* KRISTAN-TOLLMANN 1964, in fine constrictions and thinner test wall.

Dimensions: length 0,9—1,3 mm; width 0,22—0,26 mm.

Stratigraphical and geographical range: The species is known from rhaetian formation of the Alps (E. KRISTAN-TOLLMANN 1964). In the West Carpathians it is found in the Lower Carnian (Julian) Reingraben beds.

***Hyperammina stabilis* KRISTAN-TOLLMANN, 1964**

Pl. II, Fig. 2—3, 4

1964 *Hyperammina stabilis* n. sp. — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den Rhätischen Zlambachmergeln etc., p. 25, Taf. 1, Fig. 6—7.

1983 *Hyperammina stabilis* KRISTAN-TOLLMANN — J. SALAJ — K. BORZA — O. SAMUEL: Triassic Foraminifers etc., p. 59, pl. CXLVI, Fig. 2 (1).

Description: The species characteristic is identic with the original complemented description by E. KRISTAN-TOLLMANN (l.c.).

Dimensions: length 0,45—1,9 mm; width 0,2—0,5 mm.

Stratigraphical and geographical range: The species is known from the Anisian formations of the Northern Limestone Alps (M. FRANZ 1966), Carnian of the Bakony Mts. in Hungary (A. ORAVECZNÉ-SCHEFFER 1965), from the West Carpathians (Reingraben beds — Lower Carnian) and from the Rhaetian of the Austrian Eastern Alp (E. KRISTAN-TOLLMANN 1964).

***Jaculella* BRADY, 1979**

***Jaculella dentaliniformis* HOHENEGGER et LEIN 1977**

Pl. XLVII, Fig. 1a-b

1977 *Jaculella dentaliniformis* n. sp. — J. HOHENEGGER — R. LEIN: Die Reiflinger Schichten etc., p. 220—222, Taf. 15, Fig. 5; Taf. 17, Fig. 5.

Description: The West-Carpathian specimen is very ressemblat to the species *Jaculella dentaliniformis* HOHENEGGER et LEIN, 1977 described from the Reifling formation of the Austrian Alps.

Dimensions: length 0,3—0,45 mm; width 0,8—0,1 mm.

Stratigraphical and geographical range: Original description from Reifling formation (Illyrian-Fassanian) of the Austrian Alp; the Carnian (Julian) of the West Carpathians (Uppermost part of the Reingraben beds — Choč nappe).

***Ammodiscus* REUSS, 1862**

***Ammodiscus annulinoides* KRISTAN-TOLLMANN, 1970**

Pl. V, fig. 1—3, 5; Pl. VI, fig. 1,3—4; Pl. VII, fig. 1a-b, 2a-b, 3

1970 *Ammodiscus annulinoides* n. sp. — E. KRISTAN-TOLLMANN (in A. Tollmann et E. Kristan-

Tollmann) 1970: Geologische und mikropaläontologische Untersuchungen etc., p. 119—120, Taf. 3, Fig. 6, fig. 1, 3—4.

1977 *Ammodiscus annulinoides* KRISTAN-TOLLMANN, 1970 — V. J. GUPTA — L. ZANINETTI — L. K. KACHROO: Upper Triassic Foraminifera etc., p. 8, pl. 1, fig. 1—2.

Description: The test are small, planispiral, biconcave and coarsely agglutinated. The initial enrollment is made 1 1/2 — 2 whorls, It is followed 5 — 1/2 externally clearly visible whorls.

Dimensions: diameter 0,25—0,45 mm; thickness 0,07—0,09 mm.

Stratigraphical and geographical range: The species is known from the Upper Triassic of the Ostalpen. Besides the Upper Ladinian and Carnian of the West Carpathians.

Ammolagena EIMER et FICHER, 1899

Ammolagena sp.

Pl. IV, fig. 2

Remark: Test attached, with large ovoid proloculus followed by elongate undivided tubular chamber; wall finely agglutinated, aperture terminal, rounded at the open end of the tube.

Dimensions: diameter 0,19—0,22 mm.

Stratigraphical and geographical range: In the West Carpathians it is in the Cordevolian—Julian of the "Trachyceras beds" of the Choč nappe.

Ammovertella CUSHMAN, 1928

Ammovertella bulbosa GUTSCHIK et TRECKMAN, 1959

Pl. IV, fig. 3

1959 *Ammovertella bulbosa* n. sp. — R. C. GUTSCHICK — J. F. TRECKMAN: Arenaceous Foraminifera from the Rockford limestone etc., p. 247, Pl. 37, fig. 4—5, 8—9.

1962 *Ammovertella bulbosa* GUTSCHICK et TRECKMAN — E. TRIFONOVA: Foraminifery ot gornija trias etc., Tab. 3, fig. 1—4.

Description: Test attached proloculus followed by undivided elongate turbular second chamber; wall finely agglutinated, with considerable cement; aperture at the open end of the tube.

Dimensions: length 0,1—0,25 mm; width 0,05—0,09 mm.

Stratigraphical and geological range: The described species is from Upper Triassic of the Eastern Balkan (Bulgaria); in the West Carpathians it was found in the Carnian (Reingraben beds).

Tolypammina RHUMBLER, 1895

Tolypammina biplanispira n. sp.

Pl. XIII, fig. 1,4

1977 *Tolypammina* sp. — D. UROŠEVIĆ: Foraminifers from the Han-Bulog limestones etc., pl. 2, fig. 6.

Type species: Pl. XIII, fig. 1,4; in the depository of the D. Štúr Institute of Geology in Bratislava.

Determination: bi (lat.) = two, planispiral.

Type level: Upper Ladinian — Reifling limestones.

Type locality: Ráztoka, Low Tatra.

Description: The test consists of spherical or subspherical proloculum of deutoconch coiled in two planispiral-coiled double part with 2—3 whorls. The wall consists of fine quartz grains connected by siliceous cement.

It differs from *Tolypammina discoidea* TRIFONOVA 1962 in double planispiral-coiled test without the upright distal part of deutoconch.

The form denoted as *Tolypammina* sp. by D. UROŠEVIĆ (1977) is also ranged to the newly described taxon. It consists of two planispiral-coiled parts of test, connected by multiple flexible part of deutoconch.

Dimensions: diameter 0,35—0,45 mm.

Stratigraphical and geographical range: In the West Carpathians the species is scarce in the Reifling limestones (Upper Ladinian).

***Tolypammina discoidea* TRIFONOVA, 1962**

Pl. VII, fig. 4; pl. VIII, fig. 1—3; pl. IX, fig. 1a-c, 2; pl. XI, fig. 2; pl. XII, fig. 2; pl. XIII, fig. 2—3

1962 *Tolypammina discoidea* n. sp. — E. TRIFONOVA: Foraminiferi ot gornija trias etc., p. 165, pl. 1, fig. 10—13; pl. 2, fig. 1—2.

1977 *Tolypammina discoidea* TRIFONOVA — D. UROŠEVIĆ: Foraminifers from the Han-Bulog limestone etc., pl. 2, fig. 4

1977 *Tolypammina discoidea* TRIFONOVA — E. TRIFONOVA: Foraminiferen aus der Trias etc., p. 52, pl. 1, fig. 13—15.

1981 *Tolypammina discoidea* TRIFONOVA — O. JENDREJÁKOVÁ — J. MICHALÍK — J. PAPŠOVÁ: Príspevok ku stratigrafii strednotriasových karbonátov etc., pl. 10, fig. 5,7.

Description: The description of the Carpathian forms are identic with the description of the type species.

The forms with the broken upright part of deutoconch are more frequent besides scarce forms identic with the typical species of the taxon described. The characteristic spherical proloculum and the number of whorls (usually 3, sometimes 4—4 1/1) indicate that the planispiral parts belong to the species *Tolypammina discoidea* TRIFONOVA 1962.

Dimensions: diameter of the coiled portion 0,4—0,8 mm, diameter of the proloculum 0,05—0,09 mm, with of the distal portion chamber 0,1—0,2 mm.

Stratigraphical and geographical range: In the Carnian of the Eastern Balkan (Bulgaria); the Upper Ladinian Reifling limestones and the Carnian "Trachyceras beds" of the West Carpathians (Choč nappe).

***Tolypammina* aff. *milanis multiplex* UROŠEVIĆ**

Pl. X, fig. 1; pl. XII, fig. 1a-b

1977 *Tolypammina milanis multiplex* n. subsp. — D. UROŠEVIĆ: Foraminifers from Han-Bulog Limestones etc., pl. 1, fig. 4—7.

Description: Carpathian forms are most resemblant to the subspecies described by D. UROŠEVIĆ (1977). They differ from the typical species in a greater amount of planispiral whorls and from *Tolypammina discoidea* TRIFONOVA 1962 in double and triple upright distal part of deutoconch.

Dimensions: diameter of the colled portion 0,22—0,4 mm, diameter of the proloculum 0,04—0,07 mm, width of the distal portion chamber 0,09—0,2 mm.

Stratigraphical and geographical range: The Anisian of the Dinarides; the Ladinian (Reifling limestones) of the West Carpathians.

***Tolypammina milanis salayi* n. ssp.**

Pl. XIV, fig. 1a-d

Type species: The specimen in Pl. XIV, fig. 1a-d; in the depository of the D. Štúr Institute of Geology in Bratislava.

Denomination: to the honour of Dr. J. SALAJ, DrSc. (Czechoslovakia).

Type level: Upper Ladinian-Reifling limestones.

Type locality: Ráztoka, Low Tatra.

Description: The consists of a large spherical proloculum and planispiral deutoconch coiled into 2—2 1/2 whorls in the proximal part. The other part is also more-or-less planispiral-coiled. The distal part of deutoconch is upright. The test wall consists of fine equi-dimensional quartz grains bound by siliceous cement. The inner test wall is smooth. Circular aperture is on the end of the upright part of deutoconch. It differs from the species *Tolypammina* ex gr. *milanis* UROŠEVIĆ 1977 in more-or-less planispiral proximal part of the test.

Dimensions: diameter of the colled portion 0,25—0,5 mm; diameter of the proloculum 0,05—0,08 mm; width of the distal portion chamber 0,09—0,13 mm.

Stratigraphical and geographical range: In the West Carpathians it is present in the Upper Ladinian, in the Reifling limestones.

***Glomospira* RZEHAČ, 1885**

***Glomospira charoides* (JONES et PARKER, 1860)**

Pl. XV, fig. 1—2

1860 *Trochammina squamata* var. *charoides* JONES et PARKER — fide B. F. ELLIS et A. R. MESSINA: Catalogue of Foraminifera.

1977 *Glomospira charoides* (JONES et PARKER 1860) — O. SAMUEL: Agglutinated foraminifers from Paleogene etc., p. 27, pl. 4, fig. 6; pl. 23, fig. 5—6; pl. 24, fig. 1 (cum syn.).

Description: The sporadical forms show morphological features almost indentic with the species *Glomospira charoides* (JONES et PARKER 1860). Triassic forms are also ranged to this species.

Dimensions: diameter 0,09—0,2 mm.

Stratigraphical and geographical range: The Upper Triassic of the West Carpathians.

Turritellella RHUMBLER, 1904

"*Turritellella*" *mesotriasica* KOEHN-ZANINETTI, 1969

Pl. XVI, fig. 1a-c, 2a-b

- 1969 *Turritellella mesotriasica* n. sp. — L. KOEHN-ZANINETTI: Les Foraminifères etc., p. 32—35, text-fig. 4.
1977 *Turritellella mesotriasica* KOEHN-ZANINETTI — D. UROŠEVIĆ: Stratigraphic position of some Foraminifers in Triassic etc., 228, pl. 1, fig. 1—15 (partim).
1977 *Turritellella mesotriasica* KOEHN-ZANINETTI — J. HOHENEGGER — R. LEIN: Die Reiflinger Schichten etc., p. 227—230, Abb. 6, Taf. 15, Fig. 10, 11, Taf. 17, Fig. 7, 8 (cum syn.).
1983 "*Turritellella*" *mesotriasica* KOEHN-ZANINETTI — J. SALAJ — K. BORZA — O. SAMUEL: Triassic Foraminifers etc., p. 70, Pl. 16, fig. 1; Pl. 142, fig. 3.
1981 *Turritellella mesotriasica* KOHN-ZANINETTI — O. JENDREJÁKOVÁ — J. MICHALÍK — J. PAPŠOVÁ: Príspevok ku stratigrafii strednostriasových karbonátov etc., pl. 6, fig. 2, 4—5.

Description: The material mostly comprises fragments without the initial part of the test. As it is seen in Plate XVI, Fig. 1a-b, the forms miss the streptospiral or planispiral stage, characteristic of the newly determined genus *Turritiglomina* ZANINETTI, 1987. Our forms are identic with the A — generation in the sense of J. HOHENEGGER — R. LEIN (1977; Pl. XV, Fig. 11).

Dimensions: length 0,3—0,5 mm, width 0,08—0,15 mm.

Stratigraphical and geographical range: It is an index form of the Upper Anisian — Lower Carnian of the Alps, Carpathians, Dinarides, Balkan and Caucasus.

Plagioraphe KRISTAN-TOLLMANN, 1973

***Plagioraphe tornata* KRISTAN-TOLLMANN, 1973**

Pl. XVII, fig. 1a-b, 2—4

- 1973 *Plagioraphe tornata* n.g. n. sp. — E. KRISTAN-TOLLMANN: Neue sandschalige Foraminiferen etc., p. 419, 421, Abb. 1, fig. 1—5, Abb. 2, fig. 4—6.
1977 *Plagioraphe tornata* KRISTAN-TOLLMANN — E. TRIFONOVA: Foraminiferen aus der Trias etc., p. 54, pl. 2, fig. 2—4.

Description: Carpathian forms are identic with the type species described from the Austrian Alps.

Dimensions: Length 0,34—0,58 mm, width 0,03—0,1 mm.

Stratigraphical and geographical range: Upper Triassic of the Austrian Alps; the Ladinian of Bulgaria; the Norian — ? Lower Reaetian Hallstatt limestones in the West Carpathians.

Gaudryina d'ORBIGNY, 1839

***Gaudryina triassica* TRIFONOVA, 1962**

Pl. XVIII, fig. 1a-b, 2, 3a-b; Pl. XIX, fig. 1a-b, 2, 3a-b; Pl. XX, ? fig. 3a-b

- 1962 *Gaudryina triassica* n. sp. — E. TRIFONOVA: Foraminiferi ot gornij trias etc., p. 169, pl. 3, fig. 14—18.

1981 *Gaudryina triassica* TRIFONOVA — O. JENDREJÁKOVÁ — J. MICHALÍK — J. PAPŠOVÁ: Príspevok ku stratigrafii triasových karbonátov etc., pl. 7, fig. 12, pl. 10, fig. 4.

Description: The Carpathians forms are most resemblant to the species described from the Eastern Balkan by E. TRIFONOVA (1962).

Dimensions: length 0,3—0,5 mm.

Stratigraphical and geographical range: The original species was described from Upper Triassic of the Bulgaria. In the West Carpathians the typical forms occur in the Upper Ladinian and Reingraben limestones, in the Carnian "Trachyceras" beds and in The Norian Hallstatt limestones.

Textularia DEFRANCE, 1839

Textularia exigua (SCHWAGER, 1864)

Pl. XX, fig. 1a-b, 2

1864 *Textularia exigua* SCHWAGER — C. SCHWAGER: Foraminifera; in Dittmar., pl. 3, fig. 12 (fide B. F. Ellis — A. R. Messina).

1983 *Textularia exigua* (SCHWAGER, 1864) — J. SALAJ — K. BORZA — O. SAMUEL: Triassic Foraminifera etc., p. 76, pl. XIX, fig. 5; pl. XX, fig. 6; pl. XXI, fig. 1.

Description: A symmetrical, biserial test consists of 10—12 alternat, slowly enlarging chambers. Thick, agglutinate test wall; aperture a low arch at the base of the apertural face.

Dimensions: height 0,45—0,5 mm, width 0,13—0,17 mm.

Stratigraphical and geographical range: Original description from the Rhaetian Kössen member of the Tirolian Alps in Austria; the Carnian and the Norian of the West Carpathians.

Nodosinella BRADY, 1876

Nodosinella rostrata TRIFONOVA, 1972

Pl. XXIII, fig. 2a-b, 3

1972 *Nodosinella rostrata* n. sp. — E. TRIFONOVA: Triassic Foraminifera in North-Bulgaria, p. 506, pl. 1, fig. 1—4.

Description: Some forms from the Reingraben beds show the closest affinity to the species *Nodosinella rostrata*. The shell is uniserial and consists of 6—9 gradually enlarging, elongated, suboval chambers. Suture are straight, distinct. The aperture is circular, terminal, at the end of the ultimate chamber. The wall is calcareous, with microgranular external layer.

Dimensions: length 0,4—0,55 mm, width 0,08—0,09 mm.

Stratigraphical and geographical range: The species described is from the Anisian of the North-East Bulgaria. In the West Carpathians the species is scarce in the Lower Carnian (Julian) Reingraben beds of the Choč nappe.

Lunucammina SPANDEL, 1989

Lunucammina postcarbonica SPANDEL, 1901

Pl. XXXVIII, fig. 1a-b, 2, 3a-b

1901 *Geinitzina postcarbonica* SPANDEL — fide B. F. ELLIS — A. R. MESSINA: Catalogue of Foraminifera.

1965 *Geinitzina postcarbonica* SPANDEL — J. M. SELLIER de CIVRIEUX — T. F. DESSAUVAGIE: Reclassification de quelques etc., p. 34—35, Tab. 1, fig. 1—13, 16, 17, 20—23, 27—30; Tab. 2, fig. 1—4, 7—10, 13; Tab. 3, fig. 1—4; Tab. 8, fig. 2.

Description: Carpathian forms show the closest affinity to the species described by de Civrieux — Dessauvage (l.c.). The shell is uniserial, rectilinear; consisting of 5 tightly aligned, laterally compressed chambers. The width of chambers exceeds their length. The profile of the shell is elliptic. The proximal part is suboval, distal, subcircular. Sutures are shallow, horizontal, distinct. The wall is calcareous, smooth. The aperture is longitudinal, laterally compressed, terminal.

Dimensions: length 0,3—0,45 mm; width 0,13—0,18 mm.

Stratigraphical and geographical range: The described species originated from the Upper Palaeozoic (Carbonian — Permian) of the Turkey. The Uppermost part of the Reingraben beds (Lower Carnian — Julian) of the Choč nappe (Turík) in the West Carpathians).

Endothyra PHILLIPS, 1846

Endothyra kuepperi OBERHAUSER, 1960

Pl. L, fig. 1a-c, 2; pl. LI, fig. 1a-b, 2—4

1960 *Endothyra kuepperi* nov. sp. — R. OBERHAUSER: Foraminifera und Mikrofossilien "incertae sedis" etc., p. 16, pl. 3, fig. 7a-e, 22.

1976 *Endothyra kuepperi* OBERHAUSER — L. ZANINETTI: Les Foraminifères du Trias etc., p. 126—127, pl. 8, fig. 20—25 (cum syn.).

1981 *Endothyra kuepperi* OBERHAUSER — O. JENDREJÁKOVÁ — J. MICHALÍK — J. PAPŠOVÁ: Príspevok ku stratigrafii strednotriasových karbonátov etc., pl. 10, fig. 1—3.

1983 *Endothyra kuepperi* OBERHAUSER — J. SALAJ — K. BORZA — O. SAMUEL: Triassic Foraminifers etc., 38, fig. 1—2; pl. 43, fig. 4a; pl. 146, fig. 2 (2).

Description: A significant, frequent species, identical with the original description.

Dimensions: diameter 0,15—0,35 mm.

Stratigraphical and geographical range: The Upper Anisian — Carnian of the Alps, partly Norian of the Carpathians.

Conicospirillina CUSHMAN, 1927

Conicospirillina mariae KRISTAN-TOLLMAN, 1970

Pl. XLIX, fig. 2, 3a-b

- 1970 *Conicospirillina mariae* n. sp. — E. KRISTAN-TOLLMANN (in A. TOLLMANN — E. KRISTAN-TOLLMANN): Geologische und mikropaläontologische Untersuchungen etc., p. 127, Taf. 8, Fig. 21—24.

Description: The shell is small, high-conical, trochospiral-coiled. It consist of 12—15 whorls. Spiral sutures are shallow, vague. The shell profile is circular. The ventral side is slightly convex. The width of deuteroconch exceeds 1/3 of the shell diameter. The aperture is indistinct.

Carpathian forms differ from the holotype mainly in smaller shells.

Dimensions: height 0,12—0,2 mm; diameter 0,07—0,1 mm.

Stratigraphical and geographical range: The first Triassic representative of the genus *Conicospirillina* (*C. mariae*) was described by E. KRISTAN-TOLLMANN (l.c.) from the Rhetian (Zlambach beds) in the Austrian Alps. In the West Carpathians the taxon described was found in the Upper Ladinian (Reifling limestones) of the Choč nappe.

Ophthalmidium KÜBLER, 1870

Ophthalmidium cf. *exiguum* KOEHN-ZANINETTI, 1969

Pl. XXI, fig. 5

- 1969 *Ophthalmidium exiguum* n. sp. — KOEHN-ZANINETTI: Les Foraminifères du Trias etc., p. 64—67, pl. 6, fig. D, text-fig. 14.
 1976 *Ophthalmidium exiguum* KOEHN-ZANINETTI — L. ZANINETTI: Les Foraminifères du Trias etc., p. 143—144, pl. 7, fig. 20—24 (cum syn.).
 1977 *Ophthalmidium* cf. *exiguum* KOEHN-ZANINETTI — J. HOHENEGGER — R. LEIN: Die Reiflinger Schichten etc., p. 244—245, Taf. 18, Fig. 4.
 1981 *Ophthalmidium* aff. *exiguum* KOEHN-ZANINETTI — O. JENDREJÁKOVÁ — J. MICHALÍK — J. PAPŠOVÁ: Príspevok ku stratigrafii strednotriasových karbonátov etc., pl. 13, fig. 4.
 1983 *Ophthalmidium exiguum* KOEHN-ZANINETTI — J. SALAJ — K. BORZA — O. SAMUEL: Triassic Foraminifera etc., p. 108—109, pl. 67, fig. 9—12, pl. 68, fig. 1—3; pl. 141, fig. 8.

Description. The species differs from type species terminal part of the deutroloculum, with is a significant morphological character.

Dimensions: height 0,3—0,5 mm, width 0,22—0,32 mm.

Stratigraphical and geographical range: The Ladinian — Carnian of the Northern Limestones Alps, of the Italian Alps, the Bakony Mts. of Hungary, the Hellenides, the Balcan and the Caucasus; in the West Carpathians it belongs amongs the forms frequent in the Carnian and Lower Norian.

Ophthalmidium cf. *triadicum* (KRISTAN, 1957)

Pl. XXI, fig. 2

- 1957 *Spiriophthalmidium triadicum* n. sp. — E. KRISTAN: *Ophthalmediidae* und *Tetrataxinae* (Foraminifera) etc., p. 290, pl. 25, fig. 2—4.
 1976 *Ophthalmidium triadicum* (KRISTAN) — L. ZANINETTI: Les Foraminifères du Trias etc., p. 146—147, pl. 7, fig. 28, 29 (cum syn.).
 1981 *Ophthalmidium* cf. *triadicum* (KRISTAN) — O. JENDREJÁKOVÁ — J. MICHALÍK — J. PAPŠOVÁ: Príspevok ku stratigrafii strednotriasových karbonátov etc., pl. 13, fig. 8.
 1983 *Ophthalmidium triadicum* (KRISTAN) — J. SALAJ — K. BORZA — O. SAMUEL: Triassic Foraminifera etc., p. 110, pl. 68, fig. 4—12.

Description: Of free Carpathian specimen from Reifling limestones and Reingraben beds show its greatest affinity to the species *Ophthalmidium triadicum* (KRISTAN, 1957).

Dimensions: height 0,42—0,52 mm; width 0,1—0,19 mm.

Stratigraphical and geographical range: The Carnian and the Rhaetian of the Bakony Mts., in Hungary; the Rhaetian of the Austrian Alps, Transylvanian Carpathians and the Caucasus; the Carnian (Tisovec limestones, Reingraben beds), and the Norian (Furmanec limestones) of the Slovak Karst.

***Ophthalmidium tricki* (LANGER, 1960)**

Pl. XXI, fig. 3

1968 *Praeophthalmidium* (*Eophthalmidium*) *tricki* n. sp. — W. LANGER: Neue Miliolacea (Foram.) aus der mittleren Trias etc., p. 591, Taf. 1, Fig. 1—5.

1976 *Ophthalmidium tricki* (LANGER) — L. ZANINETTI: Les Foraminifères du Trias etc., p. 147, pl. 5, fig. 17, 18.

1977 *Ophthalmidium tricki* (LANGER) — J. HOHENEGGER — R. LEIN: Die Reiflinger schichten etc., p. 241—244, Taf. 16, Fig. 7—9; Taf. 18, Fig. 5—8 (cum. syn.).

1981 *Ophthalmidium tricki* (LANGER) — O. JENDREJÁKOVÁ — J. MICHALÍK — J. PAPŠOVÁ: Príspevok ku stratigrafii strednotriasových karbonátov etc., pl. 13, fig. 3.

1983 *Ophthalmidium tricki* (LANGER) — J. SALAJ — K. BORZA — O. SAMUEL: Triassic Foraminifera etc., 110, pl. 72, fig. 6b; pl. 141, fig. 11.

Description: Morphology of the Carpathian forms and of free specimens from Reifling limestones and Reingraben beds is identical with that of the originally described species.

Dimensions: height 0,26—0,32 mm; width 0,22—0,28 mm.

Stratigraphical and geographical range: The Upper Anisian of Turkey and the Caucasus; Illyrian of the Choč nappe in the Reifling limestones (Ladinian-Carnian) and Reingraben beds (Carnian — Julian) of the Choč nappe.

***Spiroloculina* d'ORBIGNY, 1826**

***Spiroloculina praecursor* OBERHAUSER, 1960**

Pl. XXI, fig. 4

1960 *Spiroloculina praecursor* n. sp. — R. OBERHAUSER: Foraminiferen und Microfossilien "incertae sedis" etc., p. 18—19, Taf. 5, Fig. 10.

1974 *Ophthalmidium praecursor* (OBERHAUSER) — N. A. EFIMOVA: Triasovije foraminifery etc., pl. 4, fig. 19a-b.

1976 *Spiroloculina?* *praecursor* OBERHAUSER — L. ZANINETTI: Les Foraminifères du Trias etc., p. 148, pl. 7, fig. 30, 31 (cum syn.).

1983 *Spiroloculina praecursor* OBERHAUSER — J. SALAJ — K. BORZA — O. SAMUEL: Triassic Foraminifera etc., p. 112, pl. 74, fig. 9—11.

Description: Morphology of the Carpathian specimens is more-or-less identical with that of type specimens.

Dimensions: height 0,28—0,42 mm, width 0,18—0,28 mm.

Stratigraphical and geographical range: The Ladinian—Carnian of the Austrian and Italian Alps, and of the Caucasus, the Carnian (Reingraben beds) and Norian of the Slovak Karst and Choč nappe in the West Carpathians.

Pachyphloides SELLIER de CIVRIEUX et DASSEUVAGIE, 1965

Pachyphloides dracosimilis (OBERHAUSER, 1960)

Pl. XLIV, fig. 1a-b, 2a-b, pl. XLV, fig. 1a-b, 2a-b; pl. XLVI, fig. 1—3.

1960 *Lingulina dracosimilis* nov. sp. — R. OBERHAUSER: Foraminiferen und Mikrofossilien "incertae sedis", etc., p. 31, Tab. 3, Fig. 6a-b.

Description: The shell is flat on both sides; its outline is deltoid; the margin is angular to subangular. A large subspheric proloculum with 7—8 gradually enlarging narrow chambers are characteristic of megalospheric forms. Microspheric forms have 8—11 chambers. Suture are bent, shallow, indistinct. The proximal part of the shell is pointed, often with a broken megalospheric proloculum. The aperture is terminal, open, compressed. The wall is calcareous, smooth on the surface, fine-perforated.

P. dracosimilis differs from *Pachyphloides oberhauseri* SELLIER de CIVRIEUX et DESSAUVAGIE, 1965 in a more elongated shell, triangular proximal part of the shell and subangular peripheral part of the shell.

Dimensions: length 0,4—0,55 mm; width 0,24—0,32 mm.

Stratigraphical and geographical range: The originally described species is from the Upper Triassic (Carnian) of the Reingraben beds (Ostalpen); the Carnian (Julian) Reingraben beds of the West Carpathians (Choč nappe).

Pachyphloides infirmis (OBERHAUSER, 1960)

Pl. XLII, fig. 2a-b

1960 *Lingulina infirmis* nov. sp. — R. OBERHAUSER: Foraminiferen und Mikrofossilien "incertae sedis" etc., p. 31—32, Taf. 3, Fig. 4a-b, 5.

Description: The shell is deltoid, subspheric in its proximal part; flat on both sides. The shell height almost equals its width or slightly exceeds it. Sutures are indistinct, bent. The shell margin is angular or subangular. The proloculum is large, ranging to 1/3 of shell diameter and next two chambers in megalospheric chambers. The terminal aperture is narrow, compressed. The wall is calcareous, smooth.

The type species comes from the Carnian Reingraben Beds in Austrian Alps. It was also found in the analogous lithostratigraphic unit (Carnian—Julian) in the profile Turík (Choč nappe) in the West Carpathians.

Dimensions: length 0,3—0,39 mm; width 0,3—0,38 mm.

Stratigraphical and geographical range: The described species originated from the Upper Trias (Carnian — Reingraben beds) of the Ostalpen; the Carnian (Julian) Reingraben beds of the Choč nappe of the West Carpathians.

Pachyphloides ex gr. *oberhauseri* SELLIER de CIVRIEUX et DESSAUVAGIE, 1965

Pl. XLII, fig. 1,3; pl. XLIII, fig. 1a-b, 2a-b

- 1965 *Pachyphloides oberhauseri* n. gen., n. sp. — J. M. SELLIER de CIVRIEUX — T. F. DESSAUVAGIE: Reclassification de quelques Nodosariidae etc., p. 84—85, pl. 18, fig. 5a-e, pl. 19, fig. 6.
 1974 *Pachyphloides oberhauseri* SELLIER de CIVRIEUX et DESSAUVAGIE — N. A. EFIMOVA: Triasovije foraminifery etc., pl. 5, fig. 20—22.
 1972 *Pachyphloides? triangularis* n. sp. — O. STYK: Kilka ważniejszych nowych gatunków etc., p. 870, pl. 1, fig. 11—12.
 1975 *Pachyphloides triangularis* STYK — O. STYK: Foraminifera the Lower and Middle Triassic etc., p. 513, pl. 35, fig. 20—21.

Description: The shell is flat on both sides, its contour is subelliptical; the margin is angular or subangular. In microspheric forms the shell is usually once as high as wide. Megalospheric forms are characterized by a large subspheric proloculum with 7—10 consequent rectangular chambers. Microspheric forms have a small subspheric proloculum and 8—12 tightly adjacent chambers. Sutures are slightly bent, indistinct. The terminal aperture is narrow, compressed. The wall is calcareous, smooth. *P. oberhauseri* differs from *Pachyphloides dracosimilis* (OBERHAUSER) in the arcuate proximal part of the shell, and angular or rim-like periphery of the shell. In their basic morphological characters the Carpathian forms are in a good accordance with the type species and forms described by R. OBERHAUSER (1960) from the Alps as *Lingulina* aff. *lata* (BURBACH 1965). Like J. M. SELLIER de Civrieux — T. F. Dessauvagie (1965), we also regard them as synonyms of the newly described species *Pachyphloides oberhauseri*.

Dimensions: length 0.54—0.7 mm; width 0.3—0.38 mm.

Stratigraphical and geographical range: The late species described from the Upper Trias (Carnian) of the Ostalpen; N. A. EFIMOVA (1974) found it in Ladinian sediments of Caucasus. In the West Carpathians the species was for the first time found in the Reingraben beds of the profile Turík (Choč nappe).

***Pachyphloides reingrabensis* n. sp.**

Pl. XLVI, fig. 4

Type species: Pl. XLVI, fig. 4; in the depository of the D. Štúr Institute of Geology in Bratislava.

Denomination: According to the lithostratigraphic unit — Reingraben beds.

Type level: Carnian (Julian) — Reingraben beds.

Type locality: Turík, Chočské vrchy Mts.

Description: The shell is large, flat on both sides, with triangular proximal and distal parts. The margin is subangular. Shells of megalospheric forms consist of a large subspheric proloculum, microspheric forms have a small subspheric proloculum. Consequent 7—10 chambers are rectangular. They form a 45° angle with the shell axis. Sutures are shallow, indistinct. The wall is calcareous, smooth on the surface. The aperture is terminal, narrow, compressed. *P. reingrabensis* differs from the species *Pachyphloides deltoides* in a more elongated (rectangular) shell with triangular and distal parts.

Dimensions: length 0.8—0.95 mm; width 0.38—0.43 mm.

Stratigraphical and geographical range: In the West Carpathians the type species was for the first time found in the Reingraben beds of the profile Turík (Choč nappe).

***Dentalina* RISSO, 1826**

***Dentalina crenata* SCHWARGER, 1865**

Pl. XXII, fig. 2, 3a-b

1865 *Dentalina crenata* SCHWAGER — fide B. F. ELLIS — A. R. MESSINA: Catalogue of Foraminifera.

1964 *Dentalina crenata* SCHWAGER — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den rhätischen Zlambachmergeln etc., p. 102—103, Taf. 17, Fig. 10, 11 (cum syn.).

Description: The Carpathian forms show the strongest affinity to the species described by E. KRISTAN-TOLLMANN (l.c.) as *Dentalina crenata* SCHWAGER 1985. It consists of 7—8 chambers gradually enlarging to 1/3 of the shell length. Other chambers are almost equal. The last one is by a half larger (ovoid) than the penultimate chamber. Sutures are distinct, diagonal. The terminal aperture is small, circular. The shell is smooth.

Dimensions: length 0,65—0,73 mm; width 0,1—0,15 mm.

Stratigraphical and geographical range: The Carpathian specimens identical with the species occur in the Upper Triassic (Rhaetian) Zlambach formation of the Austrian Alps; the Upper Triassic (Julian) Reingraben beds (Choč nappe) of the West Carpathians.

***Dentalina* aff. *luperti* EFIMOVA, 1974**

Pl. XXII, fig. 1a-b; Pl. XXIII, fig. 2a-b, 3

1974 *Dentalina luperti* EFIMOVA, sp. nov. — N. A. EFIMOVA: Triasovije foraminifery etc., p. 75, 80, pl. 5, fig. 14, 15 (cum syn.).

Description: The shell is elongated, narrow, mostly preserved in fragments. It consists of 6—8 gradually enlarging subcylindric chambers. The chambers are characterized by a lowered distal part so the shell is not compact. The chamber is once to 1 1/2 times higher than wide. The sutures are deep, straight or slightly diagonal. The chambers are very slightly overlapping one another. The aperture is terminal, radial.

Dimensions: length 0,5—0,65 mm; width 0,05—0,09 mm.

Stratigraphical and geographical range: The Cordevolian—Julian "Trachyceras beds" (Choč nappe) of the West Carpathians.

***Dentalina paucicurvata* FRANKE, 1936**

Pl. XXIII, fig. 1a-b

1936 *Dentalina paucicurvata* FRANKE — fide B. F. ELLIS — A. R. MESSINA: Catalogue of Foraminifera.

1964 *Dentalina paucicurvata* FRANKE — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den rhätischen Zlambachmergeln etc., p. 101, Taf. 17, Fig. 5, 6.

Description: The specimen is most resemblant to the form described as *Dentalina paucicurvata* FRANKE by E. KRISTAN-TOLLMANN (1964).

Dimensions: length 0,4—0,5 mm; width 0,07—0,9 mm.

Stratigraphical and geographical range: The specimens smaller than those described from the Rhaetian of the Austrian Alps; occur in the Carnian (Julian) Reingraben beds of the West Carpathians (Choč nappe).

***Dentalina pseudomonile* TERQUEM, 1858**

Pl. XXIV, fig. 1—2, 3a-b; Pl. XXV, fig. 1, 2a-b

1858 *Dentalina pseudomonile* TERQUEM — fide B. F. ELLIS — A. R. MESSINA: Catalogue of Foraminifera.

1964 *Dentalina pseudomonile* TERQUEM — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den rhätischen Zlambachmergeln etc., p. 101, pl. 16, fig. 20.

Description: The species shows most morphogenetic features in common with Alpine forms, ranged by E. KRISTAN-TOLLMANN (1962) to the species *Dentalina pseudomonile* TERQUEM 1858. Alternation of larger chambers with smaller is a characteristic feature.

Dimensions: length 0,65—0,95 mm; width 0,1—0,2 mm.

Stratigraphical and geographical range: The Zlambach formation (Rhaetian) of the Austrian Alps; the Carnian (Julian) Reingraben beds in the West Carpathians.

***Nodosaria levifracta* KRISTAN-TOLLMANN, 1964**

Pl. XXVI, fig. 1a-b

1964 *Nodosaria levifracta* n. sp. — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den rhätischen Zlambachmergeln etc., p. 69—70, pl. 10, fig. 10—11.

Description: Forms, ranged to the taxon described, consists of 3—4 gradually enlarging spherical chambers. The aperture is terminal, circular-radial.

Dimensions: length 0,31—0,68 mm; width 0,14—0,24 mm.

Stratigraphical and geographical range: According to E. KRISTAN-TOLLMANN (l.c.) it occurs in Rhaetian (Zlambach formation) of the Austrian Alps; the Carnian (Julian) Reingraben beds in the West Carpathians.

***Nodosaria ex gr. nitidana* BRAND, 1937**

Pl. XXV, fig. 3; Pl. XXVII, fig. 1—2, 3a-b; Pl. XXVIII, fig. 1—3, 4a-b

1937 *Nodosaria nitidana* BRAND — fide B. F. ELLIS — A. R. MESSINA: Catalogue of Foraminifera.

1964 *Nodosaria nitidana* BRAND — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den rhätischen Zlambachmergeln etc., p. 67, pl. 10, fig. 1—4 (cum syn.).

Description: The test is upright and consists of four-five (rarely of six) gradually enlarging spherical chambers. A small "thorn" is on the first chamber. The aperture is terminal, circular.

Dimensions: length 0,6—0,95 mm, width 0,2—0,27 mm.

Stratigraphical and geographical range: According to E. KRISTAN-TOLLMANN (l.c.) of the Austrian Alps; the Carnian (Julian) Reingraben beds in the West Carpathians.

***Nodosaria zlambachensis* KRISTAN-TOLLMANN, 1964**

Pl. XXVI, fig. 2a-b

1964 *Nodosaria zlambachensis* n. sp. — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den rhätischen Zlambachmergeln etc., p. 68—69, Taf. 10, Fig. 8—9.

Description: The shell is upright, consisting of 4 or 5 spherical, gradually enlarging chambers. The initial 3—4 chambers have also equal width and height. The ultimate

chamber is subspherical. The aperture is terminal, circular. Our forms are smaller than the originally described form. Sutures are deep. It differs from *M. ex gr. nitidana* TERQUEM, 1862 in a larger (not radial) aperture and deeper sutures.

Dimensions: length 0,5—0,9 mm; width 0,1—0,14 mm.

Stratigraphical and geographical range: The originally described form comes from the Rhaetian (Zlambach formation) of the Ostalpen. In the West Carpathians it is found in the Lower Carnian (Julian) Reingraben beds.

Pseudonosaria BOOMGAART, 1949

Pseudonodosaria obconica (REUSS, 1868)

Pl. XXIX, fig. 1a-c, 2; Pl. XXX, fig. 1a-b, 2, 3

1868 *Glandulina obconica* REUSS — fide B. F. ELLIS et A. R. MESSINA: Catalogue of Foraminifera.

1960 *Pseudoglandulina obconica* (Reuss) — R. OBERHAUSER: Foraminiferen und Mikrofossilien "incertae sedis" etc., p. 26, Pl. 6, Fig. 6, (? 7—8, 13a, b), ? Pl. 3, Fig. 9.

1983 *Pseudonodosaria obconica* (REUSS) — E. TRIFONOVA — G. ČATALOV: Vrchu stratigrafijata i litologijata na gronija trias etc., Pl. 2, fig. 9.

1981 *Pseudonodosaria* aff. *obconica* (REUSS) — O. JENDREJÁKOVÁ — J. MCHALÍK — J. PAPŠOVÁ: Príspevok ku stratigrafii strednotriasových karbonátov hronika etc., P. 6, fig. 3.

Description: The species described represents forms common in Middle- and Upper Triassic assemblages. The free forms scarcely preserve the whole shell. They mostly occur as fragments. But the shape of their chambers is so typical that their species assignment is easy when based on a single shell preserved. The shell consists of 4—6 semi-spherical, gradually enlarging chambers. The initial chamber is large, spherical. Other chamber are twice as wide as high. Chambers are loose, without overlapping one another. They are mutually connected by a narrow neck in the central part of the shell. The neck is connected with the wall by fine radial projections (Pl. 30, Fig. 1a,b). The shell outline is suboval; the aperture is terminal, circular, radial. The wall is calcareous, smooth.

Some forms from thin-sections denoted as *Nodosaria obconica* (REUSS) are not representative of the taxon described.

Dimensions: length 0,3—0,55 mm.

Stratigraphical and geographical range: The Landinian and Carnian of the Austrian Alps, Persian. The Carnian of the Trojan Balkan Mountain of the Bulgaria; Uppermost part of the Reingraben beds; "Trachyceras" beds (Carnian) Reifling limestone (Upper Ladinian) and Hallstat limestone (Norian) of the West Carpathians.

Pseudonosaria polyarthra (KRISTAN-TOLLMANN, 1964)

Pl. XXXIV, fig. 2a-b; Pl. XXXV, Fig. 1a-b, 2, 3

1964 *Rectoglandulina polyarthra* n. sp. — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den rhätischen Zlambachmergeln etc., p. 86, Taf. 13, Fig. 7.

Description: The shell is slim, long; pointed in its proximal part. Beginning with the 2nd-3rd chambers they are slightly enlarging so the shell gets cylindrical. In the distal part the ultimate chamber is constricted and subcylindrical. Sutures are round in profile. The aperture is terminal, circular, radial. The wall is calcareous, smooth.

Dimensions: length 0,37—0,5 mm; width 0,11—0,18 mm.

Stratigraphical and geographical range: The originally described species is from the Upper Triassic (Rhaetian) of the Austria Alps; in the West Carpathians it was found in the Carnian (Julian) Uppermost part of the Reingraben beds (Choč nappe).

***Pseudonodosaria pseudovulgata* n. sp.**

Pl. XXXVI, fig. 1, 2, 3a-b

Type species: Pl. XXXVI, fig. 2; in the depository of the D. Štúr Institute of Geology in Bratislava.

Denomination: pseudo — Lat., false and after the species *P. vulgata*.

Type level: Carnian (Julian) — Reingraben beds.

Type locality: Turík, Chočské vrchy Mts.

Description: The shell outline is rectangular; subspherical in the proximal and distal parts; circular or subcircular in profile. The shell consists of 5—7 tightly aligned chambers. The width of ultimate chambers is 1 to 1 1/2 times surpassing the height. The ultimate subspherical chamber occupies approximately 1/3 of the shell length. Its height equals its width. The aperture is terminal, circular, radial.

The species differs from *Pseudonodosaria vulgata* (BORNEMANN 1854) or from its subspecies *Pseudonodosaria vulgata multicamerata* KRISTAN-TOLLMANN (1964) in the suboval proximal part of the shell and in the "rectangular" shell outline.

Dimensions: length 0,5—0,65 mm; width 0,25—0,32 mm.

Stratigraphical and geographical range: In the West Carpathians the type species was for the first time found in the Reingraben beds of the profile Turík (Choč nappe).

***Pseudonodosaria semisphaerica* (KRISTAN-TOLLMANN, 1964)**

Pl. XXXVII, fig. 1—4

1964 *Rectoglandulina semisphaerica* n. sp. — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den Rhätischen Zlambachmergeln etc., p. 82—83, Taf. 12, Fig. 8—12.

Description: The material studied comprises several 2-3-chambered forms, showing the closest affinity to the species from the Alps, described by E. KRISTAN-TOLLMANN (l.c.) as *Rectoglandulina semisphaerica*.

Dimensions: length 0,3—4,2 mm; width 0,2—0,35 mm.

Stratigraphical and geographical range: The Rhaetian (Zlambach formation) of the Ostalpen; the Carnian (Julian) Reingraben beds in the West Carpathians.

***Pseudonodosaria* aff. *sphaerocephala* (KRISTAN-TOLLMANN, 1964)**

Pl. XXXIV, fig. 1

1964 *Rectoglandulina sphaerocephala* n. sp. — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den Rhätischen Zlambachmergeln etc., p. 87, Taf. 13, Fig. 8—14.

Description: Our forms show a closer affinity to the species *Pseudonodosaria sphaerocephala* (KRISTAN-TOLLMANN 1964). The shell form is compact, subcylindrical;

the proximal part is pointed; the distal part is subspherical. It consists of 5—7 partly overlapping compact chambers. Sutures shallow, indistinct. The shell profile is circular. The aperture is terminal, round, radial.

Dimensions: length 0,3—0,5 mm; max. width 0,35—0,04 mm.

Stratigraphical and geographical range: The originally described form comes from the Rhaetian (Zlambach formation) of the Ostalpen. In the West Carpathians it is found in the Lower Carnian (Julian) Reingraben beds.

***Pseudonodosaria vulgata multicamerata* (KRISTAN-TOLLMANN, 1964)**

Pl. XXXII, fig. 1, 2a-c; Pl. XXXIII, fig. 1

1964 *Rectoglandulina vulgata* (BORNEMANN 1854) subsp. *multicamerata* n. ssp. — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den Rhätischen Zlambachmergeln etc., p. 83—84, Taf. 12, Fig. 13—19.

1970 *Rectoglandulina vulgata multicamerata* KRISTAN-TOLLMANN; in A. TOLLMANN et KOLLMAN et KRISTAN-TOLLMANN: Geologische und mikropaleontologische Untersuchungen etc., Taf. 7, Fig. 24.

1983 *Pseudonodosaria vulgata multicamerata* (KRISTAN-TOLLMANN) — J. SALAJ — K. BORZA — O. SAMUEL: Triassic Foraminifers etc., p. 123, pl. 80, fig. 10, 15.

Description: The shell is cylindrical, upright; consisting of 5—8 gradually enlarging and overlapping chambers. The chambers are narrow, the ultimate one is subspherical. Sutures are shallow, distinct. The outline of the shell is oval to suboval. The aperture is circular radial. The Carpathian forms differ from the originally described form only in a smaller shell.

Dimensions: length 0,3—0,7 mm, width 0,2—0,28 mm.

Stratigraphical and geographical range: Original description from the Rhaetian of the Austrian Alps (Zlambach beds); similar profiles occur sporadically in the Norian Hallstatt limestones (J. SALAJ — K. BORZA — O. SAMUEL 1983) of the Slovak Karst and Uppermost part of the Reingraben beds (Carnian — Julian) of the Choč nappe (Turik).

***Lenticulina* LAMARCK, 1808**

***Lenticulina* (*Lenticulina*) *nautiloides* (BORNEMANN, 1854)**

Pl. XL, fig. 1—3

1854 *Robulina nautiloides* BORNEMANN — fide B. F. ELLIS — A. R. MESSINA; Catalogue of Foraminifera.

1964 *Lenticulina* (*Lenticulina*) *nautiloides* (BORNEMANN 1854) — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den Rhätischen Zlambachmergeln etc., p. 111, Taf. 21, Fig. 1a-b (cum syn.).

Description: Forms, ranged to the species described, have 10—12 chambers, indistinct intercameral and spiral sutures; the wall is smooth, calcareous. The shell outline is subspherical, suboval in profile. The aperture is elongated, oval.

Dimensions: length 0,37—0,55 mm; width 0,18—0,25 mm.

Stratigraphical and geographical range: The Rhaetian of the Austrian Alps (Zlambach beds); the Carnian (Julian) of the West Carpathians (Reingraben beds).

***Lenticulina (Astaculus) ex gr. matutina* (d'ORBIGNY, 1849)**

Pl. XLI, fig. 1a-c

1849 *Cristellaria matutina* d'ORBIGNY — fide B. F. ELLIS — A. R. MESSINA: Catalogue of Foraminifera.

1964 *Lenticulina (Astaculus) matutina matutina* (d'ORBIGNY) — E. KRISTAN-TOLLMANN: Foraminifera aus den Rhätischen Zlambachmergeln etc., p. 115, taf. 22, Fig. 1—8; Taf. 23, Fig. 1 (cum syn.).

Description: The proximal part of the shell is planispiral. It consists of 8—10 chambers, angular on the periphery. The distal part is uproght, usually with three rectangular chambers. The ultimate chamber is suboval. Sutures are vague; the shell is calcareous, smooth.

Dimensions: length 0,5—0,59 mm, width 0,32—0,39 mm.

Stratigraphical and geographical range: The Rhaetian of the Austrian Alps (Zlambach beds); the Carnian (Julian) of the West Carpathians (Reingraben beds).

***Marginulina* d'ORBIGNY**

***Marginulina erromena erromena* LOEBLICH et TAPPAN, 1950**

Pl. XXXIII, fig. 2—3; Pl. XXXIX, fig. 1a-b

1950 *Marginulina erromena* n. sp. — A. R. LOEBLICH et TAPPAN: North American Jurassic foraminifera etc., p. 46, Pl. 12, Fig. 8—9.

1964 *Marginulina erromena* LOEBLICH et TAPPAN — E. KRISTAN-TOLLMANN: Die Foraminiferen aus den Rhätischen Zlambachmergeln etc., p. 133, Taf. 18, Fig. 15a-b.

Description: Morphogenetic species of Carpathian forms are identic with those of the species described by KRISTAN-TOLLMANN (1964) from the Zlambach beds (Rhaetian) in the Alps as *Marginulina erromena* LOEBLICH et TAPPAN 1950, from which the Carpathian forms only differ in smaller shells.

Dimensions: length 0,31—0,45 mm; width 0,19—0,22 mm.

Stratigraphical and geographical range: The Carnian (Julian) Upper Reingraben beds of the Choč nappe in the West Carpathians.

***Marginulina erromena turica* n. nsp.**

Pl. XXXIX, fig. 2a-b

Type species: Pl. XXXIV, fig. 2a-b; in the depository of the D. Štúr Institute of Geology in Bratislava.

Denomination: According to the locality Turík.

Type level: Carnian (Julian) — Reingraben beds.

Type locality: Turík, Chočské vrchy Mts.

Description: The shell is large, loose, bent, slightly commpressed on sides. It consists of 5—7 chambers. The ultimate chamber occupies almost 1/3 of the shell diameter. The outer shell outline is smooth, suboval in profile. Sutures are indistinct, slightly bent. The aperture is circular, radial. The shell wall is calcareous, smooth.

It differs from *Marginulina erromena* LOEBLICH et TAPPAN, 1950 in a bent shell and shorter circumapertural radial ribs.

Dimensions: length 0,32—0,4 mm, width 0,18—0,21 mm.

Duostomina KRISTAN-TOLLMANN, 1960

Duostomina alta KRISTAN-TOLLMANN, 1960

Pl. LIII, fig. 1—4; Pl. LIV, fig. 1—4

1960 *Duostomina alta* nov. gen. nov. spec. — E. KRISTAN-TOLLMANN: Rotaliidae (Foraminifera) aus der Trias der Ostalpen etc., p. 69—70, Taf. 17, Fig. 3—6; Taf. 18, Fig. 1.

1976 *Duostomina alta* KRISTAN-TOLLMANN — L. ZANINETTI: Les Foraminifères du Trias etc., p. 187—188, pl. 17, fig. 2 (cum syn.).

1983 *Duostomina alta* KRISTAN-TOLLMANN — J. SALAJ — K. BORZA — O. SAMUEL: Triassic Foraminifera etc., p. 153, pl. XIV, fig. 2a; pl. 132, fig. 4—7; pl. 133, fig. 5; pl. 146, fig. 7.

Description: The Carpathian specimens are identical with the original illustration and description of the species *Duostomina alta* KRISTAN-TOLLMANN.

Dimensions: diameter 0,2—0,6 mm.

Stratigraphical and geographical range: The originally described form comes from the Cordevollian of the South-Tirolian Dolomites, the Anisian-Ladinian and Carnian localities of the Dinarides, the Balkan, and the Judicarian Alps. The Carnian Lunz formation in the Nizke Tatry Mts., Uppermost part of the Reingraben beds (Julian), the Uppermost Norian-Lower Rhetian Dachstein limestones of the Muránska planina plateau.

Schmidita FUSCH, 1967

Schmidita cf. *cassiana* (GÜMBEL, 1869)

Pl. LII, fig. 1a-b, 2, 3

1869 *Rotalia cassiana* GÜMBEL — fide B. F. ELLIS — A. R. MESSINA: Catalogue of Foraminifera.

1960 *Rotalia* (?) cf. *cassiana* GÜMBEL — R. OBERHAUSER: Foraminiferen und Mikrofossilien "incertae sedis" etc., Taf. 3, Fig. 8a-c.

Description: The Carpathian forms ranged to the taxon described are identical with the species described by OBERHAUSER as *Rotalia* (?) *cassiana* GÜMBEL, 1869 in the number of whorls (3), chambers (9—11 in the ultimate whorl). In their diagnostic characters they correspond to the genus *Schmidita* FUCHS 1967.

Dimensions: diameter 0,2—0,29 mm.

Stratigraphical and geographical range: Originally described in the Cassian beds. It is known from the Carnian "Halobien-schiefer" of the Ost Alps (Hohen Wand). The Upper Ladinian Reifling limestone of the Choč nappe in the West Carpathians.

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Vrchnotriasové foraminifery z oporného profilu Turík, vrtu Závod-81 a lokality Ráztoka (Západné Karpaty)

Resumé

Pri mikrobiostratigrafickom výskume hlbokých štruktúrnych vrtoch podložia miocénnych sedimentov Viedenskej panvy (porov. A. BUJNOVSKÝ — O. SAMUEL, 1989; O. SAMUEL — A. BUJNOVSKÝ — P. SNOPOKOVÁ, 1989; O. SAMUEL — A. BUJNOVSKÝ — P. SNOPOKOVÁ, 1989; O. SAMUEL — A. BUJNOVSKÝ — P. SNOPOKOVÁ, 1991; A. BUJNOVSKÝ — O. SAMUEL — P. SNOPOKOVÁ, 1992) okrem foraminifer z výbrusov sme z hallstattských vápencov získali z rezídua vzoriek rozpustených v kyseline octovej i „voľné“ foraminifery. Obdobným spôsobom sme získali foraminifery i z reiflinských vápencov lokality Ráztoka a z oporného profilu Turík. „Voľné“ foraminifery z „trachycerasových“ a reingrabenských vrstiev posledne menovaného profilu sme získali klasickým postupom (plavením).

Litológia a mikrofaunistratigrafia skúmaných litostratigrafických jednotiek

Oporný profil Turík. Opisovaný profil sa nachádza v severnej časti priamo v obci Turík, nachádzajúcej sa 6 km sv. od mesta Ružomberok (obr. 1). Sedimenty opisovaného profilu patria k chočskej jednotke (priekrovu). Sú odokryté v troch malých, nad sebou ležiacich lomoch. Širšie okolie bolo predmetom pozornosti už viacerých autorov od minulého storočia (D. ŠTÚR, 1860; E. MOISSOVICS, 1967; B. DORNAY, 1917). Prvá priama zmienka o profile Turík pochádza od V. VOGLA (1917). Ďalšie pochádzajú z tridsiatych rokov (A. MATĚJKA, 1927, 1935; D. ANDRUSOV, 1935 a in.).

Biostratigrafických problémov predmetného profilu sa dotýkajú hlavne práce J. BYSTRICKÉHO (1967), J. SALAJA — A. BIELEHO — J. BYSTRICKÉHO, (1967), J. SALAJA — O. JENDREJÁKOVEJ (1967), H. KOZÚRA — R. MOCKA (1974), M. KOCHANOVEJ (1979). Po litofaciálnej stránke prvý podrobný opis jednotlivých litostratigrafických sukcesii uvádza K. BORZA (1973).

Za účelom podrobného spracovania oporných profilov v rôznych tektonických jednotkách bol v posledných rokoch spracovaný kolektívom autorov pod vedením M. HAVRILU, ktorí doterajšie, ako aj novozískané poznatky zhrnuli v správe „Oporný profil triason: chočského priekrovu lokality Turík“ (M. HAVRILA et al., 1988). O tieto podklady sa opierame pri opise sukcesívnych litostratigrafických jednotiek.

Reiflinský dolomit (dolomitizovaný reiflinský vápenec) vystupuje v spodnej časti lomu. Zmienku o nich nájdeme vo viacerých prácach, s ktorými sa podrobne zaoberá M. HAVRILA et al. (1988). Podľa K. BORZU (1973) ide o „šedé dolomity s rohovecami vo vrchnej časti... obsahujú riasu *Physoporella dissita* (GÜMBEL) PIA“ a zaraďuje ich do pelsónu. Makro- ani mikrofauna nebola v tejto časti vrstiev zistená.

Reiflinské vápence a „parnašské bridlice“ sa pozvoľna vyvíjajú z reiflinských dolomitov. Podľa J. BYSTRICKÉHO (1985) v bezprostrednom nadloží reiflinských dolomitov vystupujú sivozelené bridlice („parnašské“), ktoré sa striedajú s reiflinským vápencom. V spodnej časti tohto vrstevného komplexu prevládajú bridlice, kým vyššie postupne nadobúdajú prevahu vápence. Makrofauna v tejto časti vrstiev nebola nájdená. Vo výbrusoch sú zachované relikty foraminifer, ostrakódov a riasy rodu *Acicularia* a iné fosílie zvyšky (konodonty, zúbky rýb, články krinoidov, rádiolárie, ihlice húb; cf. M. HAVRILA et al. 1988). Na základe fauny konodontov zhodnotenej M. HAVRILOM a J. PEVNÝM (in M. HAVRILA et al., l.c.) vek opisovaných vrstiev je stredný — vrchný longobard až kordevol.

Reiflinský vápenec (vrchná časť). Podľa M. HAVRILU (in M. HAVRILA et al., l.c) väčšinou ide o doskovité až hrubolavicovité jemnokryštalické vápence s polohami a hľuzami rohovcov a vložkami (1—2 cm hrubých) bridlic. Vedľa konodontov a mikrofosilných zvyškov, ktoré sme uviedli vyššie, sme z rezídua získali i voľné foraminifery, ktoré svojim druhovým zložením sú v podstate identické s asociáciou z reiflinských vápencov z južných svahov Nízkych Tatier (lok. Ráztoka). Vzhľadom na lepší spôsob zachovania v prílohovej (tabuľkovej) časti sú ilustrované foraminifery z vyššie uvedenej lokality: *Rhabdammina triassica* n. sp., *Hyperammina constricta* n. sp., *Ammodiscus*

cf. *inaequabilis* STYK, *Tolypammina discoidae* TRIFONOVA, *T. milanis multiplex* UROŠEVIĆ, *T. biplaniformis* n. s. *T. milaris salayi* n. ssp. „*Turritelleva*” *mesotriasica* KOEHN-ZANINETTI, *Gaudryina triassica* TRIFONOVA, *Ophthalmidium tricki* (LANGER), *Pseudonodosaria obconica* (REUSS), *Pseudonodosaria* sp., *Conicospirillina marie* KRISTAN-TOLLMANN, *Schmidia* cf. *cassiana* (GÜMBEL).

Ako vidieť z vyššie uvedeného zoznamu, k stratigraficky významnejším druhom patrí v prvom rade *Turritelleva mesotriasica* (KOEHN-ZANINETTI). Podľa doterajších literárnych údajov a vlastných výskumov zo Západných Karpát možno konštatovať, že spolu s druhom *Ophthalmidium tricki* (LANGER) a *Pseudonodosaria obconica* (REUSS) patria k charakteristickým druhom reiflinských vápencov. Prvý z menovaných druhov bol opísaný L. KOEHN-ZANINETTIOVOU v roku 1969 z pelsónskej časti reiflinských vápencov z Almtalu. F. HIRSCH (1976) na základe konodontov datuje vekové rozpätie predmetného druhu v rozsahu fasan—longobard, kým D. UROŠEVIĆ (1977a) do ladinu. J. HOHENEGGER — W. LEIN (1977) popisujú druh *Turritelleva mesotriasica* (KOEHN-ZANINETTI) z reiflinských vápencov z najvýchodnejšej časti Álp (Schneebergu) v asociácii s ilýr-fasanskými konodontami. Podľa štúdia E. TRIFONOVEJ (1978) z balkánskej oblasti vekový diapazón druhu *Turritelleva mesotriasica* (KOEHN-ZANINETTI) je v rozsahu celého ladinu až spodného karnu. O niečo širší vekový rozsah (ilýr — spodný karn) uvádza zo „série” Kocaeli (Turecko) L. ZANINETTI a Z. DAGER (1978).

Medzi ďalšie významné formy patrí *Pseudonodosaria obconica* (REUSS). Tento taxón z Východných Karpát Rumunska uvádza E. MIRĂUTA — D. M. GHEORGHIAN (1977) ako ?*Froncicularia* sp. 6, kým O. JENDREJÁKOVÁ — J. MICHALÍK — J. PAPŠOVÁ (1981) ako *Pseudonodosaria* aff. (resp. cf.) *obconica* (REUSS) z lokality Zámotie — Štefánka, ktorú datujú na ilýr respektive fasan. Z doterajších výskumov sa zdá, že ide o formu s obdobným vekovým diapazónom a batymetrickou pozíciou ako u druhu „*Turritelleva mesotriasica*” (KOEHN-ZANINETTI).

Ďalšie vyskytujúce sa formy sú tiež širšieho vekového rozsahu. Z vyššie uvedeného by vyplývalo, že podľa vyskytujúcich sa foraminifer považujeme analyzovanú asociáciu za vrchnoladinskú.

V súlade s týmto záverom je aj nález druhu *Halobia* cf. *zitteli* LINDSTÄN, ktorý je charakteristický pre kordevol (M. KOCHANOVÁ, 1979). V prospech tohto názoru svedčí aj stratigrafická pozícia trachycerasových vrstiev ležiacich v bezprostrednom nadloží vrchných reiflinských vápencov. Z uvedeného vyplýva, že reiflinské vápence, konkrétne v profile Turík i Ráztoka, majú vyššiu stratigrafickú pozíciu ako v Slovenskom krase (lok. Gombasek) a v Malých Karpatoch (lok. Hurlovec), odkiaľ J. SALAJ — K. BORZA — O. SAMUEL (1983) opisujú nižšie uvedenú spodnoilýrsku mikrofaunu (porov. obr. 2). Pre úplnosť treba poznamenať, že vek reiflinských vápencov bol dokumentovaný i konodontami (porov. R. MOCK, 1971), riasami *Physoporella dissita* (GÜMB.) STEINM. (J. BYSTRICKÝ, 1974). Na základe týchto skutočností J. BYSTRICKÝ (l.c., str. 177) konštatuje, že stratigrafické rozpätie reiflinského vápence v Západných Karpatoch je spodný ilýr až kordevol, pričom v gemeriku sa poväčšine obmedzuje len na spodný ilýr.

Trachycerasové vrstvy sú ďalším sukcesívnym členom na opornom profile Turík. Niektorí autori ich v minulosti označovali ako aónske bridlice (A. MATĚJKA 1935, J. SALAJ — O. JENDREJÁKOVÁ, 1967, K. BORZA, 1973, R. MOCK — A. KOZUR, 1974). Podľa M. HAVRILU et al. (1989) tmavosivé až čierne laminované detritické vápence, striedajúce sa s hrubodoskovitými sivými jemnokryštalickejšími vápencami, majú po litofaciálnej stránke väčšiu afinitu s trachycerasovými vrstvami ako s aónskymi. S týmto názorom sa stotožňuje tiež M. RAKÚS (in M. HAVRILA et al., 1988). Na základe údajov V. VOLGA (1917), M. KOCHANOVEJ (1979), ako aj M. RAKÚSA (l.c.), ktorý sa zaoberal štúdiom trachycerasov, im pripisuje M. HAVRILA (l.c.), prihladnuc k faune konodontov (M. HAVRILA — J. PEVNÝ, 1988; P. STRAKA, 1988) i foraminifer, kordevol-julský vek.

Z tejto litostratigrafickej jednotky boli J. SALAJOM a O. JENDREJÁKOVOU (1967, str. 311) identifikované nasledovné foraminifery: *Duostomina alta* (KRISTAN-TOLLMANN), *Trocholina multispira* OBERHAUSER, *T. ventroplana* OBERHAUSER, *Hyperammina* cf. *eulimbata* KRISTAN-TOLLMANN, *Nodosaria apheiloloculata aglabra* KRISTAN-TOLLMANN, *Neoendothyra keupperi* (OBERHAUSER), *Variostoma prolongense* KRISTAN-TOLLMANN.

Zo vzorky, pochádzajúcej podľa údajov P. STRAKU z trachycerasových vrstiev, sme z významnejších druhov navyše zistili fragmenty evidentne patriace rodu *Tolypammina* div. sp., *Gaudryina triassica* TRIFONOVA, *Pseudonodosaria obconica* (REUSS), *Dentalina* aff. *luperti* EFIMOVA a *Lamelliconus procerus* (LIEBUS).

Podľa vekového diapazónu ani jeden z identifikovaných druhov foraminifer nie je v rozpore s vyššie spomínaným zaradením trachycerasových vrstiev do kordevolu až julu. V prospech tohto názoru hovoria aj vysokovinití zástupcovia rodu *Lamelliconus* (*L. multispirus* OBERHAUSER), *L. procerus* LIEBUS resp. *Trocholina* (*T. ventriplanata* OBERHAUSER), ktorí sa v Západných Karpatoch objavujú v kordevole (porov. J. SALAJ — K. BORZA — O. SAMUEL, 1983), kým v Bulharsku niektoré vysokoklenuté formy boli preukázané už v longobarde. Na základe uvedeného aspektu môžeme teda konštatovať, že takáto stratigrafická interpretácia je v podstate v súlade aj s doterajšími poznatkami o vekovom rozšírení druhov rodov *Lamelliconus*, resp. *Trocholina* (cf. E. KRISTAN, 1957, R. OBERHAUSER, 1957).

Reingrabenské vrstvy (*bridlice*) neboli doteraz osobitne vyčlenené. Väčšinou boli označované ako aónske bridlice spolu s trachycerasovými vrstvami. Opisované vrstvy pozostávajú predovšetkým zo silne slienitých vápencov a slienitých bridlic čierosivej farby. V ich nadloží sú vyvinuté lunzské vrstvy. Podrobným petrografickým štúdiom sa zaoberala A. VOZÁROVÁ (in M. HAVRILA et al. 1989).

Pomerne bohatú asociáciu foraminifer sme získali zo vzorky č. 573, pochádzajúcej z hraničnej polohy reingrabenských a lunzských vrstiev. Podľa stratigrafickej pozície trachycerasových vrstiev (kordevol — jul), ako aj mikrobiostratigrafického obsahu analyzovaných vzoriek pripisujeme reingrabenským vrstvám (*bridliciam*) spodnokarnský (julský) vek.

Z takmer 40 identifikovných taxónov dominujú hlavne zástupcovia rodu *Nodosaria*, *Pseudonodosaria*, *Dentalina* a *Pachyphloides*. Väčšina druhov prvých troch menovaných rodov bola opísaná E. KRISTAN-TOLLMANNOU (1964) zo zlambašských vrstiev rétskeho veku. Proti rétskemu veku reingrabenských vrstiev na študovanej lokalite hovorí prítomnosť druhu *Pseudonodosaria obconica* (REUSS), ktorý patrí medzi významné formy hlavne ladinu a karnu. Podľa dostupných literárnych údajov, ako aj z výskumu Západných Karpát, tento druh nepresahuje hranice nóru. Podobne ani druh „*Turritella*“ *mesotriasica* KOEHN-ZANINETTI, ktorý sa taktiež vyskytuje na študovanej lokalite reingrabenských vrstiev. Medzi stratigraficky významné formy patria i zástupcovia rodu *Pachyphloides*. R. OBERHAUSEROM (1960) opísané formy (*P. dracosilimis*, *P. infirmis*), ako aj druh *P. oberhauseri* SELLIER de CIRVIEUX et DESSAUVAGIE boli opísané zo susedných rakúskych Álp z analogickej litostratigrafickej jednotky reingrabenských vrstiev spodnokarnského veku. U posledného menovaného druhu je zrejme väčší vekový diapazón. N. A. EFIMOVA (1974) ho uvádza už z ladinu. Druh opísaný O. STYKOVOU (1975) ako *P. ?triangularis* považujeme za synonymum druhu *P. oberhauseri*. Podľa jej údajov sa uvedený taxón vyskytuje v strednom triase.

Obdobné stratigrafické rozšírenie sa pripisuje aj druhom *Ophthalmidium tricki* (LANGER), *Spiroloculina praecursor* OBERHAUSER, *Ophthalmidium triadicum* LANGER a *Duostomina alta* KRISTAN-TOLLMANN.

Pre úplnosť uvádzame zloženie asociácie z reingrabenských vrstiev vrátane prechodnej polohy medzi reingrabenskými a lunzskými vrstvami, ktorá má ešte väčšiu afinitu k reingrabenským ako k lunzským vrstvám. Napriek tejto skutočnosti môžeme však dedukovať, že sedimentácia reingrabenských vrstiev končí v spodnom karne (jule), kým začiatok sedimentácie lunzských vrstiev začína tiež na tejto stratigrafickej úrovni.

Rhizammina sp.

Hyperrammina eulimbata KRISTAN-TOLLMANN

Hyperammina stabilis KRISTAN-TOLLMANN

Ammodiscus annulonoides KRISTAN-TOLLMANN

Ammodiscus sp.

„*Turritella*“ *mesotriasica* KOEHN-ZANINETTI

Tetrataxis sp.

Nodosinella rostrata TRIFONOVA

Ophthalmidium tori ZANINETTI et BROENNIMANN

Ophthalmidium triadicum (KRISTAN)

Ophthalmidium tricki (LANGER)

Paleomiliona sp.

Spiroloculina praecursor OBERHAUSER

Sigmoilina triadica KRISTAN

Pachyphloides dracosimilis (OBERHAUSER)

Pachyphloides infirmis (OBERHAUSER)
Pachyphloides ex gr. *oberhauseri* SELLIER de CIVRIEX et DESSSAUVAGE
Pachyphloides reingrabensis n. sp.
Dentalina crenata SCHWAGER
Dentalina paucicurvata FRANKE
Dentalina pseudomonile TERQUEM
Nodosaria levifracta KRISTAN-TOLLMANN
Nodosaria nitidana BRAND
Nodosaria zlabachensis KRISTAN-TOLLMANN
Pseudonodosaria obconica (REUSS)
Pseudonodosaria polyarta (KRISTAN-TOLLMANN)
Pseudonodosaria pseudovulgata n. sp.
Pseudonodosaria semisphaerica (KRISTAN-TOLLMANN)
Pseudonodosaria phaeocephala (KRISTAN-TOLLMANN)
Pseudonodosaria vulgata multicamerata (KRISTAN-TOLLMANN)
Pseudonodosaria sp.
Lenticulina (A.) *matutina* (d'ORBIGNY)
Lenticulina (L.) ex gr. *nautiloides* (BORNEMANN)
Lenticulina sp.
Duostomina alta KRISTAN-TOLLMANN
Nassellaria gen. et sp. indet.

Lunzské vrstvy v okolí oporného profilu Turík neboli autorom po mikropaleontologickej stránke preštudované. Mikrofaunu spomína z nich J. SALAJ — O. JENDREJÁKOVÁ (1967). Autorom bola študovaná jedine z lokality Liptovský Hrádok (zárez hlavnej cesty), kde druhy *Duostomina alta* KRISTAN-TOLLMANN a *Duostomina biconvexa* KRISTAN-TOLLMANN vytvárajú buď monospoločenstvo, alebo majú dominujúce postavenie. Analogické zloženie asociácie foraminifer uvádza i J. SALAJ — O. JENDREJÁKOVÁ (l.c.) z lunzských vrstiev zo Svätôjanskej doliny. Podľa pozície, ktorá je analogická s Východnými Alpami, sa lunzské vrstvy v Západných Karpatoch považovali za karnské (D. ANDRUSOV 1935, 1959, 1964), prípadne z jeho spodnejšieho podstupňa jul (J. BYSTRICKÝ 1965, 1972; D. ANDRUSOV 1959, 1964). Podľa pozície v nadloží svarinských vrstiev (zóna *Trachyceras aonoides*) patria hlavne vyššej časti julskeho podstupňa.

Ďalším mikrofaunisticky študovaným objektom bol vrstevný sled z vrtn Závod-81. Podľa A. BUJNOVSKÉHO — O. SAMUELA (1989) predneogénne podložie v tomto vrte bolo navŕtané v hĺbke 3610 m. Od tejto hĺbky až do 3650 m sa vyskytujú iba úlomky sivých dolomitov. Ich vek nebol biostratigraficky doložený. Z litofaciálneho hľadiska a zo superpozície môžeme jedine konštatovať, že patria pravdepodobne vrchnému triasu.

Hallstattské vápence boli navŕtané v hĺbke 3700—3704 m (jadro č. 1). Podľa grafu zloženia výplachových úlomkov a z navŕtaného jadra (1a) môžeme predpokladať, že hallstattské vápence siahajú do hĺbky 3724 m. Z litofaciálneho hľadiska sú tvorené ružovými až žltohnedými hfuznatými stylolitickými vápencami. Mikroskopicky ide o biomikrity „mudstone“ s prevládajúcou rádioláriuovou mikrofáciou. Biofaciálna zložka je zastúpená nasledovnými organickými prvkami: rádiolárie, koprolity, prierezy bivalvií, gastropódov a amonitov, ostrakódy, foraminifery, detrit krinoidových článkov, ostne ježoviek, šupiny rýb, kalcisfery, *Globochaeta alpina*, filamenty, pelety a mikrostylolity.

Na základe litofaciálnej korelácie môžeme konštatovať, že vyššie opísané hallstattské vápence sú prakticky totožné s hallstattskými vápencami Východných Álp.

V Západných Karpatoch sú hallstattské vápence rozšírené v silickom príkrove, zatiaľ čo v juhozápadnej časti Viedenskej panvy bol hallstattský typ vápencov dokázaný v lokalitách „Hernstien“ (porov. H. MOSTLER — R. OBERHAUSER — P. PLÖCHINGER 1967) vo „vysokom alpskom príkrove“ (Hohe Wand Decke), v okolí „Fischauer Berge“ (porov. B. PLÖCHINGER 1967) a v oblasti „Hohe Wand“ pri Miesenbachtal, ďalej Ödenhof-Fenster, Gösing a Priglitz.

Zo sedemnástich výbrusov hallstattského vápencu sme identifikovali foraminifery, ktoré nám indikujú, ako sme už vyššie poznamenali, vrchnotriasový vek: *Ammodiscus* sp., *Ammodiscus* sp. (cf. *A. parapriscus* HO), *Ammodiscus* cf. *infinus* STRICHLAND, *Ammodiscus parapriscus* HO, *Permodiscus*

sp., *Permodiscus planidiscoides* OBERHAUSER, *Trochammina* sp., *Tetrataxis inflata* KRISTAN, *Tetrataxis* sp. (cf. *T. nana* KRISTAN-TOLLMANN), *Dentalina* sp., *Dentalina* cf. *hoi* TRIFONOVA, *Fronidularia woodwardi* HOWCHIN, *Ophthalmidium lucidum* (TRIFONOVA), *Spiroloculina praecursor* OBERHAUSER, *Lenticulina acutiangulata* (TERQUEM), *Lenticulina* cf. *eulimbata* KRISTAN-TOLLMANN, ? *Valvulina* sp.

Z rezídua rozpustného vápence sme získali aj nasledovné voľné exempláre: *Glomospira charoides* (JONES—PARKER), *Plagioraphe tornata* KRISTAN-TOLLMANN, *Textularia exigua* (SCHWAGER), *Gaudryna triassica* TRIFONOVA, *Pseudonodosaria obconica* (REUSS), *Endothyra keupperi* OBERHAUSER.

Na základe vertikálneho rozšírenia identifikovaných druhov pripisujeme hallstattským vápencom vrchnotriasový vek. Vychádzajúc však zo všeobecných regionálnych poznatkov sa im — ako sme spomínali vyššie — pripisuje norický, prípadne až spodnorétsky (sevat) vek.

Ďalší skúmaný interval (3750—3754 m) z podložia hallstattských vápencov reprezentujú *anhydrity*. Z litofaciálneho vyhodnotenia vyplýva, že v hĺbke 3750 m sa vyskytujú brekcie, ktoré sa skladajú zo sivých a sivočiernych úlomkov silne stlačených a zbridlíčených dolomitov, ktoré sú stmelené anhydritom, kým v hĺbke 3751,2—3752,9 m sa podľa RTG vyhodnotenia vyskytuje anhydrit.

Z tejto časti vrtu boli odobrané vzorky na výskum palynomorf. Podľa analýzy P. SNOPOKOVEJ (in A. BUJNOVSKÝ et al. 1986) sú vzorky na obsah palynomorf vcelku chudobné a zle zachované. Na základe druhového zloženia koreluje asociácie palynomorf s keuprom, hlavne „Gipskeuprom“ Švajčiarska (S. W. SCHEURING 1970), ktorý zodpovedá v hlavných rysoch karnu až noriku. Pieskovce, dolomity, vápence boli navŕtané v hĺbke 3813 m — 3815 M (jadro č. 3). Vzhľadom na to, že ide len o drobné úlomky hornín, ich stratigrafickú pozíciu nebolo možné bližšie identifikovať.

Pieskovce sú jemnozrnné, sivoružovej farby. Dolomity tvoria tmavosivé škvrnité dolomikrity. Vápence sú tmavosivej farby; obsahujú ostrakódovú mikrofáciu. V hrubých črtách pripomínajú gutensteinské vápence stredného triasu.

Karbonátové pieskovce (? verfenské vrstvy) boli skúmané v intervale 3940,2—3944,0 m. Patria najskôr do súboru verfenských vrstiev, ktoré bývajú spravidla vo vrchnej časti bohaté na evapority.

Najspodnejším členom pod verfenskými vrstvami sú *anhydritové brekcie* s úlomkami dolomitov, pravdepodobne permského veku. Z hľadiska superpozície sú v analogickom postavení s alpskými „haselgebirge“.

Explanations of plates I — LIV

Plate I

Fig. 1—3 *Rhabdammina triassica* n. sp.

Upper Ladinian; 1—270 ×, 2—220 ×, 3—220 ×.

Fig. 4a, b *Hyperammina constricta* n. sp.

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 4a — 220 ×, 4b — 290 ×.

Fig. 5 A fragment of the distal part of a test of Triassic representatives of the genus *Tolypammina* div. sp. Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 200 ×.

Plate II

Fig. 1a, b *Hyperammina eulimbata* KRISTAN-TOLLMANN, 1964 Carnian (Julian); Uppermost part of the Reingraben beds; (Choč nappe), Turík; Magn. 1a—90 ×, 1b—380 ×.

Fig. 2—3, 4 *Hyperammina stabilis* KRISTAN-TOLLMANN, 1964 Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 2—3 — 150 ×, 4 — 200 ×.

Plate III

Fig. 1a, b *Hyperammina eulimbata* KRISTAN-TOLLMANN, 1964 Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 1a — 80 ×, 1b — 200 ×.

Fig. 2a-b *Hyperammina amplimuralis* (PANTIĆ 1972) Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 2a — 140 ×, 2b — 400 ×.

Plate IV

Fig. 1 ? *Serpenulina* sp.

Cordevolian-Julian; Trachyceras beds (Choč nappe), Turík; Magn. 160 ×.

Fig. 2 *Ammolagena* sp.

Cordevolian-Julian; Trachyceras beds (Choč nappe), Turík; Magn. 400 ×.

Fig. 3 *Ammovertella bulbosa* GUTSCHIK et TRECKMAN, 1959

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 140 ×.

Fig. 4 A fragment of the distal part of a test of Triassic representatives of the genus *Tolypammina* div. sp. Cordevolian-Julian; Trachyceras beds (Choč nappe), Turík; Magn. 200 ×.

Plate V

Fig. 1—3, 5 *Ammodiscus annulinoides* KRISTAN-TOLLMANN, 1970 (in TOLLMANN-KRISTAN-TOLLMANN 1970)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 200 ×, 2 — 240 ×, 3 — 200 ×, 5 — 200 ×.

Fig. 4 *Ammodiscus* sp. (cf. *A. inaequalis* STYK, 1975)

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 200 ×.

Fig. 6 *Ammodiscus* sp.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 240 ×.

Plate VI

Fig. 1, 3—4 *Ammodiscus annulinoides* KRISTAN-TOLLMANN, 1970 (in TOLLMANN-KRISTAN-TOLLMANN 1970);

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1, 3—4 — 200 ×.

Fig. 2 *Ammodiscus* sp.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 240 ×.

Plate VII

Fig. 1a, b, 2a-b, 3 *Ammodiscus annulinoides* KRISTAN-TOLLMANN, 1970 (in TOLLMANN-KRISTAN-TOLLMANN 1970).

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1a, b, 3 — 240 ×, 2a, b — 200 ×.

Fig. 4 *Tolypammina* aff. *discoidea* TRIFONOVA, 1961

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 280 ×.

Plate VIII

Fig. 1a, b, 2—3 *Tolypammina discoidea* TRIFONOVA, 1961

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 1a, b, 3 — 200 ×, 2 — 120 ×.

Plate IX

Fig. 1a-c, 2 *Tolypammina discoidea* TRIFONOVA, 1961

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 1a-b — 200 ×, 1c — 460 ×, 2 — 350 ×.

Plate X

Fig. 1 *Tolypammina* aff. *milanis multiplex* UROŠEVIĆ, 1977

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 180 ×.

Fig. 2, 3a, b *Tolypammina* div. sp.

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 2—180 ×, 3a — 280 ×, 3b — 560 ×.

Plate XI

Fig. 1 *Tolypammina* sp. (? n. sp.)

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 240 ×.

Fig. 2 *Tolypammina discoidea* TRIFONOVA, 1961

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 330 ×.

Fig. 3a, b A fragment of the distal part of a test of Triassic representatives of the genus *Tolypammina* div. sp. Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 3a — 240 ×, 3b — 520 ×.

Plate XII

Fig. 1a, b *Tolypammina* aff. *milanis multiplex* UROŠEVIĆ, 1977

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 1a — 220 ×, 1b — 260 ×.

Fig. 2 *Tolypammina discoidea* TRIFONOVA, 1961

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 160 ×.

Fig. 3 A fragment of the distal part of a test of Triassic representatives of the genus *Tolypammina* div. sp.; Magn. 180 ×.

Plate XIII

Fig. 1, 4 *Tolypammina biplaniformis* n. sp.

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 1, 4 — 220 ×.

Fig. 2—3 *Tolypammina discoidea* TRIFONOVA, 1961

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 2 — 280 ×, 3 — 280 ×.

Plate XIV

Fig. 1a-d *Tolypammina milanis salayi* n. ssp.

Upper Ladinian, Reifling limestone (Choč nappe), Ráztoka; Magn. 1a — 200 ×, 1b — 380 ×, 1c — 760 ×, 1d — 420 ×.

Plate XV

Fig. 1—2 *Glomospira charoides* (JONES et PARKER 1860) Norian — ? Lower Rhaetian; Hallstatt limestone; borehole Závod-81, 3701—3703 m; Magn. 700 ×.

Fig. 3—4 Microgastropods; Carnian (Julian); Uppermost part of the Reigraben beds (Choč nappe); Turik; Magn. 3 — 300 ×, 4 — 240 ×.

Plate XVI

Fig. 1a-c, 2a-b "*Turritellella*" *mesotriassica* KOEHN-ZENINETTI, 1968

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turik; Magn. 1a — 300 ×, 1b — 900 ×, 1c — 1000 ×, 2a — 330 ×, 2b — 1000 ×.

Plate XVII

Fig. 1a-b, 2—4 *Plagioraphe tornata* KRISTAN-TOLLMANN, 1973

Norian — ? Lower Rhaetian; Hallstatt limestone; 1b — 320 ×, 2,3,4 — 300 ×.

Plate XVIII

Fig. 1a-b, 2, 3a-b *Gaudryina triassica* TRIFONOVA, 1962

Cordevolian-Julian; "Trachyceras beds" (Choč nappe), Turik; Magn. 1a — 250 ×, 1b — 600 ×, 2 — 300 ×, 3a — 300 ×, 3b — 450 ×.

Plate XIX

Fig. 1a-b, 2, 3a-b *Gaudryina triassica* TRIFONOVA, 1962

Cordevolian-Julian; "Trachyceras beds" (Choč nappe), Turik; Magn. 1a — 300 ×, 1b — 300 ×, 2 — 300 ×, 2a — 300 ×, 3b — 900 ×.

Plate XX

Fig. 1a-b, 2 *Textularia exigua* (SCHWAGER 1864)

Norian — ? Lower Rhaetian; Hallstatt limestone; borehole Závod-81, 30701—3703 m; Magn. 1a — 200 ×, 1b — 420 ×, 2 — 300 ×.

Fig. 3a-b ? *Gaudryina triasica* TRIFONOVA, 1962

Norian — ? Lower Rhaetian; Hallstatt limestone; borehole Závod-81, 30701—3073 m; Magn. 3a — 300 ×, 3b — 420 ×.

Plate XXI

Fig. 1 ? *Paleomiliolina* sp.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 350 ×.

Fig. 2 *Ophthalmidium* cf. *triadicum* (KRISTAN 1957)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe); Turík; Magn. 320 ×.

Fig. 3 *Ophthalmidium tricki* (LANGER 1966)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 220 ×.

Fig. 4 *Spiroloculina praecursor* (OBERHAUSER 1960)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 260 ×.

Fig. 5 *Ophthalmidium* cf. *exiguum* KOEHN-ZANINETTI, 1969

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 150 ×.

Plate XXII

Fig. 1a, b *Dentalina* aff. *luperti* EFIMOVA, 1974

Cordevolian — Julian; "Trachyceras beds" (Choč nappe), Turík; Magn. 1a — 200 ×, 1b — 550 ×.

Fig. 2, 3a-b *Dentalina crenata* SCHWAGER, 1865

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 2 — 130 ×, 3a — 240 ×, 3b — 750 ×.

Plate XXIII

Fig. 1a-b *Dentalina paucicurvata* FRANKE, 1936

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1a — 240 ×, 1b — 650 ×.

Fig. 2a-b, 3 *Nodosinella rostrata* TRIFONOVA, 1972

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 2a — 180 ×, 2b — 750 ×, 3 — 240 ×.

Plate XXIV

Fig. 1, 2, 3a-b *Dentalina pseudomonile* TERQUEM, 1858

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík 1 — 240 ×, 2 — 150 ×,

Plate XXV

Fig. 1, 2a-b *Dentalina pseudomonile* TERQUEM, 1858

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 160 ×, 2a — 240 ×, 2b — 480 ×.

Fig. 3 *Nodosaria* ex gr. *nitidana* TERQUEM, 1858

Carnian (Julian); Turík; Magn. 1 — 160 ×, 2a — 240 ×, 2b — 480 ×, 3 — 240 ×.

Plate XXVI

Fig. 1a-b *Nodosaria levifracta* KRISTAN-TOLLMANN, 1964

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 270 ×, 1b — 440 ×.

Fig. 2a-b *Nodosaria zlambachensis* KRISTAN-TOLLMANN, 1964

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 2a — 260 ×, 2b — 170 ×.

Plate XXVII

Fig. 1, 2, 3a-b *Nodosaria* ex gr. *nitidana* BRAND, 1937

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 130 ×, 2 — 150 ×, 3a — 140 ×, 3b — 420 ×.

Plate XXVIII

Fig. 1, 2, 3, 4a-b *Nodosaria* ex gr. *nitidana* BRAND, 1937

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1,2,3 — 130 ×, 4a — 170 ×, 4b — 270 ×.

Plate XXIX

Fig. 1a-c, 2 *Pseudonodosaria obconica* (REUSS 1868)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1a — 240 ×, 1b — 600 ×, 1c — 500 ×, 2 — 330 ×.

Plate XXX

Fig. 1a-b, 2 *Pseudonodosaria obconica* (REUSS 1868)

Cordevolian — Julian; "Trachyceras beds" (Choč nappe), Turík; Magn. 1a — 330 ×, 1b — 990 ×, 2 — 400 ×, 3 — 300 ×.

Fig. 3 *Pseudonodosaria obconica* (REUSS 1868)

Upper Ladinian, Reifling limestone (Choč nappe), Ráztoka; Magn. 260 ×.

Plate XXXI

Fig. 1—4 ? *Pseudonodosaria* sp.

Upper Ladinian, Reifling limestone (Choč nappe), Ráztoka; Magn. 210 ×, 2 — 440 ×, 3 — 300 ×, 4 — 220 ×.

Plate XXXII

Fig. 1, 2a-c *Pseudonodosaria vulgata multicamerata* (KRISTAN-TOLLMANN 1964)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 280 ×, 2, b — 360 ×, 2c — 1200 ×.

Plate XXXIII

Fig. 1 *Pseudonodosaria vulgata multicamerata* (KRISTAN-TOLLMANN 1964)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 260 ×.

Fig. 2, 3 *Marginulina erromena erromena* LOEBLICH et TAPPAN, 1950

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 2 — 240 ×, 3 — 300 ×.

Plate XXXIV

Fig. 1 *Pseudonodosaria* aff. *sphaerocephala* (KRISTAN-TOLLMANN 1964)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 300 ×, 2a — 300 ×, 2b — 1200 ×.

Fig. 2a-b *Pseudonodosaria polyarthra* (KRISTAN-TOLLMANN 1964)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1a — 300 ×, 2a — 300 ×, 2b — 1200 ×.

Plate XXXV

Fig. 1a-b, 2, 3 *Pseudonodosaria polyarthra* (KRISTAN-TOLLMANN, 1964)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1a — 250 ×, 1b — 500 ×, 2 — 230 ×, 3 — 300 ×.

Plate XXXVI

Fig. 1 *Pseudonodosaria pseudovulgata* n. sp.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 160 ×.

Fig. 2,3a-b *Pseudonodosaria pseudovulgata* n. sp.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 140 ×, 3a — 160 ×, 3b — 600 ×.

Plate XXXVII

Fig. 1—4 *Pseudonodosaria semisphaerica* (KRISTAN-TOLLMANN 1964)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1,3,4 — 200 ×, 2 — 180 ×.

Plate XXXVIII

Fig. 1a-b, 2, 3a-b *Lunucammina postcarbonica* SPANDEL, 1901

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1a, b — 250 ×, 2 — 280 ×, 3a — 280 ×, 3b — 300 ×.

Plate XXXIX

Fig. 1a-b *Marginulina erromena erromena* LOEBLICH et TAPPAN, 1950

Carnian (Julian); Uppermost part of the Reingraben beds Choč nappe), Turík; Magn. 1a — 250 ×, 1b — 1300 ×.

Fig. 2a-b *Marginulina erromena turika* n. ssp.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 2a — 250 ×, 2b — 1000 ×.

Plate XL

Fig. 1—3 *Lenticulina (Lenticulina) nautiloides* (BORNEMANN 1854)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 220 ×, 2 — 220 ×, 3 — 150 ×.

Fig. 4 *Lenticulina (Lenticulina)* sp.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 4 — 320 ×.

Plate XLI

Fig. 1a-c *Lenticulina (Astaculus) ex gr. matutina* (d'ORBIGNY 1849)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1a — 130 ×, 1b — 400 ×, 1c — 170 ×.

Plate XLII

Fig. 1, 3 *Pachyphloides ex gr. oberhauseri* CIVRIEUX et DESSAUVAGIE, 1965

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 150 ×, 3 — 180 ×.

Fig. 2a-b *Pachyphloides infirmis* (OBERHAUSER, 1960)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 2a — 180 ×, 2b — 300 ×.

Plate XLIII

Fig. 1a-b, 2a-b *Pachyphloides ex gr. oberhauseri* CIVRIEUX et DESSAUVAGIE, 1965

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1a — 160 ×, 1b — 400 ×.

Plate XLIV

Fig. 1a-b, 2a-b *Pachyphloides dracosimilis* (OBERHAUSER 1960)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1a — 160 ×, 1b — 180 ×, 2a — 180 ×, 2b — 360 ×.

Plate XLV

Fig. 1a-b, 2a-b *Pachyphloides dracosimilis* (OBERHAUSER 1960)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1a — 720 ×, 1b — 360 ×, 2a — 720 ×, 2b — 240 ×.

Plate XLVI

Fig. 1—3 *Pachyphloides dracosimilis* (OBERHAUSER 1960)

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 130 ×, 2 — 180 ×, 3 — 280 ×, 4 — 100 100 ×.

Fig. 4 *Pachyphloides reingrabensis* n. sp.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 100 ×.

Plate XLVII

Fig. 1a-b *Jaculella dentaliniformis* HOHENEGGER et LEIN, 1977

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 5a — 640 ×, 5b — 320 ×.

Fig. 2—4 *Nasselaria* gen. et sp. indet.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 320 ×, 2 — 240 ×, 3 — 180 ×, 4 — 250 ×.

Plate XLVIII

Fig. 1a-b *Nasselaria* gen. et sp. indet.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 130 ×.

Fig. 2 *Nasselaria* gen. et sp. ident.

Cordevolian-Julian; "Trachyceras beds" (Choč nappe), Turík; Magn. 2a — 250 ×, 2b — 1000 ×.

Fig. ? 3a-b, 4 *Nasselaria* gen. et sp. indet.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 3a — 250 ×, 3b — 400 ×, 4 — 350 ×.

Plate XLIX

Fig. 1 ? *Tetraxis* sp.

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 280 ×.

Fig. 2, 3a-b *Conicospirillina mariae* KRISTAN-TOLLMANN (in TOLLMANN et KRISTAN-TOLLMANN 1970)
Upper Ladinian; Magn. 1a — 700 ×, 1b — 1200 ×, 2 — 600 ×.

Plate L

Fig. 1a-c, 2 *Endothyra kuepperi* OBERHAUSER, 1960

Norian-? Lower Rhaetian; Hallstatt limestone; borehole Závod — 81, 3701 — 3703 m; Magn. 1a — 1800 ×, 1b,c — 800 ×, 2 — 600 ×.

Plate LI

Fig. 1a-b, 2—4 *Endothyra kuepperi* OBERHAUSER, 1960

Norian-? Lower Rhaetian; Hallstatt limestone; borehole Závod-81, 3701—3703 m; Magn. 1a, b — 600 ×, 2 — 360 ×, 3 — 660 ×, 4 — 600 ×.

Plate LII

Fig. 1a-b, 2,3 *Schmidita* cf. *cassiana* (GÜMBEL 1869)

Upper Ladinian; Reifling limestone (Choč nappe), Ráztoka; Magn. 1a-b — 440 ×, 2 — 400 c, 3 — 440 ×.

Plate LIII

Fig. 1—4 *Duostomina alta* KRISTAN-TOLLMANN, 1960

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1,2 — 280 ×, 3,4 — 300 ×.

Plate LIV

Fig. 1—4 *Duostomina alta* KRISTAN-TOLLMANN, 1960

Carnian (Julian); Uppermost part of the Reingraben beds (Choč nappe), Turík; Magn. 1 — 280 ×, 2,3,4 — 300 ×.

HELENA ELIÁŠOVÁ

Quelques Scléractiniaires nouveaux de la Slovaquie (Crétacé et Paléogène, Tchécoslovaquie)

1 texte-fig., 6 Pls (LV-LX), Sommaire

Ce travail a pu être exécuté grâce à l'amabilité de Messieurs P. Gross, R. Marschalko et V. Thomka qui m'ont confié la détermination de leurs échantillons de Coraux. Les quatre colonies qu'ils ont bien voulu me charger d'identifier se présentent à l'état de galets. Deux d'entre elles proviennent des conglomérats de glissements sous-marins qui se trouvent dans les couches crétacées de la zone des klippes: L'âge de l'espèce *Astraraea roberti* sp. n., trouvé à Beňova Lehota près de Dolný Kubín, région d'Orava en Slovaquie, n'est pas sûr. Le polypier a été recolté dans des marnes représentant soit les couches albiennes (Unité de Klappe), soit les couches sénoniennes (Unité de Kysuca). Malheureusement, le genre *Astraraea* FELIX, 1900 qui présente une large extension stratigraphique allant de l'Oxfordien au Campanien ne peut fournir de renseignements stratigraphiques précis.

Le deuxième polypier crétacé — *Caryophyllia* sp. provient des marnes santoniennes (Unité de Kysuca) à Žilinská Lehota près de Žilina (cf. MARSCHALKO R. — KYSELA J. 1980).

L'échantillon de l'espèce *Rhabdophylliopsis thomkai* sp. n. a été recolté dans un conglomérat de glissement des couches de Proč (Paléocène-Eocène inférieur), lui aussi situé dans la zone des klippes dans les Carpathes, en Slovaquie de l'Est.

La colonie de *Liptodendron grossi* gen. nov. sp. n. a été trouvée dans un gravier d'âge holocène du ruisseau Hybica, bassin de Liptov au pied de la montagne Tatras. D'après les études de M. GROSS (GRSS P.—KÖHLER, E.—SAMUEL O. 1984) ce polypier provient des calcaires récifaux du Priabonien inférieur des couches de Borov (lithofaciès transgressif à la base du Paléogène des Carpathes centrales). Voir texte-figure 1.

Faviidae GREGORY, 1900

Rhabdophylliopsis ALLOITEAU et TISSIER, 1958

Espèce-type: *Rhabdophyllia tenuis* ALLOITEAU et TISSIER, 1958 (non REUSS, 1868) devenant *Rhabdophylliopsis alloiteaui* n. nom par BARTA—CALMUS 1973.

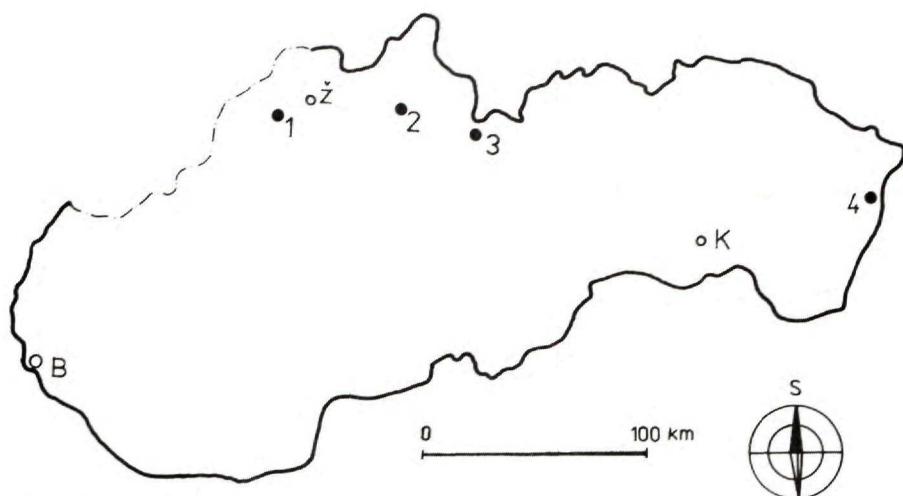


Fig. 1 Position des gisements étudiés

1 — Žilinská Lehota près de la ville de Žilina, 2 — Beňova Lehota près de la ville de Dolný Kubín, 3 — ruisseau Hybica, 4 — village de Beňatina, B — Bratislava; K — Košice; Ž — Žilina.

Rhabdophylliopsis thomkai sp. n.

Pl. LV, Fig. 1,2; pl. LVI, Fig. 1 — 3; pl. LVIII, Fig. 3

Holotype: no SNM/Z 20655 dont les lames minces: 76794/II, 76795/II, 88898/II, 88899/II. Déposé au Muséum national de Slovaquie à Bratislava.

Horizon-type: Paléocène- Eocène inférieur. Conglomérat des couches de Proč.

Localité-type: Beňatina (1.125 m au Sud du village de Beňatina, dans un col au SSE de la cote 658, près de la frontière d'Etat avec l'U.R.S.S.).

Origine du nom: En l'honneur de M. Vladimír Thomka, ingénieur forestier du Musée d'Humenné (Slovaquie de l'Est).

Diagnose: *Rhabdophylliopsis* présentant des polypierites dont le diamètre des calices est de 9—15 mm, et ayant 48 costoseptes environ par polypierite. Epithèque bien développée en anneaux concentriques.

Matériau: Un fragment de polypier, 4 lames minces.

Dimensions: * D = (7) 9—15; c-c = 15—20; N_s = 43—54; d_c = 12—13/10 mm; d_e = 5—8/5 mm.

Description: Polypier phacéloïde, lâche. Les polypierites sont subcylindriques, revêtus d'une épithèque qui forme de minces anneaux successifs à des distances irrégulières. Côtes fortes, subégales en largeur. Les costoseptes fusiformes sont disposés en symétrie radiaire et en systèmes égaux. Les faces latérales sont ornées de gros granules

* Abréviations employées dans les descriptions: C = côtes; c-c = distance centre à centre des polypierites; D = diamètre du polypierite; d = densité; d_c = densité des côtes; d_e = densité de l'endothèque; d_s = densité des septes; e = endothèque; larg = largeur; mur = muraille; N = nombre; S = septe; Dimensions en millimètres.

pointus. Le bord interne de tous les septes est muni de lobes trabéculaires. Les S_1 et S_2 arrivent jusqu'au centre, les S_3 sont plus courts, les S_4 atteignent la moitié du rayon calicinal environ. Il existe quelques septes rudimentaires du V^e cycle dans les polypières les plus âgés. Les septes sont libres. Seuls quelques septes plus longs se soudent par leur bord interne et créent une columelle pariétale, peu développée, lâche. Dissépiments fréquents, vésiculeux. La muraille parathéciale mince est revêtue d'une épithèque bien développée qui repose soit directement sur elle, soit assez éloignée des côtes. Les dissépiments exothécaux sont grands et étendus. Bourgeonnement intracalical marginal.

Remarque: L'espèce nouvelle s'écarte par ses dimensions beaucoup plus grandes et par les côtes moins denses de *Rhabdophylliopsis alloiteaui* ALLOITEAU et TISSIER 1958 du Montien des Petites Pyrénées (chez *R. alloiteaui*, la taille des polypières varie entre 3,6—5,8 mm et la densité des côtes est 22—23/10 mm).

Répartition: Paléogène carpathique en Tchécoslovaquie.

Liptodendron gen. nov.

Espèce-type: *Liptodendron grossi* sp. n.

Origine du nom: L'exemplaire provient de la région de Liptov en Slovaquie.

Diagnose: Polypier branchu. Polypières allongés, irrégulièrement gonflés, liés par endroits par processus de l'épithèque. Celle-ci est lisse, continue. Les éléments radiaires sont des costoseptes, très minces, subcompacts, dont le bord interne est muni de lobes trabéculaires peu nombreux. Les faces latérales sont couvertes de rares granules pointus. Les côtes sont très peu développées. Columelle pariétale, faible. Endothèque vésiculeuse. Muraille parathéciale, fine. Bourgeonnement latéral.

Constitution du genre: On ne connaît actuellement de ce genre que son espèce-type.

Remarque: Une ressemblance frappante existe entre le genre *Liptodendron* et le genre *Cyclophyllia* RONIEWICZ, 1989 du Rhétien d'Autriche (Roniewicz 1989). Ayant la même constitution fine du squelette, la même construction de la muraille, le même habitus des éléments radiaires ainsi que le même type du bourgeonnement, ces deux genres sont presque homéomorphes. La seule différence entre eux concerne l'endothèque qui, chez *Liptodendron* est de type favidé tandis que chez *Cyclophyllia* elle est de type -montlivalité.

Liptodendron gen. nov. diffère par son squelette extrêmement fin de tous les autres genres branchus de la famille des *Favidae* *Rhabdophylliopsis*, *Desmocoenia* ALLOITEAU, 1966, *Cladocora* EHRENBERG, 1834 et *Dendrocora* DUNCAN, 1876. De plus, *Liptodendron* s'écarte de *Rhabdophylliopsis* par la forme différente des éléments radiaires (chez *Rh.* ils sont fusiformes), par le développement de la structure épico-stale (chez *Rh.* c'est une pellicule qui laisse entrevoir les côtes) ainsi que par les liaisons épithécales entre les polypières. De même, la forme des éléments radiaires -qui ne sont pas biconnéiformes- et la présence de columelle l'éloigne du genre *Desmocoenia*, chez lequel existent aussi des connections entre les polypières. Les genres *Cladocora* et *Dendrocora* ne montrent, à la différence du genre nouveau, ni les gonflements des polypières ni de connections épithécales entre eux; la columelle est plus développée et l'épithèque manque chez ces deux genres.

Répartition: Celle de l'espèce-type.

Liptodendron grossi sp. n.

Pl. LVII, Fig. 1,2; pl. LVIII, Fig. 1,2

Holotype: no SNM/Z 20657 dont les lames minces no 798a, b, 799a, b, 2564/III et 2565/III. Déposé au Muséum national de Slovaquie à Bratislava.

Horizon-type: Calcaires récifaux des couches de Borov.

Localité-type: ruisseau Hybica, 820 m au N de la cote 774,8 m, bassin de Lip-tov au pied de la montagne Tatras.

Origine du nom: En l'honneur de RNDr Pavol Gross du Service géologique (GÚDŠ), Bratislava.

Diagnose: Donnée par les dimensions.

Matériel: Un fragment d'une grosse colonie, 6 lames minces.

Dimensions: $D = (2) 5,0 - 6,5 (8)$; $N_s = 21 - 46$; $d_s = 4/1$ mm (mesuré sur une section verticale); $d_c = 3/1$ mm mesuré sur une section transversale); $d_e = 5 - 7/2$ mm; larg $S_1 = 45 \mu\text{m}$ dans une partie périaixiale, $91 \mu\text{m}$ près de la mur; larg $S_4 = 15 \mu\text{m}$ au bord interne, $60 \mu\text{m}$ devant la mur; épaisseur de la mur = $115 - 212 \mu\text{m}$.

Description: Polypier branchu, dense. Les polypierites sont allongés, subparallèles ou légèrement sinueux et gonflés à l'intervalle irrégulier. Leurs côtes sont revêtues d'une épithèque mince, continue et lisse intimement soudée à la muraille dont elle constitue la partie externe. Par endroits, des processus de l'épithèque contenant quelques dissépiments lient les branches contigues (Pl. LVIII, Fig. 1,2). Le diamètre des polypierites présente un grand écart. Les éléments radiaires sont extrêmement minces, un peu en zigzag ou parfois ondulés, légèrement inégaux en épaisseur. Les faces latérales sont couvertes de rares granules pointus. Le bord interne des septes est muni de lobes trabéculaires peu nombrés. Les S_1 s'étendent jusqu'au centre, les S_2 sont un peu plus courts, les S_3 atteignent environ $3/4$ du rayon calicinal, les S_4 ne dépassent pas une moitié de la longueur des S_1 . La partie costale des éléments radiaires est rudimentaire, les côtes n'existent presque pas. La columelle pariétale, étant constituée de quelques éléments est faible. De riches dissépiments vésiculeux sont inclinés vers le centre du polypierite. La muraille parathéciale est très fine. Bourgeonnement latéral fréquent.

Répartition: Paléogène carpathique en Tchécoslovaquie.

Haplaraeidae VAUGHAN et WELLS, 1943

Astraraea FELIX, 1900

Espèce-type: *Thamnastraea multiradiata* REUSS, 1854

Astraraea roberti sp. n.

Pl. LIX, Fig. 1,2

Holotype: no SNM/Z 20656 dont les lames minces no 26890/II et 26891/II. Déposé au Muséum national de Slovaquie à Bratislava.

Horizon-type: Sénonien? (Albien?), marnes bigarrées.

Localité-type: Beňova Lehota près de Dolný Kubín, dans la vallée de la rivière Orava, Slovaquie.

Origine du nom: en l'honneur de l'Ing. Robert Marschalko Dr Sc de l'Académie des Sciences de Slovaquie, Bratislava.

Diagnose: *Astraraea* aux calices de petites dimensions ($2,5 - 3,0$ mm).

Matériel: Un polypier, deux lames minces.

Dimensions: $\varnothing$ du polypier: $35 \times 45 \times 30$ mm; $D = (2,0) 2,5 - 3,0 (3,5)$; $c - c = 2,5 - 6,0$; $N_s 36 - 38 (44)$; $d_s = 7,0 - 7,5/2$ mm.

Description: Petite colonie thamnastéroïde de forme massive dont la surface calicifère est convexe et légèrement aplatie. Les lames biseptales, de largeur subégale, sont fortement perforées. Anastomose présente. De nombreuses synapticules sont disposées régulièrement. L'endothèque est faite de dissépiments fins, subhorizontaux, étendus. Columelle pariétale faible.

Remarque: Cette nouvelle espèce diffère des autres espèces connues du genre c'est-à-dire: *A. multiradiata* (REUSS, 1854), *A. media* (SOWERBY, 1832), *A. submedia* OPPENHEIM, 1930, *A. columellata* OPPENHEIM, 1930, *A. senessei* ALLOITEAU, 1939 et *A. corbarica* ALLOITEAU, 1939, par le petit diamètre de ses calices.

Répartition: Sénonien des Carpathes, Tchécoslovaquie.

Caryophylliidae GRAY, 1847

Caryophyllia LAMARCK, 1801

Espèce-type: *Madrepora cyathus* ELLIS et SOLANDER, 1786

Caryophyllia sp.

Pl. LX, Fig. 1

Matériel: Un polypier, 1 lame mince (de Žilinská Lehota à l'ouest de la ville de Žilina, Slovaquie).

Dimensions: D = 16 × 10; N_s = 48 environ.

Remarque: Polypier solitaire de section transversale elliptique; la forme des éléments radiaires et leur disposition ainsi que des traces de la microstructure fine suggèrent le genre *Caryophyllia*. Le matériel, mal conservé, ne permet pas discerner l'espèce.

Répartition: Sénonien des Carpathes, Tchécoslovaquie.

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Několik nových korálů ze Slovenska
(křída, paleogén)

Resumé

V práci jsou popsány 4 kolonie korálů. Tři z nich pocházejí ze skluzových sedimentů křídý a paleogénu obalových hornin bradlového pásma: *Astraraea roberti* sp. n. (alb klapského vývoje?, senon kysuckého vývoje?) z lokality Beňova Lehota u Dolného Kubína na Oravě, *Caryophyllia* sp. ze santonských slínů kysuckého vývoje v Žilinské Lehotě u Žiliny, *Rhabdophylliopsis thomkai* sp. n. z pročských vrstev (paleocén—spodní eocén) a Beňatiny na východním Slovensku. Velký fragment kolonie *Liptodendron grossi* gen. nov. sp. n. pochází z holocenního štěrku v potoce Hybica v Liptovské pánvi (biohermové vápence spodnopriabonského stáří v borovských vrstvách centrálně karpatského paleogénu).

Explications des planches LV—LX

Planche LV

- 1,2 *Rhabdophylliopsis thomkai* sp. n. Holotype. Beňatina. Conglomérat des couches de Proč.
Paléocène-Eocène inférieur.
1 Fragment de la colonie. 4 × environ.
2 Vue latérale. 4 × environ.

Photos Vladislav Skala

Planche LVI

- 1—3 *Rhabdophylliopsis thomkai* sp. n. Holotype. Beňatina. Conglomérat des couches de Proč.
Paléocène-Eocène inférieur. Lames minces.
1 Section transversale montrant le bourgeonnement. 9 ×.
2 Section transversale. 2,5 × environ.
3 Section verticale. 9 ×.

Photos Květoslava Navrátilová

Planche LVII

- 1,2 *Liptodendron grossi* gen. nov. sp. n. Holotype. Hybica. Calcaires récifaux des couches de Borov. Priabonien inférieur. Lames minces.
1 Section transversale. 6,75 ×.
2 Section verticale. 6 × environ.

Photo 1 Květoslava Navrátilová, Photo 2 Martin Eliáš

Planche LVIII

- 1,2 *Liptodendron grossi* gen. nov. sp. n. Holotype. Hybica. Calcaires récifaux des couches de Borov. Priabonien inférieur. Lames minces. Sections verticales montrant la liaison épithéciale des polypières. 6 × environ.
3 *Rhabdophylliopsis thomkai* sp. n. Holotype. Beňatina. Conglomérat des couches de Proč. Paléocène-Eocène inférieur. Lame mince. Section transversale. 9 ×.

Photos 1, 2 Martin Eliáš, photo 3 Naděžda Hrdličková

Planche LIX

- 1,2 *Astraraea roberti* sp. n. Holotype. Beňova Lehota près de Dolný Kubín. Sénonien? (Albien?).
Lames minces.
1 Section transversale 9 ×.
2 Section verticale. 9 ×.

Photos Naděžda Hrdličková

Planche LX

- 1 *Caryophyllia* sp. Žilinská Lehota près de Žilina. Santonien. Lame mince. Section transversale.
9,5 ×.

Photo Martin Eliáš



KLEMENT FORDINÁL

Biometrical Evaluation of *Melanopsis pygmaea pygmaea* M. Hoernes, *Melanopsis lebedai* Lueger, and its Significance for Monitoring of Paleoecological Changes

(12 text-fig. 10 tab.)

Abstract. The results of paleoecological evaluation of Pannonian and Pontian molluscs from localities near Bratislava, from boreholes JRD-206 and Ma-1 (K. FORDINÁL—L. TUBA 1988) are correlated with biometric data about shells of *Melanopsis pygmaea pygmaea* M. Hoernes and *Melanopsis lebedai* Lueger from boreholes mentioned above. The changing salinity of the environment, its influence upon the size of shells, the rate of changes and its influence upon the correlation coefficient concerning shells of gastropods studied have been investigated.

In the area of Bratislava the basement of the Danube Lowlands Quaternary was almost unknown till the beginning of this century. KONHUBER'S (1856, ex B. ZALÁNYI 1923) report about a find of a lignite seam during a well sinking contains the only information about the Pannonian s.l. present in this area.

Drilling explorations performed at the beginning of this century resulted in more exact data about stratigraphy of the basement sediments.

During the World War II a borehole was drilled in Bratislava near the Dynamite Factory (now CHZJD) and reached Pannonian sediments at the depth of 4,5 m. F. TOULA (1915) studied the borehole and found out the extension of the Pannonian to the depth of 109 m. Sarmatian sediments were bored at the depth of 109.0—201.7 m. The drilling penetrated granite at the depth of 201.7 m.

In the twenties of this century the drilling hydrogeological exploration was performed in the area of Bratislava. The boreholes were evaluated by B. ZALÁNYI (1923) who had also evaluated the former borehole near the Dynamite Factory. Basing on fauna, he placed the Sarmatian/Pannonian boundary in the borehole to the depth of 133.6 m.

In Kann's factory in the Račičdorf street a 59 m deep borehole was drilled. Macrofauna from the borehole was examined by T. BUDAY (J. KOUTEK—V. ZOUBEK 1936). Basing upon molluscs represented by *Congeria ornithopsis* and *C. partschi* he ranged the fossil-bearing horizon to the upper Part of of the Lower Pannonian.

This is a brief outline of the most significant works so far performed in the area of Bratislava. Details on the geological structure of this region are given in the book by T. BUDAY (B. CAMBEL—M. MAHEĽ et al. 1962).

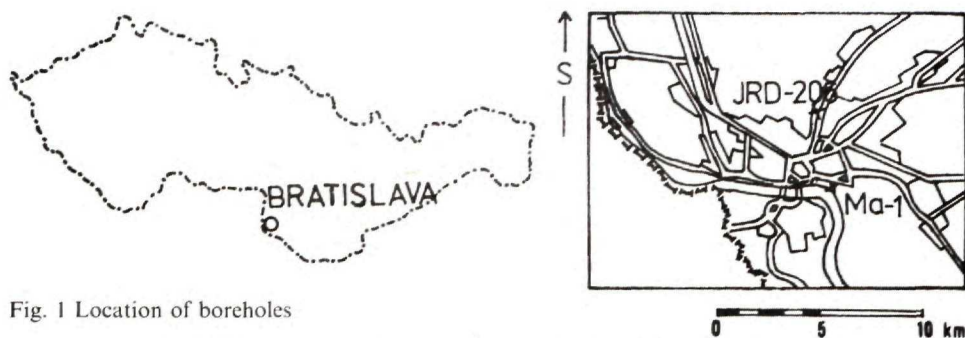


Fig. 1 Location of boreholes

At present the drilling exploration is performed in Bratislava in relation with geological mapping and construction of fast railway. Molluscs and ostracods from the boreholes were studied (K. FORDINÁL — L. TUBA 1988). On the basis of the fauna the fossil-bearing sediments were classified stratigraphically, and paleoecological conditions in the southwestern part of the Gabčíkovo basin during the Pannonian-Pontian were reconstructed.

The study of molluscan assemblages has shown that *Melanopsis pygmaea pygmaea* M. HOERNES occurs in the borehole JRD-206 in the oldest (zone C-D of the Pannonian, A. PAPP 1951, 1953) and in the youngest (zone F₁ of the Pontian) drilled sediments. This form also occurred in the borehole Ma-1.

Following is the stratigraphical classification (K. FORDINÁL — L. TUBA 1988) of fossil-bearing sediments from the boreholes JRD-206 and Ma-1 (Fig. 1), containing *Melanopsis pygmaea pygmaea* M. HOERNES:

JRD-206 (Mikovinyho str.)

- 22.40—24.00 m — Pontian, zone F₁
- 45.70—45.80 m — Upper Pannonian-Pontian
- 57.20—57.50 m — Pannonian, zone D-E
- 68.10—68.45 m — Pannonian, zone C—D
- 69.00—70.00 m — Pannonian, zone C—D

Ma-1 (Martanovičova str.)

- 161.5—163.8 m — Pannonian, zone C-D

Molluscan assemblages from these boreholes indicate the environments of the origin of sediments from the above depths (l. c.)

JRD-206

- 22.40—24.00; 45.70—45.80 m lagoonal, oligohaline brackish (0.5—3.0‰) desalinating environment
- 57.20—57.50 m sublittoral, miohaline brackish (3—5‰) calm environment
- 68.10—68.45 m sublittoral, mesohaline brackish (5—9‰)
- 69.00—70.00 m environment

Ma-1

- 161.5—163.8 m sublittoral, mesohaline brackish (5—9‰) environment

The salinity of environment is variable and we want to find out whether the changing salinity affected the size (height) of shells of *Melanopsis pygmaea pygmaea* M. HOERNES. This is the purpose of their biometrical evaluation. We have also evaluated shells of *Melanopsis pygmaea pygmaea* M. HOERNES from the borehole Ma-1 and *Melanopsis lebedai* LUEGER from the borehole JRD-206 (Fig. 2).

Water salinity classification after HILTERMANN (1949)

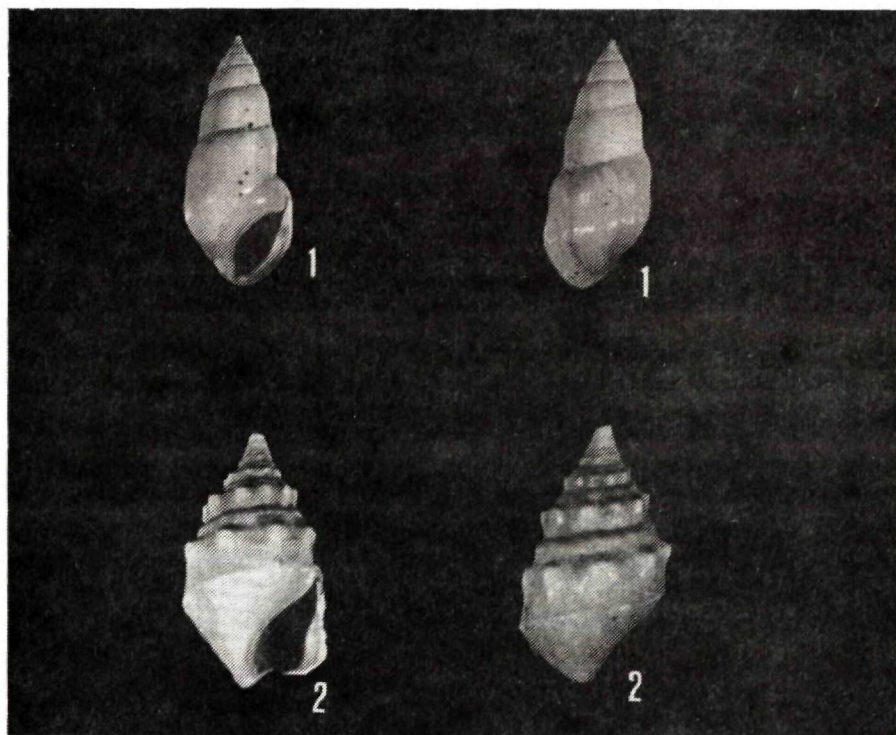


Fig. 2 Depiction of mollusc species studied

1 — *Melanopsis pygmaea pygmaea* M. HOERNES, JRD-206, 69.00—70.0 m, magn. 2 × ; 2 — *Melanopsis lebedai* LUEGER, JRD-206, 68.10—68.45 m; magn. 3 ×

Biometrical study

In our biometrical study we apply methods and characteristics current in modern statistical analysis. The arithmetic mean (A) is simplest and most frequent

$$A_x = \frac{\sum x}{n} \quad A_y = \frac{\sum y}{n} \quad \begin{array}{l} x, y \text{ — parameters measured} \\ n \text{ — number of specimens} \end{array}$$

The standard deviation (τ) is the variability measure of the character studied in the respective specimen. The higher the value of τ , the looser the dispersion of the values of the character measured around the arithmetic mean.

$$\tau_x = \sqrt{\frac{\sum \xi^2}{n}} \quad \xi = x - A_x$$

$$\tau_y = \sqrt{\frac{\sum \eta^2}{n}} \quad \eta = y - A_y$$

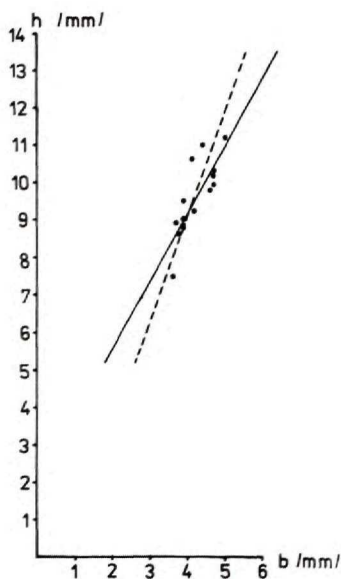


Fig. 3

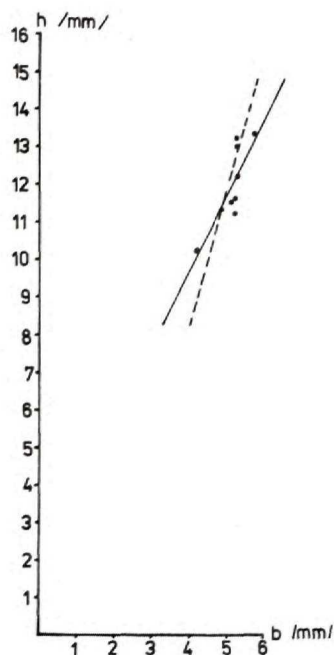


Fig. 4

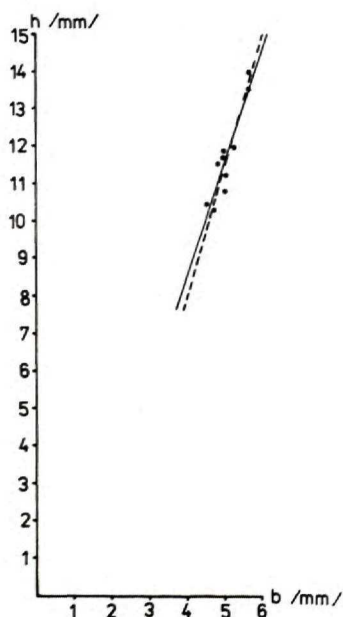


Fig. 5

Fig. 3 Graph of parameters h and b with calculated regression lines *Melanopsis pygmaea pygmaea* M. HOERNES (JRD-206, 22.4—24.0 m); h — shell height; B — shell width.

Fig. 4 Graph of parameters h and b width calculated regression lines *Melanopsis pygmaea pygmaea* M. HOERNES (JRD-206, 45.7—45.8 m).

Fig. 5 Graph of parameters h and b with calculated regression lines *Melanopsis pygmaea pygmaea* M. HOERNES (JRD-206, 57.2—57.5 m).

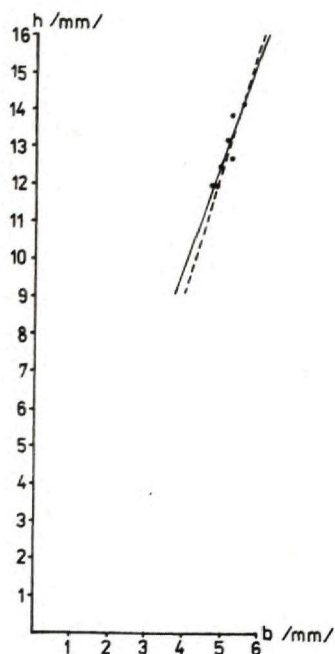


Fig. 6

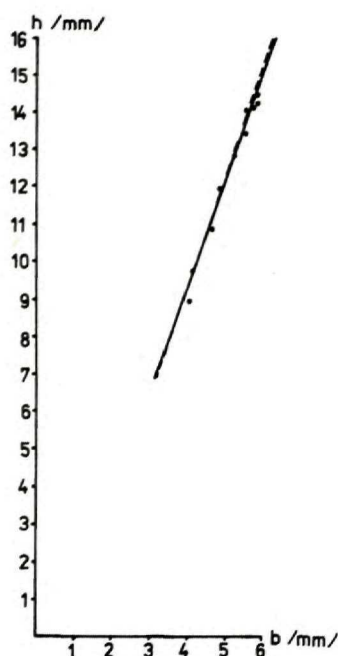


Fig. 7

Fig. 8

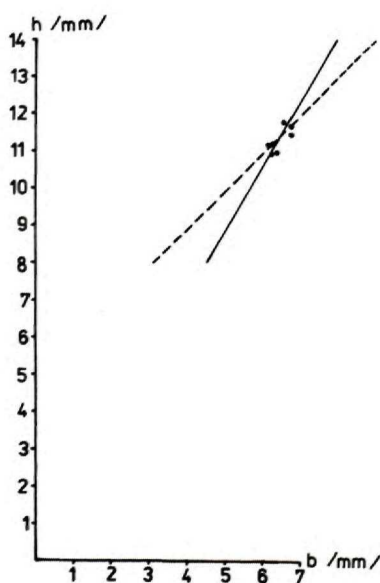


Fig. 6 Graph of parameters h and b with calculated regression lines
Melanopsis pygmaea pygmaea M. HOERNES (JRD-206, 68.10—68.45 m).

Fig. 7 Graph of parameters h and b with calculated regression lines
Melanopsis pygmaea pygmaea M. HOERNES (JRD-206, 69.0—70.0 m)

Fig. 8 Graph of parameters h and b with calculated regression lines
Melanopsis lebedai LUEGER (JRD-206, 56.40—56.55 m).

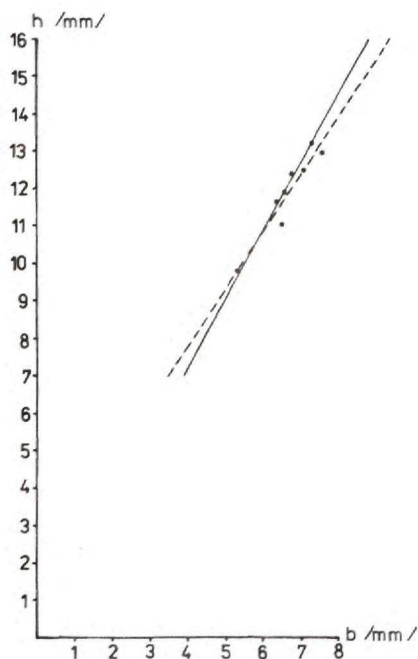


Fig. 9

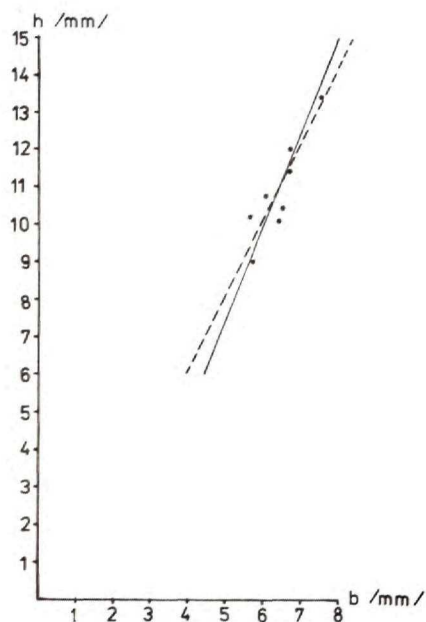


Fig. 10

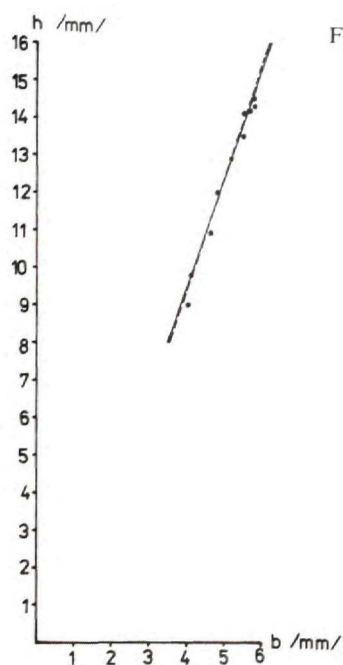


Fig. 11

Fig. 9 Graph of parameters h and b with calculated regression lines *Melanopsis lebedai* LUEGER (JRD-206, 57.2—57.5 m).

Fig. 10 Graph of parameters h and b with calculated regression lines *Melanopsis lebedai* LUEGER (JRD-206, 68.10—68.45 m).

Fig. 11 Graph of parameters h and b with calculated regression lines *Melanopsis pygmaea pygmaea* M. HOERNES (Ma-1, 161.5—163.8 m)

Two populations (for example forms of one species, originating from vari-aged sediments) may be compared in the simplest way on the basis of one morphological feature (e.g. shell height). At first the arithmetic mean of values of the feature studied is calculated separately for each population (A_1 , A_2) as well as their standard deviations (τ_1 , τ_2). Then the standard deviation of sample parameters (τ_d) and difference of arithmetic means $d = (A_1 - A_2)$ are calculated. Finally, the quotient $s = \frac{d}{\tau_d}$ is calculated. When $s < 2$, the difference between arithmetic means is statistically insignificant, when $2 < s < 3$, it cannot be unambiguously determined, but when $s > 3$, the difference between arithmetic means is statistically significant.

$$\tau_d = \sqrt{\frac{\tau_1^2}{n_1} + \frac{\tau_2^2}{n_2}} \quad \begin{array}{l} n_1 - \text{number of specimens in population 1} \\ n_2 - \text{number of specimens in population 2} \end{array}$$

Following is the correlation coefficient (K_{xy}). It is the measure of linear correlation between x and y . On the basis of the correlation coefficient we can say whether the specimens of the population preserve the same or approximately the same regularity in the course of their growth. The correlation coefficient value can increase from 0 to 1.

$$K_{xy} = \frac{\sum \xi \cdot \eta}{n \cdot \tau_x \cdot \tau_y}$$

When $K_{xy} < 1$, we get two regression lines. The closer the K_{xy} value to 1, the lesser the angle of the two lines. When the $K_{xy} = 1$, the two lines fuse into one regression line.

Regression lines equation: $y = ax + b$ where

$$a = \frac{n \sum xy - x \sum y}{n \sum x^2 - (\sum x)^2} \quad b = \frac{\sum x^2 \sum y - \sum xy \sum x}{n \sum x^2 - (\sum x)^2}$$

Results of biometrical study

Since the fossils come from drill cores, there are few specimens of individual species, so the resulting data are tentative. After having collected more fossils we shall continue our research.

Following are conclusions based on the biometrical evaluation of shells of *Melanopsis pygmaea pygmaea* M. HOERNES from the borehole JRD-206:

The calculated average heights of shells decrease with the decreasing salinity of the environment (in our case from the oldest sediments to the younger), except for shells from the depth of 57.2—57.5 m, because the shell population originating from the overlying fossil-bearing horizon (45.7—45.8 m) displays a higher average value of shell heights (Fig. 12). So in the time of the formation of sediments in the depth of 57.2—57.5 m the environment must have been less favourable for molluscs than in the time of deposition of the fossil-bearing horizon in the depth of 45.7—45.8 m. The cause of the deterioration of the environment is indicated by pyrite crystals found in sediments from the depth of 57.2—57.5 m. Their presence is indicative of a poorly aerated environment with weak water circulation.

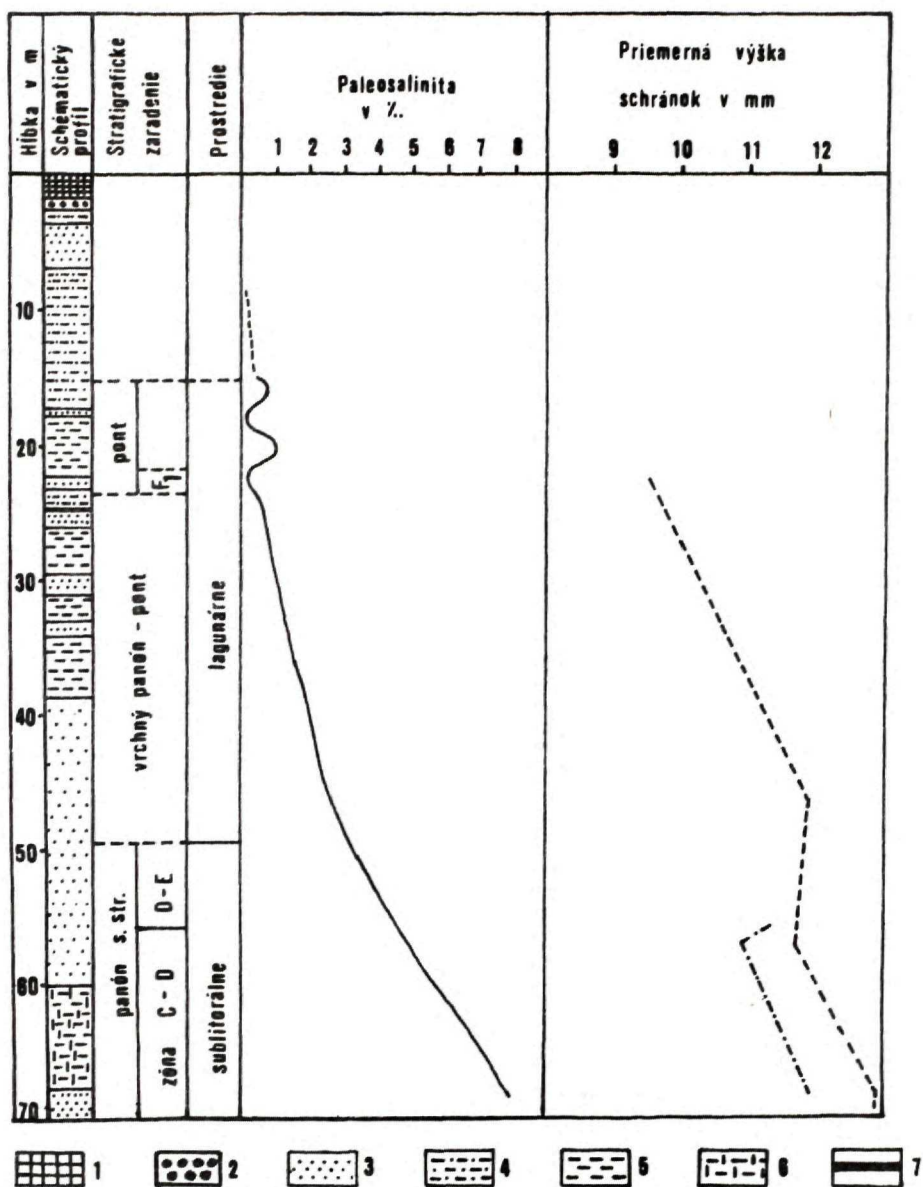


Fig. 12 Relation between changes in average shell height of *Melanopsis pygmaea pygmaea* M. HOERNES and salinity of environment in borehole JRD-206
 1 — charge, 2 — gravel, 3 — sand, 4 — clayey loam, 5 — clay, 6 — aleurite, 7 — lignite

Biometrical evaluation of shells of *Melanopsis lebedai* LUEGER from the borehole JRD-206, from the depths: 56.40—56.55 m; 57.2—57.5 m and 68.10—68.45 m has been done to find out whether also other molluscan species reacted to this change. Shells from the depth 57.2—57.5 m showed again the lowest value of the arithmetic mean of their heights (Fig. 12).

We have compared shell populations from different fossilbearing horizons. The comparison has shown that the shell population from the depth 22.4—24.0 m is most different from other populations: its value is higher than 3 (Pl. 10). It is indicative of conditions very different from those existing in the time of the formation of other fossil-bearing horizons.

Generally we can say that the correlation coefficient of the shells of *Melanopsis pygmaea pygmaea* M. HOERNES originating from the Pannonian is higher than in Pontian shells. It may be explained by the lagoonal environment existing in this part of the basin during the Pontian. L. TUBA (in K. FORDINÁL — L. TUBA 1988) studying ostracods from the borehole JRD-206 found out a repeated alternation of layers containing freshwater ostracod species with layers containing brackish species in the depth interval 15.5—24.6 m. The quick oscillation was certainly unfavourable for the shell growth and disturbed the growth relation between the height and width of shells. The same concerns shells from the depth 45.7—45.8 m, stratigraphically ranged to the Upper Pannonian — Pontian. Also this fossil-bearing sediment is presumed to have deposited in a lagoonal environment.

The high correlation coefficient of the shells of *Melanopsis pygmaea pygmaea* M. HOERNES originating from the Pannonian is indicative of a slow gradual decrease of salinity. The molluscs were able to adapt themselves without disturbing the growth relation between the height and width of shells. The same is indicated by the values of correlation coefficients of *Melanopsis lebedai* LUEGER from the Pannonian (Pl. 7—8), except for shells from the depth 56.40—56.55 m (Pl. 6)

Melanopsis pygmaea pygmaea M. HOERNES from the borehole Ma-1 has also been biometrically evaluated. Since there the form was only found in one horizon (161.5—163.8 m), it was impossible to study its changing evolution. A comparison of calculated biometrical characteristics of the shell population from the borehole Ma-1 (Tab. 9) with the values concerning populations from the borehole JRD-206 (Tab. 1—5) shows that they are almost identic with the values of characteristics of shell populations from the depths 68.10—68.45 m and 69—70 m, stratigraphically ranged to the Pannonian — Zone C—D. The fossil-bearing sediments (161.5—163.8 m) was ranged to these zones also on the basis of the entire molluscan assemblage. It is indicative of similar conditions in both places of the Gabčíkovo basin.

Shells of *Melanopsis pygmaea pygmaea* M. HOERNES from the loam-pit of the brick-kiln in Pezinok have also been biometrically evaluated (K. FORDINÁL 1986). Following are the resulting values: $A_h = 9.08$ mm, $A_b = 3.99$ mm, $K_{hb} = 0.802$.

When the stratigraphical classification of the sediments from Pezinok is only based on the values of A_h , K_{hb} , and on their changes in the borehole JRD-206, they must be ranged to the Pontian. But according to the molluscan fauna they are ranged to the Pannonian — zone E₁ (l. c.). So the conditions in the zone E must have been different in both places of the Gabčíkovo basin.

Table 1 Calculations of standard deviations, correlation coefficient, and regression lines of parameters "h" and "b"

Melanopsis pygmaea pygmaea M. HOERNES
(JRD-206, 22,4—24,0 m)

n	h(mm)	b(mm)	ξ	η	$\xi \cdot \eta$	ξ^2	η^2
1.	11,2	5,0	1,59	0,77	1,2243	2,5281	0,5929
2.	11,0	4,4	1,39	0,17	0,2363	1,9321	0,0289
3.	10,6	4,1	0,99	-0,13	-0,1287	0,9801	0,0160
4.	10,3	4,7	0,69	0,47	0,3243	0,4761	0,2209
5.	10,2	4,7	0,59	0,47	0,2773	0,3481	0,2209
6.	9,9	4,7	0,29	0,47	0,1363	0,0841	0,2209
7.	9,8	4,6	0,19	0,37	0,0703	0,0361	0,1369
8.	9,5	3,9	-0,11	-0,33	0,0363	0,0121	0,1089
9.	9,2	4,2	-0,41	-0,03	0,0123	0,1681	0,0009
10.	9,0	3,9	-0,61	-0,33	0,2013	0,3721	0,1089
11.	8,9	3,7	-0,71	-0,53	0,3763	0,5041	0,2809
12.	8,8	3,9	-0,81	-0,33	0,2673	0,6561	0,1089
13.	8,6	3,8	-1,01	-0,43	0,4343	1,0201	0,1849
14.	7,5	3,6	-2,11	-0,63	1,3293	4,4521	0,3969
Σ	134,5	59,2	$\tau_h = 0,985$ $\tau_b = 0,433$ $K_{hb} = 0,80$				
A	9,61	4,23	$h = 1,83b + 1,89$ $b = 0,35h + 0,83$				

Table 2 Calculations of standard deviations, correlation coefficient, and regression lines of parameters "h" and "b"

Melanopsis pygmaea pygmaea M. HOERNES
(JRD-206, 45,7—45,8 m)

n	h(mm)	b(mm)	ξ	η	$\xi \cdot \eta$	ξ^2	η^2
1.	13,3	5,7	1,36	0,61	0,8296	1,8496	0,3721
2.	13,2	5,2	1,26	0,11	0,1386	1,5876	0,0121
3.	13,0	5,2	1,06	0,11	0,1166	1,1236	0,0121
4.	12,2	5,1	0,26	0,01	0,0026	0,0676	0,0001
5.	11,6	5,2	-0,34	0,11	-0,0374	0,1156	0,0121
6.	11,6	5,2	-0,34	0,11	-0,0374	0,1156	0,0121
7.	11,5	5,1	-0,44	0,01	-0,0044	0,1936	0,0001
8.	11,3	4,8	-0,64	-0,29	0,1856	0,4096	0,0841
9.	11,2	5,2	-0,74	0,11	-0,0814	0,5476	0,0121
10.	10,2	4,2	-1,74	-0,89	1,5486	3,0276	0,7921
Σ	119,1	50,9	$\tau_h = 0,951$ $\tau_b = 0,362$ $K_{hb} = 0,77$				
A	11,94	5,09	$h = 2,03b + 1,56$ $b = 0,29h + 1,58$				

Table 3 Calculations of standard deviations, correlation coefficient, and regression lines of parameters "h" and "b"

Melanopsis pygmaea pygmaea M. HOERNES (JRD-206, 57,2—57,3 m)

n	h(mm)	b(mm)	ξ	η	$\xi \cdot \eta$	ξ^2	η^2
1.	14,0	5,6	2,29	0,58	1,3282	5,2441	0,3364
2.	13,5	5,6	1,79	0,58	1,0382	3,2041	0,3364
3.	11,9	5,2	0,19	0,18	0,0342	0,0361	0,0324
4.	11,8	4,9	0,09	-0,12	-0,0108	0,0081	0,0144
5.	11,7	4,9	-0,01	-0,12	0,0012	0,0001	0,0144
6.	11,5	4,8	-0,21	-0,22	0,0462	0,0441	0,0484
7.	11,2	5,0	-0,51	-0,02	0,0102	0,2601	0,0004
8.	10,8	5,0	-0,91	-0,02	0,0182	0,8281	0,0004
9.	10,4	4,5	-1,31	-0,52	0,6812	1,7161	0,2704
10.	10,3	4,7	-1,41	-0,32	0,4512	1,9881	0,1024
Σ	117,1	50,2	$\tau_h = 1,155$ $\tau_b = 0,34$ $K_{hb} = 0,92$				
A	11,71	5,02	$h = 3,11b - 3,91$ $b = 0,27h + 1,86$				

Table 4 Calculations of standard deviations, correlation coefficient, and regression lines of parameters "h" and "b"

Melanopsis pygmaea pygmaea M. HOERNES (JRD-206, 68,10—68,45 m)

n	h(mm)	b(mm)	ξ	η	$\xi \cdot \eta$	ξ^2	η^2
1.	14,2	5,5	1,27	0,44	0,5588	1,6129	0,1936
2.	13,9	5,2	0,97	0,14	0,1358	0,9409	0,0196
3.	13,2	5,1	0,27	0,04	0,0108	0,0729	0,0016
4.	12,7	5,2	-0,23	0,14	-0,0322	0,0529	0,0196
5.	12,5	4,9	-0,43	-0,16	0,0688	0,1849	0,0256
6.	12,0	4,8	-0,93	-0,26	0,2418	0,8649	0,0676
7.	12,0	4,7	-0,93	-0,36	0,3348	0,8649	0,1296
Σ	90,5	35,4	$\tau_h = 0,810$ $\tau_b = 0,256$ $K_{hb} = 0,91$				
A	12,93	5,06	$h = 2,88b - 1,66$ $b = 0,29h + 1,35$				

Table 5 Calculations of standard deviations, correlation coefficient, and regression lines of parameters "h" and "b"

Melanopsis pygmaea pygmaea M. HOERNES (JRD-206, 69,0—70,0 m)

n	h(mm)	b(mm)	ξ	η	$\xi \cdot \eta$	ξ^2	η^2
1.	14,5	5,8	1,59	0,58	0,9222	2,5281	0,3364
2.	14,3	5,8	1,39	0,58	0,8062	1,9321	0,3364
3.	14,2	5,7	1,29	0,48	0,6192	1,6641	0,2304
4.	14,1	5,5	1,19	0,28	0,3332	1,4161	0,0784
5.	13,5	5,5	0,59	0,28	0,1652	0,3481	0,0784
6.	12,9	5,2	-0,01	-0,02	0,0002	0,0001	0,0004
7.	12,0	4,8	-0,91	-0,42	0,3822	0,8281	0,1764
8.	10,9	4,6	-2,01	-0,62	1,2462	4,0401	0,3844
9.	9,8	4,1	-3,11	-1,12	3,4832	9,6721	1,2544
Σ	116,2	47	$\tau_h = 1,58$ $\tau_b = 0,57$ $K_{hb} = 0,98$				
A	12,91	5,22	$h = 2,77b - 1,54$ $b = 0,35h + 0,64$				

Table 6 Calculations of standard deviations, correlation coefficient, and regression lines of parameters "h" and "b"

Melanopsis lebedai LUEGER (JRD-206, 56,40 — 56,55 m)

n	h(mm)	b(mm)	ξ	η	$\xi \cdot \eta$	ξ^2	η^2
1.	11,8	6,5	0,46	0,11	0,0506	0,2116	0,0121
2.	11,7	6,7	0,36	0,31	0,1116	0,1296	0,0961
3.	11,5	6,7	0,16	0,31	0,0496	0,0256	0,0961
4.	11,2	6,2	-0,14	-0,19	0,0266	0,0196	0,0361
5.	11,2	6,1	-0,14	-0,29	0,0406	0,0196	0,0841
6.	11,0	6,3	-0,34	-0,09	0,0306	0,1156	0,0081
7.	11,0	6,2	-0,34	-0,19	0,0646	0,1156	0,0361
Σ	79,4	44,7	$\tau_h = 0,30$ $\tau_b = 0,23$ $K_{hb} = 0,78$				
A	11,34	6,39	$h = 1,02b + 4,86$ $b = 0,59h - 0,28$				

Table 7 Calculations of standard deviations, correlation coefficient, and regression lines of parameters "h" and "b"

Melanopsis lebedai LUEGER (JRD-206, 57,2—57,5 m)

n	h(mm)	b(mm)	ξ	η	$\xi \cdot \eta$	ξ^2	η^2
1.	13,4	7,4	2,5	1,09	2,725	6,25	1,1881
2.	12,0	6,6	1,1	0,29	0,319	1,21	0,0841
3.	11,4	6,6	0,5	0,29	0,145	0,25	0,0841
4.	10,7	6,0	-0,2	-0,31	0,062	0,04	0,0961
5.	10,4	6,4	-0,5	0,09	-0,045	0,25	0,0081
6.	10,2	5,6	-0,7	-0,71	0,497	0,49	0,5041
7.	10,1	6,3	-0,8	-0,01	0,008	0,64	0,0001
8.	9,0	5,6	-1,9	-0,71	1,349	3,61	0,5041
Σ	87,2	50,5	$\tau_h = 1,26$ $\tau_b = 0,56$ $K_{hb} = 0,90$				
A	10,9	6,31	$h = 2,05b - 2,04$ $b = 0,40h + 1,98$				

Table 8 Calculations of standard deviations, correlation coefficient, and regression lines of parameters "h" and "b"

Melanopsis lebedai LUEGER (JRD-206, 68,10 — 68,45 m)

n	h(mm)	b(mm)	ξ	η	$\xi \cdot \eta$	ξ^2	η^2
1.	13,2	7,2	1,27	0,57	0,7239	1,6129	0,3249
2.	13,0	7,5	1,07	0,87	0,9309	1,1449	0,7569
3.	12,5	7,0	0,57	0,37	0,2109	0,3249	0,1369
4.	12,4	6,7	0,47	0,07	0,0329	0,2209	0,0049
5.	11,9	6,5	-0,03	-0,13	0,0039	0,0009	0,0169
6.	11,6	6,3	-0,33	-0,33	0,1089	0,1089	0,1089
7.	11,0	6,5	-0,93	-0,13	0,1209	0,8649	0,0169
8.	9,8	5,3	-2,13	-1,33	2,8329	4,5369	1,7689
Σ	95,4	53	$\tau_h = 1,05$ $\tau_b = 0,63$ $K_{hb} = 0,94$				
A	11,93	6,63	$h = 1,58b + 1,43$ $b = 0,56h - 0,09$				

Table 9 Calculations of standard deviations, correlation coefficient, and regression lines of parameters "h" and "b"

Melanopsis pygmaea pygmaea M. HOERNES (Ma-I, 161,5 — 163,8 m)

n	h(mm)	b(mm)	ξ	η	$\xi \cdot \eta$	ξ^2	η^2
1.	13,8	5,4	1,34	0,47	0,6298	1,7956	0,2209
2.	13,4	5,2	0,94	0,27	0,2538	0,8836	0,0729
3.	12,2	4,8	-0,26	-0,13	0,0338	0,0676	0,0169
4.	12,1	4,9	-0,36	-0,03	0,0108	0,1296	0,0009
5.	12,0	4,7	-0,46	-0,23	0,1058	0,2116	0,0529
6.	11,9	4,8	-0,56	-0,13	0,0728	0,3136	0,0169
7.	11,8	4,7	-0,66	-0,23	0,1518	0,4356	0,0529
Σ	87,2	34,5	$\tau_h = 0,740$ $\tau_b = 0,249$ $K_{hb} = 0,98$				
A	12,46	4,93	$h = 2,9b - 1,83$ $b = 0,33h + 0,84$				

Table 10 Comparison of mollusc shell populations from different fossil-bearing horizons of borehole JRD-206, based on parameter "s"

	22,4—24,0	45,7—45,8	57,2—57,5	68,10—68,45	69,0—70,0
22,4—24,0		5,7	4,9	7,7	6,7
45,7—45,8	5,7		0,5	2,2	1,9
57,2—57,5	4,9	0,5		2,1	2,2
68,10—68,45	7,7	2,2	2,1		0,04
69,0—70,0	6,7	1,9	2,2	0,04	

Summary

Shells of *Melanopsis pygmaea pygmaea* M. HOERNES, 1856 and *Melanopsis lebedai* LUEGER 1980 from boreholes JRD-206 and Ma-1 in Bratislava were biometrically evaluated. The results were compared with data resulting from paleoecological evaluation of molluscs from these boreholes (K. FORDINÁL — L. TUBA 1988). It has been found out that the average height of shells of *Melanopsis pygmaea pygmaea* HOERNES decreases with the dropping salinity of the environment. The correlation coefficient of gastropod shells studied is lower in the Pontian than in the Pannonian. This phenomenon is associated with the rate of changes in salinity, because it was found out that in this part of the basin the Pontian sedimentation proceeded in the lagoonal environment with quickly changing salinity; and in the sublittoral part of the basin the Pannonian sedimentation proceeded in the environment with much slower changing salinity (l.c.).

The quick changes of salinity in the Pontian disturbed the growth relation between the width and height of shells, whereas in the Pannonian the relation was undisturbed because of the gradual changes in salinity.

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KLEMENT FORDINÁL

Congeria doderleini Brusina from Pannonian sediments in a loam pit of the brick plant at Pezinok

5 Figs., 2 Tabs., 2 Phototabs. (LXI—LXII)

Abstract. The article deals with systematic assignation, way of life and biometric evaluation of the species *Congeria doderleini* Brusina from a loam pit of brick plant at Pezinok.

Introduction

Studies of Pannonian molluscan fauna in a loam pit of the brick plant at Pezinok (Fig. 1) have revealed that some shells of the gastropods *Melanopsis impressa* Krauss contain specimens of the species *Congeria doderleini* Brusina (K. FORDINÁL 1986). These are fairly abundant and include specimens of various growth stages.

Adult forms of this species collected in the loam pit of the Pezinok brick plant are characterized by a wing-shaped protuberance on the back part of the shell. In addition to adult forms, the studied set also contained juvenile shells with preserved coloured pattern as well as specimens without the wing-shaped protuberance.

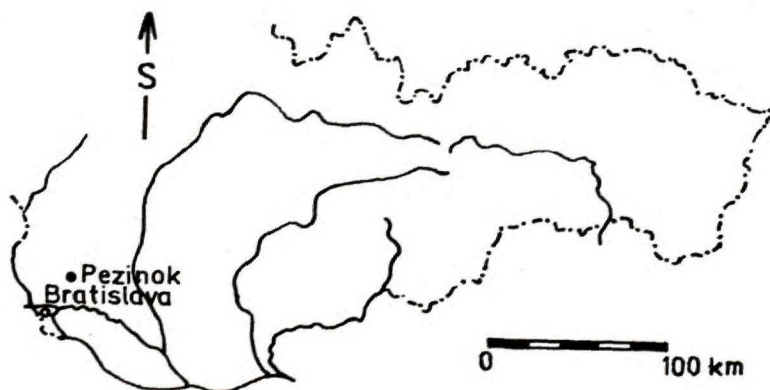


Fig. 1 Schematic map showing localtion of the town of Pezinok

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The phototables illustrate the most important growth stages of the species *Congeria doderleini* BRUSINA. The length-to-width ratios of its shells in various growth stages have been biometrically studied. On the basis of the available literature, the distribution, stratigraphic range and way of life of this *Congeria* have been investigated.

General characteristics

The genus *Congeria*, defined by P. PARTSCH in 1836, includes numerous specialized forms, which, on the basis of their shell morphology and phylogenetic relationships, were divided by N. Andrusov (1897) into 6 groups:

1. mytiliformes
2. modioliformes
3. triangulares
4. subglobosae
5. rhomboidea
6. eocaenae

Congeria doderleini BRUSINA belongs into the group mytiliformes. This group is characterized by mytiloid shells with reduced front margin. The shells have a distinct keel or, in an extreme case, a blunt margin and more or less distinct byssus aperture. The apophysis is well developed (pers. comm.).

Systematic part

Phylum: *Mollusca*

Class: *Bivalvia*

Order: *Dysodonta*

Family: *Dreissenidae*

Genus: *Congeria* PARTSCH, 1836

Typical species: *Congeria subglobosa* PARTSCH, 1836

Congeria doderleini BRUSINA, 1892

- 1892 *Congeria Doderleini* BRUSINA n. sp. — S. BRUSINA: Fauna fossile di Markusevec etc. p. 71
- 1897 *Congeria Doderleini* BRUS. — N. ANDRUSOV: Fossile und lebende Dreissensidae etc. p. 126, tab. 3, fig. 23—30
- 1902 *Congeria Doderleini* BRUS. — S. BRUSINA: Iconographia etc. tab. 17, fig. 1—6
- 1902 *Congeria Doderleini* BRUS. — I. LÖRENTHEY: Die pannonische Fauna von Budapest. p. 150, tab. 10, fig. 16—18
- 1911 *Congeria Doderleini* BRUSINA — I. LÖRENTHEY: Beiträge zur Fauna d. pannonischen Schichten etc. p. 56
- 1928 *Congeria Doderleini* BRUSINA — P. S. PAVLOVIC: Les mollusques etc. p. 6
- 1944 *Congeria doderleini* BRUSINA — E. JEKELIUS: Sarmat und Pont etc. p. 142, tab. 59, fig. 11—16
- 1953 *Congeria doderleini* BRUSINA — A. PAPP: Die Molluskenfauna des Pannon etc. p. 164, tab. 13, fig. 8—12

Diagnosis: S. Brusina (1892) p. 71

Holotype: undefined

Type locality: Markusevec

Stratotype: Tertiary

Material: 110 specimens

Description: Small thin shell, very inflated, most frequently of triangular shape. The keel of the shell is bent, S-shaped. The shell of adult specimens is wing-shaped, widened at its end.

Size: It varies from 3.2 to 12.2 mm.

Stratigraphic and geographic distribution: Pannonian—Pannonian Basin: Hungary (Tinnye, Szosa, Peremartoni). Yugoslavia (Begelica), Vienna Basin: Austria (Neudorf), Pontian — Pannonian Basin: Yugoslavia (Mala Ivanča, Ripanj), Rumania (Turislav).

Occurrence: loam pit of the Pezinok brick plant

Remarks: Original specimens of *Congerina doderleini* BRUSINA come from Tertiary sediments at the locality Markusevec (near Zagreb) and are illustrated in N. ANDRUSOV'S (1897) work (tab. 3, figs. 23—30).

At all above-described localities, *Congerina doderleini* BRUSINA is accompanied by the

Tab. 1 Measured size parameters of shells of *Congerina doderleini* BRUSINA

P. č.	d	š	P. č.	d	š	P. č.	d	š	P. č.	d	š
1	12,2	7,0	26	9,0	4,4	51	7,4	4,1	76	6,0	3,0
2	11,0	6,2	27	9,0	4,3	52	7,4	4,1	77	5,8	2,9
3	10,8	7,0	28	8,8	4,5	53	7,3	3,9	78	5,7	3,5
4	10,7	5,0	29	8,7	5,0	54	7,3	3,6	79	5,6	3,5
5	10,6	5,8	30	8,6	4,5	55	7,2	3,6	80	5,6	2,8
6	10,6	5,5	31	8,5	4,5	56	7,1	3,7	81	5,6	2,6
7	10,5	5,6	32	8,5	4,0	57	7,0	3,8	82	5,5	30,0
8	10,4	5,1	33	8,4	4,3	58	7,0	3,5	83	5,5	2,5
9	10,3	6,5	34	8,4	4,1	59	7,0	3,2	84	5,4	2,9
10	10,3	6,3	35	8,4	4,1	60	7,0	3,2	85	5,4	2,3
11	10,3	5,7	36	8,4	4,0	61	6,9	3,5	86	5,3	2,7
12	10,1	7,0	37	8,3	4,2	62	6,9	3,1	87	5,3	2,5
13	10,0	6,5	38	8,3	4,2	63	6,9	3,1	88	5,3	2,4
14	10,0	5,3	39	8,2	4,5	64	6,8	3,3	89	5,1	2,5
15	10,0	4,6	40	8,1	5,5	65	6,7	3,3	90	5,0	2,5
16	9,5	6,0	41	8,0	4,0	66	6,6	3,5	91	4,9	2,6
17	9,5	5,0	42	7,9	4,5	67	6,6	3,0	92	4,9	2,4
18	9,5	5,0	43	7,9	4,4	68	6,5	3,1	93	4,8	2,3
19	9,4	5,3	44	7,9	4,0	69	6,5	3,1	94	4,5	2,1
20	9,4	4,7	45	7,7	4,0	70	6,4	3,3	95	4,4	2,2
21	9,3	4,7	46	7,7	3,8	71	6,4	3,1	96	4,2	2,3
22	9,1	5,0	47	7,6	4,0	72	6,2	3,1	97	4,2	2,2
23	9,1	5,0	48	7,6	4,0	73	6,1	3,0	98	3,8	1,9
24	9,0	6,5	49	7,6	3,6	74	6,0	3,5	99	3,4	1,8
25	9,0	4,6	50	7,5	3,6	75	6,0	3,4	100	3,2	1,5

d — shell length | š — shell width | □ — shells with wing-shaped protuberance

following species: *Melanopsis vindobonensis* FUCHS, *M. stricturata* BRUSINA, *Congeria martonfii* LOERENTHEY, *C. ramphophora* BRUSINA.

Way of life

The genus *Congeria* is a brackish one. Individual species of this genus live in an environment with salinity ranging from 16 to 0‰ and belong among filtrators.

In the loam pit of the Pezinok brick plant, shells of the species *Congeria doderleini* BRUSINA have been found mutually connected only in apertures of shells of *Melanopsis impressa* KRAUSS, which suggests that the former species lived in dead gastropod shells of the genus *Melanopsis*. This way of life is also described by A. PAPP (1953) and is probably one of several possible ways of life of this *Congeria*.

At Pezinok, *Congeria doderleini* BRUSINA has been found to accompany the assemblage of molluscs *Melanopsis vindobonensis* FUCHS, *M. bouei affinis* HANDMANN, *Micromelania variabilis* LOERENTHEY, *Congeria unguilacprae* MÜNSTER, *Limnocardium conjungens* (PARTSCH) etc. Known salinity requirements of these molluscs (tab. 2) make it possible to state that this *Congeria* lived in a mio- to mesohaline environment (3—9‰).

Tab. 2 Salinity requirements of some molluscan species (after F. BARTHA 1971)

Species	Salinity ‰				
	0—0,5	0,5—3	3—5	5—9	9—16
<i>Melanopsis bouei affinis</i>					
<i>Melanopsis vindobonensis</i>					
<i>Micromelania variabilis</i>					
<i>Congeria croatica</i>					
<i>Congeria neumayri</i>					
<i>Congeria unguilacprae</i>					
<i>Limnocardium conjungens</i>					
<i>Psilunio atavus</i>					

Biometric evaluation

One of the methods to characterize molluscan shells is biometric study. In this case, we have studied the length-to-width ratio of the shell (Fig. 2). Biometric study techniques are described in articles by O. KUMPERA — F. PRANTL — B. RUŽIČKA (1960), K. FORDINÁL (in press) that I recommend to read.

Adult shells of the species *Congeria doderleini* BRUSINA have a wing-shaped protuberance and therefore shells with and without the protuberance have been inves-

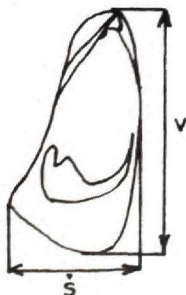


Fig. 2 Measured size parameters of the shell of *Congeria doderleini* BRUSINA

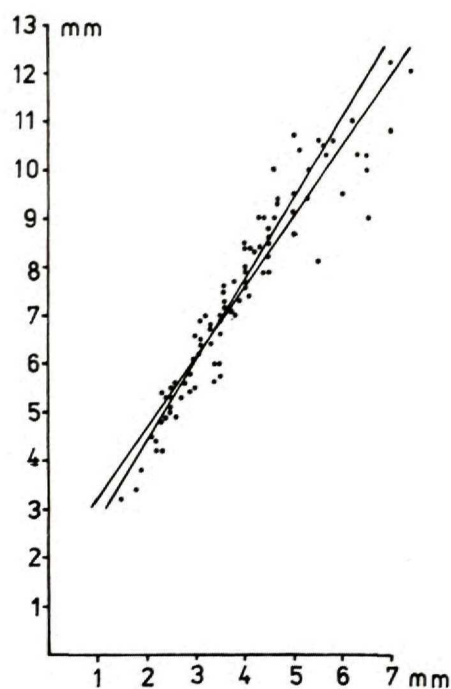


Fig. 3

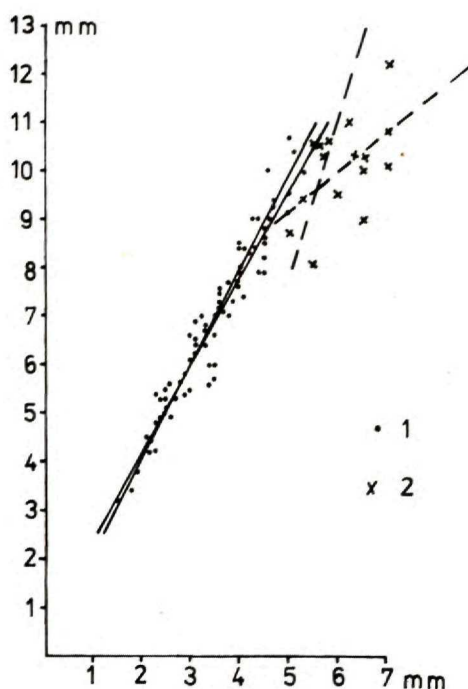


Fig. 4

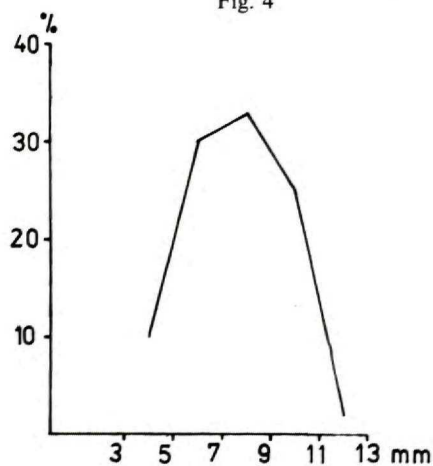


Fig. 5

Fig. 3 Diagram to illustrate parameters v and $\bar{s}$ with calculated regression curves of the whole shell set.

Fig. 4 Diagram illustrating parameters v and $\bar{s}$ along with calculated regression curves of shells with (— — —) and without (————) wing-shaped protuberance. 1 — shells without wing-shaped protuberance, 2 — shells with wing-shaped protuberance

Fig. 5 Percentages of the individual growth stages of shells of *Congeriodon doderleini* BRUSINA from the locality Pezinok.

tigated separately. To biometrically characterize development of the shells throughout their ontogenesis, the whole set has been biometrically evaluated, i.e. from juvenile to mature forms. The following results have thus been obtained:

1. Biometric characteristics of the whole shell set

$$\begin{array}{lll} A_d = 7.5 \text{ mm} & \tau_d = 1.95 & K_{ds} = 0.94 \\ A_s = 3.9 \text{ mm} & \tau_s = 1.26 & \end{array}$$

2. Biometric characteristics of the subset of shells with the wing-shaped protuberance

$$\begin{array}{lll} A_d = 10.1 \text{ mm} & \tau_d = 0.95 & K_{ds} = 0.53 \\ A_s = 6.1 \text{ mm} & \tau_s = 0.61 & \end{array}$$

3. Biometric characteristics of the subset of shells without the wing-shaped protuberance

$$\begin{array}{lll} A_d = 7.0 \text{ mm} & \tau_d = 1.68 & K_{ds} = 0.97 \\ A_s = 3.5 \text{ mm} & \tau_s = 0.88 & \end{array}$$

A — arithmetic mean τ — standard deviation
d — shell length K — correlation coefficient
s — shell width

The obtained biometric characteristics allow me to state that shells of the species *Congeria doderleini* BRUSINA generally display very good correlation between their length and width ($K_{ds} = 0.94$). As far as adult specimens are concerned, the correlation is low ($K_{ds} = 0.53$), which is caused by the existence of the wing-shaped protuberance. I assume that the protuberance served to protect siphons and therefore its size little depended upon the growth of the shell length.

Summary

Investigations of Pannonian molluscan fauna in the loam pit of the Pezinok brick plant have resulted in the discovery of connected shells of *Congeria doderleini* BRUSINA inside shells of the gastropods *Melanopsis impressa* KRAUSS.

Study of literature indicates that the former species occurs in Pannonian sediments of the Pannonian and Vienna Basins as well as in Pontian deposits of the Pannonian Basin.

It has been revealed that *Congeria doderleini* BRUSINA lived in apertures of shells of the genus *Melanopsis* in an environment whose salinity ranged from 3 to 9‰.

Biometry of the whole investigated shell set has indicated very good correlation between the length and width of the shell during its growth. As regards adult specimens, however, this correlation is low, which results from the existence of a wing-shaped protuberance probably serving to protect siphons.

Translated by L. Böhmer

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Explanations to Plates LXI—LXII

Pl. LXI

Congerid doderleini BRUSINA, Pezinok

Fig. 1—3 juvenile shells, magn. 5 ×

Fig. 4—6 magn. 3 ×

Pl. LXII

Congerid doderleini BRUSINA, Pezinok

Fig. 1—4, magn. 3 ×

MIROSLAV PLIČKA — ALENA NĚMCOVÁ

Solanichnium spinari n. ichnogen, n. sp. and Monomorphichnus lineatus Crimes et al. 1977, New Trace Fossils in the Carpathian Flysch Sediments in Czechoslovakia

4 text-figs., 2 pls. LXIII—LIV. Czech summary

Abstract. In the submitted paper the authors describe two new trace fossils discovered in the Carpathian flysch — *Solanichnium spinari* n. ichnogen. n. sp. (Cretaceous, Paleogene) and *Monomorphichnus lineatus* CRIMES et al. 1977 (T. P. CRIMES — I. LEGG — A. MARCOS — M. ARBOLEYA 1977). Both trace fossils are on the lower bedding plane of sandstones (positive hyporelief).

Introduction

In 1961—1965, two new trace fossils were found during rock jointing study in the Carpathian flysch on the Czechoslovak territory (M. PLIČKA 1962) and later during the study of trace fossils in the western part of the Carpathian flysch again on the territory of Czechoslovakia (A. NĚMCOVÁ 1973). One of the trace fossils is small, Cretaceous and Paleogene in age, and was not spotted by geologists and paleontologists for a long time — *Solanichnium spinari* n.ichnogen n.sp. The second trace — *Monomorphichnus lineatus* CRIMES et al. 1977 is larger but it was not found so far on our territory. It is of Cretaceous age and its origin is enigmatic because its shape is quite identical with that of a specimen discovered in Spain (Cambrium) where T. P. CRIMES et al. (1977) believe that the trace may have been created by the activity of trilobites. As this trace has been found in much younger sediments (Cretaceous) on our territory, other origin has to be looked for. As has been shown by new oceanographic researches, the trace seems to appear on the sea floor also nowadays (R. A. DAVIS — M. EWING 1967, p. 289, Fig. 24—88).

Systematical description

Ichnogenus *Solanichnium* n. ichnogen.

Type species: *Solanichnium spinari* n.sp.

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Dr. A. NĚMCOVÁ, Moravian Petroleum Mines, Úprkova 5, Hodonín

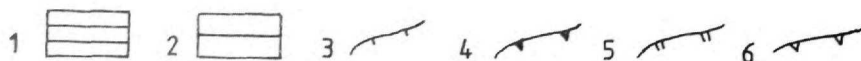
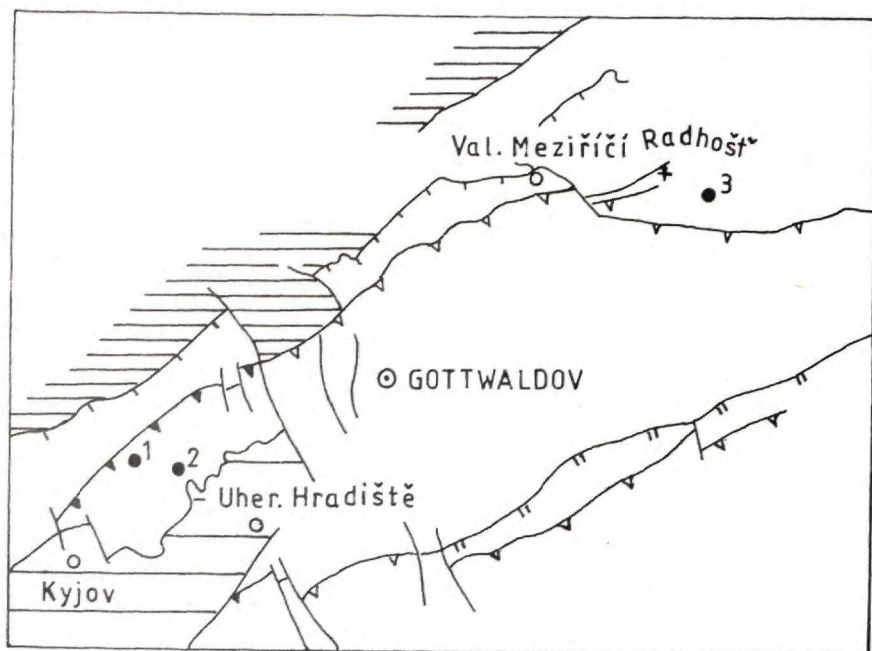


Fig. 1 Location of new trace fossil occurrences in the western part of the Carpathian flysch. (Geology according to Tectonic map of Czechoslovakia, scale 1:1 000 000, T. BUDAY et al. 1960). Explanations: 1 — Neogene of the Carpathian Foredeep, 2 — Neogene of the Vienna Basin, 3—6 thrust lines: 3 — Ždánice-Subsilesian unit, 5 — Bystrica unit, 6 — Bílé Karpaty unit, Localities: 1 — Staré Hutě, 2 — Jankovice, quarry pod Pustevnami.

Denomination: According to its occurrence in the Solán Formation of the Magura nappe, where this fossil was found for the first time.

Diagnosis: Circular protuberances on the lower bedding plane of sandstone, 3—5 mm in diameter, arranged in line or single.

Distribution: Outer Carpathian flysch, Cretaceous, Paleogene.

Solanichnium spinari n.ichnosp.

Pl. LXIII, Fig. 1,2, text. figs. 2,3

Holotype: Trace fossil illustrated in Pl. LXIII, Fig. 1, and text. fig. 1 on a bedding plane in the quarry at Staré Hutě.

Type locality: Abandoned quarry near the village Staré Hutě.

Denomination: In the honour of important Czechoslovak paleontologist Prof. Dr. Z. ŠPINAR, DrSc.

Material: Trace fossils on the lower bedding plane of sandstone of the Soláň beds from a quarry near Staré Hutě, two sandstone fragments of the Soláň beds from a quarry 1 km E of Jankovice and one sandstone fragment of the Godula beds from a quarry at a road bend pod Pustevnami (the specimen is deposited in the collections of the Moravian Museum in Brno, No. Ge 24745).

Diagnosis: Circular protuberances on the lower bedding plane of sandstone, with a slight depression in the centre, diameter 3—5 mm, 2—4 mm apart. They are arranged in line (its course sometimes changes at a right angle) or are single (Fig. 2,3).

Description: On the lower bedding plane of sandstones of the Soláň and Godula beds occur circular protuberances arranged mostly in line or single, about 1 mm high, with a slight depression in the middle (positive hyporelief). The distances between individual protuberances, if arranged in line, are approximately the same — smaller than their diameter.

Remarks: The newly described trace fossils partly resemble the problematic fossil of the genus *Taitia* CROAKALL 1931 (Upper Silurian in Scotland, W. HÄNTZSCHEL 1975, p.W 152, Fig. 91/5a, 5b), which differs from the trace fossil described by us in densely arranged, circular, considerably flat impressions up to 1 cm in diameter, with a marked marginal fringe about 1 mm wide near the margin. W. HÄNTZSCHEL (1975) assigns it to the group "Body Fossil".

Sediments: Yellowish-gray, noncalcareous, fine-grained sandstone, with irregular fine-tabular jointing, slightly micaceous (localities Staré Hutě and Jankovice) and green-gray, fine-grained, siliceous, noncalcareous sandstone, micaceous, with fine-tabular jointing (locality quarry at a road bend pod Pustevnami).

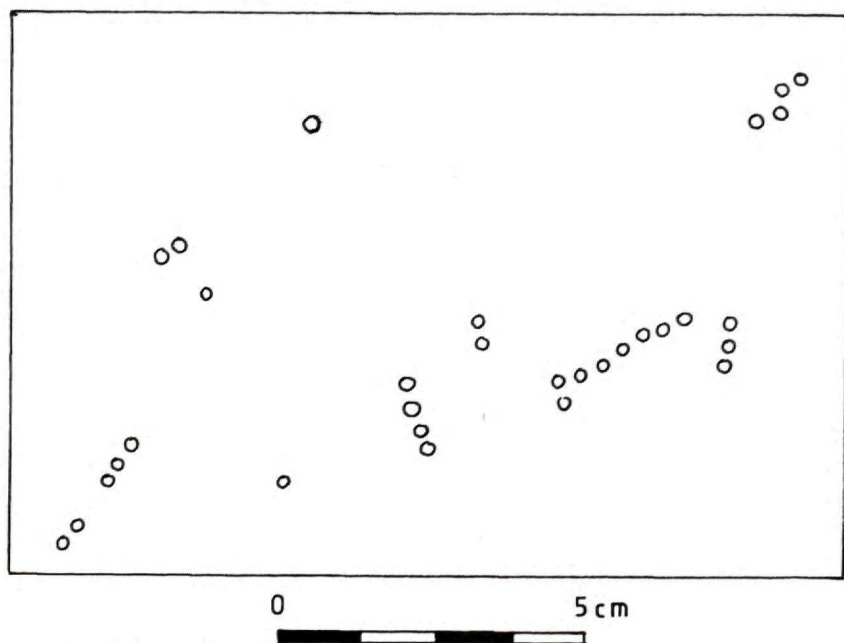


Fig. 2 *Solanichnium spinari* n. ichnogen. n. sp., holotype. Lower bedding plane of sandstone of the Soláň Formation in a quarry near the village Staré Hutě (Paleocene). Situation of trace fossils on the bedding plane.

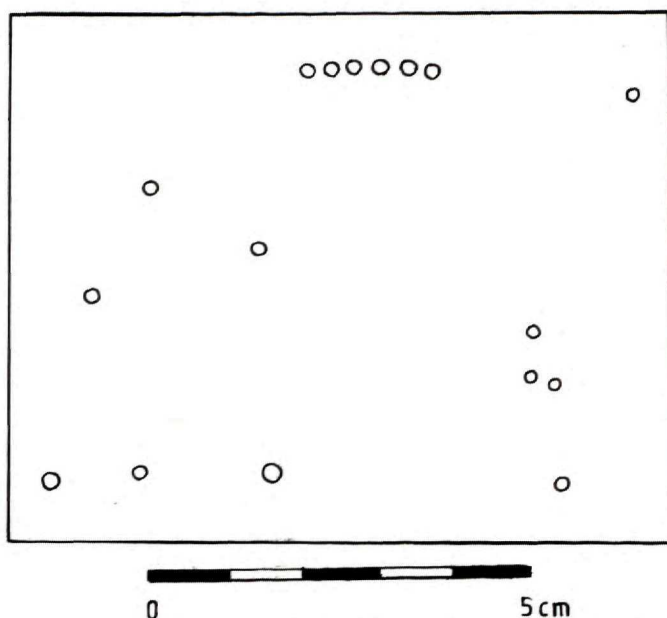


Fig. 3 *Solanichnium spinari* n. ichnogen. n. sp., lower bedding plane of sandstone of the Godula beds (Cretaceous) in a road bend pod Pustevnami. Situation of traces o the lower bedding plane of a sandstone fragment. Sample No. Ge 24745 is deposited in the collections of the Moravian Museum in Brno.

Association: In the quarries near Staré Hutě and E of Jankovice (Soláň Formation, Paelocene) — *Carpatia tubiformis*, *Megagraption irregulare*, *Planolites* sp. In the quarry pod Pustevnami (Godula beds, Cretaceous, A. NĚMCOVÁ 1973) — *Planolites* sp., *Taprhelminthopsis auricularis*, *Scolicia prisca*, *Godulaichnium tenue*, *Saportia* sp., *Gyrichnites* sp., *Zoophycos* sp., *Helminthopsis granulata*, *Paleodictyon miocenicum*.

Origin: Marine organism living near the seafloor surface into which it impressed itself, either, irregularly in single impressions or discontinuously in line.

Distribution: Soláň Formation of the Magura nappe (Paleocene), abandoned quarry near the village Staré Hutě and a quarry 1 km E of Jankovice, Godula beds (Cretaceous), quarry in a road bend pod Pustevnami.

Ichnogenus *Monomorphichnus* CRIMES 1970

Monomorphichnus lineatus CRIMES et al. 1977

Pl. LXIV, Fig. 1

Description: On the lower bedding plane of sandstone of the Godula beds of the Silesian nappe there are oblong, paralelly arranged protuberances, in one end narrowing into a point, the other end of the protuberances is rounded. The length of the protuberances varies from 7 to 17 mm, the width is 3—4 mm, and the protuberances are 1—3 mm apart. The sample Ge 24746 is deposited in the collections of the Moravian Museum in Brno.

Remarks: A trace fossil of this character has been found in Spain in the Cambrian (Pl. II, Fig. 2). T. P. CRIMES et al. (1977) believe that it could have originated by the activity of trilobites. Because the trace has been newly discovered in the Czechoslovak Carpathian flysch (Cretaceous), its origin has to be explained in some other way. The trace has recently been found by R. MIKULÁŠ (in press) in the Kosov Formation of the Bohemian Upper Ordovician in Barrandien. Its shape equals that of the specimen found in the Godula beds of Cretaceous age.

Traces of organisms have recently been photographically observed virtually all over the world during oceanographic researches of the ocean floor (R. A. DAVIS — M. EWING 1967). On the sea floor of the SW part of Africa a trace of a marine organism, which resembles in its shape the trace fossils in the Cambrian of Spain and Cretaceous of the Czechoslovak Carpathian flysch, has been found (R. A. DAVIS — M. EWING 1967, Fig. 24—88, p. 289). The recent trace photographically discovered on the floor of the Atlantic Ocean is similar to the sketch in Fig. 5a, 5b in the work of T. P. CRIMES et al. (1977) on the page 104.

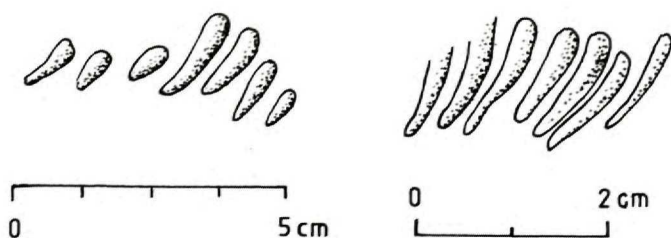


Fig. 4a *Monomorphichnus lineatus* CRIMES et al. 1977, lower bedding plane of a sandstone fragment of the Godula beds (Cretaceous), quarry in a road bend under Pustevňa. The sample is deposited in the collections of the Moravian Museum in Brno under inventory number Ge 24746.

Fig. 4b *Monomorphichnus lineatus* CRIMES et al. 1977, lower bedding plane of Herreria Sandstone (Cambrian), holotype. Locality: Barrios de Luna, Spain (T. P. CRIMES et al., 1977, Fig. Pl. 3b). Sketch.

Conclusions

In the Carpathian flysch on our territory we discover other new trace fossils often a long time after their findings as late as during laboratory processing of collected samples. This is the case e.g. with the new trace fossil *Solanichnium spinari* ichnogen. n. sp. n. In the case of the trace of the genus *Monomorphichnus* CRIMES 1970 it has turned out that oceanographic researches considerably contribute to the explanation of trace fossil origin. In our case the initiative came from scientists carrying out oceanographic researches. One of them, R. A. DAVIS, sent us the joint publication of 1967 which gives not only the latest knowledge on the character and shape of recent traces, but also on their originators. E. g. the trace fossil of the genus *Spirorhaphe* FUCHS, 1895 (Fig. 24—5 and 24—6, p. 264) is created by a meander-shaped marine organism, and its transition into a spiral is shown by the photography on p. 262 and 263 (Fig. 24—3 and Fig. 24—4) and therefore the mutual connection of these two scientific branches is necessary.

The explanation of the origin of trace fossils is facilitated by the discovery that they often occur within long time spans, as it is the case with the trace *Monomorphichnus lineatus* CRIMES et al. 1977, i. e. Upper Ordovician — Cretaceous.

Translated by L. Böhmer

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MIROSLAV PLIČKA — ALENA NĚMCOVÁ

Solanichnium spinari n. ichnogen. n. sp. a Monomorphichnus lineatus Crimes et al. 1977, nové fosilní stopy v sedimentech karpatského flyše v Československu

V roce 1961—1965 při studiu puklinatosti hornin v karpatském flyši na území Československa (M. PLIČKA 1962) a později při studiu fosilních stop v západní oblasti karpatského flyše na území naší republiky (A. NĚMCOVÁ 1973) byly zjištěny dvě nové fosilní stopy, z nichž jedna je malých rozměrů, je křídového a paleogénního stáří a unikala dosud pozornosti geologů a paleontologů — *Solanichnium spinari* n. ichnogen. n.sp. Druhá stopa — *Monomorphichnus lineatus* CRIMES et al. 1977 je sice větších rozměrů, nebyla však v karpatském flyši u nás dosud zjištěná. Je křídového stáří. Je záhadného původu, protože svým tvarem se zcela shoduje s nálezem ze Španělska (kambrium), kde se T. P. CRIMES et al. (1977) domnívají, že stopa snad vznikla činností trilobitů. Vzhledem k tomu, že tato stopa byla u nás zjištěná v mnohem mladších sedimentech (křída), je třeba uvažovat o jejím jiném původu. Jak ukázaly nové oceanografické výzkumy se zdá, že tato stopa se objevuje na mořském dně i v současné době (R. A. DAVIS — M. EWING 1967, p. 289, fig. 24—88).

Nová fosilní stopa *Solanichnium spinari* n. ichnogen. n.sp. tvoří drobné kruhovitě výčnělky na spodní vrstevní ploše pískovců uspořádané v řadě (někdy se ve svém průběhu lomí v pravém úhlu) nebo jsou ojedinělé (obr. 2, 3 v textu, tab. LXII, obr. 1, 2). Stopy mají kruhovitý tvar, jejich průměr je 3—5 mm, nejčastěji 2—4 mm a jsou vysoké asi 1 mm, uprostřed mají nepatrnou prohlubeň.

Tyto fosilní stopy byly zjištěny jako pozitivní hyporelief na spodní vrstevní ploše pískovců solánského souvrství v západní oblasti magurského flyše (paleocén) v opuštěném lomu u Starých Hutí a v lomu 1 km v. od Jankovic a pískovců godulských slezského příkrovu (křída) v lomu v ohybu silnice pod Pustevnami.

U výskytů v pískovcích solánského souvrství byly zjištěny v asociaci tyto fosilní stopy: *Carpatia tubiformis*, *Megagraptus irregularis*, *Planolites* sp. U nálezů v lomu pod Pustevnami byly zjištěny stopy: *Planolites* sp., *Taprhelminthopsis auricularis*, *Scolicia prisca*, *Godulaichnium tenue*, *Zoophycos* sp., *Helminthopsis granulata* a *Paleodictyon miocenicum*.

Tyto drobné stopy vznikly činností mořských organismů, žijících při povrchu mořského dna.

Fosilní stopa *Monomorphichnus lineatus* CRIMES et al. tvoří na spodní vrstevní ploše pískovců godulských vrstev protáhlé, paralelně uspořádané výčnělky, jedním směrem se zužující do špičky, druhý konec výčnělků je zaoblený. Délka výčnělků se pohybuje od 7 mm do 17 mm, šířka je

3—4 mm, vzájemně rozestupy jsou 1—3 mm (obr. 4a, 4b v textu, tab. II. obr. 1). Vzorek č. Ge 24746 je uložen ve sbírkách Moravského muzea v Brně.

Fosilní stopa této povahy byla zjištěna ve Španělsku v kambriu (Pl. LIV, fig. 2). T. P. CRIMES et al. (1977) se domnívají, že mohla vzniknout činností trilobitů. Vzhledem však k tomu, že byla tato stopa nově zjištěna u nás v karpatském flyši (křída), je třeba uvažovat i o jiné možnosti jejího původu. V poslední době při oceanografických výzkumech dna oceánů od hloubky 30 m až do hloubky 5950 metrů byly fotograficky sledované stopy po organizmech prakticky po celé zeměkouli (R. A. DAVIS — M. EWING 1967). Při jz. části Afriky, na 27° 15' jižní zeměpisné šířky a 6° 12' východní zeměpisné délky byla v hloubce 4865 m zjištěna stopa po mořském organismu podobného vzhledu, jako jsou nálezy fosilních stop z kambria ve Španělsku a z křídý v karpatském flyši u nás v Československu (R. A. DAVIS — M. EWING 1967, fig. 24—88 na str. 289). Recentní stopa, fotograficky zjištěná na dně Atlantického oceánu, se blíží nákrese na obr. 5a, 5b v práci T. P. CRIMES et al. (1977) na str. 104.

Pro objasnění původu fosilních stop velmi přispívá zjištění jejich existence často ve velkých časových úsecích, jak je tomu v případě stopy *Monomorphichnus lineatus* CRIMES et al. 1977, t. j. svrchní ordovik — křída.

Explanations to Plates LXIII—LIV (Photo M. Plička)

Pl. LXII

1 *Solanichnium spinari* n. ichnogen. n. sp., holotype, lower bedding plane of sandstone of the Solán Formation of the Magura nappe (positive hyporelief) in a quarry near the village Staré Hutě (Paleocene), $\times 0,5$.

2 *Solanichnium spinari* n. ichnogen. n. sp., lower bedding plane of sandstone of the Godula beds (positive hyporelief) in a quarry in a road bend pod Pustevnami (Cretaceous), Silesian nappe. Sample No. Ge 24745, Moravian Museum in Brno, $\times 1$.

Pl. LXIV

1 *Monomorphichnus lineatus* CRIMES et al. 1977, lower bedding plane of a sandstone fragment of the Godula beds of the Silesian nappe (Cretaceous). Quarry in a road bend pod Pustevnami. Sample No. Ge 24746 is deposited in the collections of the Moravian Museum in Brno.

2 *Monomorphichnus lineatus* CRIMES et al. 1977, lower bedding plane of a sandstone fragment (Herreria Sandstone, Cambrium), holotype. Locality Barrios de Luna, Spain (T. P. CRIMES et al. 1977, Fig. Pl. 3b).

ZÁPADNÉ KARPATY

Séria

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