Jb. Geol. B.-A.	ISSN 0016-7800	Band **134**	Heft 2	S. 271–297	Wien, Oktober 1991

New Middle Carnian and Rhaetian Conodonts from Hungary and the Alps. Stratigraphic Importance and Tectonic Implications for the Buda Mountains and Adjacent Areas

By HEINZ KOZUR & RUDOLF MOCK*)

With 1 Text-Figure, 2 Tables and 7 Plates

Hungary
Alps
Buda Mountains
Conodonts
Stratigraphy

Contents

Neue mittelkarnische und rhätische Conodonten aus Ungarn und den Alpen. Stratigraphische Bedeutung und tektonische Konsequenzen für die Budaer Berge und angrenzende Gebiete.

Zusammenfassung

Zum ersten Mal wurden mittelkarnische Conodonten in den nordwestlichen Budaer Bergen und in Pilisvörösvár, beide Lokalitäten NW der Buda-Linie, gefunden. Aus diesen Schichten wird *Nicoraella ? budaensis* n. sp. beschrieben, die einzige darin vorkommende Conodontenart. Ein neuer Einzahnconodont, *Zieglericonus rhaeticus* n. gen. n. sp., und die neuen Arten *Misikella ultima* n. sp., *Neohindeodella detrei* n. sp., *N. rhaetica* n.sp. und *Parvigondolella rhaetica* n. sp. werden aus rhätischen Gesteinen beschrieben.

Der stratigraphische Wert rhätischer Conodonten speziell aus Ungarn und aus den Alpen wird diskutiert. Innerhalb des postsevatischen Rhät-Abschnittes können 3 Conodontenzonen unterschieden werden. Die älteste dieser Zonen kann noch weiter in 2 Subzonen unterteilt werden.

Die völlig neue stratigraphische Unterteilung der Trias in den Budaer Bergen (Ungarn) und die Deckenstrukturen dieses Gebietes werden diskutiert. Zum ersten Mal wurden rhätische Ablagerungen (Mátyáshegy-Kalk) in den Budaer Bergen nachgewiesen. Der Mátyáshegy-Kalk, der bisher ins Unterkarn gestellt wurde, ist das Zeit- und Fazies-Äquivalent der Csővár-Kalk-Formation s.str.; er gehört größtenteils in Rhät. Er kommt nur in der nun neu eingeführten Csővár-Decke vor, die ebenso wie die Buda-Decke s.str. zum Dinarischen Deckensystem gehört. Diese beiden Decken SE der Buda-Linie (sensu BÁLDI & NAGYMAROSI, 1976) zeigen eine ganz andere spät-triadische Entwicklung als die Nagykovácsi-Decke (wird hier ebenfalls neu eingeführt)

*) Authors' addresses: Dr. sc. HEINZ KOZUR, Részü u. 83, H-1029 Budapest; RNDr. RUDOLF MOCK, Department of Geology and Paleontology, J.A. Comenius University, Mlynská dolina, ČSFR-84215 Bratislava.

NW der Buda-Linie, die höchstwahrscheinlich zum Adriatischen Deckensystem gehört. Die Ansicht von BÁLDI & NAGYMAROSI (1976) und BÁLDI (1986), daß die Buda-Linie ein tektonisches Element erster Ordnung mit ausgedehnten Horizontalbewegungen im späten Miozän ist, kann durch unsere Untersuchungen bestätigt werden. Neuere paläogeographische und tektonische Rekonstruktionen, welche die Existenz dieses wichtigen tektonischen Elementes widerlegen, können nicht bestätigt werden.

Abstract

For the first time Middle Carnian conodonts were found in the northwestern Buda Mts and in Pilisvörösvár, both NW of the Buda Line. *Nicoraella ? budaensis* n. sp. is described from these beds in which it represents the only conodont species. A new single cone conodont, *Zieglericonus rhaeticus* n. gen. n. sp., and the new species *Misikella ultima* n. sp., *Neohindeodella detrei* n. sp., *N. rhaetica* n.sp., and *Parvigondolella rhaetica* n. sp. are described from Rhaetian rocks.

The stratigraphic value of the Rhaetian conodonts especially of Hungary and the Alps is discussed. 3 conodont zones can be discriminated within the post-Sevatian Rhaetian stage. The oldest of these zones can be still subdivided into 2 subzones.

The quite new stratigraphic subdivision of the Triassic in the Buda Mountains (Hungary) and the nappe structures of this area are briefly discussed. For the first time Rhaetian beds (Mátyáshegy Limestone) were found in the Buda Mts. The Mátyáshegy Limestone, placed until now into the Lower Carnian, is the time- and facial equivalent of the Csővár Limestone Formation s.str. and it belongs to its largest part to the Rhaetian. It is only present in the Csővár Nappe (newly introduced here) that belongs, like the Buda Nappe s.str. to the Dinaric nappe system. These two nappes SE of the Buda Line (sensu BÁLDI & NAGYMAROSI, 1976) have a quite different Late Triassic development than the Nagykovácsi Nappe (newly introduced here) NW of the Buda Line that belongs most probably to the Adriatic nappe system. The view of BÁLDI & NAGYMAROSI (1976) and BÁLDI (1986) that the Buda Line is a first order tectonic element with large-scale horizontal movements in the Late Miocene can be confirmed by our investigations. New paleogeographic and tectonic reconstructions that reject the existence of this important tectonic element cannot be confirmed.

1. Introduction

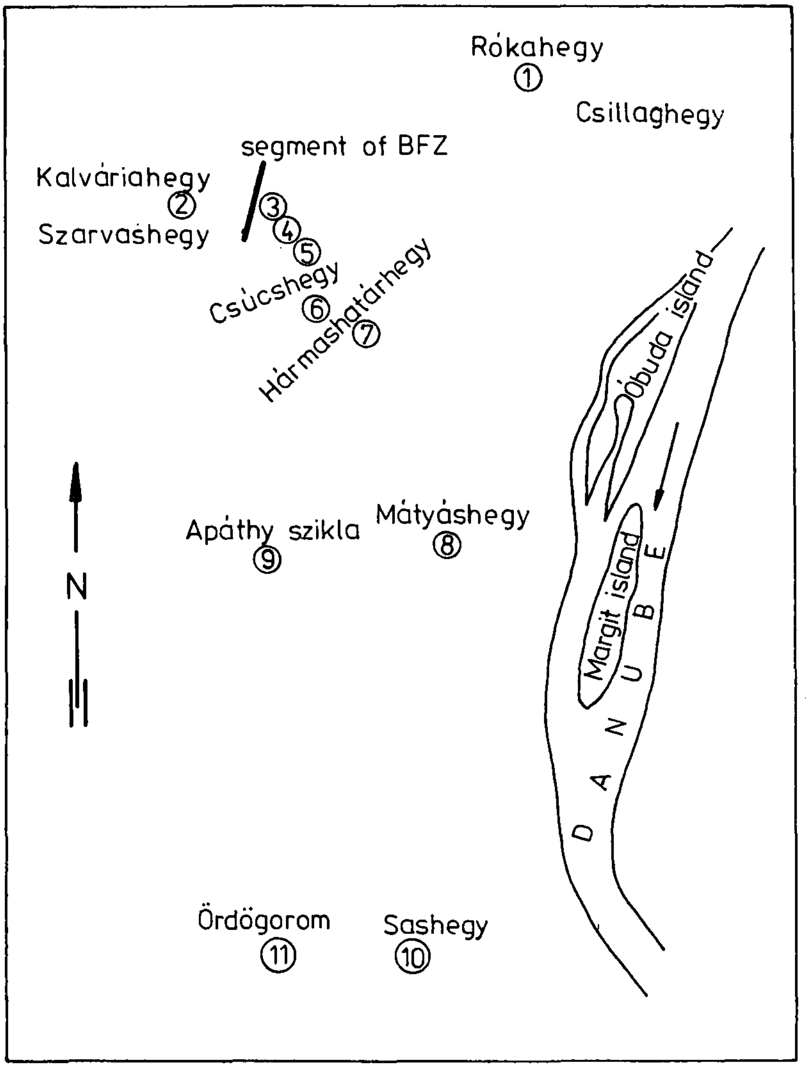
KOZUR & MOSTLER (1973) found for the first time conodonts and holothurian sclerites in the Csővár Limestone Formation near Csőövár. They placed these beds, before regarded as Lower Carnian, into the topmost Triassic. These data were now also confirmed by the discovery of *Choristoceras*, an exclusively Rhaetian ammonoid genus, found by DETRE, DOSZTÁLY & HERMAN (1986). More detailed investigations of the conodont distribution inside the Csővár Limestone Formation s.str. in its type locality have shown that it contains all 3 Rhaetian conodont zones discriminated in this paper on the base of conodont ranges in the Alpine Triassic of Europe.

No conodonts were published so far from the Buda Mts and from Pilisvörösvár (between Buda Mts and Pilis Mts). The first evidence of Rhaetian conodonts in the Mátyáshegy Limestone, regarded by all Hungarian geologists since more than 100 years as Lower Carnian or even Late Ladinian, as well as further new biostratigraphic data, resulted in a quite new stratigraphic subdivision of the Triassic in the Buda Mts. This new subdivision in at least 3 different Late Triassic developments in the Buda Mts. (instead of the hitherto assumed one hypothetical sequence for the whole Buda Mts.) has considerable tectonic importance. At least 3 nappes could be recognized in the Buda Mts. Moreover, the Buda Line sensu BÁLDI & NAGYMAROSI (1976), that indicate large-scale Late Miocene lateral movements, separates the Buda Mts. into a South Alpine/Dinaric southeastern part from the quite differently developed northwestern part that belongs to the Adriatic nappe system sensu FLÜGEL, FAUPL & MAURITSCH (1986).

The Triassic facial developments in Hungary, among it the Triassic sequences of the Buda Mountains and of the Csővár area (on the left side of Danube river) are often regarded as decisive for paleogeographic reconstructions in the Alpine, Carpathian and Dinaric areas (e.g. KOVÁCS, 1982). Triassic rocks are originally wider distributed or (and) facially more differentiated than older and younger rocks in most part of the Alpine Neoeurope. Therefore they are very useful for reconstructions of the pre-rift paleogeography. However, if the ages of the compared facial developments are not correctly determined, this method leads to considerable mistakes.

The most important unit for paleogeographic considerations of the Buda Mountains, the so-called Mátyáshegy „Formation" (HAAS & KOVÁCS, 1985) was, e.g., not dated by its fossil content, but placed into the Lower/Middle Carnian according to its assumed paleogeographic connection and correlation with the Lower/Middle Carnian Veszprém Marl Formation of the Balaton Highland. Especially the Lower/Middle Carnian cherty dolomites and cherty limestones of the borehole Zsámbék were used as "evidence" that the Mátyáshegy "Formation" cannot be Rhaetian in age (as shown by KOZUR, 1987 on the base of conodonts, holothurian sclerites and radiolarians), but must be placed into the Lower to Middle Carnian. This assumed, but not fossil-proven Lower to Middle Carnian age of the Mátyáshegy "Formation" was than used as evidence for the direct paleogeographic connection between the Triassic of the Balaton Highland and the Triassic of the whole Buda Mts (also SE of the Buda Line) within one tectonic unit. However, the Zsámbék borehole lies far NW of the Buda Line in a quite different tectonic unit than the Mátyáshegy Limestones SE of the Buda Line. Such really Middle Carnian cherty dolomites and marly limestones are known from the Buda Mts, but only NW of the Buda Line (Pesthidegkút, Kálváriahegy), where the marly limestones yielded rich conodont faunas with *Nicoraella ? budaensis* described in the present paper.

Our paleontological investigations have shown that the Late Triassic stratigraphy of the Buda Mts. has to be totally revised. The only age determinations that could be confirmed, are the ages of the megalodontid-bearing rocks (VÉGH-NEUBRANDT, 1974, 1982).



Text-Fig. 1.
Sampling sites in the Buda Mountains.
1 = Norian Dachstein Limestone; 2 = Middle Carnian massive cherty shallow water lagoonal dolomite and marly thin-bedded limestones; 3 = pelagic cherty dolomite (secondarily dolomitized cherty limestone with pelagic fauna), from the NE slope of Csúcshegy, topmost Sevatian and Rhaetian; 4,5,6,7 = laminated, cherty dolomite with pelagic fauna, including *Monotis* and brachiopods), Norian, slope and top of the Hármashatárhegy; 8 = Norian cherty pelagic dolomite (secondarily dolomitized cherty limestone with pelagic fauna) and Rhaetian Mátyáshegy Limestone from the Mátyáshegy quarry and Mátyáshegy cave; 9 = ammonoid- and gastropod-bearing dolomites, topmost Carnian to basal Norian; 10,11 = pelagic cherty dolomite (secondarily dolomitized cherty limestone with pelagic fauna).
BFZ = segment of the Buda Fault Zone.
The Buda Line is separated by small-scale post-Miocene horizontal movements (nearly perpendicular to this fault) into several segments. By this a fault zone of 1–2 km width evolved. Locality 2 lies NW of the Buda Line (Buda Fault Zone), localities 3–11 are situated SE of it. Locality 1 lies near to the Buda Line and it is either a tectonic slice, transported along the Buda Line or (more probably) a tectonic window below the Csővár Nappe immediately SE of the Buda Line.

2. Taxonomic Part

Genus *Misikella* Kozur & Mock, 1974

Type species: *Spathognathodus hernsteini* Mostler, 1967.

Misikella ultima n.sp.
(Pl. 5, Fig. 2; Pl. 6, Figs. 2,4–6)

1978 *Misikella posthernsteini* Kozur & Mock, pars – Mostler, Scheuring & Ulrichs, Pl. 1, Figs. 20,21, non! Fig. 22.

Derivatio nominis: ultimus (lat.). Last representative of the genus Misikella.

Holotype: The specimen on Pl. 6, Fig. 5; rep.-no. KoMock 1988/I-1.

Locus typicus: Old large quarry in the Kecskés valley S of the Várhegy near Cs'ővár (S of Cserhát Mts).

Stratum typicum: Sample 1C, higher Late Rhaetian above the occurrence of *Choristoceras*.

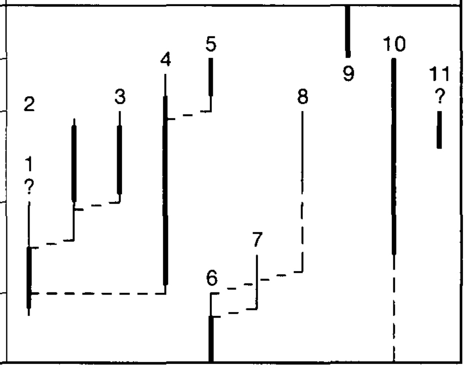
Material: 32 specimens.

Diagnosis: The main (anterior) blade consists of 3, rarely 4 large denticles. Sometimes still further 1–2 small denticles are present in the anterior part of the blade. All denticles are laterally compressed. The anterior denticles are erect or only slightly inclined. The inclination of the denticles increases toward the posterior end. At the posterior end of the main blade a very deep V-shaped incision is present. After the last denticle of the main blade and above the V-shaped incision 1–3 smaller denticles follow which built up a secondary short posterior blade, considerably lower than the main blade. The denticles of this secondary posterior blade are strongly inclined, the last one lies sometimes almost horizontally.
Basal cavity strongly expanded and deeply excavated. It is present below the whole main blade, but not below the posterior bar. Cup large.

Occurrence: Higher part of the Rhaetian. Kössen Beds, Zlambach Beds, Csővár Limestone Formation. Alps, Csővár (Hungary).

Remarks: This species is distinguished from *Misikella posthernsteini* Kozur & Mock, 1974 by the presence of a secondary posterior bar. In this feature it is distinguished from *M. posthernsteini* in the same manner as *M. rhaetica* Mostler, 1978 from *M. hernsteini* (Mostler, 1967). Seemingly the development of a secondary posterior bar occurs independently in 2 different lines within the genus *Misikella* Kozur & Mock.
Misikella rhaetica Mostler, 1978 is distinguished by the absence of the V-shaped incision at the posterior end of the blade.

Table 1.
Stratigraphic ranges of the topmost Sevatian and Rhaetian *Misikella*- and *Parvigondolella* species and of all newly described species.

Stage	Substage	Ammonoid Zone	Conodont Zone		Species Ranges
Rhaetian		?	*Neohindeododella detrei* Zone		
		Choristoceras marshi	*Misikella ultima* Zone		
		Choristoceras marshi	*Misikella posthernsteini* Assemblage Zone	*Misikella koessenensis* Subzone	
		Vandaites stuerzenbaumi			
		„*Choristoceras*" *haueri*		*Miskella hernsteini* – *Misikella posthernsteini* Subzone	
disputed		*Cochloceras suessi*			
Norian	Sevatian		*Misikella hernsteini* – *Parvigondolella andrusovi* Assemblage Zone		

1 = *Misikella hernsteini* (MOSTLER); 2 = *Misikella rhaetica* MOSTLER; 3 = *Misikella koessenensis* MOSTLER; 4 = *Misikella posthernsteini* KOZUR & MOCK; 5 = *Misikella ultima* n.sp.; 6 = *Parvigondolella andrusovi* KOZUR & MOCK; 7 = *Parvigondolella* ? *lata* KOZUR & MOCK; 8 = *Parvigondolella rhaetica* n.sp.; 9 = *Neohindeodella detrei* n.sp.; 10 = *Neohindeodella rhaetica* n.sp.; 11 = *Zieglericonus rhaeticus* n.gen n.sp.

Genus *Neohindeodella* KOZUR, 1968

Type species: *Hindeodella triassica* MÜLLER, 1956.

Neohindeodella detrei n.sp.
(Pl. 6, Fig. 1)

Derivatio nominis: In honour of Dr. CS. DETRE, Budapest, for his outstanding contributions to the knowledge of the Triassic in the Csővár area.

Holotype: The specimen on Pl. 6, Fig. 1; rep.-no. KoMock 1988/I-2.

Locus typicus: As for *Misikella ultima* n.sp.

Stratum typicum: Sample 1F, marly-silty limestones with terrigenous detritus content and few plant detritus. Top-most Rhaetian or basal Liassic. Considerably above the last occurrence of *Choristoceras*.

Material: 26 specimens.

Diagnosis: Blade very long, extremely thin. Anterior bar short, only with 2, but long denticles. Main cusp distinct. Posterior bar very long, with more than 30 denticles of irregular size. They are needle-shaped and very densily arranged. In the posterior part the denticles are broader and more widely spaced.
Lower side slightly curved, inverted.

Occurrence: Topmost Rhaetian or basalmost Liassic well above the last occurrence of *Choristoceras*. Until now only from the type locality.

Remarks: Neohindeodella dropla (SPASOV & GANEV, 1960) has a longer anterior bar and no distinct main cusp. The whole blade is higher.
Neohindeodella detrei n.sp. is so far the youngest known conodont species, still younger than *Misikella ultima* n.sp. and *M. posthernsteini* KOZUR & MOCK which was until now assumed to be the youngest conodont species at all.

Neohindeodella rhaetica n.sp.
(Pl. 5, Figs. 1,7,8)

Derivatio nominis: According the rich occurrence in Rhaetian beds.

Holotype: The specimens on Pl. 5, Fig. 1; rep.-no. KoMock 1988/I-3.

Locus typicus: Old large quarry in the Kecskés valley S of the Várhegy near Csővár.

Stratum typicum: Sample 1X, light-gray cherty limestone without graded bedding about 3 m below the highest occurrence of Choristoceras. Higher part of *M. koessenensis* sub-zone, middle part of Late Rhaetian.

Material: More than 50 specimens.

Diagnosis: Blade moderately high, very thin. Anterior bar short, with 5–6 denticles. The first denticle is small to moderately long, the following 1–3 denticles are long, then 3–4 small denticles follow. Main cusp distinct, but not larger than the largest denticles on the anterior bar. It is followed on the posterior bar by 4–6 small to moderately long denticles. The following 1–3 denticles are very long and after these big denticles still 1–4 small to moderately long denticles are present.
The first 1–3 denticles are in their lower part slightly anteriorly inclined, but in their upper part backward curved. All other denticles are inclined toward the posterior end. The last denticle is often situated in prolongation of the blade.
Lower surface inverted, sharp-edged, under the anterior blade a little prolongated to form a triangle, under the posterior blade quite straight.

Occurrence: Csővár Limestone Formation of Csővár and Budapest (Mátyáshegy Limestone). Zlambach Marls of the Alps.

Remarks: *Neohindeodella summesbergeri praecursor* KOZUR & MOSTLER, 1970 has a higher anterior bar and the denticles in the posterior part of the unit are smaller.
In *Neohindedella triassica* (MÜLLER, 1956) the main cusp is larger than the largest denticles in the posterior third of the unit. The anterior bar has fewer denticles.
In the Tuvalian and Norian transitional forms between *N. triassica* and *N. rhaetica* are present, in which the main cusp is about so large as the largest denticle in the posterior third of the unit. These transitional forms belong rather to a new species than to the typical *N. triassica* from the Scythian and Anisian.

Genus *Nicoraella* KOZUR, 1980

Type species: *Ozarkodina kockeli* TATGE, 1956.

Nicoraella ? budaensis n.sp.

(Pl. 1, Figs. 1–5; Pl. 2, Figs. 1–6,8,9; Pl. 3, Figs. 1–11; Pl. 4, Figs. 1,3–8)

Derivatio nominis: According to its rich occurrence in the Middle Carnian of northernmost Buda Mts. (Pesthidegkút Kálváriahegy).

Holotype: A conodont cluster, Pl. 1, Fig. 3; rep.-no. KoMock 1987/I-4786.

Locus typicus: Saddle between Kálváriahegy and Szarvashegy N of Pesthidegkút (Buda Mts, NW of Buda Line).

Stratum typicum: Sample KS2, bituminous limestone, Middle Carnian.

Material: More than 100 specimens.

Diagnosis: Spathognathodiform element very small. Blade equal to subequal high in the whole unit or in the anteriormost part a little lower than in the remaining unit. Main cusp terminal, considerably broader and distinctly larger than the other denticles which are either uniform in length (with exception of the first, smaller denticle) or they become a little larger toward the posterior end. All denticles are laterally compressed, subtriangular and moderately high, sometimes more slender and longer. Attachment area of lower surface broad and it overreaches a little the posterior end of the blade. The excavation of the lower surface is rather shallow. The broad basal furrow begins behind the anterior end and it ends in a not very distinct basal cavity behind the midlength of the unit. After this pit a short, shallow furrow continues, mostly somewhat separated, like a second elongated pit.

The modified ozarkodiniform element is very similar to the spathognathodiform element, but the nearly needle-shaped denticles are longer and the attachment area is not so broad. The basal cavity lies in subterminal position and it is distinct.

The modified hindeodelliform (metaprioniodiform) element has a rather high anterior bar with 1–2 large denticles behind its middle part. The main cusp is distinct, but often not larger than the highest denticle on the anterior bar. The posterior bar is long, lower than the anterior bar. Its denticles are low behind the main cusp, but high in the posterior half or third of the posterior bar. The lower surface has a distinct basal furrow with basal cavity below the main cusp. The posteriormost part of the lower surface is sharp-edged without basal furrow.

The modified prioniodiniform (cypridodelliform) element has a very long anterior bar. It is straight, only in the posteriormost part curved and it bears needle-like denticles which become increasingly larger in the posterior part of the bar. Only just before the main cusp 1–2 smaller denticles are present. Main cusp prominent, inward curved. Posterior bar almost perpendicular to the anterior bar, very short, often missing. If present, it bears 1–3 denticles. After the main cusp a large denticle follows that is often so large as the main cusp. The remaining 1–2 denticles are small. Lower surface with distinct basal furrow below the anterior bar and indistinct basal cavity below the main cusp. The lower surface below the posterior bar is sharp-edged.

Enantiognathiform element with high and often fully preserved main bar which lies obliquely to the direction of the main cusp (about 45°). Denticulation variable, but like in all enantiognathiform elements in the middle part of the main bar the smallest denticles are present. The denticles in the anterior third of the main bar are very large and broad, often larger than the main cusp. 1–3 denticles behind the main cusp are also very large, partly nearly as long as the main cusp. The side bar is curved, low, delicate and therefore mostly incompletely preserved. It bears only small denticles.

Hibbardelliform element quite similar to the hindeodelliform one, but the anterior bar is dibranchiated into 2 symmetrical side-branches in some distance before the main cusp. The side-branches have 3–4 denticles which become in general somewhat larger toward the ends, but sometimes they become als somewhat smaller toward the ends. Denticle above the branching point always very large, so long as the prominent main cusp or only a little shorter. Between these 2 large denticles, there are 2–5 smaller denticles which are nevertheless in general more than half so long than the denticle above the branching point, but more needle-like. Posterior bar behind the main cusp as in the hindeodelliform element, but first denticle often large. Basal furrow rather narrow, lower surface of side-branches in general sharp-edged. Basal cavity below the main cusp indistinct.

Occurrences: Middle Carnian of Pesthidegkút Kálváriahegy (northern Buda Mts. NW of the Buda Line) and Pilisvörösvár (Pilis Mts). Paparino near Palermo (Sicily). In restricted basin facies the only conodont species, but here often in mass occurrences. Present also in pelagic sediments (Paparino), there together with *Gladigondolella.*

Remarks: *Nicoraella ? budaensis* n.sp. has considerably smaller spathognathodiform elements than typical representatives from the Anisian to Lower Carnian. Specimens with terminal main cusp and missing posterior bar begins already in the Pelsonian and some representatives on *N. ? budaensis* n.sp. have still a quite rudimentary posterior bar with one denticle. But the apparatus is identical. The modified ozarkodiniform element belongs to the form-group of *Cornudina ? latidentata* KOZUR & MOSTLER, 1970, only known from the apparatus of *Nicoraella*. Characteristical for *Nicoraella* is also the enantiognathiform element, in which the main cusp lies obliquely to the throughout high, short main bar. Also all other ramiform elements are similar to the ramiform elements of *Nicoraella*, but these elements are similar in all gondolellid/metapolygnathid conodonts. Unlike to all other apparatuses, the hindeodelliform element has a rather high and relatively short posterior bar.

The very small spathognathodiform element is homoeomorph to the spathognathodiform elements of *Celsigondolella* KOZUR, 1968 and of highly evolved Rhaetian *Parvigondolella* KOZUR & MOCK, 1972 without posterior bar. The spathognathodiform element of *Celsigondolella* is distinguished by its terminal basal cavity. Moreover, there are differences in the apparatus. All ramiform elements of *Celsigondolella*, with exception of the cypridodelliform one, have considerably lower bars than in *Nicoraella* ? *budaensis* n.sp. Moreover, the modified ozarkodiniform (pollognathiform) element in *Celsigondolella* has widely spaced denticles and the denticulation of the hindeodelliform element is quite different. In *Parvigondolella* even the Late Rhaetian forms have in general still a rudimentary posterior bar (with at least one denticle). Only *Parvigondolella* ? *lata* KOZUR & MOCK 1974, has no posterior bar, but the position of this species in *Parvigondolella* is somewhat doubtful. No distinct terminal main cusp can be observed in this species. The apparatus of *Parvigondolella* shows clear differences. The modified hindeodelliform element, *Metaprioniodus andrusovi* (KOZUR & MOSTLER) has a low posterior bar with subequal denticles. The enantiognathiform element has a low main bar, situated about in the same direction as the main cusp, no ozarkodiniform element of the *Cornudina* ? *latdentata* form-group is known.

Genus *Parvigondolella* KOZUR & MOCK, 1972

Type species: *Parvigondolella andrusovi* KOZUR & MOCK, 1972.

Parvigondolella rhaetica n.sp.

(Pl. 5, Fig. 9)

Derivatio nominis: According to its occurrence in the Rhaetian.

Holotype: The specimen on Pl. 5, Fig. 9; rep.-no. KoMock 1988/I-4.

Locus typicus and stratum typicum: As for *Neohindeodella* rhaetica n.sp.

Material: 5 specimens.

Diagnosis: The short anterior and the very short posterior blade are nearly of the same height. Only the anteriormost part of the blade is lower than the remaining unit. Anterior blade with 3–4 large, separated denticles and sometimes with an additional very small denticle. All denticles are laterally compressed. First denticle nearly erect, all other denticles uniformly and moderately inclined.

Lower surface in typical representatives quite straight, in one specimen slightly concave. Basal furrow narrow, deep. Basal cavity indistinct, not expanded.

Only the cypridodelliform element is known from the ramiform elements of the apparatus. It belongs to the highly variable form-group of *Prioniodina (Cypridodella) muelleri* TATGE.

Occurrence: Middle part of Late Rhaetian from the type locality. Upper part of *M. koessenensis* subzone (above the last occurrence of *M. rhaetica* MOSTLER). Rhaetian (and topmost Norian?) of western Sicily.

Remarks: In *Parvigondolella andrusovi* KOZUR & MOCK, 1972 the height of the blade considerably decreases toward the posterior end of the unit.

Parvigondolella ? *lata* KOZUR & MOCK, 1974 has no posterior blade and the main cusp is indistinct.

Parvigondolella* ? *vrielyncki n.sp.

1980 *Epigondolella bidentata* MOSHER, pars – KRYSTYN, Pl. 14, only Fig. 4, non! Figs. 1–3,5,6.

1981 *Parvigondolella andrusovi* KOZUR & MOCK – VRIELYNCK, p. 217–218, Pl. 7, Figs. 19,20.

Derivatio nominis: In honour of Dr. B. VRIELYNCK, Paris, who assigned this species for the first time to *Parvigondolella*.

Holotype: The specimen, figured by KRYSTYN (1980, Pl. 14, Fig. 4) as *"Epigondolella bidentata"*.

Locus typicus: Western Timor, Bihati near Baun, block F.

Stratum typicum: Sample no. F 18, according to KRYSTYN (1980) Alaunian 2/IV (= upper *Halorites macer* Zone, here regarded as Lower Sevatian).

Diagnosis: Large for the genus, with 10–13 denticles in adult specimens. With exception of the small anteriormost 1–2 denticles and an often present small denticle at the posterior end, all denticles have about the same length and they are rather high. The blade is highest in the anterior half, but its height decreases only a little toward the posterior end. Therefore also the posterior half of the blade is high.

Lower surface slightly arched or in its anterior part straight, in its posterior part slightly downward-bended. Basal furrow narrow, basal cavity indistinct, situated in the midlength or somewhat behind it.

Occurrence: Upper Alaunian to Lower Sevatian of the Asiatic and Dinaric faunal provinces.

Remarks: Our material from the higher Norian of Sicily consists predominantly of juvenile forms and the few adult specimens are broken or have partly broken denticles. Therefore we have choicen the completely preserved adult specimen figured by KRYSTYN (1980, Pl. 14, Fig. 4 as "juvenile" specimen of *"Epigondolella"* bidentata MOSHER) as holotype.

As proven in sections from the Alps, Western Carpathians and Lagonegro Basin (southern Italy), the genus *Parvigondolella* KOZUR & MOCK, 1972 evolved a little before the disappearence of *Mockina bidentata* (MOSHER, 1968) from this species. This development was first recognized by MOSTLER (1967) in the Hernstein section (Austria). Here all transitions between *Mockina bidentata* (MOSHER) and *Parvigondolella* andrusovi KOZUR & MOCK are known in stratigraphic order. In adult specimens the following morphogenetic changes can be observed: Specimens with one denticle on each side (typical *M. bidentata*) – specimens with one denticle on one side only (transitional forms *M. bidentata/P. andrusovi*) – specimens without platform rudiments or denticles (*P. andrusovi*). The same transition series in stratigraphic order could be observed in the section Bohúňovo (Western Carpathians) by KOZUR & MOCK (1972) and in the Lagonegro Basin (d'ARGANIO, KOZUR & MRSELLA, in press). Only KRYSTYN (1980) did not recognize the horizon with *P. andrusovi* in the Alps, but seemingly he regarded this species as juvenile *M. bidentata*.

Parvigondolella ? *vrielyncki* n.sp. begins already before *Mockina bidentata* (MOSHER). In contrary to all other *Parvigondolella* species it has no main cusp. Its adults are considerably larger than adult *Parvigondolella*, the blade is higher and the denticles are more numerous than in any other *Parvigondolella* species. Therefore it is most probably a homeomorph form which does not

belong to *Parvigondolella* KOZUR & MOCK. Perhaps it is related to the *Nicoraella* ? *budaensis* group or any other Late Triassic *Nicoraella* species. But this cannot be decided, because the apparatus is not yet known.
KRYSTYN (1980) rejected the genus *Parvigondolella* KOZUR & MOCK and he regarded its representatives as juvenile platform-less stages (*andrusovi* stage) of *"Epigondolella" bidentata* MOSHER. But the main occurrence of *Parvigondolella* is in the topmost Norian and Rhaetian, beyond the highest occurrence of *Mockina bidentata* (MOSHER) or any other platform-bearing metapolygnathids. KRYSTYN (1980, Pl. 14, Fig. 4) placed also a typical, well preserved *P.* ? *vrielyncki* n.sp., here choicen as holotype, into *"Epigondolella" bidentata* MOSHER. But as already visible by KRYSTYN (1980, Pl. 14, Figs. 1–4) this assumed "juvenile platform-less *andrusovi* stage" of *M. bidentata* is considerably larger, has more denticles and a higher blade than even the largest adult specimens of *M. bidentata* (MOSHER) figured by KRYSTYN (1980). An ontogenesis, where the early juvenile quite platform-less stages are larger, have more denticles and a higher blade than the largest adult specimens of the same species, is quite unknown among the conodonts and not to expect in any species. Moreover, *M. bidentata* (MOSHER) has a quite different range (Sevatian, with exception of uppermost Sevatian) from *Parvigondolella* (? higher Alaunian, Upper Sevatian to Upper Rhaetian). Therefore the view of KRYSTYN, expressed in several papers, that *Parvigondolella* comprises the juvenile specimens of *M. bidentata*, has to be abandoned.

Genus *Zieglericonus* n.gen.

Derivatio nominis: In honour of Prof. Dr. W. ZIEGLER, Frankfurt a. M., in recognition of his excellent contributions to the conodont research.

Type species: *Zieglericonus rhaeticus* n.gen. n.sp.

Diagnosis: Single cone conodont with a widely expanded and deeply excavated base. Cone laterally compressed.

Occurrence: Middle part of Late Rhaetian, upper *M. koessenensis* Subzone, ?basal *M. ultima* zone of Hungary (Csővár). Pre-*planorbe* beds of Great Britain.

Remarks: Secondary single cone conodont. The forerunner is not yet known. It could be a *Misikella* of the *M. longidentata* group or *Oncodella paucidentata* (MOSTLER).

Zieglericonus rhaeticus n.gen. n.sp.
(Pl. 5, Fig. 5; Pl. 7, Figs. 3,4)

Derivatio nominis: According to its occurrence in the Rhaetian.

Holotype: The specimen on Pl. 7, Fig. 3; rep.-no. KoMock 1988/I-5.

Locus typicus: Old large quarry in the Kecskés valley S of the Várhegy near Csővár, Hungary.

Stratum typicum: Thick bank of organodetritic limestone in a block in the lower left part of the quarry, sample 1 Z, upper *M. koessenensis* subzone with the index species.

Material: 7 specimens.

Diagnosis: Single cone conodont with widely expanded and deeply excavated basal cavity. The cone is laterally compressed. Its basal part is straight, whereas the higher part is strongly backward-bended.
The basal cavity is very deep and it reaches straightly into the beginning of the backward-bended part. By this its tip is situated more near to the anterior margin of the cone.
The distribution of the "white matter" is quite characteristical: The upper half of the cone is quite hyaline and its lower half is totally filled with "white matter" with a quite sharp boundary between these 2 parts.

Occurence and remarks: See under the genus.

3. Stratigraphic Evaluation of the Rhaetian Conodonts in the Alps and Hungary

Stratigraphically most important are the species of *Misikella* KOZUR & MOCK (see Table 1) which are especially in fully pelagic sediments very frequent, but occur also in the Kössen facies.

Also some other genera yielded stratigraphically important species. Different species of *Parvigondolella* are wide-spread (but often rare) in the Rhaetian (Alps, Western Carpathians, Csővár/Hungary, Lagonegro Basin). But until now often only the ramiform elements were found, whereas the very small, important spathognathodiform elements were lost by using 0,1 mm sieves, usually applied in the conodont research.

Neohindeodella detrei n.sp. is the index species of the youngest conodont zone above the last occurrences of the genera *Misikella* and *Parvigondolella*. *Neohindeodella rhaetica* n.sp. is a frequent and characteristical Rhaetian species, but similar forms, transitional between *N. triassica* (MÜLLER) and *N. rhaetica* n.sp., occur in the higher Tuvalian and Norian.

Zieglericonus rhaeticus n.gen. n.sp., a single cone conodont, is quite characteristical for the higher *M. koessenensis* subzone and ranges perhaps still into the basal *M. ultima* zone. It occurs also in the Germanic Rhaetian (pre-*planorbe* beds of Great Britain, SWIFT, poster on ECOS-V, Frankfurt 1988) together with *Misikella posthernsteini* KOZUR & MOCK and ramiform elements of *Parvigondolella*.

In fully pelagic cherty limestones (Csővár Limestone Formation) *Norigondolella steinbergensis* (MOSHER) is still frequent up to the top of the *M. koessenensis* Subzone (Middle part of Late Rhaetian) and perhaps it ranges still into the basal *M. ultima* A.-Z. Its upper range coincides with the upper range of *Zieglericonus rhaeticus* n.gen. n.sp.

Chirodella dinodoides (TATGE) and *Grodella delicatula* (MOSHER) are long-ranging species which ranges as high as *Misikella* and *Parvigondolella*.

The following conodont zones can be discriminated within the higher Sevatian and Rhaetian:

3.1. *Misikella hernsteini* – *Parvigondolella andrusovi* Assemblage Zone

Definition
Occurrence of the index species without *Mockina bidentata* (MOSHER) and without *Misikella posthernsteini* KOZUR & MOCK.

Lower boundary
Disappearence of *Mockina bidentata* (MOSHER) and *M. slovakensis* (KOZUR).

Upper boundary
Appearence of *Misikella* posthernsteini KOZUR & MOCK.

Type locality
Hernstein (Austria).

Observed conodonts
Chirodella dinodoides (TATGE), *Grodella delicatula* (MOSHER), *Misikella hernsteini* (MOSTLER), *Neohindeodella dropla* (SPASOV & GANEV), *N.* cf. *rhaetica* n.sp., *Norigondolella steinbergensis* (MOSHER), only in pelagic limestones and cherts, *Oncodella paucidentata* (MOSTLER), only in pelagic sediments, *Parvigondolella andrusovi* KOZUR & MOCK (very rare or absent in the higher part of the zone), *P.* ? *lata* KOZUR & MOCK (only in the higher part of the zone).

Stratigraphic range
Uppermost undoubtedly Sevatian.

Distribution
Whole Eurasiatic Tethys.

Remarks
KOZUR & MOCK (1972) introduced 2 zones for this interval, the *Parvigondolella andrusovi* A.-Z. and the *Misikella hernsteini* A.-Z. However, the interval with frequent *P. andrusovi* is rather short and above this level the species is rare, whereas *M. hernsteini* becomes more and more frequent. Therefore the separation of these 2 zones is rather difficult, in spite of the fact that the horizon with frequent *P. andrusovi* (without *M. bidentata*) is well recognizable and widely distributed, especially in non-condensed sequences, like in the Lagonegro Basin (southern Italy).

The *Norigondolella steinbergensis* Zone sensu KRYSTYN (1980) is a clear facies assemblage, but not a biostratigraphic zone. Because it has moreover no priority, it can be also not used after redefinition. According to KRYSTYN (1980) its lower boundary is defined by the disappearence of platform-bearing *Epigondolella* and it would therefore coincide with the lower boundary of the *M. hernsteini* – *P. andrusovi* A.-Z. On the other hand, he correlated the *N. steinbergensis* Zone with the *Vandaites stuerzenbaumi* ammonoid subzone. But even in the underlying *"Choristoceras" haueri* Zone neither *M. bidentata* nor *P. andrusovi* are present and at least in the largest parts of the still older *Cochloceras suessi* ammonoid zone *M. bidentata* is missing. So, the definition of the *N. steinbergensis* Zone and its correlation with the ammonoid zonation exclude each other. The upper boundary of the *N. steinbergensis* Zone was defined by KRYSTYN (1980) with the disappearence of *N. steinbergensis*. Because we have found *N. steinbergensis* up to the *M. koessenensis* subzone of the *M. posthernsteini* A.-Z., the *N. steinbergensis* Zone would comprise according to its original definition several conodont zones from the base of the *M. hernsteini* – *P. andrusovi* A.-Z. up to the top of the *M. posthernsteini* A.-Z.

The disappearence of *N. steinbergensis* is a clearly facies-controlled event. The highest range of the species can be observed in fully pelagic cherty limestone facies, where it can be found up to the lower part of Late Rhaetian together with *Choristoceras* s. str. In the likewise pelagic transition between Hallstatt Limestones and Zlambach Marls *N. steinbergensis* disappeared considerably earlier, at the top of the transitional beds inside the Lower Rhaetian, because it is absent or very rare in clayey-marly sediments even in fully pelagic environments. This is clearly to recognize in Rhaetian sections with cherty limestones and marls/marly limestones. Even, if the cherty limestones (pure limestones) are rich in *N. steinbergensis*, this species is absent in conodont-bearing intercalated marls/marly limestones. In shallow water, but pure, biogenic limestones with ammonoids *N. steinbergensis* is, like all conodonts, rare, but present here up to the top of the Lower Rhaetian in beds with *Vandaites stuerzenbaumi* (MOJSISOVICS) as in Bleskový prameň (Slovakia). In restricted basin sediments (Kössen Beds) *N. steinbergensis* is quite missing. Therefore the *N. steinbergensis* Zone could not be recognized in a large part of conodont-bearing topmost Sevatian to Rhaetian beds.

After finishing this paper we have got the paper KRYSTYN, L. (1987): Zur Rhät-Stratigraphie in den Zlambach-Schichten (vorläufiger Bericht). – Sitzungsber. Österr. Akad. Wiss., Mathem.-naturwiss. Kl., **196** (1–4), 21–36. In this paper the *N. steinbergensis* A.-Z. was redefined and a new correlation with the *"Choristoceras" haueri* Subzone was given. But as mentioned above, for priority reasons and because of the extrem facies-dependence of *N. steinbergensis*, this zone cannot be used after redefinition.

KRYSTYN (1987) pointed out that according to his opinion the *N. steinbergensis* A.-Z. is not identical with the original *M. hernsteini* A.-Z. As erroneously stated by KRYSTYN (1987, p. 27) according the original definition by KOZUR & MOCK (1972, p. 7), *N. steinbergensis* is already missing in the *M. hernsteini* A.-Z. But the original definition of the zone by KOZUR & MOCK (1972, p. 7) is:

„ ... Lebensbereich von Spathognathodus hernsteini ohne das gleichzeitige Vorkommen von E. bidentata und P. andrusovi ... "

The occurrence and range of the long-ranging, extremely facies-controlled and therefore stratigraphically not important *N. steinbergensis* were even not discussed by KOZUR & MOCK (1972).

KOZUR (1980) has not changed the scope of the *M. hernsteini* A.-Z. as stated by KRYSTYN (1987), but the diagnosis was quite the same as in KOZUR & MOCK (1972):

„ ... Vorkommen von M. hernsteini ohne Metapolygnathus bidentatus und Parvigondolella andrusovi ... " (KOZUR, 1980, p. 108).

KOZUR (1980) has given additionally a list of all known species from the *M. hernsteini* A.-Z., including also *N. steinbergensis* (MOSHER). Such a list was not given in KOZUR & MOCK (1972), but it has no influence to the definition of the zone!

KRYSTYN (1987) pointed out that the *M. hernsteini* A.-Z. sensu KOZUR & MOCK (1972) and KOZUR (1980) must be Rhaetian in age, that means according to the *Norian/Rhaetian boundary between the Cochloceras suessi* and *"Choristoceras" haueri* zones (KOZUR, 1973, 1980, now also accepted by KRYSTYN, 1987) younger than the *Cochloceras* *suessi* Zone. No Rhaetian fossils were reported from the Hernstein section choicen as type section for the *M. hernsteini* A.-Z., only Norians ones, like *Monotis* and Sevatian holothurian sclerites. Moreover, KOZUR (1980) recognized an upper *M. hernsteini* A.-Z. with *M. hernsteini*, *M. posthernsteini*, *N. steinbergensis*, *O. paucidentata* and *P.* ? *lata* and a lower *M. hernsteini* A.-Z. without *M. posthernsteini* (otherwise with the same above listed species). The conodont fauna of the upper *M. hernsteini* A.-Z. sensu KOZUR (1980) is characteristical for the larger part of the *Cochloceras suessi* ammonoid zone, placed by KOZUR (1980) into the topmost Norian, an age assignment which is also accepted by KRYSTYN (1987). The lower *M. hernsteini* A.-Z. would even remain Norian, if the Norian/Rhaetian boundary would be finally defined with the first appearence of *M. posthernsteini* (see below).

Compared with the original definition of the *M. hernsteini* A.-Z., the upper range of the *M. hernsteini* – *P. andrusovi* A.-Z. is here changed. The disappearence of *M. hernsteini* seems not to be a good marker for the definition of the upper boundary, because just in the Norian/Rhaetian transition with frequent occurrences of allodapical limestones and other signs of reworking the disappearence of a species alone is not a good marker. In several higher Lower Rhaetian samples with dominating *M. posthernsteini* (up to 500 specimens per kg sediment) some *M. hernsteini* were found, often accompanied by some specimens of E. abneptis and other older, clearly reworked conodonts. It is difficult to decide, whether *M. hernsteini* is in such samples reworked or still present in the higher Lower Rhaetian as assumed by KRYSTYN (1987). Unfortunately, KRYSTYN (1987) has not figured any Lower Rhaetian *M. hernsteini*, so that a confusion of this species with highly evolved *Parvigondolella*, present in Lower Rhaetian cannot be excluded.

The appearence of *M. posthernsteini* is documented by transitional forms inside the phylomorphogenetic line *M. hernsteini* – *M. posthernsteini* and worldwide recognizable. Therefore the first appearence of *M. posthernsteini* in the former upper *M. hernsteini* A.-Z. would be an ideal marker for the definition of the Norian/Rhaetian boundary. As discussed by BIRKENMAJER, KOZUR & MOCK (1990) this boundary is worldwide recognizable in all conodont-bearing facies and it lies near to the somewhat diachronous original, lithologically defined, base of the Rhaetian. In this case large parts (or the whole?) Cochloceras suessi ammonoid zone would belong to the Rhaetian. The Norian/Rhaetian boundary between the *Cochloceras suessi* and *"Choristoceras" haueri* ammonoid zone or any other reliable ammonoid-based Sevatian/Rhaetian boundary could be in Eurasia only recognized within the Hallstatt/Zlambach facies area and would be so a rather academic boundary.

3.2. *Misikella posthernsteini* Assemblage-Zone

Definition

Occurrence of *Misikella posthernsteini* KOZUR & MOCK without typical representatives of *M. ultima* n.sp.

Lower boundary

Appearence of *M. posthernsteini* KOZUR & MOCK.

Upper boundary

Appearence of typical representatives of *M. ultima* n.sp. Transitional forms to *M. posthernsteini* with one tiny denticle behind the main blade begin already somewhat earlier.

Type locality

Siwiańskie Turnie (Choč Nappe), Polish Tatra.

Observed conodonts

Chirodella dinodoides (TATGE), *Grodella delicatula* (MOSHER), *Misikella hernsteini* (MOSTLER), only in the lower subzone, *M. koessenensis* MOSTLER, only in the upper subzone, *M. posthernsteini* KOZUR & MOCK, *M. rhaetica* MOSTLER, *Neohindeodella dropla* (SPASOV & GANEV), *N. rhaetica* n.sp., *Norigondelella steinbergensis* (MOSHER), only in limestones of open-sea, fully pelagic facies, *Oncodella paucidentata* (MOSTLER), restricted to fully pelagic open-sea facies, not more present in the higher part of the upper subzone, *Parvigondolella* ? *lata* KOZUR & MOCK, only in the lower subzone, *P. rhaetica* n.sp., *Zieglericonus rhaeticus* n.gen. n.sp., only in the upper subzone.

Stratigraphic range

Cochloceras suessi to lower *Choristoceras marshi* ammonoid zones. Topmost Norian to lower part of Late Rhaetian. By definition of the lower boundary of the Rhaetian with the first appearence of *M. posthernsteini* this zone would be restricted to the Lower Rhaetian and lower part of Upper Rhaetian.

Distribution

Alps, Western Carpathians, Hungary (Buda Ms., Csővár, Keszthely Mts.), Lagonegro Basin (southern Italy), western Sicily, Himalaya, Japan, Papua New Guinea, ?North America.

Remarks

In the above definition, the *M. posthernsteini* A.-Z. is worldwide recognizable in all conodont-bearing facies. The first appearences both of *M. posthernsteini* and of *M. ultima* lie in a well-known phylomorphogenetic line (*M. hernsteini* – *M. posthernsteini* – *M. ultima*) and both species occur in all conodont-bearing facies.

The *M. posthernsteini* A.-Z. is here used in a somewhat wider range (including the upper *M. hernsteini* A.-Z. sensu KOZUR, 1980) than in the original definition by KOZUR & MOCK (1974 b). The reason for this new definition of the lower boundary has been discussed under the *M. hernsteini* – *P. andrusovi* A.-Z. (see above).

The *M. posthernsteini* A.-Z. sensu MOSTLER, SCHEURING & ULRICHS (1978) and KRYSTYN (1980, 1987) does not correspond to the *M. posthernsteini* A.-Z. sensu KOZUR & MOCK (1974 b) or to the *M. posthernsteini* A.-Z. used in the present publication. Conodonts of this stratigraphic level (higher Late Rhaetian) were not included into the *M. posthernsteini* A.-Z. by KOZUR & MOCK (1974 b). The *M. posthernsteini* A.-Z. sensu MOSTLER et al. (1978) and KRYSTYN (1980, 1987) corresponds to the *M. ultima* Zone, newly introduced here. 2 of 3 figured specimens of *M. posthernsteini* by MOSTLER et al. (1978, Pl. 1, Figs. 20,21) belong to *M. ultima* n.sp., also the figured sketches of *M. posthernsteini* from the higher Late Rhaetian by MOSTLER et al. (1978) and KRYSTYN (1987) are clearly *M. ultima*. *M. posthernsteini* occurs still in the *M. ultima* Zone, but inside this zone it is more and more replaced by *M. ultima*

Inside the *M. posthernsteini* A.-Z. several conodont zones were discriminated during the last years, but all are based on facies-controlled ranges of different species. MOSTLER et al. (1978) introduced the *M. rhaetica* Zone and defined it with the range of the index species. They restricted this zone to the lower part of the *Choristoceras marshi* ammonoid zone (lower part of Late Rhaetian). This corresponds to the range of this species in the Weißloferbach section.

There, like in all occurrences in the Kössen facies, *M. rhaetica* is restricted to the more basinal facies of the Kössen Beds and therefore only the upper range of the total range of this species can be observed. The real total range of this species begins well inside the *Choristoceras haueri* ammonoid zone. Even in the *Cochloceras suessi* ammonoid zone some specimens occur, which are very similar, perhaps identical, with *M. rhaetica* (also the holotype of *Neospathodus lanceolatus* MOSHER, 1968 belongs to these forms).

KRYSTYN (1980) recognized the considerably larger total range of this species in the fully pelagic Zlambach Marl facies and in agreement with the original definition he used the *M. rhaetica* Zone as a range zone in a by far wider scope as by MOSTLER et al. (1978). In this scope it corresponds, in agreement with the original definition, nearly perfectly to the originally discriminated *M. posthernsteini* A.-Z. sensu KOZUR & MOCK (1974 b), who had not investigated higher Late Rhaetian conodonts. KRYSTYN (1987), in turn, used this *M. rhaetica* Zone as assemblage zone above his *Oncodella paucidentata* A.-Z. in a stratigraphic scope which does not agree neither with the *M. rhaetica* Zone sensu MOSTLER et al. (1978) nor with the *M. rhaetica* Zone sensu KRYSTYN (1980). These changes in the stratigraphic range of the *M. rhaetica* Zone (A.-Z.) reflect the sporadic, strongly facies-controlled occurrences of this species. Even in fully pelagic sequences many samples occur inside the *M. rhaetica* Zone (A.-Z.), where *M. rhaetica* is missing in spite of the presence of more than 100 specimens of *M. posthernsteini* per sample. Moreover, in large parts of the Kössen Beds *M. rhaetica* is quite missing and only *M. posthernsteini* or *M. posthernsteini* and *M. hernsteini* are present. Therefore the *M. rhaetica* Zone, which corresponds to the largest part of the originally defined *M. posthernsteini* A.-Z., is not used here.

KRYSTYN (1987) used 3 conodont zones inside the originally defined *M. posthernsteini* A.-Z. His zonations is based on the Zlambach Marl sections of the Salzkammergut. As he pointed out, conodonts are very rare in this facies, every second sample yielded no conodonts and the conodont-bearing samples yielded in general 3–5 conodonts per 5 kg sample. In such very poor faunas the real ranges of the species can be hardly determined. Moreover, the Zlambach Marl sequences are characterized by the transition from limestones/marly limestones into clayey marls and some marly limestones. This causes additionally facies-dependent upper ranges of some species (e.g. *N. steinbergensis*).

Our investigations in fully pelagic Rhaetian cherty limestones, where all samples yielded between 20 and 1000 conodonts per kg sample, have shown that the zonation by KRYSTYN (1987) inside the *M. posthernsteini* A.-Z. is based on facies-controlled disappearences of conodonts. The *"Gondolella" steinbergensis* A.-Z. from the *"Choristoceras" haueri* ammonoid zone (nearly the same conodont fauna is also known from the higher *Cochloceras suessi* ammonoid zone) was already discussed under the *M. hernsteini – P. andrusovi* A.-Z. and rejected as facies-controlled assemblage (see above).

Likewise a facies-controlled conodont assemblage is the *Oncodella paucidentata* A.-Z. introduced by KRYSTYN (1987). Its lower boundary is defined by the disappearance of *N. steinbergensis*, but in the cherty limestone facies this species ranges even by far higher up than *O. paucidentata* and it disappears there even later than *M. rhaetica*, the index species of the next higher assemblage-zone discriminated by KRYSTYN (1987) within the *M. posthernsteini* A.-Z. sensu KOZUR & MOCK. Moreover, *O. paucidentata* is restricted to pelagic sequences (quite missing in the Kössen beds). For this reason the *O. paucidentata* A.-Z. can be only found in the special facial sequence of the Alpine Zlambach Marls. In fully pelagic cherty limestone sequences it cannot be separated from the *N. steinbergensis* facial assemblage, because here *N. steinbergensis* does not disappear (because of increasing clay contents) before *O. paucidentata*, but considerably later than this species. In the Kössen Beds, in turn, *O. paucidentata* is missing for facial reasons, so that this zone cannot be discriminated there as well.

3.2.1. *Misikella hernsteini – Misikella posthernsteini* Subzone

Definition

Joint occurrences of *M. hernsteini* (MOSTLER) and *M. posthernsteini* KOZUR & MOCK.

Lower boundary

Appearence of *M. posthernsteini*.

Upper boundary

Disappearence of *M. hernsteini*.

Observed conodonts

Chirodella dinodoides (TATGE), *Grodella delicatula* (MOSHER), *Misikella hernsteini* (MOSTLER), *M. posthernsteini* KOZUR & MOCK, *M. rhaetica* MOSTLER (typical specimens only in the upper part of the subzone), *Neohindeodella dropla* (SPASOV & GANEV), *N. rhaetica* n.sp., *Norigondolella steinbergensis* (MOSHER), only in limestones of open-sea, fully pelagic facies, *Oncodella paucidentata* (MOSTLER), only in fully pelagic facies, *Parvigondolella ? lata* KOZUR & MOCK.

Stratigraphic range

Cochloceras suessi and *haueri* ammonoid zones (topmost Norian and lower part of Lower Rhaetian or only Lower part of Lower Rhaetian, if the first appearance of *M. posthernsteini* is used for the definition of the lower boundary of the Rhaetian).

Distribution

Alps, Western Carpathians, Hungary (Buda Mts., Keszthely Mts.), Lagonegro Basin (southern Italy), western Sicily, Himalaya, Japan, ? North America.

The *M.hernsteini – M. posthernsteini* Subzone is well recognizable in all conodont-bearing sediments: Pelagic Hallstatt Limestones, pelagic cherty limestones, cherts, pelagic marls/marly limestones (Zlambach Marl), restricted basin facies (Kössen Beds), here both in limestones, marls and marly claystones.

3.2.2. *Misikella koessenensis* Subzone

Diagnosis

Joint occurrences of *M. posthernsteini* KOZUR & MOCK, *M. koessenensis* MOSTLER, *M. rhaetica* MOSTLER without *M. hernsteini* (MOSTLER) and *M. ultima* n.sp.

Lower boundary

Disappearence of *M. hernsteini*.

Upper boundary

Appearence of typical representatives of *M. ultima*.

Observed conodonts

Chirodella dinodoides (TATGE), *Grodella delicatula* (MOSHER), *Misikella koessenensis* MOSTLER, *M. posthernsteini* KOZUR & MOCK, *M. rhaetica* MOSTLER, *Neohindeodella dropla* (SPASOV & GANEV), *N. rhaetica* n.sp., *Norigondolella steinbergensis* (MOSHER), only in limestones of open-sea, fully pelagic facies, *Oncodella paucidentata* (MOSTLER), only in fully pelagic open-sea sediments, not more present in the upper part of the subzone, *Parvigondolella rhaetica* n.sp., *Zieglericonus rhaeticus* n.gen. n.sp.

Stratigraphic range

Vandaites stuerzenbaumi to middle part of *Choristoceras marshi* ammonoid zones (higher part of Lower Rhaetian to lower part of Upper Rhaetian).

Distribution

Alps, Western Carpathians, Hungary (Buda Mts. Csővár, Lagonegro Basin (southern Italy), Germanic Rhaetian (Great Britain), Himalaya, Japan, ? North America.

Remarks

This subzone was originally introduced as zone by KOZUR (1989). Later investigations has confirmed the view of KOZUR (1989) that *M. koessenensis* ranges higher up than *M. rhaetica*, but has as a whole a shorter range than this species. Unfortunately also this species has a rather sporadic, strongly facies-controlled occurrence. Like *M. rhaetica* it occurs rarely in fully pelagic sediments and it is only frequent in the more basinal, but nevertheless rather shallow-water facies of the Kössen beds. In conodont-rich (100–1000 conodonts per kg material), fully pelagic sediments *M. koessenensis* may be quite missing, like *M. rhaetica*, but unlike *M. posthernsteini*, which is very frequent in such samples. Therefore neither the first, nor the least appearence of *M. koessenensis* can be used for exact defining a conodont zone.

The first appearence of the facies-independent *M. ultima* (present in all conodont-bearing facies) is a good marker for the upper boundary of the *M. koessenensis* Subzone and for the upper boundary of the *M. posthernsteini* A.-Z., but the disappearence of *M. hernsteini* can be only used in subzonal rank (see remarks to the upper boundary of the *M. hernsteini* – *P. andrusovi* A.-Z.). In few conodont-rich samples *M. hernsteini* was still found inside the *M. koessenensis* Subzone, but always in very low frequencies of one specimen per several hundreds specimens of *M. posthernsteini*, but in these samples also clearly reworked metapolygnathids (e.g. E. abneptis), in about the same low frequency, like *M. hernsteini*, were found. Therefore also *M. hernsteini* could be reworked. KRYSTYN (1987) reported one sample with *M. hernsteini* from the lower part of the *M. koessenenesis* Subzone. Also this sample derived from allodapical limestones so that reworking cannot be excluded. If *M. hernsteini* would be still present (unreworked) in the *M. koessenensis* Subzone, than its frequency is extremely low, quite in the contrary to the lower subzone of the *M. posthernsteini* A.-Z., where *M. hernsteini* belongs to the frequent to dominant conodont species.

Also some other features can be used for recognition of the *M. koessenensis* Subzone: The occurrences of *M. koessenensis* MOSTLER and of *Zieglericonus rhaeticus* n.gen. n.sp. Both these species are restricted to this subzone, and Z. rhaeticus occurs even both in pelagic Tethyan and non-pelagic outer-Tethyan deposits (Germanic Basin). Unfortunately, both species have a rather sporadic occurrence, in some samples of the same sequence rather frequent, in other ones quite missing (even in conodont-rich sediments). Therefore their presence is an evidence for the presence of the *M. koessenensis* Subzone, but their absence even in conodont-rich samples does not exclude this stratigraphic level. The majority of the samples from the *M. koessenensis* Subzone yielded among the stratigraphically important conodonts only *M. posthernsteini*. This is the case in the Kössen Beds with exception of the highest part of the sub-zone, where during a deepening of the basin *M. koessenensis* and *M. rhaetica* invaded. But there are also samples of fully pelagic cherty limestones inside the *M. koessenensis* Subzone which yielded more than 500 specimens of *M. posthernsteini*, but no other species of *Misikella*. Even in samples, where *M. koessenensis* and *M. rhaetica* are present, *M. posthernsteini* is mostly clearly dominating in ratios of 10 : 1 or even higher ratios. The real characteristic and dominant species of the *M. koessenensis* Subzone is therefore *M. posthernsteini*.

This is still underlined by the fact that the *M. koessenensis* Subzone corresponds to the *M. posthernsteini* A.-Z. in its original scope (occurrence of *M. posthernsteini* without *M. hernsteini*), because higher Rhaetian conodont faunas with *M. ultima* n.sp. (*M. ultima* Zone = "*M. posthernsteini* A.-Z." sensu MOSTLER et al., 1978 and KRYSTYN, 1980, 1987) were not investigated by KOZUR & MOCK (1974 b) and were even not known in this time. Also for this reason it is better to use a *M. koessenensis* Subzone rather than a *M. koessenensis* Zone.

M. rhaetica cannot be used as index species for the *M. koessenensis* Subzone, because it is already present in a level, where *M. hernsteini* is still rather frequent. Because of the above mentioned sporadic occurrences of *M. rhaetica* and its restriction to basinal facies, the first appearence of this species cannot be used to separate the 2 subzones within the *M. posthernsteini* A.-Z.

3.3. *Misikella ultima* Zone

Definition

Stratigraphic range of typical representatives of *M. ultima* n.sp.

Lower boundary

Appearence of typical representatives of *M. ultima* n.sp.

Upper boundary

Disappearence of the genera *Misikella* and *Parvigondolella* (*Parvigondolella* n.sp., not yet described).

Type locality
Old large quarry in the Kecskés valley S of the Várhegy near Csővár (Hungary).

Observed conodonts
Chirodella dinodoides (TATGE), *Grodella delicatula* (MOSHER), *Misikella posthernsteini* KOZUR & MOCK (rare, only in the lower part of the zone still frequent), *M. ultima* n.sp., *Neohindeodella rhaetica* n.sp., *Parvigondolella* n.sp.

Stratigraphic range
Upper part of *Choristoceras marshi* ammonoid zone and beds immediately above the last occurrence of *Choristoceras*. Higher part of Late Rhaetian.

Distribution
Alps (upper part of higher Kössen Beds, upper part of Zlambach Marls), Hungary (Csővár).

Remarks
In the type locality the whole zone is present in conodont-rich beds, well distinguishable from the underlying *M. koessensis* Subzone of the *M. posthernsteini* A.-Z. and from the overlying *N. detrei* Zone, from which only the index species (but still rather frequent) is known. Transitional forms between *M. posthernsteini* and *M. ultima*, characterized by the presence of a tiny denticle behind the main blade, begin already within the underlying beds of the *M. koessenensis* Subzone.

The *M. ultima* A.-Z. ranges some meters above the last occurrence of *Choristoceras*. These beds are facially identically with the underlying *Choristoceras*-bearing Late Rhaetian, but they contain no guide-fossils for the Triassic or Jurassic, if the conodonts are not regarded as decisive pre-Jurassic. In this connection it is highly interesting that in the pre-*planorbe* beds of topmost Rhaetian in Great Britain *Zieglericonus rhaeticus* n.gen. n.sp. (quite typical for the *M. koessenensis* Subzone), *M. posthernsteini* KOZUR & MOCK and ramiform elements are present (SWIFT, poster on ECOS-V, Frankfurt a.M., 1988). In the pre-*planorbe* beds already a Jurassic bivalve fauna (SYKES et al., 1970) was found that occur together with a Rhaetian, higher up Rhaeto-Liassic sporomorph association (FISHER, 1972). The still younger *M. ultima* Zone, especially its upper part above the last occurrence of *Choristoceras*, should therefore represent the youngest Triassic.

3.4. *Neohindeodella detrei* Zone

Definition
Stratigraphic range of *N. detrei* n.sp. without any other conodonts.

Lower boundary
Disappearence of the genera *Misikella* KOZUR & MOCK and *Parvigondolella* KOZUR & MOCK.

Upper boundary
Disappearence of *Neohindeodella detrei* n.sp., the youngest and last conodont species of the world.

Type locality
Old quarry in the Kecskés valley S of the Várhegy near Csővár (Hungary).

Observed conodonts
Only *N. detrei* n.sp., in some samples still rather frequent.

Stratigraphic range
Topmost Rhaetian or basalmost Liassic.

Distribution
Until now only known from the type locality.

Remarks
The *N. detrei* Zone occurs in its type locality over a distanoe of several meters. Its basis lies already several meters above the last occurrence of *Choristoceras*. In contrary to the higher part of the *M. ultima* Zone which lies also above the last observed occurrence of *Choristoceras*, a distinct facial change can be observed at the base of the *N. detrei* Zone. The fully pelagic, often allodapical limestones and cherty limestones of the Late Rhaetian were replaced by thin-bedded, detrical marly limestones with plant debris. No index fossils were found in these beds. Only some holothurian sclerites occur which are known both from the Rhaetian and Liassic. A basal Liassic age of these beds cannot be excluded. Because of the last presence of conodonts in these beds, the *N. detrei* Zone is here tentatively placed into the topmost Rhaetian. Further studies about the age of this zone are in progress.

After finishing this paper, *N. detrei* was found also soewhat higher, in light-coloured micritic limestones of the basal Várhegy Cherty Limestone Formation that yielded Hettangian to Lower Sinemurian radiolarians. *Relanus hettangicus* KOZUR & MOSTLER was found immediately above the beds with *N. detrei* that have not yielded radiolarians. A basal Liassic age of these beds is probably.

4. Stratigraphic and Tectonic Implications of the New Rhaetian Conodont Data for the Investigated Areas in Hungary

4.1. Csővár

(Triassic of the left side of Danube river)

The classical outcrop of the Csővár Limestone Formation (formation name introduced by BALOGH, 1981) is the old large quarry in the Kecskés valley S of the Várhegy near Csővár. The lithological character of the rocks from this section is described by KOZUR & MOSTLER (1973). The sequence consists of well-bedded gray, marly bituminous limestones, marls, partly cherty and often graded biogenic limestones. In the highest part (not discussed by KOZUR & MOSTLER, 1973) marly silty limestones with plant remains are present. According to KOZUR & MOSTLER (1973) this is a pelagic basinal sequence from a reef slope with repeated influx of reef debris and other shallow water components. Graded bedding is quite characteristical for several beds and also slumping structures (intraformational breccias) occur in some beds.

For about 80 years these beds were placed on the base of macrofaunas into the Lower Carnian by all Hungarian geologists. But KOZUR & MOSTLER (1973) could show that according to the conodonts and holothurian sclerites these beds belong to the highest Triassic (*Misikella hernsteini* A.-Z. s.l. including the

Table 2.
Stratigraphic columns in the Buda Mts.

Stage	Substage	Se of Buda Line Buda Nappe	Se of Buda Line Csövár Nappe	NW of Buda Line Nagykovácsi Nappe
Rhaetian			Csövár Limestone Formation (bedded, partly fine-laminated, dark-gray, bituminous, partly cherty or marly limestones)	
Norian	Sevatian		Csövár Limestone Formation	Dachstein Limestone Formation
Norian	Alaunian	Sashegy Dolomite Formation (massive and bedded, light-colored, above dark, pelagic cherty dolomites - originally cherty limestones)		Limestones and dolomites
Norian	Lower Norian	Sashegy Dolomite Formation; Ammonoid-bearing dolomites	? Nézsa Limestone Formation	Hauptdolomite Formation
Carnian	Tuvalian	Dolomites with megalodontids	Dolomites	Hauptdolomite Formation
Carnian	Julian	Dolomites with megalodontids	Dolomites	dolomites / marly limestones, marls, cherty massive dolomites
Carnian	Cordevolian	Wetterstein Dolomite subordinate volcanics	Dolomite	Wetterstein Dolomite
Ladinian	Longobardian	Wetterstein Dolomite subordinate volcanics	Dolomite	Wetterstein Dolomite
Ladinian	Fassanian	Wetterstein Dolomite subordinate volcanics	Dolomite	Wetterstein Dolomite

younger *Misikella* faunas not yet separated in this time). This fauna was placed into the Upper Sevatian (including the Rhaetian). According to DETRE, DOSZTÁLY & HERMAN (1986) this age determination was in the beginning doubted by the Hungarian geologists. Also the new ammonoid fauna determined by ZAPFE and KRYSTYN (in KOZUR & MOSTLER, 1973) confirmed again a Carnian age of these beds. But DETRE (1981) and BALOGH (1981) finally accepted the age determinations by KOZUR & MOSTLER (1973). Now these age determinations were supported by the discovery of *Choristoceras nobile* MOJSISOVICS in the middle part of the quarry (DETRE, DOSZTÁLY & HERMAN, 1986). By this the contradictions between the age determinations after macrofauna (Lower Carnian) and after microfossils (Rhaetian) could be removed, because *Choristoceras* is an index genus for the Rhaetian.

Bed by bed sampling in this outcrop has now yielded a lot of conodonts and holothurian sclerites, among it also new conodont species, described in the present paper. The age of the Csővár Limestone Formation in its type locality could be determined by these fossils as Upper Rhaetian. A basal Liassic age for the topmost beds of the outcrop (silty, marly, plant-bearing limestones) cannot be quite excluded.

The light-coloured, partly massive, partly thick-bedded cherty limestones from the southern slope of the adjacent Várhegy were also placed into the Csővár Limestone Formation by BALOGH (1981) and HAAS & KOVÁCS (1985), but they are here separated from this formation. These limestones were deposited at the slope of an open basin (debris flows, slump folds), but without influx of reef debris and other shallow water material. They yielded radiolarians and holothurian sclerites of Liassic age (KOZUR, in press, KOZUR, MOCK & MOSTLER, in prep.). These beds are named here as Várhegy Cherty Limestone Formation (type locality Várhegy near Csővár). Only the basal part of the Várhegy section (gray limestones) belongs to the Csővár Limestone Formation. Also above the Csővár Limestone Formation of the quarry several meters of the Várhegy Formation are exposed. Sample 249 a little below the Tertiary yielded Hettangian radiolarians with *Relanus hettangicus* KOZUR & MOSTLER.

4.2. Buda Mountains and Pilis Mountains
(sampling points in the Buda Mts. see Fig.2)

As already pointed out by VÉGH-NEUBRANDT (1974), the geology of the Buda Mts. is extremely complicated. For the first time WEIN (1977, 1978) came in his genial synthesis to the opinion that the tectonic complication of the Buda Mts. is caused both by nappe structures

(Buda Nappe s.l.) and later horizontal displacements during the Tertiary. Nappe structures were already assumed by HORUSITZKY (1943) who recongized a typical South Alpine Triassic development in the SE (Buda Triassic) and a quite different North Alpine Pilis-Kovácsi development in the NW. The boundary between these really existing quite different Triassic developments in the Buda Mts. is a first order tectonic line. Along this fault zone, later named as Buda Line by BÁLDI & NAGYMAROSI (1976) not only the Triassic, but also the Late Eocene and Oligocene change drastically as already recognized by HORUSITZKY (1943) and later carefully elaborated by BALDI (1986). Because the late Eocene and Oligocene sequences are so different that they were surely not sedimentated in the present day directly adjacent position, large-scale horizontal movements must be present after the Oligocene.

HAAS & KOVÁCS (1985), in turn, disregarded both the nappe structures and the Buda Line and they placed the 3 major different Triassic developments of the Buda Mts. into one stratigraphic sequence which does not exist in any place of the Buda Mts. Moreover, the age determinations of the Late Triassic Formations within the constructed "sequence" are not correct. Seemingly, this "sequence" was established on the base of tectonic models published by KOVÁCS in several papers before, in which this "sequence", in turn, is used to support the paleogeographic and paleotectonic reconstructions by KOVÁCS (e.g. KOVÁCS, 1982, KÁZMÉR & KOVÁCS, 1985, see also BALLA, 1988). Because the basic stratigraphic data in the Late Triassic are not correct, also the paleogeographic reconstruction by KÁZMÉR & KOVÁCS (1985) cannot be confirmed. A postulated place of the general Norian facies boundary between Norian Hauptdolomite W of Vértes Mts. to Norian Dachstein Limestone east of it, e.g. in the whole Buda Mts. cannot be confirmed. However, just this place of the above facies boundary is one of the main supports for this reconstruction (KÁZMÉR & KOVÁCS, 1985, Figs. 1,2,4). In 2 of 3 (?4) nappes of the Buda Mts. Norian Dachstein Limestone is quite unknown and where it is present (widespread in the Nagykovácsi Nappe) it begins in the higher Middle Norian, like west of the postulated, but in the assumed place not existing general Late Triassic facies boundary. Even in the northern Bakony Mts, far west of this "facies boundary line", the Dachstein Limestone begins already in the Middle Norian (VÉGH-NEUBRANDT, 1963, BALOGH, 1981) and ranges up to the Rhaetian, quite the same range as in the Nagykovácsi Nappe of the Buda Mts. far east of the postulated place of this facies boundary.

Likewise, the Hallstatt Limestone development south and southeast of Salzburg (Hallein-Hallstatt area, the type region of the Hallstatt Limestone!) was omitted in the reconstruction by KÁZMÉR & KOVÁCS (1985, Fig. 1) and overtaken so by BALLA (1988, Fig. 2A), because it also does not fit into this reconstruction. The westernmost present-day occurrences of Hallstatt Limestones in the Alps were placed into the Northern Calcareous Alps in the meridian of Graz, about 200 km east of the Hallstatt Limestone type area, from where only Dachstein Limestone was recognized.

The Late Triassic "sequence" of the Buda Mts, reconstructed by HAAS & KOVÁCS (1985) on the base of their models for Late Triassic facies distributions, but not on reliable stratigraphic data from concrete sections, is the most erroneous one since the end of the last century. The Mátyáshegy Limestone is not Lower Carnian, like all Hungarian geologists (and also HAAS & KOVÁCS, 1985 after extensive restudies of the type section) assumed according to age determinations from the last century, but its main part is Rhaetian (see below). The Dachstein Limestones is not present in the whole Buda Mts. "sequence" as assumed by HAAS & KOVÁCS (1985), it does not begin in the Late Carnian and it does not end within the higher Norian, but it begins in the higher Middle Norian and it ranges well into the Rhaetian. There is no lateral facies transition between the Hauptdolomite and Dachstein Limestone during the interval of Late Carnian up to Middle Norian within the Buda Mts. as shown by HAAS & KOVÁCS (1985). There is only a vertical transition from Hauptdolomite into Dachstein Limestone in the Middle Norian as already shown by WEIN (1977), clearly recognizable from the geologic map of Buda Mts. (WEIN, 1977), e.g. in the large Dachstein Limestone occurrences S of Nagykovácsi.

Independent from these mistakes in the age determinations, the single stratigraphic units do not occur in one sequence as generally assumed in the last time. Where the pelagic topmost Norian to Rhaetian Mátyáshegy Limestone or the likewise pelagic Norian cherty dolomite is present, we find no Dachstein Limestone and where Dachstein Limestone is present, we never find these pelagic sediments, because contemporaneous extremely shallow water and pelagic limestones (the cherty dolomite is secondarily dolomitized cherty limestone (KOZUR & MOCK, in prep.) of the same age cannot occur in the same sequence, if they are not tectonically attached to each other.

In the area NW of the Buda Line the Late Triassic is well exposed, e.g., around Nagykovácsi NW of Budapest. From this area a sequence of Ladinian to Lower Carnian Diplopore dolomites (Wetterstein Dolomite), Carnian dolomites, partly with megalodontids, similar Lower and Middle Norian dolomites (Hauptdolomite) and higher Middle Norian to Rhaetian Dachstein Limestone is known. Mainly the Norian-Rhaetian part of the sequence is exposed here, but according to the geologic map by WEIN (1977) N of Nagykovácsi also larger areas with Ladinian to Lower Carnian Diplopore dolomites are exposed. Maybe that the Middle Carnian part of the sequence, well known from the Pesthidegkút Kálváriahegy, from the underground of the Solymar Eocene Basin or from Pilisvörösvár (all likewise NW of the Buda Line) is not exposed around Nagykovácsi or developed in a dolomitic faces like the Lower and Upper Carnian (see below).

The change from Hauptdolomite to Dachstein Limestone is transitional and in these transitional beds late Middle Norian ammonoids were found placed into the Late Carnian *Tropites subbullatus* Zone and into the Lower Norian by BÉRCZI-MAKK (1969). The holothurian sclerites from these ammonoid-bearing beds indicate likewise Middle Norian age. The typical Dachstein Limestone yielded in several places ammonoids including the Late Norian to Lower Rhaetian index fossil *Rhabdoceras suessi* known since KUTASSY (1927) from the Remetehegy locality. KUTASSY (1936) found even *Choristoceras (Peripleurites) rotundatus* and other species, now placed into the genus *Vandaites* of Lower Rhaetian age.

Also the rich occurrences of *Triasina hantkeni* (foraminifer) indicate Rhaetian age for the higher Dachstein Limestone of the Buda Mountains. This Rhaetian age of parts of Dachstein Limestone known already since HOFMANN (1871) and still indicated by BALOGH (1981) was quite omitted by HAAS & KOVÁCS (1985). According to these authors the Dachstein Limestone of the Buda Mts. ends well below the base of the Rhaetian.

The above discussed Triassic sequence NW of the Buda Line is characteristical for the Nagykovácsi Nappe, newly introduced here. It belongs perhaps to the Adriatic nappe system sensu FLÜGEL, FAUPL & MAURITSCH (1987). Quite the same Late Triassic development is present S and E of Csobánka (N of Budapest) and in large parts of the Pilis Mountains.

The transition from the Hauptdolomite into the Dachstein Limestone has a similar Late Alaunian age in the Mány-Zsámbék-Dorog area, in the Gerecse Mts, Vértes Mts, and in the northern Bakony, in contrary to the opinion of KÁZMÉR & KOVÁCS (1985) that within this area lies a facies boundary with Norian Hauptdolomite in the W and Norian Dachstein Limestone in the E.

From the Pesthidegkút Kálváriahegy through the Solymár Eocene Basin until Pilisvörösvár (between Buda Mts. and Pilis Mts) a sequence of cherty dolomites, dolomitic marls and marly limestone of Middle Carnian age is known. At the surface this sequence is best known from the Pesthidegkút Kálváriahegy. Here gray dolomite of probably Lower Carnian age is overlain by gray, partly bituminous massive dolomites with numerous layers of black cherty nodules. This cherty dolomite yielded a very poor fauna (few holothurian sclerites, a monospecific sponge spicule association, few euryhaline ostracods) that indicates a shallow-water, slightly hypersalinar environment. This fauna is both in age and according to the indicated facies quite different from the rich pelagic Norian conodont, radiolarian and holothurian fauna from the cherty dolomite SE of the Buda Line. At the Pesthidegkút Kálváriahegy the bituminous, massive cherty dolomite is overlain by bituminous, well stratified, gray, wheathered brownish-gray to brownish-yellow, partly biogenic marly limestone, thin, often dolomitic marls and limestones that yielded rich conodont and holothurian sclerite faunas of Middle Carnian age. The monospecific conodont fauna without any pelagic elements indicates restricted basin development. This part of the sequence is also well exposed in the outcrop behind the office of State Mineral and Ore Enterprise at the western margin of Pilisvörösvár south of the road to Piliscsaba. Here quite the same Middle Carnian conodont and holothurian sclerite faunas can be observed. According to VÉGH-NEUBRANDT (1974) these beds are overlain in the Pilisvörösvár area by dolomites with *Cornucardia hornigi* BITTNER (late Carnian), but she did not exclude that between both units some beds could be missing. At the Pesthidegkút Kálváriahegy the marly limestones are overlain by few meters of pure, more light-coloured limestones which contain many large bivalves, but only a poor microfauna. Dolomites follow higher up, but the direct transition is not exposed.

The Middle Carnian beds from the Pesthidegkút Kálváriahegy were mapped until now as Mátyáshegy Limestone. The Mátyáshegy Limestone (= Csővár Limestone Formation s.str.) is an open sea pelagic basin sediment with repeated influx of reef-debris, onkoids and ooliths, like we know it from the Csővár area. It contains many pelagic fossils, like radiolarians. Moreover, the Rhaetian Csővár Limestone Formation s.str. developed from Norian pelagic cherty limestones, whereas the Middle Carnian beds of Pesthidegkút Kálváriahegy developed from shallow water lagoonal dolomites through shallow water lagoonal cherty dolomites. In the lower part of the Middle Carnian marly limestones still some minute chert nodules of some mm diameter are present, but higher up no cherty nodules occur. The Mátyáshegy Limestone contains throughout its range layers with black chert nodules and without it. The Middle Carnian marly limestone does not contain radiolarians or any other pelagic fossils. Conodonts are in some beds very frequent (up to 1000 specimens per kg), but only one non-pelagic species is present. Among the holothurian sclerites only *Theelia* and *Achistrum* are present. Therefore the water depth in this restricted basin was not much higher than in the platform carbonates (dolomites) below and above.

In the Pilis Mts, at the northern slope of the Feketehegy and in the adjacent Cserepes valley, lithologically similar restricted basin sediments were partly also placed into the Carnian (ORAVECZ, 1961). Earlier authors (VIGH, 1928, SCHAFARZIK & VENDL, 1929) compared these beds with Rhaetian Kössen Beds. Even *Rhaetavicula contorta* was reported from these beds, but later not confirmed. BALOGH (1981) recognized that the presence of *Rhabdoceras suessi* in these beds that indicates Late Norian age and even does not ecxlude Lower Rhaetian age. BUDAI & KOVÁCS (1986) reported *Metapolygnathus slovakensis* KOZUR from these beds, but did not indicate, whether this species occurs in the lower or upper part of the Feketehegy Limestone sequence. We have found *Mockina slovakensis* (KOZUR) both from beds on the northern slope of the Feketehegy (primitive forms) and from the Cserepes valley (highly evolved forms). *M. slovakensis* is a typical Sevatian species with its main occurrence in the upper *M. bidentata* Zone (KOZUR, in press). Because no other metapolygnathid conodont and no gondolellid conodont occur in the Feketehegy Limestone, restricted basin facies is indicated.

So, the Feketehegy Limestone has similar restricted basin facies like the Middle Carnian of Pesthidegkút Kálváriahegy, Solymár Eocene Basin and Pilisvörösvár, but is quite different (Sevatian) in age. Therefore in the Late Triassic NW of the Buda Line a shallow carbonate platform existed, in which in different times and at different places shallow intraplatform basins developed, which had no basinal connection to the open pelagic realm. On the contrary, SE of the Buda Line the whole Norian and Rhaetian has open sea pelagic facies.

The Middle Carnian sequence with marly limestones, marls and partly massive, cherty dolomites from the above mentioned area NW of the Buda Line is always tectonically separated from the typical sequence of the Nagykovácsi Nappe. In an old quarry NW of the Pesthidegkút Kálváriahegy the tectonic overthrusting of Carnian dolomites on Norian Dachstein Limestone was formerly exposed (WEIN, 1977). Today this overthrust is not more visible because of a waste deposit, but the overthrusted strongly brecciated dolomite is still exposed. It is overlain by not brecciated dolomite which is, in turn, overlain by the Middle Carnian restricted basin sequence. At the SW foot of the Pesthidegkút

Kálváriahegy Dachstein Limestone is still exposed in some smaller blocks. Higher up follows again brecciated dolomite etc., but the direct thrust-plane is not exposed. Nevertheless, this geological situation confirms the data given by WEIN (1977) that the Carnian sediments overthrust the Norian Dachstein Limestone.

Probably, this Middle Carnian restricted basin facies occurs in a tectonic slice within the Nagykovácsi Nappe. But on the other hand, until now Middle Carnian restricted basin sediments are unknown from the Nagykovácsi area. Perhaps this depends from the higher stratigraphic level, generally exposed there (mostly Norian-Rhaetian). But also N of Nagykovácsi, where Middle Carnian sediments could be expected, Middle Carnian restricted basin sediments were not yet found. Therefore it cannot be excluded that there are 2 facial developments within the Nagykovácsi Nappe, one with uninterrupted carbonate platform development (dolomites) within the Middle Carnian and an other one with Middle Carnian restricted basin development within the dolomitic carbonate platform development. Because of the tectonic contact of Norian Dachstein Limestone with the overthrusted sequence which contains the Middle Carnian restricted basin sediments, it cannot be excluded that here slices of a partial nappe inside the Nagykovácsi Nappe are present.

As already pointed out, SE of the Buda Line not only a quite e SE of the Buda Line the same development as in the Bükk Mts. (in the Triassic only in the Fennsík Nappe system) can be observed, quite different from contemporaneous sediments NW of the Buda Line. The present day predominant opinion in Hungary that there is a pre-Tertiary tectonic unit or even subunit from the Drauzug through Balaton Highland until the Darnó Line (HAAS & KOVÁCS, 1985: Transdanubian Central Range Unit, by FÜLÖP, BREZSNYÁNSZKY & HAAS, 1987 regarded as subunit of the Pelso "Unit") has to be abandoned. This area was neither before the nappe building (e.g. in the Late Triassic or Jurassic) nor in the pre-Middle Miocene post-nappe time a tectonic unit. This area contains several nappes which belong to quite different nappe systems, including remnants of the Tethyan Mobile Belt and nappes of the outer Dinaric, Adriatic and Inner Western Carpathian nappe systems. After the nappe-building we can observe during the Late Eocene and Oligocene 2 different facial developments within the Transdanubian Central Range Unit (Subunit), separated today by the Buda Line (compare BÁLDI, 1986).

The Pelso "Unit" sensu FÜLÖP, BREZSNYÁNSKY & HAAS (1987) contain still more different units. Except the above discussed Transdanubian Central Range "Subunit" (not a tectonic subunit or unit, see above), it comprises also the Transdanubian (Igal) Subunit and the Borsod Subunit (Bükk Mts). In the Igal "Subunit" nappes with Outer Dinaric Paleozoic and Triassic development lies on melanges of Tethyan Mobile Belt with very low grade metamorphic deep-water Triassic and basic/ultrabasic magmatics (borehole Inke, see KOZUR & MOCK, 1987, 1988). In the Borsod "Subunit" melange nappes of the Tethyan Mobile Belt (Meliaticum), Inner Western Carpathian nappes (N-Rudabányaicum, Silicicum), and nappes with an original depositional area south of the Meliata-Hallstatt rift (e.g. Fennsíkum) are present. Therefore the Pelso "Unit" cannot be regarded as a pre-Tertiary tectonic unit.

There are 2 Triassic developments with pelagic Norian and Rhaetian SE of the Buda Line. In the largest part of the Buda Mts. SE of the Buda Line the following sequence can be observed: Late Ladinian to Cordevolian Diplopore Dolomite – Middle to Late Carnian partly megalodontid-bearing dolomites – topmost Carnian basal Norian ammonoid- and gastropod-bearing dolomites – Lower Norian to Sevatian light-coloured, thick-bedded, in some parts rather massive, in the Sevatian part dark fine-laminated and thin-bedded cherty dolomites with reddish, higher up gray and black cherty nodules. HORVÁTH & TARI (1987) found also Middle Triassic andesitic volcanics which belong to this sequence, but mostly they are only known from the overlying Eocene basal conglomerate.

The Diplopore dolomite (Wetterstein Dolomite) was named by BALOGH (1981) as Budaörs Dolomite Formation, the cherty dolomites as Sashegy Dolomite Formation. The latter term is overtaken here. This development, which we find in the whole Buda Mts. SE of the Buda Line (e.g. Ördögorom, Sashegy and toward the NE until the Hármashatárhegy-Csúcshegy), we place here into the Buda Nappe s.str. This nappe is here used in a by far more restricted sense than the Buda Nappe sensu WEIN (1977) for a nappe exposed in the Buda Mts. SE of the Buda Line until the Csúcshegy-Hármashatárhegy in the NE. Quite characteristical for the Budda Nappe s.str. is the secondary dolomitization of the Norian pelagic cherty limestone into the Sashegy Dolomite Formation during post-Norian – pre-Priabonian time. At the tectonic line on the NE slope of the Hármashatárhegy-Csúcshegy, the Buda Nappe is overthrusted by the frontal part of the Csővár Nappe with SW vergency. The Csővár Nappe, newly introduced here, is named according to its typical development in the Csővár area (S of Cserhát Mts. on the left side of Danube river), has originally quite the same Late Triassic lithological development as in the Buda Nappe, but the pelagic Norian and Rhaetian beds (dark, bituminous, bedded, partly fine-laminated, often allodapical, partly cherty limestones, marls = Csővár Limestone Formation s.str.) are not secondarily dolomitized.

The exact sequence immediately below the Csővár Limestone Formation is not yet clear, because the contact to the underlying dolomites is either not exposed or tectonically (e.g. in the Csővár borehole). Dolomitic limestones and limy dolomites adjacent to the cherty limestones are probably the transitional beds between the dolomitic shallow water sediments and the cherty limestone pelagic development.

Not clear is the position of the Late Carnian "Dachstein reef limestone"*) of Nézsa in the vicinity of the northwesternmost occurrence of Norian cherty limestones between Csővár and Nézsa. The following possibilities can be assumed:

a) This light-coloured shallow-water limestone with ammonoids, brachiopods, megalodontids etc. lies in stratigraphic sequence between the dolomitic limestones/limy dolomites and the cherty limestones. In this case the Norian Dachstein Limestone of Keszeg and Szelehegy NW of Nézsa would be tectonically separated (NW of Buda Line or tectonic slice along the Buda Line).

*) We introduce here for these limestones the name Nésza Limestone Formation.

b) The Late Carnian Nézsa Limestone Formation underlies the Norian Dachstein Limestone of Szelehegy and Keszeg. In this case the Nézsa Limestone Formation would belong to an other tectonic unit than the Csővár Limestone Formation. Than it would belong either to a further independent nappe SE of the Buda Line or to a tectonic slice along the Buda Line. But even in this latter case the Nézsa Limestone Formation would not belong to the typical development NW of the Buda Line, where shallow water dolomites occur from the Ladinian up to the Middle Norian (partly with short interruption by Middle Carnian shallow restricted basin deposits) and only in the higher Middle Norian the deposition of pure limestones (Dachstein Limestones Formation) begins.

Likewise problematical is the tectonic position of the Dachstein Limestone from the Rókahegy (near Csillaghegy, NE Budapest), situated immediately SE of the Buda Line. In contrary to the general development SE of the Buda Line (fully pelagic Norian and Rhaetian) here shallow water sedimentation like NW of the Buda Line can be observed. But this Dachstein Limestone is in contrary to the Dachstein Limestone of the Nagykovácsi Nappe NW of the Buda Line massive and not stratified into thick beds. Megalodontids, very frequent in the Dachstein Limestone of the Nagykovácsi Nappe, are extremely rare, partly even missing (not yet found in the well exposed Rókahegy locality). According to FORGÁCS (in ORAVECZ-SCHEFFER, 1987) the age of this Dachstein Limestone is Carnian and not higher Middle Norian to Rhaetian like NW of the Buda Line. But this latter age determination could not be confirmed by our investigations. We have found in the middle part of the sequence a holothurian fauna with *Theelia variabilis* ZANKL and *Theelia zawidzkae* KOZUR & MOCK indicating Middle Norian to basal Sevatian age. Of course, an earlier beginning of the Dachstein limestone in this area cannot be excluded, because the transition to the Hauptdolomite is not exposed.

The Tertiary basal conglomerate contains both pebbles from the underlying Dachstein Limestone and from pelagic Norian rocks with rich holothurian and radiolarian faunas, a facies which is quite unknown NW of the Buda Line. For this situation here the following explanation is given: The Dachstein Limestone from Rókahegy (as well as from boreholes S of Csillaghegy and on the Margit Island, in both cases overlain by Buda Marl/Tard Clay, see WEIN, 1977) represent a tectonic window below the higher Buda- and Csővár Nappes, from where both the pebbles with pelagic Norian and the pebbles of Middle Triassic andesitic volcanics derived. The sequence of the Jánoshegy (also situated just adjacent to the Buda Line), likewise with Dachstein Limestone and with Middle Triassic andesitic pebbles in the Eocene basal conglomerate could belong to the same tectonic unit as the Rókahegy, HORVÁTH & TARI (1987) could demonstrate that the source area of the andesitic pebbles was south of the Jánoshegy, inside the Buda Nappe s.str.

Since more than 100 years the Mátyáshegy Limestone was regarded as the oldest unit of the Late Triassic in the Buda Mts. or even as topmost Ladinian by all Hungarian geologists. This age determination was not based on fossils, but on correlations with facial similar rocks outside the Buda Mts. An important role played in this connection the (correct!) correlation between the Mátyáshegy Limestone and the ammonoid-bearing Csővár Limestone which was placed before KOZUR & MOSTLER (1973) on the base of its macrofauna into the Lower Carnian (see chapter II.1.). This correlation we find already by VADÁSZ (1910) and KUTASSY (1927). The latter author wrote:

„ ... Auf die stratigraphische Stellung des Hornsteinkalkes können wir also lediglich aus den Lagerungsverhältnissen und eventuell aus der stratigraphischen Stellung der naheliegenden Gesteine von gleicher petrographischer Beschaffenheit Schlüsse ziehen ... "

Because all leading Hungarian geologists since VADÁSZ (1910) correlated correctly the Mátyáshegy Limestone with the assumed Lower Carnian Csővár Limestone, the Lower Carnian assignment of the Mátyáshegy Limestone (Horsteinkalk in the quotation above) was quite logical. However, after the placement of the Csővár Limestone s.str. into the higher Sevatian to Rhaetian by KOZUR & MOSTLER (1973) also a higher Sevatian to Rhaetian age assignment for the Mátyáshegy Limestone was quite logical. WEIN (1977) had clearly recognized the big stratigraphical and tectonical consequences for the Transdanubian Hungarian Mid-Mountains, if the highest Sevatian/Rhaetian age of the Csővár Limestone s.str. could be confirmed (see footnote in WEIN, 1977).

HAAS & KOVÁCS (1985), in turn, placed their newly introduced Mátyáshegy Formation again into the Lower Carnian and this not on the base of the rich microfauna in the type locality of this "formation", but like in the beginning of this century, on the base of lithostratigraphic correlations. To preserve the Lower Carnian age of the Mátyáshegy "Formation" they regarded now these beds as facial- and time-equivalents of Lower (Middle) Carnian cherty limestones and cherty dolomits of the Zsámbék area far NW of the Buda Line which they did not accept. This view was even furthermore expressed after KOZUR (1987) has shown by conodonts, holothurian sclerites, radiolarians the Norian age of the cherty dolomites and the Rhaetian age of the Mátyáshegy Limestone. By the correlation of the Mátyáshegy "Formation" with the Lower (Middle) Carnian cherty limestones/dolomites of Zsámbék, HAAS & KOVÁCS (1985) rejected, moreover, the former (correct) correlation of the Mátyáshegy Limestone with the Csővár Limestone (on the same side of the Buda Line) by all Hungarian geologists, because they accepted on the other hand the younger age of the Csővár Limestone Formation.

With very big financial expense the stratotype of the Mátyáshegy "Formation" was cleaned and bed by bed micropaleontologically investigated (conodonts: Dr. S. KOVÁCS, foraminifers: Dr. A. ORAVECZ-SCHEFFER). Moreover, a lot of paleomagnetic samples were taken, the whole profile was bed by bed numbered, measured and like all stratotypes of lithostratigraphic unit investigated. Inspite of this extensive and expensive preparations and investigations of the outcrop, the clear tectonic situation and the correct age of the very fossil-rich rocks (conodonts, holothurian sclerites, foraminifers, radiolarians etc.) were not recognized.

The Mátyáshegy "Formation" introduced by HAAS & KOVÁCS (1985) cannot be accepted for the following reasons:

1) In its stratotype (western corner of the Mátyáshegy quarry, Budapest) it contains 2 different lithologic units which follow each other in tectonic position:

the predominantly Rhaetian Mátyáshegy Limestone (below) and the Norian cherty dolomite (above).

2) For the cherty dolomites already the term Sashegy Dolomite Formation was introduced by BALOGH (1981), whereas the Mátyáshegy Limestone is a facial- and time-equivalent of the Csővár Limestone Formation s.str., introduced by BALOGH (1981). Therefore the Mátyáshegy "Formation" sensu HAAS & KOVÁCS (1985) is a "tectonic mixture" of 2 already formerly named formations which are in the stratotype of the Mátyáshegy "Formation" in tectonic superposition and which belong to 2 different nappes.

Already HORUSITZKY (in SCHRÉTER et al., 1958) recognized the tectonic succession of the beds in the western corner of the Mátyáshegy quarry which is therefore quite unsuitable as stratotype. Under these circumstances it is hardly to understand, why such a section was choicen as stratotype and extensively cleaned and investigated under high financial expense. As clearly seen in the section and documented already by a good photo in WEIN (1977), the Mátyáshegy Limestone and the Priabonian limestones are downthrusted below the cherty dolomite. Blocks of Mátyáshegy Limestone below the cherty dolomites contain even pockets with Eocene basal conglomerate (KOZUR & MOCK, in press) and it is therefore impossible that the Mátyáshegy Limestone is the stratigraphic underlayer of the cherty dolomite as assumed by HAAS & KOVÁCS (1985) in agreement with older opinions which were repeatedly expressed since more than 100 years. So, e.g., KUTASSY (1927) wrote:

„ ... Ein ähnlich klares Bild des stratigraphischen Nacheinanders zeigt auch der Aufschluß des Mátyáshegyberges, wo ebenfalls der obertriadische Dolomit unmittelbar dem hornsteinführenden Kalk auflagert ... "

This view, expressed in similar statements since the late years of the last century was overtaken like a dogma until today. Only KOZUR (1987) recognized that the Mátyáshegy Limestone in the Mátyáshegy quarry is Rhaetian and the tectonically overlying cherty dolomite Norian in age.

Also without any paleontological investigation this situation is quite clear for the following reasons:

1) The overthrusting of the beds is clearly visible.
2) If the Mátyáshegy Limestone below the cherty dolomite contains partly pockets with Eocene basal conglomerate, than it cannot be the stratigraphic underlayer of the cherty dolomite.
3) Also the fine-laminated cherty, partly marly dolomite with black cherts lies below the bedded cherty dolomites with reddish cherty nodules. Already HOFMANN (1871) has known that the fine-laminated cherty, partly marly dolomite built up the uppermost part of the cherty dolomite sequence and nobody has questioned this correct statement made more than 100 years before. Therefore also by pure lithostratigraphic methods can be clearly shown that at the stratotype of the Mátyáshegy "Formation" sensu HAAS & KOVÁCS (1985) the younger beds lie below the older ones, separated by a distinct tectonic breccia.

The tectonic position of the Mátyáshegy Limestone below the cherty dolomite in the Mátyáshegy quarry is the result of 2 tectonic movements:

1) The SW-vergent overthrusting of the stirnfront of the Csővár Nappe brings the Csővár Limestone Formation (Mátyáshegy Limestone) in a tectonic position above the Sashegy Dolomite Formation (cherty dolomite) of the Buda Nappe.
2) Post-Priabonian thrusting brings the tectonically overlying Csővár Limestone Formation together with the uppermost parts of the Sashegy Dolomite Formation and Priabonian limestones below the lower part of the Sashegy Dolomite Formation.

Also in all other occurrences of bituminous, partly cherty topmost Sevatian to Rhaetian limestones, the contact to the Norian cherty dolomites is tectonical. Along the NE slope of the Hármashatárhegy/Csúcshegy topmost Norian to Rhaetian partly cherty limestones are badly exposed over a long distance. Here they lie seemingly on the cherty dolomites and not below it as in the Mátyáshegy quarry.

Both the Buda Nappe s.str. and the Csővár Nappe belong to the Dinaric nappe system. The vergency is SW or SWW like in the Dinarides. The nappes were formed before the Priabonian, because Priabonian limestones overlie both the Buda Nappe s.str. and the Csővár Nappe. Probably the area SE of the Buda Line was during the Eocene still part of the Dinarides and only during the Middle and Late Miocene this area was displaced several 100 km toward the NE.

The cherty dolomite (Sashegy Dolomite Formation) of the Mátyáshegy section, Hármashatárhegy, Sashegy and Ördögorom is very rich in conodonts, holothurian sclerites and radiolarians which are described in an other paper (KOZUR & MOCK, in press). The youngest beds of this formation have the same higher Sevatian age as the oldest beds of the Mátyáshegy Limestone. Also the Mátyáshegy Limestone is partly rich in microfossils (conodonts, foraminifers, holothurian sclerites, sponge spicules). Samples were investigated from the Mátyáshegy section, from the Mátyáshegy cave (for samples from the cave we thank very much Dr. SZ. LEEL-ÖSSY, Budapest) and from the NE slope of the Csúcshegy and Hármashatárhegy. The bulk of the samples belongs to the Rhaetian, the oldest fauna yielded Upper Sevatian holothurian sclerites. In the next younger fauna *Misikella hernsteini* (MOSTLER), *M. posthernsteini* KOZUR & MOCK, *Oncodella paucidentata* and other conodonts as well as a very rich holothurian associaton are present. This fauna is quite identical with the conodont and holothurian sclerite fauna from *Cochloceras suessi*-bearing topmost Hallstatt Limestones of the Alps. Depending from the final definition of Norian Rhaetian boundary this fauna belongs either to the topmost Sevatian or to the basal Rhaetian. The undoubtedly Rhaetian samples yielded mainly *Neohindeodella rhaetica* KOZUR & MOCK, partly also *Misikella posthernsteini*. In most of these samples holothurian sclerites, radiolarians and partly also foraminifers are present. Some samples yielded the radiolarian genus *Podobursa*, not known so far from pre-Jurassic beds. Therefore a Jurassic age for the topmost parts of the Mátyáshegy Limestone is indicated, the more as none of the *Podobursa*-bearing sample yielded conodonts or Triassic holothurian sclerites.

Like in the Csővár Limestone Formation from Csővár graded bedding is frequent in the Mátyáshegy Limestone from Budapest, caused by repeated influx of shallow water material (including onkoids and ooliths), but even in beds with many shallow water components pelagic fossils from the matrix are present.

Acknowledgements

The authors thank very much Dr. SZ. LEEL-ÖSSY, Budapest, for samples of Mátyáshegy Limestone from the Mátyáshegy cave.

We thank very much Prof. Dr. H. MOSTLER, Innsbruck for numerous data on Rhaetian conodonts from the Alps, the possibility to study his Rhaetian collections and important data to the Rhaetian stratigraphy of the Alps.

We are also very grateful to Prof. Dr. E. VÉGH, Budapest, for critical reading of the manuscript and important data and discussions.

Plate 1

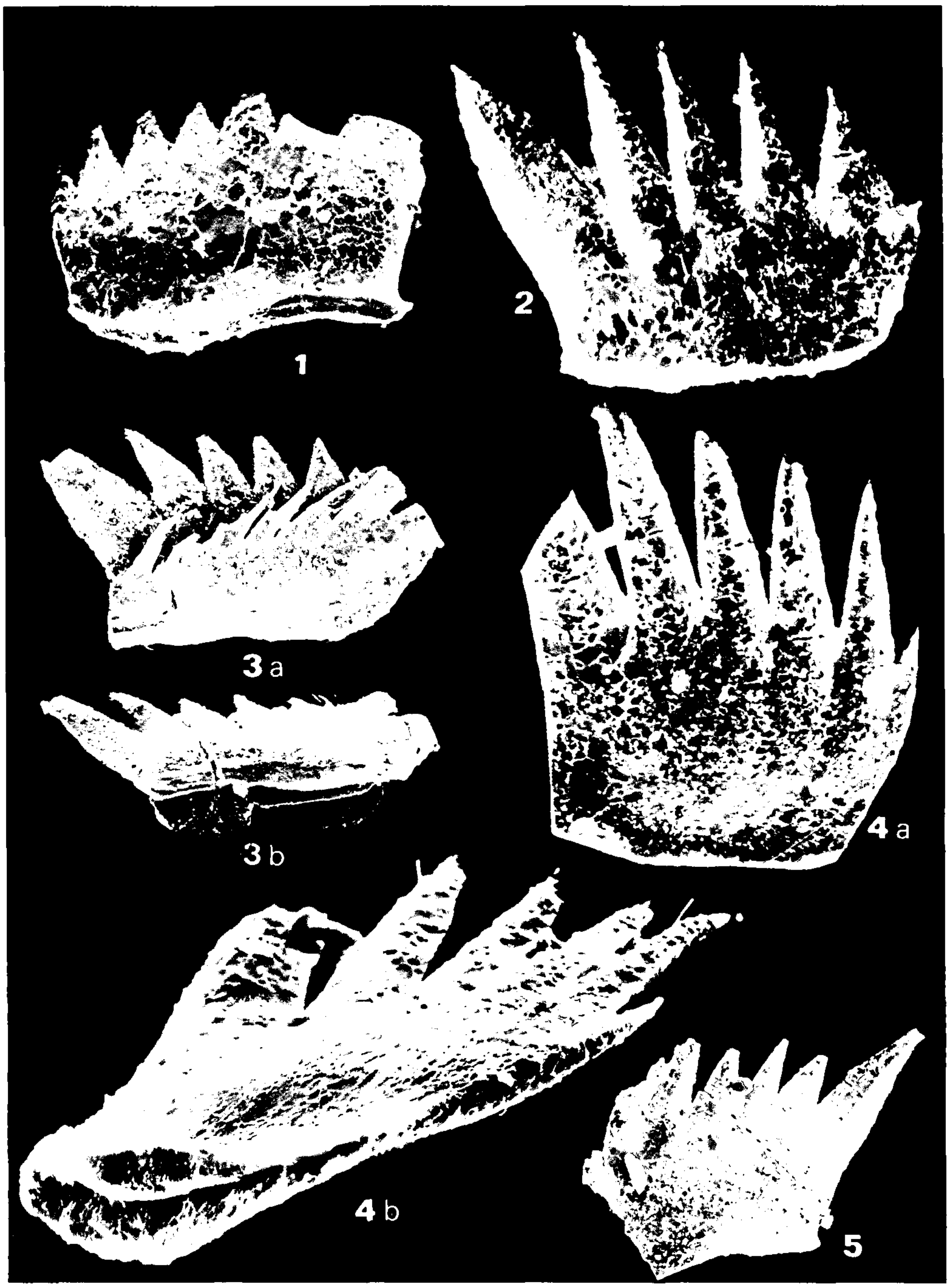


Fig. 1: ***Nicoraella ? budaensis*** **n.sp.**
Pesthidegkút, Kálváriahegy, sample Ka 5, Middle Carnian, ×220.

Fig. 2: ***Nicorallea ? budaensis*** **n.sp.**
Pilisvörösvár, sample P 7, Middle Carnian, ×300.

Fig. 3a,b: ***Nicoraella ? budaensis*** **n.sp.**
Holotype, cluster, spathognathodiform and hindeodelliform element.
Pesthidegkút Kálváriahegy, sample Ka 2, Middle Carnian, ×220.
a) Lateral view.
b) Oblique lower view.

Fig. 4a,b: ***Nicoraella ? budaensis*** **n.sp..**
Modified ozarkodiniform element, Pilisvörösvár, sample P 7, Middle Carnian.
a) Lateral view, ×280.
b) Oblique lower view, ×480.

Fig. 5: ***Nicoraella ? budaensis*** **n.sp.**
Pesthidegkút, Kálváriahegy, sample Ka 2, Middle Carnian, ×220.

Plate 2

Fig. 1: ***Nicoraella ? budaensis*** **n. sp.**
Pesthidegkút, Kálváriahegy, sample Ka 2 A, Middle Carnian, ×220.

Fig. 2: ***Nicoraella ? budaensis*** **n. sp.**
Pesthidegkút, Kálváriahegy, sample Ka 2 A, Middle Carnian, ×220.

Fig. 3: ***Nicoraella ? budaensis*** **n. sp.**
Pesthidegkút, Kálváriahegy, sample Ka 2 A, Middle Carnian, ×220.

Fig. 4: ***Nicoraella ? budaensis*** **n. sp.**
Pesthidegkút, Kálváriahegy, sample Ka 2 A, Middle Carnian, ×220.

Fig. 5: ***Nicoraella ? budaensis*** **n. sp.**
Oblique lower view, Pilisvörösvár, sample P 7, Middle Carnian, ×300.

Fig. 6: ***Nicoraella ? budaensis*** **n. sp.**
Lower view, Pilisvörösvár, sample P 7, Middle Carnian, ×600.

Fig. 7: ***Oncodella paucidentata*** **(MOSTLER, 1967).**
NE slope of Csúcshegy just SE of Buda Line, sample Cs 5, lowermost *M. posthernsteini* A.-Z. – topmost Norian or basal Rhaetian, ×140.

Figs. 8,9: ***Nicoraella ? budaensis*** **n. sp.**
Hindeodelliform element, Pesthidegkút, Kálváriahegy, sample Ka 5, Middle Carnian, ×80.

Plate 3

Fig. 1: ***Nicoraella ? budaensis* n.sp.**
Pesthidegkút, Kálváriahegy, sample Ka 5, Middle Carnian, ×220.

Fig. 2: ***Nicoraella ? budaensis* n.sp.**
Prioniodiniform element, Pesthidegkút, Kálváriahegy, sample Ka 5, Middle Carnian, ×200.

Fig. 3: ***Nicoraella ? budaensis* n.sp.**
Enantiognathiform element, Pilisvörösvár, sample P 7, Middle Carnian, ×80.

Fig. 4: ***Nicoraella ? budaensis* n.sp.**
Prioniodiniform element, Pilisvörösvár, sample P 7, Middle Carnian, ×80.

Fig. 5: ***Nicoraella ? budaensis* n.sp.**
Hibbardelliform element, Pilisvörösvár, sample P 7, Middle Carnian, ×160.

Fig. 6: ***Nicoraella ? budaensis* n.sp.**
Hibbardelliform element, Pesthidegkút, Kálváriahegy, sample Ka 2A, Middle Carnian, ×200.

Figs. 7, 8: ***Nicoraella ? budaensis* n.sp.**
Hibbardelliform element, Pesthidegkút, Kálváriahegy, sample Ka 5, Middle Carnian, ×200.

Fig. 9: ***Nicoraella ? budaensis* n.sp.**
Prioniodiniform element, Pesthidegkút, Kálváriahegy, sample Ka 2, Middle Carnian, ×200.

Figs. 10,11: ***Nicoraella ? budaensis* n.sp.**
Hindeodelliform element, Pilisvörösvár, sample P 7, Middle Car-nian, ×80.

Plate 4

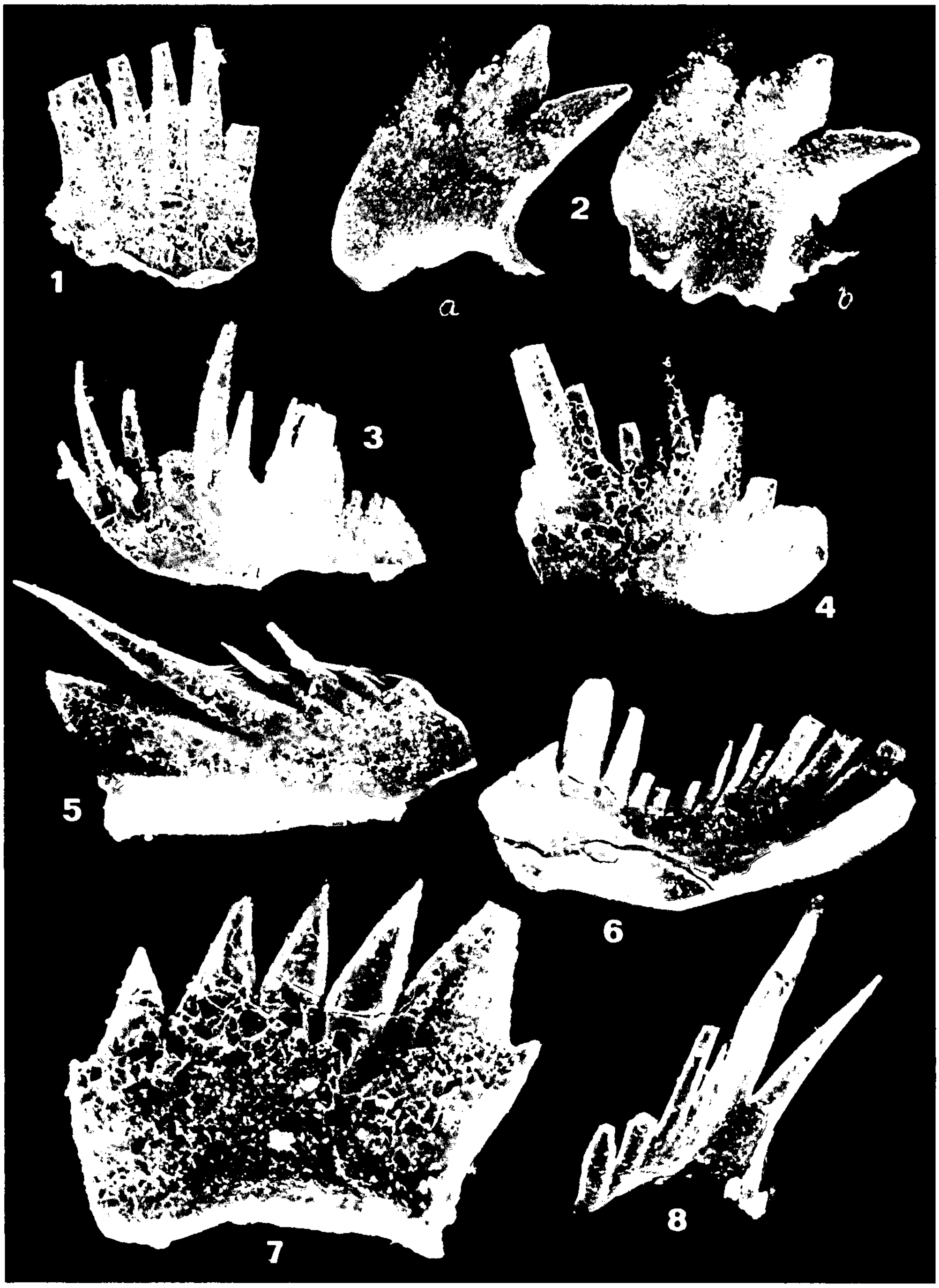


Fig. 1: ***Nicoraella ? budaensis* n.sp.**
Modified ozarkodiniform element, Pesthidegkút, Kálváriahegy, sample Ka 2, Middle Carnian, ×200.

Fig. 2a,b: ***Misikella posthernsteini* KOZUR & MOCK, 1974.**
NE slope of Csúcshegy just SE of Buda Line, sample Cs5, lowermost *M. posthernsteini* A.-Z., topmost Norian or basal Rhaetian, ×200.

Fig. 3: ***Nicoraella ? budaensis* n.sp.**
Hindeodelliform element, Pesthidegkút, Kálváriahegy, sample Ka 2, Middle Carnian, ×200.

Fig. 4: ***Nicoraella ? budaensis* n.sp.**
Hindeodelliform element, Pesthidegkút, Kálváriahegy, sample Ka 5, Middle Carnian, ×200.

Figs. 5,6: ***Nicoraella ? budaensis* n.sp.**
Enantiognathiform element, Pesthidegkút, Kálváriahegy, sample Ka 2A, Middle Carnian.
Fig. 5: ×190.
Fig. 6: ×160.

Fig. 7: ***Nicoraella ? cf. budaensis* n.sp.**
Pilisvörösvár, sample P 7, Middle Carnian, ×340.

Fig. 8: ***Nicoraella ? budaensis* n.sp.**
Enantiognathiform element, Pesthidegkút, Kálváriahegy, sample Ka 2A, Middle Carnian, ×190.

Plate 5

Fig. 1: ***Neohindeodella rhaetica* n. sp.**
Holotype, Csővár, sample 1X, Late Rhaetian, ×120.

Fig. 2: ***Misikella ultima* n. sp.**
Transitional form to *M. posthernsteini*, Csővár, float sample, Late Rhaetian, ×150.

Fig. 3: ***Hungarella* sp.**
Csővár, sample 1X, Late Rhaetian, ×160.

Fig. 4: ***Misikella posthernsteini* KOZUR & MOCK, 1974.**
Csővár, sample 1X, Late Rhaetian, ×220.

Fig. 5: ***Zieglericonus rhaeticus* n. gen. n. sp.**
Csővár, sample 1X, Late Rhaetian, ×220.

Fig. 6: ***Misikella posthernsteini* KOZUR & MOCK, 1974.**
Csővár, sample 1X, Late Rhaetian, ×220.

Fig. 7: ***Neohindeodella rhaetica* n. sp.**
Csővár, sample 1C, upper Late Rhaetian, ×140.

Fig. 8: ***Neohindeodella rhaetica* n. sp.**
Csővár, sample 1X, Late Rhaetian, ×160.

Fig. 9: ***Parvigondolella rhaetica* n. sp.**
Holotype, Csővár, sample 1X, Late Rhaetian, ×260.

Plate 6

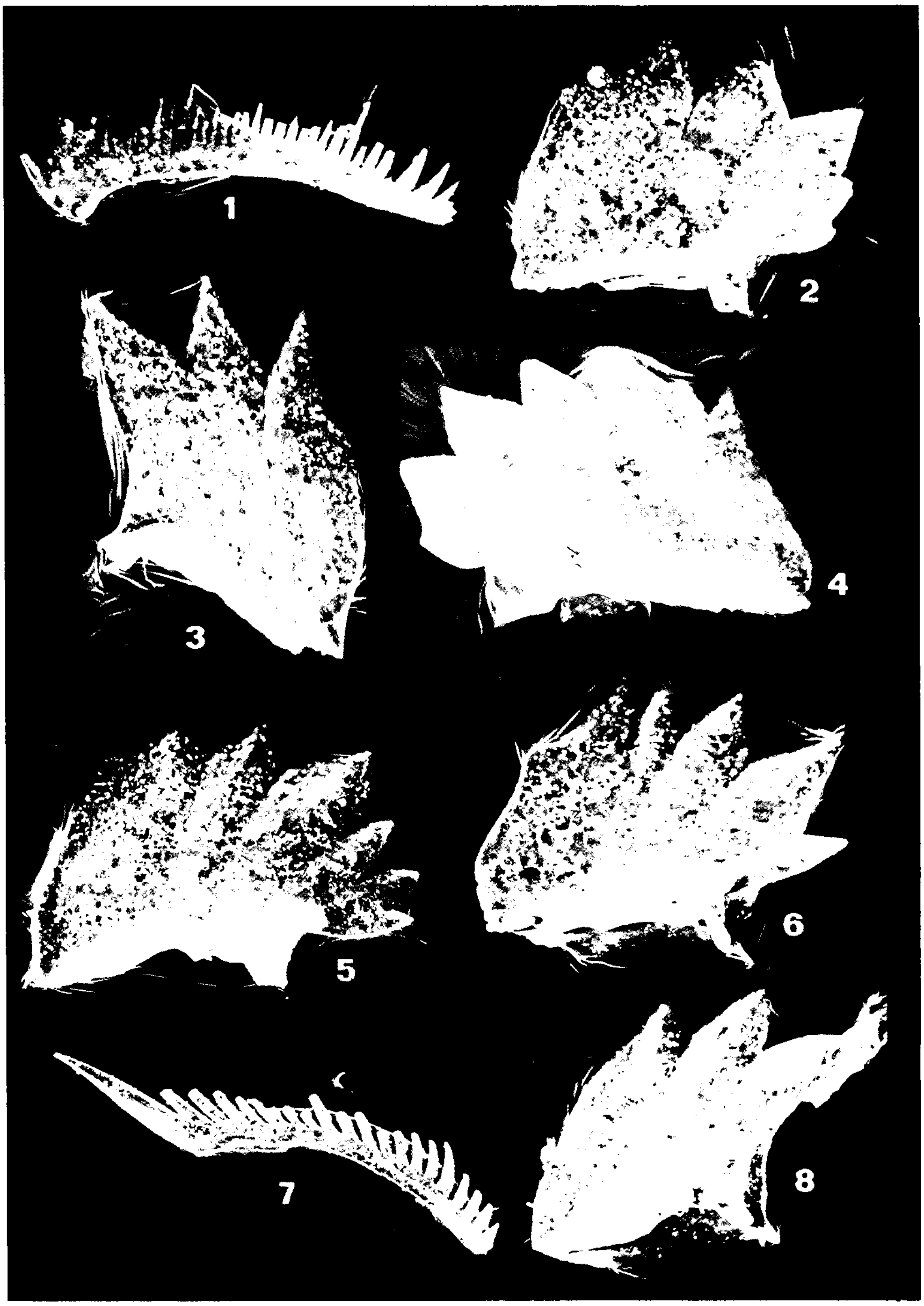


Fig. 1: ***Neohindeodella detrei*** **n.sp.**
Csővár, sample 1F, topmost Rhaetian or basalmost Liassic, ×120.

Fig. 2: ***Misikella ultima*** **n.sp.**
Csővár, sample 1C, upper Late Rhaetian, ×160.

Fig. 3: ***Misikella posthernsteini*** **KOZUR & MOCK, 1974.**
Csővár, sample 1C, upper Late Rhaetian, ×210.

Fig. 4: ***Misikella ultima*** **n.sp.**
Csővár, sample 1C, upper Late Rhaetian, ×160.

Fig. 5: ***Misikella ultima*** **n.sp.**
Holotype, Csővár, sample 1C, upper Late Rhaetian, ×160.

Fig. 6: ***Misikella ultima*** **n.sp.**
Csővár, sample 1C, upper Late Rhaetian, ×180.

Fig. 7: ***Grodella delicatula*** **(MOSHER, 1968).**
Csővár, sample 1C, upper Late Rhaetian, ×60.

Fig. 8: ***Misikella posthernsteini*** **KOZUR & MOCK, 1974.**
Csővár, sample 1C, upper Late Rhaetian, ×150.

Plate 7

Figs. 1,2: ***Misikella koessenensis*** **MOSTLER, 1978.**
Csővár, sample 1X, Late Rhaetian.
Fig. 1: ×300.
Fig. 2: ×250.

Fig . 3: ***Zieglericonus rhaeticus*** **n.gen. n.sp..**
Holotype, Csővár, sample 1Z, Late Rhaetian, ×220.

Fig. 4: ***Zieglericonus rhaeticus*** **n.gen. n.sp.**
Csővár, sample 1Q, Late Rhaetian, ×210.

Figs. 5,6: ***Nicoraella cf. budaensis*** **n.sp.**
Pesthidegkút, Kálváriahegy, sample Ka 2, Middle Carnian.
Figs. 5,6b: Lateral view, ×220.
Fig. 6a : Oblique lower view, ×260.

Fig. 7: ***Misikella posthernsteini*** **KOZUR & MOCK, 1974.**
Csővár, sample 1X, Late Rhaetian, ×210.

Fig. 8: ***Norigondolella steinbergensis*** **(MOSHER, 1968).**
Csővár, sample 1Q, Late Rhaetian.
a) ×90.
b) ×87.

References

BÁLDI, T. (1986): Mid-Tertiary stratigraphy and paleogeographic evolution of Hungary. – Akadémiai kiadó, 201 pp., Budapest.

BÁLDI, T. & NAGYMAROSI, A. (1976): A hárshegyi homokkő kovásodása és annak hidrotermális eredete. – Földt. Közl., **106**, 257–275, Budapest.

BALLA, Z. (1988): Clockwise paleomagnetic rotations in the Alps in the light of the structural pattern of the Transdanubian Range (Hungary). – Tectonophysics, **145**, 277–292, Amsterdam.

BALOGH, K. (1981): Correlation of the Hungarian Triassic. – Acta Geol. Acad. Sci. Hungar., **24**/1, 3–48, Budapest.

BÉRCZINÉ MAKK, A. (1969): A Fazeksas-hegyi felsőtriász ammonoideák. – Földt. Közl., **99**/4, 351–367, Budapest.

BIRKENMAJER, K., KOZUR, H. & MOCK, R. (1990): Exotic Triassic limestone pebbles from the Pieniny Klippen Belt of Poland. – Ann. Soc. Geol. Polon., **60**, 3–44, Warszawa.

BUDAI, T. & KOVÁCS, S. (1986): A rézi dolomit rétegtani helyzete a Keszthelyi-hegységben. – MÁFI Évi Jel. 1984-böl, 175–191, Budapest.

DETRE, CS. (1969): A Csővár-nézsai triászrögök öslénytani vizsgálatának legújabb eredményei. – Ősl. Viták, **11**, 9–17, Budapest.

DETRE, CS. (1970): Paläontologische und sedimentologische Untersuchungen über die Triasschollen in der Umgebung von Csővár, Nézsa und Keszeg. – Földt. Közl., **100**, 173–184, Budapest.

DETRE, CS. (1981): A Duna-balparti triász rögök rétegtani helyzete. – MÁFI Évi Jel. 1979-böl, 81–95, Budapest.

DETRE, CS., DOSZTÁLY, L. & HERMAN, V. (1986): Uj kicsavarodott Ammonoidea-lelet a hazai triászból. – Ásványgyüjtő Figyelő, **3**/2, 24–27, Budapest.

FISHER, M.H. (1972): Rhaeto-Liassic palynomorphs from the Barnstone railway cutting, Nottinghamshire. – Mercian Geol., **4**/2, 101–106.

FLÜGEL, H.W., FAUPL, P. & MAURITSCH, H.J. (1987): Implications on the Alpidic evolution of the eastern parts of the Eastern Alps. – In: FLÜGEL, H.W. & FAUPL, P. (eds.): Geodynamics of the Eastern Alps, , 407–414, Vienna (Deuticke).

FÜLÖP, J., BREZSNYÁNSKY, K. & HAAS, J. (1987): The new map of basin basement of Hungary. – Acta Geol. Hungar., **30**/1–2, 3–20, Budapest.

GAZDZICKI, A., KOZUR, H. & MOCK, R. (1979): The Norian-Rhaetian boundary in the light of micropaleontological data. – Geologija, **22**/1, 71–112, Ljubljana.

HAAS, J. & KOVÁCS, S. (1985): Lithostratigraphical subdivision of the Hungarian Traissic. – Albertiana, **4**, 5–15, Utrecht.

HOFMANN, K. (1871): Die geologischen Verhältnisse des Ofen-Kovácsier Gebirges. – Mitth. Jahrb., Königl. Ungar. Geol. Anst., **1**, 149–235, Budapest.

HORUSITZKY, F. (1943): A Budai-hegység hegyszerkezetének nagy egységei. – Beszám. A Magy. Kir. Földt. Int., **5**/1, 238–251, Budapest.

HORUSITZKY, F. (1961): Magyarország triász képződményei a nagyszerkezet tükrében. – MÁFI Évk., **49**/2, 267–278, Budapest.

HORVÁTH, E. & TARI, G. (1987): Middle Triassic volcanism in the Buda Mts. – Ann. Univ. Sc. Budapest, **27**, 1–16, Budapest.

KÁZMÉR, M. & KOVÁCS, S. (1985): Permian–Paleogene paleogeography along the eastern part of the Insubric-Periadriatic Lineament system: Evidence for Continental escape of the Bakony-Drauzug Unit. – Acta Geol. Hungar., **28**/1–2, 69–82, Budapest.

KOVÁCS, S. (1982): Problems of the "Pannonian Median Massif" and the plate tectonic concept. Contributions based on the distribution of Late Paleozoic-Early Mesozoic isopic zones. – Geol. Rdsch., **71**/2, 617–640, Stuttgart.

KOZUR, H. (1968): Conodonten aus dem Muschelkalk des germanischen Binnenbeckens und ihr stratigraphischer Wert. Teil II. – Zahnreihen-Conodonten. – Geologie, **17**/9, 1070–1085, Berlin.

KOZUR, H. (1980): Revision der Conodontenzonierung der Mittel- und Obertrias des tethyalen Faunenreichs. – Geol. Paläont. Mitt. Innsbruck, **10**/3–4, 79–172, Innsbruck.

KOZUR, H. (1987): Relations between the boundaries of Tertiary basins and Pre-Tertiary substratum on the example of the Buda Mts. Abstract. – In: Konferencia – Štruktúrny vývoj karpatsko-balkánskeho orogénneho pásma, Oct. 1987, Dom techniky ČSVTS, Bratislava.

KOZUR, H. (1989): The taxonomy of the gondolellid conodonts in the Permian and Triassic. – Cour. Forsch.-Inst. Senckenberg., **111**, 409–469, Frankfurt a.M.

KOZUR, H. & MOCK, R. (1972): Neue Conodonten aus der Trias der Slowakei und ihre stratigraphische Bedeutung. – Geol. Paläont. Mitt. Innsbruck, **2**/4, p. 20, Innsbruck.

KOZUR, H. & MOCK, R. (1974a): Zwei neue Conodonten-Arten aus der Trias des Slowakischen Karstes. – Čas. min. geol. **19**/2, 135–139, Praha.

KOZUR, H. & MOCK, R. (1974b): *Misikella posthernsteini* n.sp., die jüngste Conodontenart der tethyalen Trias. – Čas. min. geol., **19**/3, 245–250, Praha.

KOZUR, H. & MOCK, R. (1977): Conodonts and holothurian sclerites from the Upper Permian and Triassic of the Bükk Mountain (North Hungary). – Acta Mineral.-Petrograph., **23**/1, 109–126, Szeged.

KOZUR, H. & MOSTLER, H. (1972): Die Conodonten der Trias und ihr stratigraphischer Wert. I. Die „Zahnreihen-Conodonten" der Mittel- und Obertrias. – Abh. Geol. B.-A., **28**/1, 1–36, Wien.

KOZUR, H. & MOSTLER, H. (1973): Mikrofaunistische Untersuchungen der Triasschollen im Raume Csövár, Ungarn. – Verh. Geol. B.-A., 973/2 291–325, Wien.

KRYSTYN, L. (1980): Triassic conodont localities of the Salzkammergut region (Northern Calcareous Alps). Second European Conodont Symposium (ECOS II). – Abh. Geol. B.-A., **35**, 61–98, Wien.

KUTASSY, E. (1927): Beiträge zur Stratigraphie und Paläontologie der alpinen Triasschichten in der Umgebung von Budapest. – Annales Inst. Geol. Hung., **27**/2, 107–190, Budapest.

KUTASSY, E. (1936): Födolomit és Dachstein mészkő faunák a Budai hegységböl. – Mat. Természettud. Ert., **54**, 1006–1050, Budapest.

MOSTLER, H. (1967): Conodonten und Holothuriensklerite aus den norischen Hallstätter Kalken von Hernstein (Niederösterreich). – Verh. Geol. B.-A., **1967**/1–2, 177–188, Wien.

MOSTLER, H., SCHEURING, B. & ULRICHS, M. (1978): Zur Mega-, Mikrofanua und Mikroflora der Kössener Schichten (alpine Obertrias) vom Weißloferbach in Tirol unter besonderer Berücksichtigung der in der *suessi-* und *marshi*-Zone auftretenden Conodonten. – Schriftenr. Erdwiss. Komm. österr. Akad. Wiss., **4**, 141–174, Wien.

ORAVECZ, J. (1961): A Gerecse- és Buda-Pilisi hegység közötti rögterület triász képzödményei. – Földt. Közl., **91**/2, 173–185, Budapest.

ORAVECZ, J. (1963): A Dunántúli Középhegység felsőtriász képződményeinek rétegtani- és fácieskérdései. – Földt. Közl., **93**/1, 63–73, Budapest.

ORAVECZ-SCHEFFER, A. (1987): Triassic foraminifers of the Transdanubian Central Range. – Geol. Hungar., Ser. Palaeont., **50**, 1–331, Budapest.

SCHAFARZIK, F. & VENDL, A. (1929): Excursions in the neighbouring of Budapest. – pp. 342, Budapest.

SCHRÉTER, Z. et al. (1958): Budapest és környékének geológiája. – Budapest természeti képe, pp. 33-145, Budapest.

SYKES, J.H., CARGILL, J.S. & FRYER (1970): The stratigraphy and palaeontology of the Rhaetic beds (Rhaetian, Upper Triassic) of Barnstone, Nottinghamshire. – Mercian Géol., **3**/2, 233–264.

VADÁSZ, E. (1910): A Duna-balparti idősebb rögök öslénytani és földtani viszonyai. – M. kir. Földt. Int. Évk., **18**/2, 101–174, Budapest.

VÉGH-NEUBRANDT, E. (1963): Norischer Dachsteinkalk im Nord Bakony. – Földt. Közl., **93**/3, 332–340, Budapest.

VÉGH-NEUBRANDT, E. (1974): Stratigraphische Lage der Triaskomplexe des Budaer Gebirges. – Ann. Univ. Sci., **17**, 287–301, Budapest.

VÉGH-NEUBRANDT, E. (1982): Triassische Megalodonten. Entwicklung, Stratigraphie und Paläontologie. – Akadémiai Kiadó, 526 pp., Budapest.

VIGH, GY. (1928): Adatok a Budai és Gerecse hegységi triász ismeretéhez. – Földt. Közl., **57**, 53–63, Budapest.

VRIELYNCK, B. (1987): Conodontes du Trias périméditerranéen. Systématique, stratigraphie. – Docum. Lab. Géol. Lyon„ **97** (1986), 301 pp., Lyon.

WEIN, GY. (1977): A Budai hegység tektonikája. – MÁFI Alk. Kiadv., 76 pp., Budapest.

WEIN, GY. (1978): Kárpát-Medence Alpi tektogenézise,. – MÁFI Évi Jel., **1976**, 245–256, Budapest.

Manuskript bei der Schriftleitung eingelangt am 16. Jänner 1991.