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CONODONTS AND HOLOTHURIAN SCLERITES FROM THE UPPER PERMIAN AND TRIASSIC OF THE BÜKK MOUNTAINS (NORTH HUNGARY)

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SUMMARY

5 Upper Permian samples from the Bükk mountains have yielded holothurian sclerites. *Theelia dzhulfaensis* MOSTLER et RAHIMI–YAZD, in the Permian hitherto known only from the Iranian and Soviet Transcaucasia, was found for the first time in the European Upper Permian. 2 Upper Permian samples of the same region have yielded a rather rich conodont fauna with *Anchinathodus minutus* (ELLISON) and *Stepanovites dobruskinae* KOZUR et PJATAKOVA. The age of this fauna was determined to be Upper Baisalian (Dzhulfian).

8 samples have yielded Triassic conodonts. By the aid of these conodonts the age of the cherty limestones of Kiseged could be determined as Middle Sevatian. A Lower to Middle Norian age could be determined for the gray limestones with nodular cherts that overlay the "sericitic shale facies". These cherty limestones were hitherto assigned to the Upper Ladinian (Cordevolian) and Carnian. Therefore the "sericitic shale complex" has not ended in the Middle Ladinian, as hitherto assumed, but it has continued up to the Upper Carnian. A sample immediately above the last shales of the "sericitic shale complex" have yielded an Upper Tuvalian to lowermost Norian conodont fauna. A Julian (Middle Carnian) age could be determined for parts of the "sericitic shale complex" by conodont association of *Gondolella polygnathiformis* BUDUROV et STEFANOV, *Gladigondolella tethydis* (HUCKRIEDE) and *Metapolygnathus* cf. *mišiki* KOZUR et MOCK. The "sericitic shale complex" of the Bükk mountains has therefore the same age as the shaly complex with radiolarites and diabases of the Meliata group. A short summary about the development of the Middle and Upper Triassic in the Bükk mountains and the Meliata group is presented.

The Triassic beds of the Bükk mountains as well as of the Meliata group were deposited in a single highly mobile augeosynclinal belt. After the flysch deposition of Carnian age the deep sea basin was uplifted without any folding and metamorphosis. The Triassic of the Bükk mountains and the Meliata group is very similar to the Dinaric and South Alpine ones and it belongs to the Dinaric faunal province. The austroalpine (North Alpine) Triassic of the Silica nappe must be overthrusted from the north to south over the Dinaric (South Alpine) Triassic of the Meliata group. This is indicated by lithological, tectonical and paleontological evidences.

INTRODUCTION

Resembling to certain parts of the Dinarides, mainly the Ladinian–Carnian complex of the Bükk Mountains (North Hungary) and of the Meliata series (Slovakian Karst) shows extraordinary lithological similarity to the Devonian–Carboniferous sequence. This lithological similarity will be more conspicuous when taking also into consideration the diabases and diabase tuffites occurred both in the Upper Devonian–Lower Carboniferous and the Ladinian–Carnian sequence, as well as their equal metamorphic grade. When taking into consideration the great tectonic complexity of these areas and the usually total absence of macrofossils, it less astonishing that a lot of sequences have been stratigraphically drastically re-classified and numerous classifications are questionable still recently, as well. E.g. the re-classification of sequences assumed formerly to be Carboniferous to the Ladinian by K. BALOGH [1964] in the Bükk Mountains; the re-classification of the Meliata Series from the Permian into the Middle and Upper Triassic by H. KOZUR–R. MOCK [1973a, 1973b]; the frequent re-classifications of the limestone–schist group of the Uppony Mountains, e.g. into the Lower Carboniferous by G. PANTÓ [1954], Á. JÁMBOR [1961], K. BALOGH [1964], into the Silurian by J. ORAVECZ [1965], K. BALOGH–L. KŐRÖSSY [1974], into the Devonian up to Lower Upper Carboniferous by Z. SCHRÉTER [1945], into the Devonian up to Bashkirian by H. KOZUR–R. MOCK [1977]; as well as the re-classification of the „lower sequence" of the magnesite deposits of Ochtiná (Gemerides) into the Upper Visean and Serpukhovian by H. KOZUR – R. MOCK – H. MOSTLER [1976]. The exact stratigraphic classification of the strata is, however, indispensable in order to throw light upon both the tectonics of the area in question and the tectonic of the whole region, as well. Since most strata are free of macrofossils or only a small number of macrofossils of little stratigraphic value are found (e.g. crinoid stem ossicles), first of all the micropaleontological investigations should be taken into account. Nevertheless, the microfossils are also unexpected very sparse in most of the investigated strata. Only the conodonts have a wider spread but they are also less frequent. First the upper stratigraphic reach of the Triassic shale–radiolarite complex was to be determined, of course, in order to confirm its correlation with the corresponding members of the Meliata series, which is, however, also very poor in conodonts. The scarcity of microfossils in this members is caused certainly by the great water depth during the sedimentation. This complex bearing partly manganese oxide nodules and iron jaspilites well as many diabase tuff, furthermore pillow lava intercalations, too, was apparently deposited for the most part below the Triassic lime solving limit. As it was stated by H. KOZUR [1974b, 1976] most of the conodonts have a minimum in deep water and are represented here mostly by juvenile forms. The same phenomenon can be observed in the conodont faunas of this limestone banks within the shale–radiolarite sequence. Difficulties with obtaining of conodonts from epimetamorphic strata originate first of all from the large quantity of the solution residue. On the contrary, disregarding the rather frequent occurrence of an extremely plastical deformation the preservation of the fauna is surprisingly good, thus in most of the samples the conodonts can be easily identified. In this paper only the conodonts and holothurian sclerits from the Upper Permian and Triassic of the Bükk Mountains will be dealt with, but the results of conodont investigations carried out in the Meliata Series will also be used in order to make comparisons with the formers.

LIST OF SAMPLES *(Fig. 1)*

Samples 4, 7, 7A and 10: exposures in the cut of the main road between Eger and Szarvaskő, about 7 km NNW of Eger, in the map of K. BALOGH [1964] called as Ladinian ("dark-grey shale complex with sandstone and cherty limestone intercalations").

Sample 4: collected at the telephone pole No. 64/52 from a grey limestone bed with some chert (2 kg). The banked, partly dolomitic limestone alternates with marls.

Sample 7: at half-way between the telephone poles No. 73/52 and 74/52, marly, strongly folded limestone being very similar to the "Campilian marls" (3 kg). It is underlain by grey limestone.

Sample 7A: Thick bank of grey limestone, one metre above sample 7 (3 kg).

Sample 10: dark-grey to black grained limestone with black nodules of chert (8 kg), occuring within the grey shales between the telephone poles No. 79/52 and 80/52 (15 m of the latter one).

Sample 18: cliff-forming exposure beside the asphalt road between Szilvásvárad—Nagymező and Csipkéskút, about 9,5 km of Szilvásvárad, 550 m behind the kilometre stone 9 KM. The sample derives from the transition of the "Ladinian" shale into "Plateau limestone", from grey banked limestone (4 kg).

Sample 22: Lillafüred, limestone exposure at the cross-way of the main road to Miskolc-Csanyik-völgy. Light grey, banked cherty limestone (being like "Reiflinger-Limestone") which is assigned to the Upper Ladinian—Carnian in the map of K. BALOGH [1964], (3 kg).

Samples 23, 25 and 26: Upper Permian limestone from the Mihalovits-quarry at Nagyvisnyó *(Fig. 2).*

Sample 23: 20 cm thick bank of black limestone with a few crinoid stem ossicles, relatively rich in algae (2 kg).

Sample 25: 40 cm thick bank of black limestone with brachipods, crinoids, algae and nautiloids sp. (2 kg).

Sample 26: 2 metres above the sample 25, black banked limestone with algae, brachiopods, corals and crinoid stem ossicles.

Samples 28, 28A and 30: Upper Permian limestones from the railway cut No. 5 by K. BALOGH [1964] near the hectometre stone 425.

Sample 28: it derives from the upper part of the exposure, from a dark-grey limestone bank full with great brachiopods (2 kg).

Sample 28A: Scattered material around the sample 28, deriving probably from the same layer (3 kg).

Sample 30: 10 cm thick dark-grey limestone bank, 160 cm below the sample 28 (2 kg).

Samples 47—48: Norian limestone on the northern side of the Kiseged hill, east of Eger.

Sample 47: organodetrital banked limestone with large chert nodules, of the two small quarries in the western one, from its lower part (3 kg).

Sample 48: it derives from the eastern quarry, from its lower left side, from a banked limestone, which is like "Reiflinger-Kalk" (3 kg).

III. LIST OF FOSSILS AND AGE OF THE MICROFAUNA

The conodonts and holothurian sclerites are seen in Plates I–III. The scanning photos were carried out with JSM–U3 by K. ŠEBOR and M. ŠVEC in the Dionýz Štúr Geological Institute of Bratislava. The paleontological matter is found at R. MOCK, Bratislava.

Holothurian sclerites

Sample 23, 25, 28, 30:

Achistrum cf. *monochordatum* HODSON, HARRIS et LAWSON, 1956
Achistrum cf. *issleri* (CRONEIS, 1932)

The *Achistrum* species being poor in special peculiarities could not be applied for stratigraphic purposes till now.

Sample 26:

Theelia dzhulfaënsis MOSTLER et RAHIMI-YAZD, 1976

Age: The species ranges from the Abadehian up the Anisian, thus it cannot be applied for exact age determinations. The occurrence of this species in the Bükk Mountains, however, is interesting being known in the Upper Permian only in Iran, as yet.

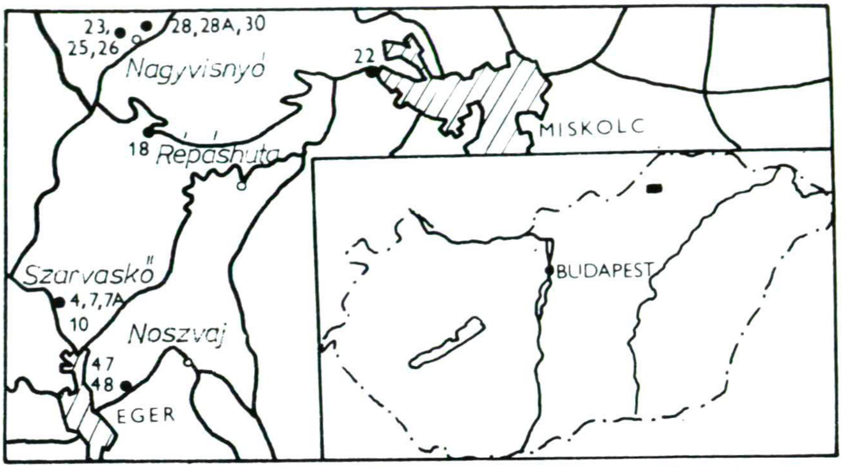

Fig. 1. Schematic sketch on the investigated area and the sampling points.

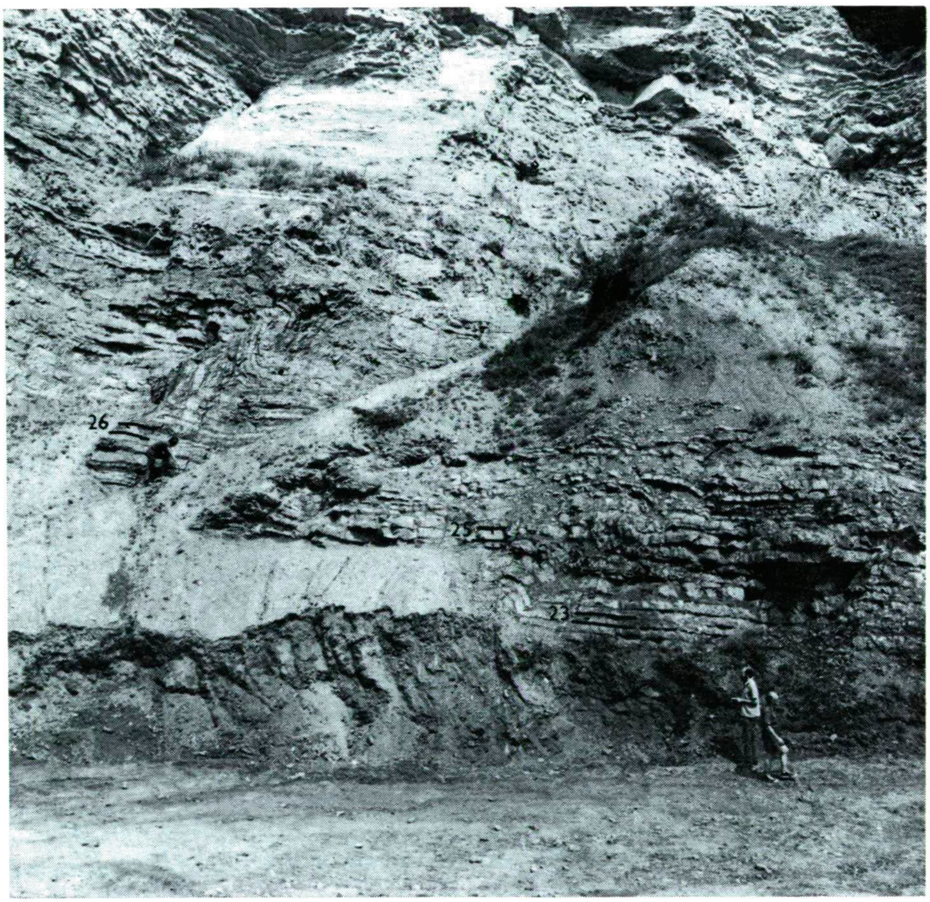

Fig. 2. Mihalovits-quarry in Nagyvisnyó. Lower and middle part of the quarry with the collecting localities of the sample No. 23, 25 and 26. — Photo: R. Mock, 1977

Conodonts

Samples 28, 28A:

Both samples presented the same conodont fauna:

Anchignathodus minutus (ELLISON, 1941), (frequent)
Stepanovites dobruskinae KOZUR et PJATAKOVA, 1975 (rare)

Age: Stepanovites dobruskinae is known only from the Baisalian (Lower Dzhulfian) of Iran and of Transcaucasia. Occurences, which, in consequence of the labile determination, are uncertain taken into the Abadehian, too, and in the Upper Abadehian this species is assumed to occur because in the Lowermost Dzhulfian it is represented already by typical forms. *Anchignathodus minutus* ranges from the Upper Carboniferous up to the uppermost Permian [see H. KOZUR, 1975 and H. KOZUR–H. MOSTLER–A. RAHIMI-YAZD, 1975]. The available forms are highly developed. The rather frequent occurrence of *A. minutus* being extraordinarily rare in the Dorashamian (Upper Dzhulfian) of Iran and Transcaucasia as well as the contemporary absence of *A. julfensis* SWEET, 1973 which is the index fossil of the Dorashamian and the occurrence of *Stepanovites dobruskinae* indicate that the samples 28 and 28A from the fossil-rich horizon of the railway-cut No. 5 of Nagyvisnyó belong still to the Baisalian (because of the highly developed forms of *A. minutus* rather to the Upper Baisalian). In this way a slight difference originates in the classification as compared to that after brachiopods, according to which, on the basis of the occurrence of *Comelicania,* an assignment into the lowermost Dorashamian *(Phisonites–Comelicania fauna)* is rather taken. Since above this brachiopod-rich horizon at the hectometre No. 435 (in the railway cut No. 5 at Nagyvisnyó), after K. BALOGH [1964], there are still about 30–35 m thick Permian sediments there is much to said for the conformity between the Permian and Triassic of the Bükk Mountains suggested by K. BALOGH [1964]. In the case, however, if yet there is a paraconformity (and the profile in the Sebesvíz Valley pictured by S. ANTAL [1975], in which the generally carbonate sequence is interrupted at the Permian/Triassic boundary by a thin slaty marl speaks for this, the gap should be only in the Doroshamian or in the lowermost Triassic. Because of the very high stratigraphic position of the samples 28 and 28A in the Permian proved also on the basis of conodonts, it is excluded that above this horizon still another horizon with *Waagenophyllum* follows as it has been suggested by K. BALOGH [1964]. The opinion of S. ANTAL [1975] can rather be accepted, *i.e.* only one horizon with *Waagenphyllum* is found which is clearly older than the beds from which both conodont-bearing samples derive.

The significance of the conodont fauna demonstrated here is manifested first of all in the fact that within the Tethys itself stratigraphically such high Permian conodont faunas can be found only in a few regions of the world (Iran, Transcaucasia). From the *Bellerophon* strata of the South Alps conodonts are only mentioned buth neither figured nor precisely determined [R. ASSERETO, A. BOSELLINI *et al.* 1973; W. BUGGISCH, 1975; W. BUGGISCH *et al.* 1976].

Sample 4:

Gondolella navicula HUCKRIEDE, 1958 juvenile forms (very rare)
Enantiognathus ziegleri [DIEBEL, 1956], (one specimen)
1 fragment of a compound conodont with *Gladigondolella tethydis* [HUCKRIEDE, 1958].

Age: A more exact classification than into the Upper Anisian up to the Julian is impossible on the basis of the conodonts.

Sample 7:

Gondolella navicula HUCKRIEDE, 1958 juvenile form (one fragment)

Age: Middle to Upper Triassic.

Sample 7A:

One unidentifiable fragment of a compound conodont.

Sample 10:

Gondolella navicula HUCKRIEDE, 1958, mostly juvenile forms (very rare)
Gondolella polygnathiformis BUDUROV et STEFANOV, 1965 (rare)
Metapolygnathus cf. *mišiki* KOZUR et MOCK, 1973 (very rare)
Metapolygnathus pseudodiebeli KOZUR, 1972 (very rare)
Metaprioniodus suevicus [TATGE, 1956] (one specimen)
3 fragments of compound conodonts of the apparatus with *Gladigondolella tethydis* [HUCKRIEDE, 1958].

Age: Julian. — The upper extension of *Gladigondolella tethydis* is Julian. *Gondolella polygnathiformis* occurs only in the Carnian (including the *Frankites sutherlandi*-Zone assigned to the Lower Cordevolian [see H. KOZUR, 1974a]. *Metapolygnathus* cf. *mišiki* is a somewhat more primitive form than the holotype, *i.e.* the platform is somewhat broader and beside the two long and high denticles on the platform there is a tiny third denticle on one side of the platform. Therefore, this form compares to *M. mišiki* as *M. posterus* to *M. bidentatus*. If further matter will be available, this form will be rank as a new species. The deep occurrence of *Metapolygnathus pseudodiebeli* is especially interesting. As it has been demonstrated by H. KOZUR–R. MOCK (in press) this gives a further charasteristic evidences for the Dinaric and Asiatic faunal province. *M. pseudodiebeli* was already described by H. BENDER [1970] from the Julian of Greece and it has been assigned then still to *Tardogondolella abneptis*. E. KRISTAN-TOLLMANN–L. KRYSTYN [1975] found this form also in the Julian. Because of its deep stratigraphic position they created a new species, i.e. *Epigonolella carnica*, although their form demonstrated in Plate 3, Fig. 1. belongs to *M. pseudodiebeli*, while most of the other forms, included also the holotype, belong to *M. nodosus* which similarly in this deep stratigraphic level starts. As it has been suggested by H. KOZUR and R. MOCK (in press) the *M. primitius* taken as yet mostly as synonym of *M. nodosus* [MOSHER, 1968] is an independent species [see also L. C. MOSHER, 1973], which in Tuvalian developed from *Gondolella polygnathiformis* through *M. communisti* HAYASHI [1968]. Among the stratigraphically younger *Metapolygnathus* species E. KRISTAN-TOLLMANN and L. KRYSTYN [1975] discuss only the differences against *M. abneptis* and *M. nodosus* (the latter in the sense of E. KRISTAN-TOLLMANN–L. KRYSTYN, 1975 is *M. primitius*). As it has been emphasized by H. KOZUR–R. MOCK (in press) the differences enumerated against *M. abneptis* cannot be accepted. Thus in the Julian such forms occur that have spiniform elongated marginal denticles (such a form is pictured in *Plate I, Fig*. 22). Nevertheless the absent denticulation of the platform posterior end cannot be used to make difference between the two species as it has been taken by E. KRISTAN-TOLLMANN–L. KRYSTYN, since also the holotype of *M. abneptis* has an undenticulated platform posterior end. There is, however, a difference as against the concept of E. KRISTAN-TOLLMANN–L. KRYSTYN [1975], *i.e.* the contour of "*Epigondolella carnica*" considerably differs from that of *M. abneptis*, the posterior platform part of which becomes considerably and discontinuously broader. As a difference from

M. nodosus [HAYASHI, 1968] E. KRISTAN-TOLLMANN and L. KRYSTYN state that the platform at this species reaches always more than the half-length of the specimen. When they make such a difference to assign the specimen belonging to *M. pseudodiebeli* to another species and figur it as *Epigondolella carnica* in their Plate 3, *Fig. 1,* they come to a contradiction since at this specimen the platform reaches up to the rontal frontal end. The holotype of *M. nodosus* has of course the same relative short platform as that of the holotype of *E. carnica* (see also the expoundings of L. C. MOSHER. 1973 and the forms figurated by H. KOZUR, 1972 in Pl. 4, *Figs 2* and *3* as *M. nodosus* that are near to the holotype of this species). The differences in the development of the carina suggested by E. KRISTAN–TOLLMANN–L. KRYSTYN [1975] (sometimes against *M. primitius* with which they their new species compare) are also not existing. The height of melting of the denticles vary much rather with the ontogenic evolution. In this way no differences can be determined between the *M. nodosus* (in its narrow sense corresponding to the holotype) and the *Epigondolella carnica* if being restricted to the holotype of this species. The specimen, however, demonstrated in Plate 3. *Fig. 4* as *E. carnica* is undoubtedly a new species which can be easily distinguished from *M. nodosus* and from other *Metapolyngathus* species (the holotype of "*E. carnica*" included).

As it has been stated by H. KOZUR–R. MOCK (in press) the *M. pseudodiebeli* develops from the *M. diebeli* (KOZUR et MOSTLER, 1971). By this, the denticulation of the posterior third of the platform will be reduced (such forms are repeatedly pictured by E. KRISTAN–TOLLMANN–L. KRYSTYN as *Epigondolella diebeli*) and an oviform pit will be developed (this latter feature occurs already rather early, *see* e.g. the specimen of *M. diebeli* pictured by H. KOZUR, 1972 in Pl. 2, *Fig. 6.*). Thus it can be stated that the *M. pseudodiebeli* and the *M. nodosus* which start in the Austro-Alpine province first in the Upper Tuvalian, occur already in the Julian in the Dinaric and Asiatic fauna provinces. The theme of the fauna migrations of certain conodont species from the Asiatic resp. Dinaric fauna province into the Austro–Alpine fauna province was dealt with in detail by H. KOZUR–R. MOCK (in press). For this reason the occurrence of *M. nodosus* and *M. pseudodiebeli* may not conduce to assign the sample 10 already into the Upper Tuvalian since both the *M. mišiki* and the *Gladigondolella tethydis* have their upper reach in the Julian.

Sample 18:

Metapolygnathus nodosus [HAYASHI, 1968], (frequent)
Metapolygnathus pseudodiebeli KOZUR, 1972 (rare)
Gondolella navicula HUCKRIEDE, 1958 (frequent)

Age: The absence of *Gladigondolella tethydis* in this conodont-rich sample indicates it to be younger than Julian. In the Lower Tuvalian of the Meliata Triassic *Gondolella polygnathiformis* BUDUROV et STEFANOV predominates far away (J. MELLO–R. MOCK, in press *A*) similarly as it is known from the Austro-Alpine Triassic, where in this period the genus *Metapolygnathus* by no means can be traced till now. In the Middle Tuvalian *G. polygnathiformis* is also very frequent and is accompanied by *Metapolygnathus communisti* HAYASHI. The *nodosus* and *M. pseudodiebeli* are frequent again first in the Upper Tuvalian (*Klamathites macrolobatus*-Zone) and in the Lower Norian (*Mojsisovicsites kerri*-Zone) and at the same time the *G. polygnathiformis* will be strongly restricted here, but it is already absent in the Lower Norian. On the basis of the facts above sample 18 is assigned to the Uppermost Tuvalian up to the Lowermost Norian.

Sample 22:

Metapolygnathus abneptis abneptis [HUCKRIEDE, 1958], (frequent)
Metapolygnathus abneptis spatulatus [HAYASHI, 1968], (very frequent)
Metapolygnathus posterus [KOZUR et MOSTLER, 1971], (rare)
Prioniodina muelleri [TATGE, 1956], (rare)

Age: Later Lower up to Middle Norian. The occurrence of *M. posterus* indicates rather Middle Norian.

Sample 47:

Metapolygnathus bidentatus [MOSHER, 1968], (primitive form, frequent)
Metapolygnathus posterus [KOZUR et MOSTLER, 1971], (rare)
Gondolella navicula HUCKRIEDE, 1958, (mostly juvenile forms, frequent)
Prioniodina muelleri [TATGE, 1956], (rare)
Enantiognathus sp. (one specimen)

Age: Middle *bidentatus*-Zone (Middle Sevatian, *Sagenites giebeli*-Zone)*.

Sample 48:

Gondolella navicus hallstattensis (MOSHER, 1968), (mostly juvenile forms, frequent)
Hibbardella sp. (one specimen)

Age: Norian*.

IV GEOLOGICAL EVALUATION

The period of drastic re-classification of the sequences, assigned formerly into the Paleozoic, into the Triassic is terminated by the imposing Bükk-monograph of K. BALOGH [1964] in the Bükk Mountins and his environs. Only the re-classification of the sequences of the Meliata series (Gemerides, South Slovakia), believed formerly to be Permian or Carboniferous, into Pelsonian up to Norian by H. KOZUR–R. MOCK [1973a, 1973b] falls still to this phase of research, but by means of cono-

Fig. 3—4: Thick triassic pillow-lavas in the environs of Szarvaskő. — Photo: R. MOCK, 1977

* On the basis of the *Monotia salinaris* BRONN found on the Nagyeged-hill, the rock of these occurrences was assigned already by K. BALOGH, 1964 to the Norian.

donts the biostratigraphically evidenced detailed classification of these strata can be carried out.

To throw light upon the tectonic position of the parts of the Western Carpatians lying south of the Gemeride suture (this suture zone slightly inclining to the south probably transits into the deep-reaching Roznava Line in the depth, *see* P. GRECULA, 1974), the fine-stratigraphic subdivision of the Bükk–Meliata–Rudabánya Trias is as significant as the stratigraphic classification of the pre-Permian Paleozoic of the Gemerides and of the Uppony and Szendrő Mountains. First of all the exact chronological classification of the eugeosynclinal Middle and Upper Triassic of the Bükk Mountains with its spatially and temporally changing of shallow and deep-water-sequences proved to be necessary. Especially the upper stratigraphic limit of the sericitic shale complex, *i.e.* of an epimetamorphic sequence of darkgrey shales and greywackes partly with graded bedding, with intercalations of dark and platy limestones with chert, dark or red siliceous schists containing partly also iron-jaspilites, tuffites and diabases (partly pillow lavas, too, *Figs. 3–4*) had to be elucidated. It was all the more necessary since the previously supposed Lower to Middle Ladinian age of this complex had been occasionally used as the strongest argument as against the identification of the Meliata shales complex with their Bükkian equivalents. The Meliata shale complex has a similar lithofacies as that of the Bükk, but its parts the age of which has been determined until now belong to the Cordevolian and Julian on the basis of conodonts. However, when the correlation of the two complexes is valid it is one of the most decisive arguments to the fact that not only the Triassic of the Bükk Mountains but that of the Meliata Series, *i.e.* the covering unity of the Gemerides, belongs to the South Alpine–Dinaric development. This is evidenced both by the lithofacies and by the basic volcanism of wide extension as well as by the belonging to the Dinaric faunal province [see H. KOZUR, 1973]. On the other hand, this is extraordinarily important in order to make clear the overthrust directions of the Silica-nappe which is to identify with the southern Upper–East–Alpine, and which belongs to the Austro–Alpine (also to North–Alpine) faunal province.

The grey cherty limestones in the direct roof of the sericitic shale complex of the Bükk Mountains were put till now into the Cordevolian and Carnian. The strata of the Répáshuta and Plateau-limestone facies overlying directly the sericitic shales were similarly classified. The sample 22 from the grey cherty limestone facies is, however, unambiguously Norian (Later Lower up to Middle Norian) and the sample 18 which derives from the direct roof of the sericitic shale facies belongs to the Upper Tuvalian up to Lowermost Norian. The limestones from wich the sample 18 was taken and that are connected to the underlying sericitic shale facies through lithological transitions, form at the same time the direct floor of the Plateau-limestones as it has been emphasized already by K. BALOGH [1964]. There is no room for doubt that the grey cherty limestone facies and the Répáshuta limestone facies overlie the sericitic shale facies and on the basis of the macrofauna these strata show similar age than the Plateau-limestone facies.

The "Lower to Middle Ladinian age" of the sericitic shale facies is based on the fact that it directly underlies the above-mentioned three limestone complexes of "Upper Ladinian–Carnian" age. The re-classification of the limestones in the direct roof of the sericitic shale facies into Upper Tuvalian up to Lowermost Norian means, however, expressively that this facies does not come to end in the Middle Ladinian as believed up to the present day but it reaches to the Upper Carnian, as well. The Julian age of a part of the seriticid shale complex can be directly evidenced by the sample

10. In this way the contemporaneity of the Bükkian sericitic shale complex and of the facially similar complex of the Meliata Series is confirmed again. The age of the appearence of the sericitic shale facies and of the corresponding complexes in the Meliata series is hitherto unknown. In the Bükk no samples have been investigated from the zone transitional to the underlying beds. In the Gemerides, at locality Meliata, on the basis of the thick shale and sandstone sequence, an alternation of cherty limestones with shales, siliceous schists and iron-jaspilites occurs which belongs after the recently confirmed classification to the Carnian. In this part of the sequence conodonts occur, the age of which is almost the same as that in the Bükkian sample 10. Thus it seems very probable that the Meliata series forms the direct northern continuation of the Bükk-Triassic. Unfortunately, the shale complex of Meliata lies tectonically on massive white limestones in which intercalations (fissure fillings?) of Pelsonian red limestones with large quantities of conodonts occur. It is unknown whether the limestones and siliceous schists alternating with the dark shales forms already the floor of the shale complex of the Meliata Series or these are only intercalations within this complex. The latter possibility seems to be more probable.

Taking into consideration the results of K. BALOGH [1964] the following schematic profile of the Middle and Upper Triassic of the Bükk Mountains can be demonstrated *(Fig. 5)*. This scheme will be completed by an explanation concerning the age determination of the lower, "Pelsonian" eruptive complex and of an at first proved emergence horizon within the Middle Triassic.

The limestones in the floor of the lower, "Pelsonian" eruptive complex were looked upon formerly as Lower Anisian. Really they are laterally substituted mostly by dolomite, but cannot be considered to be Lower Anisian since *Triadophyllum* occurs in them, and from the Lower Anisian of the Alpine–Dinaric Region no corals are known till now. An assignment of these strata into the Pelsonian seems to be most probable. In the profile of the Sebesvíz Valley the Lower Anisian up to (Lower) Pelsonian dolomite is overlain by a characteristic conglomerate horizon above which first the "Pelsonian" eruptive complex and then the light, probably Ladinian, Fehérkő-limestone follow. Certain parts of the several metres thick conglomerate show typical features of an emergence horizon (the conglomerate is locally interbedded into a lateritic-bauxitic groundmass). Members of this conglomerate horizon in close connection with a dolomite-inclusion-bearing porphyrite agglomerate at the boundary of the dolomite and porphyrite series were first described by K. BALOGH [1964. pp. 379–380, 635] from the western side of the Savós Valley, from the northern side of the Fehérkő cliff and from the Teknős Valley. K. BALOGH assigned an intraformational character to the coarse-grained dolomite breccia. The new, imposing exposures above the Sebesvíz Valley allow to modify the explanation of the phenomenon. Namely, since the eruptive complex consists partly of ignimbrites, it may be of subaerial formation except its uppermost part. Its age may be uppermost Anisian up to lowermost Fassanian and thus it corresponds to the first volcanite maximum of the Southern Alps. The alternation of limestones and tuffites in the transitional zone of the lower eruptive complex towards the Fehérkő-limestone observed already by K. BALOGH [1964] refer to submarine formation conditions concerning the uppermost part of the lower eruptive complex, at least . This part of the lower eruptive complex is certainly younger than the emergence horizon which can be still assigned to the Upper Anisian. The question that the emergence began already in the Lower Illyrian or even in the Upper Pelsonian, or these strata were eroded only in an Upper Illyrian emergence phase, is recently still open. In connection with the existence of an Upper Anisian emergence horizon it is interesting that the low-grade metamorphic red limestones of Žarnov (at the northeastern end of the Rudabánya Mountains; J. MELLO–R. MOCK, in press *A*) are abundant in their Illyrian part in terrigenic, rolled quartz that seems to derive from the above mentioned emerged land area. The existence of an Anisian emergence phase in the Bükk Mountains shows significant parallelism with the evolution of the Southern Alps.

By means of conodonts from the Lowermost Norian (*Mojsisovicsites kerri*-Zone) up to the Middle Sevatian (*Sagenites giebeli*-Zone) only the age of the gray cherty limestone facies can be evidenced. The Norian age of the Plateau-limestone facies is now still unproved, according to K. BALOGH, however, there are lateral transitions between the chert-bearing grey limestone and the lower part of the Plateau-limestone. The cherty limestone shows partly transitions into the Plateau-limestone through repeated alternation of the beds. The geological evidences suggested by K. BALOGH [1964] for the identity of the floor of the grey cherty limestone facies and of the Plateau-limestone facies seems to be convincing. Thus, within the Norian we have to assume a facies-differentiation to a mostly shallow water facies of Dachstein limestone type and to a basin facies with grey cherty limestones, respectively. Strata younger than Middle Sevatian have not been detected yet. Even if considering only the basin facies being assigned hitherto unambiguously to the Norian, the Norian has, against the former opinions, a wide extension in the Bükk Mountains and in the Trias of Rudabánya [J. MELLO–R. MOCK, in press *A*; S. KOVÁCS, 1977].

The sequence of the Bükk/Meliata Middle and Upper Triassic outlined above shows great similarity to the South Alpine (first of all to the eastern South Alpine) and especially to the Dinaric development. It also faunistically belongs to the Dinaric fauna province [*see* H. KOZUR, 1973; H. KOZUR–R. MOCK, 1973a, b]. The Pelsoniain red limestone (evidenced only in the Triassic of the Meliata and Rudabánya) indicates an early, intensive breaking up of the "carbonate platform". Pelsonian red limestones are known also from the Dinarides. E.g. the red limestones of Han Bulog reach unambigously into the Pelsonian on the basis of the occurrence of *Neospathodus kockeli* (TATGE) [*see* H. KOZUR, 1973]. Areas emerging above the sea level in the Upper Anisian are found also in the Southern Alps. The strong submarine intermediary to mostly basic (first of all in the upper parts) and, rather subordinate, also acid volcanism in the Ladinian and Carnian (starting in the Upper Anisian) is equally characteristic for both the Southern Alps and the Dinarides. So characteristic deep-sea sediments with widespread radiolarites and more scattered iron jaspilites and manganese oxide nodules deposited probably below the Triassic lime-solving limit as found in the Bükk and Meliata Triassic, cannot be seen in the Southern Alps. The similarity is towards the Intra-Dinaric development (Vardar Zone) much stronger.

The Bükk and Meliata Middle and Upper Triassic is an eugeosyncline sequence with strong submarine mostly basic volcanism (diabases, thick pillow lavas, tuffites) and with typical flysch sediments (part of the sericitic shale facies is lithologically very similar to the Kulm-flysch, considering the sediment fabrics, too. After the deposition of the Triassic flysch, however only a shallowing of this area followed without folding and metamorphism (Norian cherty limestones of the basin facies and light shallow water limestones). A similar geosynclinal sequence is found in the Upper Devonian and Carboniferous of this area (Uppony Mountains, see H. KOZUR–R. MOCK, 1977]. The deposition of the eugeosynclinal sequence is connected with basic volcanites and after the deposition of the flysch, emergence followed without folding and metamorphism.

Finally, let us have some notes on the overthrust direction of the Silica nappe. There is no doubt more regarding both the nappe character of this unit and the direct continuation of the Bükk Triassic northwards to that of the Meliata [*see* also M. MAHEL', 1975]. Within the Bükk/Meliata Triassic there is an interesting succession from south to north. In the Southern Bükk Mountains the proportion of classic sediments is the greatest. Here conglomeratic beds with quartz grains of pea-size, further thick sandstone strata occur that contain terrestrial plant impressions in some places and quite locally very thin coal strips, too [see K. BALOGH, 1964]. On the contrary, in the Northern Bükk Mountains the coarse clastic part is pushed into the background and the limestone intercalations become a little more frequent. In the continuation of this trend towards north, in the Southern Meliata Unit the overlying cherty limestones occur somewhat earlier (Lower Tuvalian; *see* J. MELLO–R. MOCK, in press *B*) and in the northern Meliata Unit the clastic sequence between the under- and overlying carbonates will be strongly reduced and a progressive advance to the development of the Silica nappe in which the clastic discharges are totally absent in the Carnian, occurs. Thus, in the Bükk and Meliata Middle and Upper Triassic the clastic transport came obviously from the south. Consequently, it seems us to be excluded to deduce the Silica nappe from a suture zone lying south of the Bükk Mountains. Similarly, the tracing from a cicatrix south or north of the Uppony Mountains is also excluded. In this latter case the Silica nappe would be originate from the facies range of the Bükk/Meliata Triassic, but this is impossible on the one hand because of the uninterrupted sedimentary environment of the Bükk/Meliata Triassic traceable from the lithofacial development, on the other hand, however, for faunistical reasons (the Silica nappe belonging to the Austro-Alpine fauna province would be surrounded in this case both from the south and from the north by the Dinaric faunal province). In the first case the Silica nappe would be traced from the source area of the clastic Carnian discharges although it holds no clastic sediments in the Carnian. This is all the more increditable since in the Southern Bükk Mountains an apparent south-vergency occurs [*see* K. BALOGH, 1964]. Moreover, a clear contradiction would occur concerning the faunal provinces since in this case the Silica nappe with its typical Austro-Alpine fauna would be settled south of the Bükk/Meliata Triassic characterized by South Alpine–Dinaric fauna. The Silica nappe can be correlated with the Mürztal Facies of the Southern Upper–East–Alpine and it belongs to the same faunal province as the Triassic of the Upper–East–Alpine, as it has been deduced above. Accordingly, there is no possibility either from sedimentological-tectonic or from paleontological points of view to overthurst the Silica nappe onto the Meliata Series from the south. It is far better to suppose a nappe-fan with a southward overthrusting of the Silica nappe, with a near-suture position of the North-Gemeride Triassic as well as with the northwards overthrusting of the Stražov and Choč nappes, which all can be traced from the same suture zone. These conceptions emphasized already by us in 1973 are further firmed by our recent investigations. The only argument against the southward overthrusting of the Silica nappe is that at the Gemeride suture the Gemerides themselves are overthrusted northwards onto the Veporides. It is, however, absolutely not evidenced that this flat overthrust took place simultaneously with the displacement of the Silica nappe, and not later, as it has been suggested here. The southward directed overthrust of the Silica nappe as North-Alpine (better to say North–Slovako–Carpathian, in sense of H. KOZUR–R. MOCK, 1973a, b) unit onto the South–Alpine–Dinaric (better to say South–Slovako–Carpathian or Intra–West–Carpathian) Bükk/Meliata Triassic contradicts to the common picture in the Alpine–West-Carpathian region. The geological facts, however, cannot be modified in order to obtain conformity with the older conceptions. According to our recent knowledge no feasible choice is expected for southward directed overthrust of the Silica nappe.

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EXPLANATION OF THE PLATES

PLATE I

Scale of enlargement 60x; excepted Fig. 3 (100x)

1—2: *Achistrum* cf. *issleri* (CRONEIS, 1932). — Sample 23 (2910).
3: *Theelia dzhulfaënsis* MOSTLER et RAHIMI-YAZD, 1976. — Sample 26 (2911)
4—7: *Anchignathodus minutus* (ELLISON, 1941). — Sample 28A (*4:* 2915; *5:* 2912; *6:* 2913; *7:* 2914)
8, 9, 11: *Stepanovites dobruskinae* KOZUR et PJATAKOVA, 1975. — Sample 28 (*8:* 2920; *9:* 2922; *11:* 2921)
10, 12—16: *Anchignathodus minutus* (ELLISON), neoprioniodiniform und enantiognathiform elements. — Sample 28A (*10:* 2917; *12:* 2919; *13:* 2917; *14:* 2916; *15, 16:* 2918)
17: *? Prioniodina (Cypridodella) venusta* (HUCKRIEDE, 1958). — Sample 4 (2927).
18: *Metapolygnathus* cf. *mišiki* KOZUR et MOCK, 1973. — Sample 10 (2925)
19: *? Prioniodina (C.) venusta* (HUCKRIEDE, 1958). — Sample 10 (2924)
21: *Gondolella navicula* HUCKRIEDE, 1958. — Sample 10 (2923).
22: *Metapolygnathus pseudodiebeli* KOZUR, 1972. — Sample 10 (2926)

PLATE II

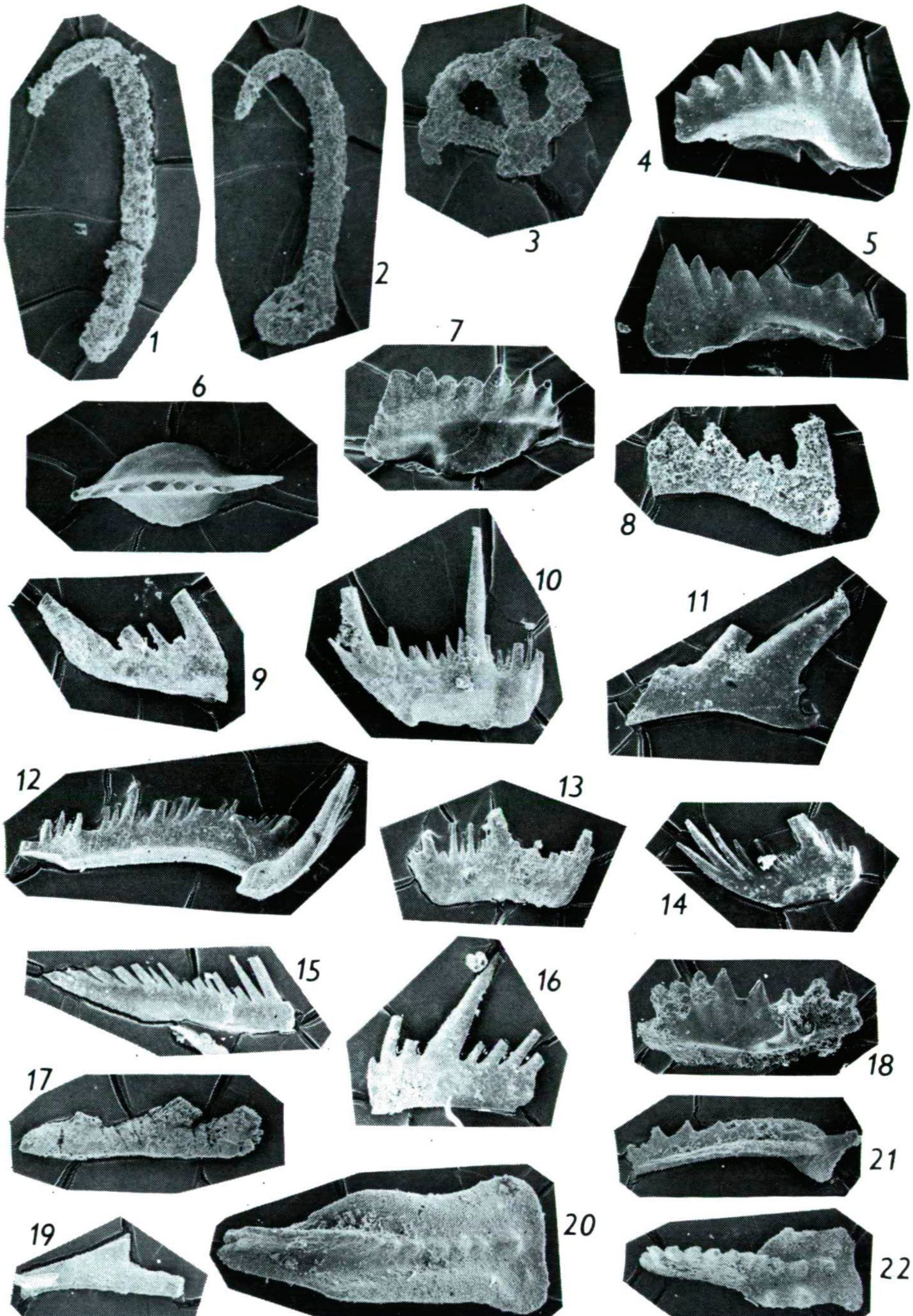
Scale of enlargement: 60x
All the Conodonts from the sample 18

1: *Gondolella navicula* HUCKRIEDE, 1958. — Two entwined specimens (2956)
2—7, 9—11: *Metapolygnathus nodosus* (HAYASHI, 1968). — (*2:* 2952; *3:* 2949; *4:* 2957; *5:* 2951; *6:* 2955; *7:* 2958; *9:* 2954; *10:* 2953; *11:* 2950)
8: *Gondolella navicula* HUCKRIEDE, 1958. — (2959)

PLATE III

Scale of enlargement: 60x

1—12: *Metapolygnathus abneptis* (HUCKRIEDE, 1958). — Sample 22 (*1:* 2946; *2:* 2940; *3:* 2948; *4:* 2939; *5:* 2941; *6:* 2944; *7:* 2938; *8:* 2947; *9:* 2942; *10:* 2945; *11:* 2943; *12:* 2937)
13—16: *Gondolella navicula* HUCKRIEDE, 1958. — Sample 47 (*13:* 2934; *14:* 2929; *15:* 2931; *16:* 2929)
17—18: *Metapolygnathus bidentatus* (MOSHER, 1968). — Sample 47 (*17:* 2935; *18:* 2930).
19—21: *Metapolygnathus posterus* (KOZUR et MOSTLER, 1971). — Sample 47 (*19:* 2930; *20:* 2928; *21:* 2933)
22—23: *Prioniodina (Cypridodella muelleri* (TATGE, 1956). — Sample 47 (2932)
24: *Gondolella navicula hallstattensis* (MOSHER, 1968). — Sample 48 (2936)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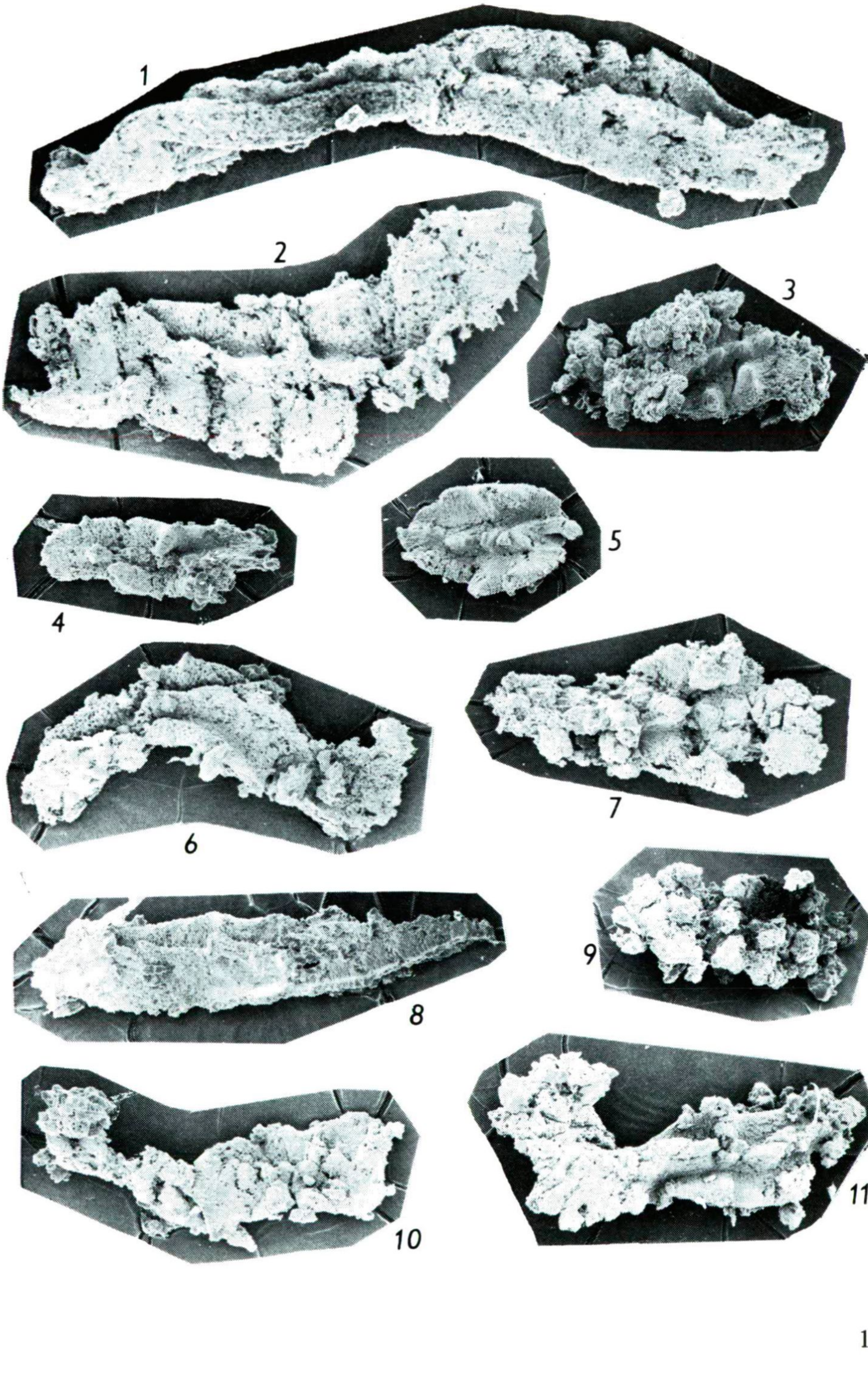
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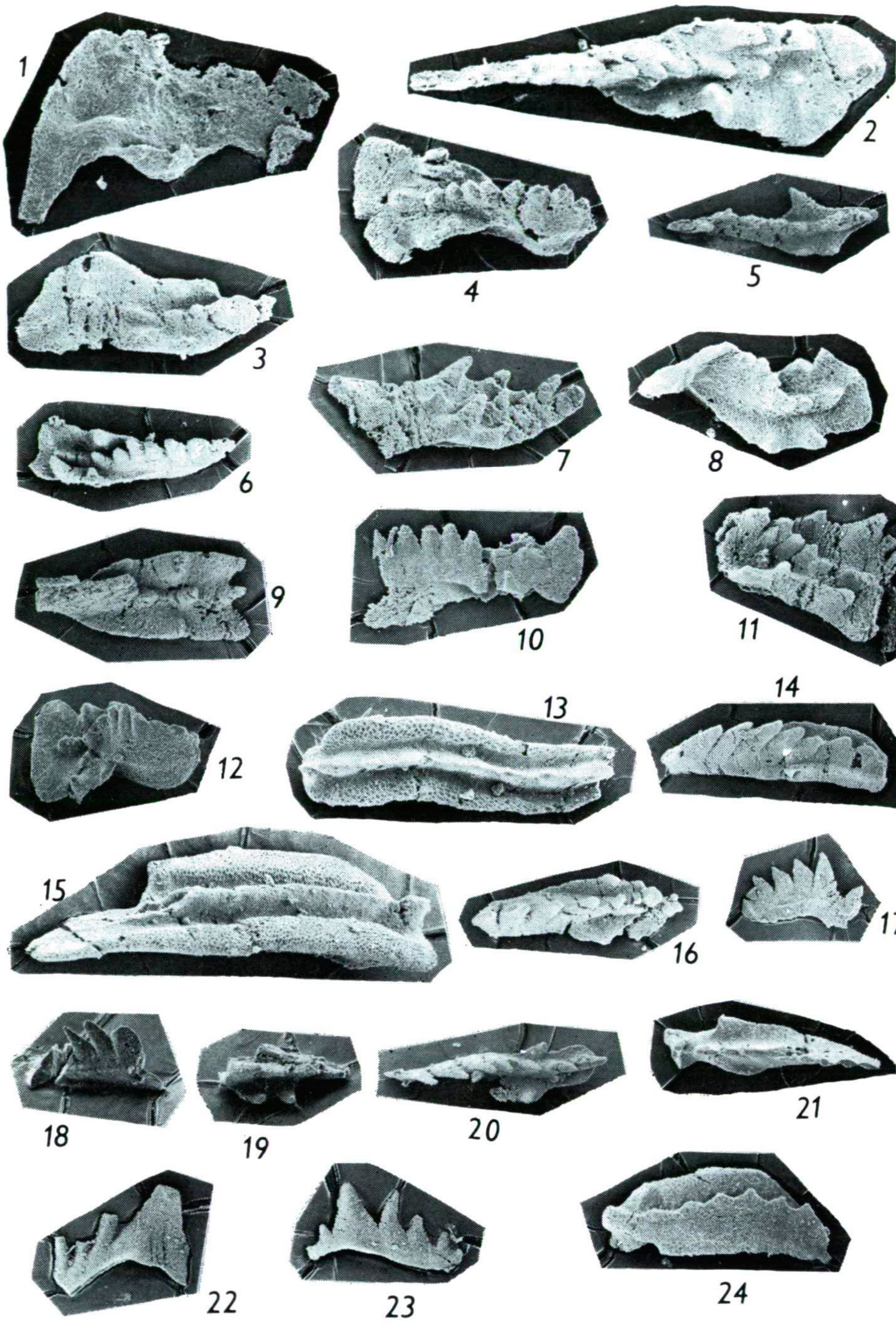
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REFERENCES

ANTAL, S. [1975]: Subdivision of the Upper Permian sequence of the Bükk Mountians in Northern Hungary. — Acta Min.—Petr., *22*, 1, p. 113—118, Szeged.

ASSERETO, R.—BOSELLINO, A. *et al.* [1973]: The Permian-Triassic boundary in the Southern Alps (Italy). — *In:* LOGAN, A.—HILLS, L. V. [1973]: The Permian and Triassic systems and their mutual boundary. — Canadian Soc. Petrol. Geol., Mem. *2*, p. 176—199, Calgary.

BALOGH, K. [1964]: Die geologischen Bildungen des Bükk-Gebirges. — Ann. Inst. Geol. Publ. Hung. *48*, 2, p. 245—719, Budapest.

BALOGH, K.—KŐRÖSSY, L. [1974]: Hungarian Midd-Mountains and adjecent areas. p. 391—403. — *In:* MAHEL', M. (edit.) 1974: Tectonic of the Carpathian Balkan Regions. Bratislava, 455 p.

BENDER, H. [1970]: Zur Gliederung der mediterranen Trias II. Die Conodontenchronologie der mediterranen Trias. — Ann. Géol. Pays Hell., *19*, p. 465—540, Athen.

BUGGISCH, W. [1975]: Die Bellerophonschichten der Reppwand (Gartnerkofel) (Oberperm, Karnische Alpen). — Carinthia II, *164/84*, p. 17—26, Klagenfurt.

BUGGISCH, W. *et al.* [1976]: Die fazielle und paleogeographische Entwicklung im Perm der Karnischen Alpen und in den Randgebieten. — Geol. Rdsch., *65*, 2, p. 649—690, Stuttgart.

GRECULA, P. [1974]: Domovská oblast gemerika a jeho metalogenéza. — Mineralia slov., *5*, p. 221—245, Spišská Nová Ves.

JÁMBOR, Á. [1961]: Comparaison géologique entre les montagnes de Szendrő et d'Uppony. — Rel. annuae Inst. Geol. Publ. Hung. 1957—58. p. 103—119, Budapest.

KOZUR, H. [1972]: Die Conodontengattung *Metapolygnathus* HAYASHI 1968 und ihr stratigraphischer Wert. — Geol. Paläont. Mitt., *2*, 11, p. 1—37, Innsbruck.

KOZUR, H. [1973]: Faunenprovinzen in der Trias und ihre Bedeutung für die Klärung der Paläogeographie. — Geol. Paläont. Mitt., *3*, 8, p. 1—41, Innsbruck.

KOZUR, H. [1974a]: Die Conodontengattung *Metapolygnathus* HAYASHI 1968 und ihr stratigraphischer Wert. Teil II. — Geol. Paläont. Mitt., *4*, 1, p. 1—35, Innsbruck.

KOZUR, H. [1974b]: Beiträge zur Paläoökologie der Triasconodonten. — Geol. Palàont. Mitt., *4*, 7, p. 1—16, Innsbruck.

KOZUR, H. [1975]: Beiträge zur Conodontenfauna des Perm. — Geol. Paläont. Mitt., *5*, 4, p. 1—44, Innsbruck.

KOZUR, H. [1976]: Palaoecology of Triassic conodonts and its bearing on Multielemt Taxonomy. —The Geol. Assoc. of Canada, Spec. Paper No. *15*, p. 313—324, Ottawa.

KOZUR, H.—MOCK, R. [1973a]: Die Bedeutung der Trias-Conodonten für die Stratigraphie und Tektonik der Trias in den Westkarpaten. — Geol. Paläont. Mitt., *3*, 2, p. 1—14, Innsbruck.

KOZUR, H.—MOCK, R. [1973b]: Zum Alter und zur tektonischen Stellung der Meliata-Serie. — Geol. zbornik, *24*, 2, p. 365—374, Bratislava.

KOZUR, H.—MOCK, R. [1977]: On the age of the Paleozoic of the Uppony Mountains (North Hungary). — Acta Miner. Petr., Szeged, *23*, 1. p. 91—107.

KOZUR, H.—MOCK, R. [*in press*]: Unterschiedliche stratigraphische Reichweiten von Conodonten in der austroalpinen und dinarischen Faunenprovinz. — Geol. zborník, Bratislava.

KOZUR, H.—MOCK, R.—MOSTLER, H. [1976]: Stratigraphische Neueinstufung der Karbonatgesteine der „unteren Schichtenfolge" von Ochtiná (Slovakei) in das oberste Visé Serpukhovian (Namur *A*). — Geol. Paläont. Mitt., *6*, 1, p. 1—29, Innsbruck.

KOZUR, H.—MOSTLER, H.—RAHIMI-YAZD, A. [1975]: Beiträge zur Mikrofauna permotriadischer Schichtfolgen. Teil II: Neue Conodonten aus dem Oberperm und der basalen Trias von Nord- und Centraliran. — Geol. Paläont. Mitt., *5*, 3, p. 1—23, Innsbruck.

KOZUR, H.—PJATAKOVA, M. [1976]: Die Conodontenart *Anchignathodus parvus* n. sp., eine wichtige Leitform der basalen Trias. — Koninkl. Nederl. Akad. Wetenschappen, Proc., Ser. B, *79*, 2, p. 123—128, Amsterdam.

KRISTAN-TOLLMAN, E.—KRYSTYN, L. [1975]: Die Mikrofauna der ladinisch-karnischen Hallstätter Kalke von Saklibeli (Taurus-Gebirge, Türkei) I. — Österr. Akad. Wiss., Math.-naturwiss. Kl., *184*, 8—10, p. 259—340, Wien.

MAHEL', M. [1975]: Postavenie gemerika. Position of the Gemeric. — Mineralia slov., *7*, 3, p. 33—52, Spišská Nová Ves.

MELLO, J.—MOCK, R. [in press *A*]: Nové poznatky o triase čs. časti Rudabaňského pohoria. — Geol. práce, Správy, Bratislava.

MELLO, J.—MOCK, R. [in press *B*]: Nové poznatky o metamorfovanom triase v oblasti Slovenského krasu. — Geol. práce, Správy, Bratislava.

MOSHER, L. C. [1973]: Triassic conodonts from British Columbia and the northern Arctic Islands. — Geol. Surv. Canada, Bull., *222*, p. 141—193, Ottawa.

MOSTLER, H.—RAHIMI-YAZD, A. [1976]: Neue Holothuriensklerite aus dem Oberperm von Julfa in Nordiran. — Geol. Paläont. Mitt., *5*, 7, p. 1—35, Innsbruck.

ORAVECZ, J. [1965]: Über die erdgeschichtliche Rolle silurischer Gesteinschotter in den klastischen Schichtenkomplexen Ungarns. — Föld. Közlöny, *95*, 4, p. 401—405, Budapest.
PANTÓ, G. [1954]: La levé des gîtes métalliques dans la montagne de Uppony. — Rel. ann. Inst. Geol. Publ. Hung. *1952*. p. 91—110, Budapest.
SCHRÉTER, Z. [1945]: Geologische Aufnahmen im Gebiete von Uppony, Dédes und Nekézseny, ferner im Gebiete von Putnok. — Rel. ann. Inst. Geol. Publ. Hung. *1941—42*, p. 197—237, 1 map, Budapest.
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