

Jb. Geol. B.-A.	ISSN 0016-7800	Band 132	Heft 4	S. 665-676	Wien, Dezember 1989
-----------------	----------------	----------	--------	------------	---------------------

Uppermost Triassic Conodonts from the Kössen Formation of the Northern Calcareous Alps (Austria)

By R. K. KACHROO*)

With 2 Figures and 2 Plates

Austria
Northern Calcareous Alps
Triassic
Kössen Formation
Stratigraphy
Misikella faunas
Microfacies

Österreichische Karte 1 : 50.000

Blätter 66, 69, 72, 88, 90-92, 94, 95, 100, 118, 119, 142

Contents

Zusammenfassung	665
Abstract	665
1. Introduction	666
2. Materials and Methods	666
3. Previous Work on Conodonts	666
4. Stratigraphical and Lithological Outline of the Localities of Conodont-Bearing Beds	667
4.1. Vorarlberg	667
4.2. Tyrol	667
4.3. Salzburg	668
4.4. Upper Austria (Oberösterreich)	669
4.5. Styria	669
4.6. Lower Austria (Niederösterreich)	669
5. Facies Interpretation of the Conodont-Bearing Rocks	669
6. Systematic Descriptions	670
Acknowledgments	672
References	676

Zusammenfassung

Von den 20 detaillierten Profilen in den Kössener Schichten (Obertrias) der Nördlichen Kalkalpen werden 34 neue Conodonten führende Niveaus beschrieben. Die Fauna beschränkt sich auf *Misikella hernsteini*, *M. posthernsteini*, *M. rhaetica* und *M. koessenensis*, vereinzelt vergesellschaftet mit Astformconodonten.

Auf Grund der verschiedenen Faunenzusammensetzung können vier stratigraphisch übereinander folgende Bereiche unterteilt werden, die sich in alle Profilen biostratigraphisch wie lithostratigraphisch korrelieren lassen: *hernsteini*-Bereich, *hernsteini/posthernsteini*-Bereich, *rhaetica*-Bereich und *posthernsteini*-Bereich (siehe Abb. 2).

Zum ersten Mal wurden an der Basis der schwäbischen Fazies *Misikella hernsteini* gefunden – *hernsteini*-Bereich – ein weiterer Hinweis auf das oberrheinische Alter der Basis der Kössener Schichten. *Misikella hernsteini* reicht zusammen mit *Misikella posthernsteini* – *hernsteini/posthernsteini*-Bereich – bis an die Basis der Kössener Fazies, wo *Misikella rhaetica* zum ersten Mal auftritt. Die untere Hälfte der Kössener Fazies wird durch die Vergesellschaftung von *Misikella posthernsteini*, *M. rhaetica* und *M. koessenensis* charakterisiert – *rhaetica*-Bereich – und entspricht der *rhaetica* Zone nach MOSTLER (1978).

In der oberen Hälfte konnte nur *Misikella posthernsteini* gefunden werden, obwohl sich die Fazies für Conodonten generell

nicht ändert. Dieser *posthernsteini*-Bereich ist mit der eingegengten *posthernsteini* assemblage-Zone sensu KOZUR & MOCK (1974) zu vergleichen.

Zu Beginn des obersten Drittels der Kössener Schichten (Kössener Fazies), unmittelbar über dem Lithodendronkalkniveau, einem bedeutenden lithostratigraphischen Marker, fällt das Erstauftreten von *Misikella rhaetica*, mit dem der Gattung *Choristoceras* zusammen. Dieses Ereignis bietet sich, neben dem starken lithofaziellen und faunistischen Schnitt, als Anhaltspunkt für eine Nor-Rhät-Grenzziehung an. Weiters wurden die conodontenführenden Gesteine mit Hilfe der Standard-Mikrofaziestypen charakterisiert und mit dem Fazieschema von WILSON (1975) verglichen. Hinzu kommt eine systematische Beschreibung und Auflistung der Fundpunkte der Gattung *Misikella*.

Abstract

Based on the study of 20 sections the conodont fauna of the Alpine Koessen Formation, Austria, is described. It is a fauna composed exclusively of one genus, *Misikella*, and associated with rare ramiform elements (*Hindeodella*, *Enantiognathus*, *Cypridodella*, *Priniodina*, *Chirodella*, *Cornudina*, *Hibardella*). *Misikella* is represented by *Misikella hernsteini*, *Misikella posthernsteini*, *Misikella rhaetica* and *Misikella koessenensis*. Based on their different vertical distribution, four stratigraphically distinct assemblages can be established. These are, from the base to the top the *hernsteini*, the *hernsteini/posthernsteini*-, the *rhaetica*- and the *posthernsteini*- assemblages. The long standing discussion about

*) Author's address: Dr. R. K. KACHROO, Department of Geology, Faculty of Science, University of Maiduguri, P.M.B. 1069 Maiduguri, Nigeria.

the lower age of the Koessen Formation can be resolved by the finding of *Misikella hernsteini* in four sections. Thus the base of the Koessen Formation can be tentatively taken as Upper Norian. The four assemblages give a detailed biostratigraphic correlation of the described sections and suggest the Lithodendronkalk as a lithostratigraphic marker bed. The first occurrence of *Misikella rhaetica* in the upper third of the sequence corresponds to the appearance of the ammonoid genus *Choristoceras* and which may be used as a marker for establishing the Norian-Rhaetian boundary.

1. Introduction

Koessen Formation is named after a village "Kössen" near Weißloferbach, Tyrol, which is the type locality of the Rhaetian stage (GÜMBEL, 1861). The Koessen Formation is mainly formed by a sequence of dark limestone bands and alternating marls yielding rich macro- and microfaunas. The general thickness varies between 100 to 200 meters. The upper part can be substituted by the Steinplattekalk*) (about 100 m in thickness). These widely distributed beds are exposed on the northern flank of the Northern Calcareous Alps, striking from west to east, nearly in all tectonic units of Bajuvarikum and Tirolikum. These types of beds are also represented in the Engadiner Dolomiten (FURRER et al., 1982), the Lienzer Dolomiten (SCHLAGER, 1963), the Gailtaler Alpen (KOEHLER, 1973), the Drauzug (WARCH, 1973), in the Fatra Formation (MICHALIK, 1977) and the Norovica Formation (GAZDZICKI & MICHALIK, 1980) of the West Carpatians of Slovakia and Poland, in the Papuk

2. Material and Methods

Detailed stratigraphical investigations and sampling of 26 outcrops (Text-Fig. 1) were carried out from the summer 1983 to 1986 as part of the research for the Ph. D. thesis of R. GOLEBIOWSKI about the Koessen Formation. The samples, weighing 3 to 10 kilograms, were collected bed by bed at different stratigraphical levels for conodont separation. Following maceration in acetic acid, the residues were separated by the Tetrabromäthan method resulting in the yield of conodont specimens. The conodont fauna was recovered from 35 samples from 20 localities (Text-Fig. 2). The most promising quantity of rock samples for conodont-maceration amounts to about 7 to 8 kilograms each. All the specimens are deposited in the microfossil collection of the Institute of Palaeontology, University of Vienna, Vienna/Austria.

3. Previous Work on Conodonts

Conodonts from the Koessen Formation were investigated for the first time by MOSHER (1968). He examined the well known locality of Kendlbach, previously

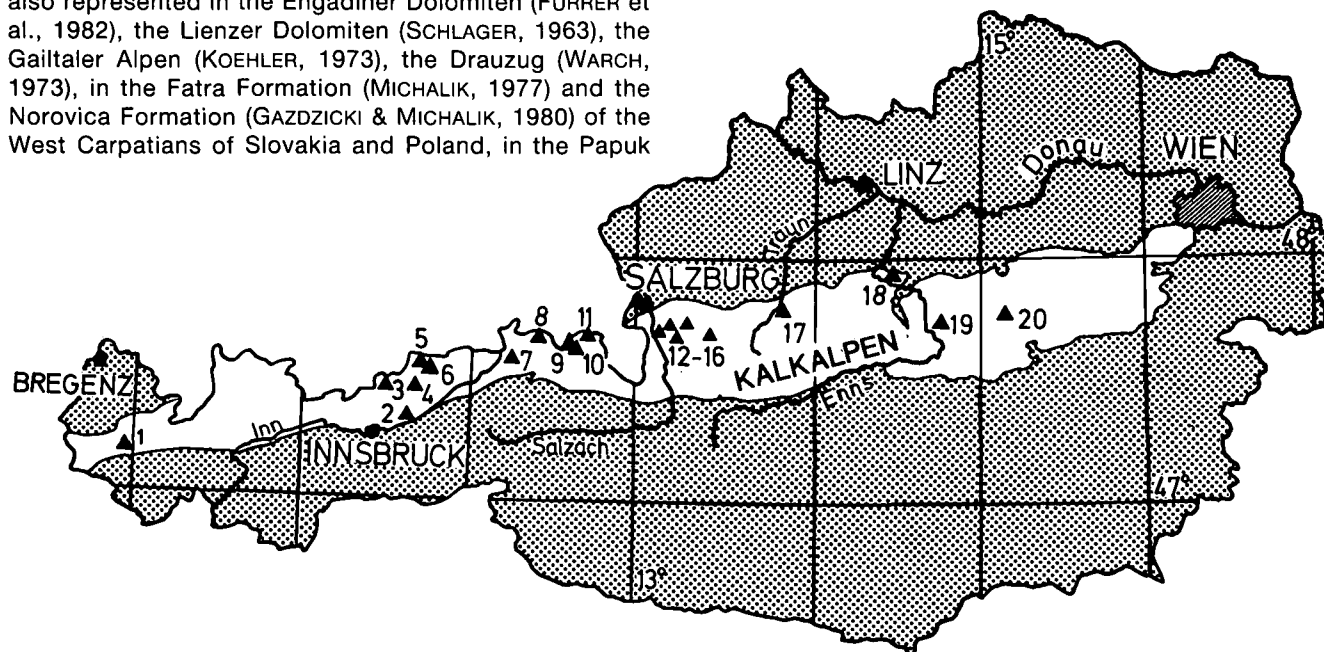


Fig. 1. Localities of upper Triassic conodont finds in the Northern Calcareous Alps (Austria).

Mountains (SIKIC et al., 1975) in Yugoslavia, in the Bakony Mountains (VEGH, 1964) in Hungary and in a few parts of Rumania.

The stratigraphical position of the Koessen Formation lies between the Upper Norian Hauptdolomit, overlain by Plattenkalk (CZURDA & NICKLAS, 1970) and various Liassic sediments such as the Adneter Kalk, Hierlatzkalk or Fleckenmergel. According to the ammonite zonation of TOZER (1967) the Koessen Formation is placed between the *Rhabdoceras suessi* and the *Choristoceras marshi* zone.

*) The informal term "Upper Rhaetian Limestone" has been replaced by the correct name Steinplattekalk (SCHLAGER & SCHÖLLNERBERGER, 1975).

studied by SUESS & MOJSISOVICS (1868), and described these conodont specimens as *Neospathodus lanceolatus*.

The work was continued by KOZUR (1971) and KOZUR & MOSTLER (1973). KOZUR & MOCK (1974) gave a description of the genus *Misikella* and established the *Misikella posthernsteini* assemblage zone corresponding to the *Choristoceras marshi*-zone. MOSTLER et al. (1978) published the conodont fauna from the Weißloferbach section, describing *Misikella rhaetica* and *Misikella koessenensis*. In this work he subdivided the *posthernsteini* assemblage-zone by keeping the *rhaetica*-zone in the lower part.

EXARCHOS (1977) studied the Gaissau section in detail and supported the proposed zonation of MOSTLER (1978). GAZDZICKI (1978) and GAZDZICKI et al. (1979) have also reported *Misikella* faunas from the West Car-

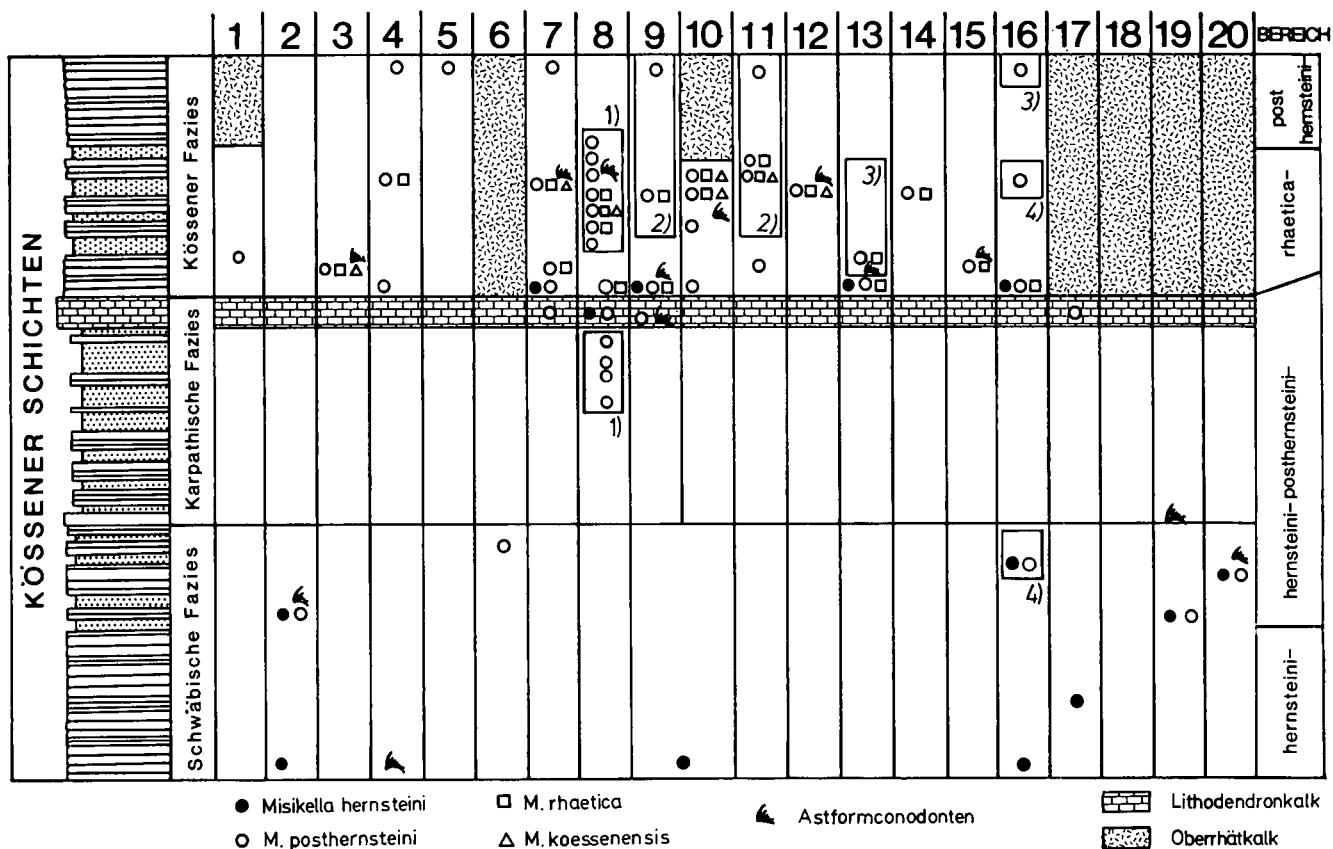


Fig. 2. Generalized stratigraphic section of Koessen Beds showing range of *Misikella*.

patians. KRYSZYN (1980) described additional conodont faunas from the Kendlbach and Gaissau section and found conodonts in the sections of Steinplatte and Hochalm (personal communication).

4. Stratigraphical and Lithological Outline of the Localities of Conodont Bearing Beds

(Text-Fig. 1)

4.1. Vorarlberg

- ① **Formarin-See**
ÖK 142*) 4710/1000
This locality, 1918 m above sea level, north of the Klostertal, can be reached via Lech near Arlberg by road. On the southern lake side a complete section exposes Plattenkalk, Koessen Formation and Steinplattekalk. The samples were collected from a limestone band, 7 meters below the base of the Steinplattekalk.

4.2. Tyrol

- ② **Mahdgraben**
ÖK 119 472130/1140, 110 m
It is located on the southern flank of the Karwendelgebirge and can be reached from the village

Vomp in the Inn Valley. The samples were collected from the Swabian Facies, exposed on a forest road. The conodont specimens are somewhat metamorphosed.

- ③ **Hinter-Riss**
ÖK 118 472730/1129
The outcrop is situated north of the Karwendelgebirge on the right side of Hinter-Riss. The sediments of the upper half of the Koessen Formation are distinct, rich in marls and well exposed along the forest road of the Schloßgraben. The sample point belongs to the Lower Koessen Facies and is situated 3 meters above the top of the Lithodendronkalk.
- ④ **Fonsjoch**
ÖK 119 4728/1139, 1800 m
This locality is on the eastern side of the Karwendelgebirge near Achensee and can be reached from the village Pertisau along a forest road to the Überschüb-Alm. The section is well exposed at the foothill of Juchen-Kogel and consists of Plattenkalk, Koessen Formation and overlying Liassic red limestone. The sample 83/7/2 was collected 5 meters and the sample 83/7/4 25 meters above the Lithodendronkalk. Both samples belong to the upper Koessen Facies. The sample point 85/7/6 lies only 2 meters above the top of Lithodendronkalk at the base of the Koessen Facies. The sample point 85/7/6 lies only 2 meters above the top of Lithodendronkalk at the base of the Koessen Facies. F2/1 was taken exactly from the base of the Koessen Formation, outcropping along the forest road to the

*) ÖK means the Austrian map 1 : 50.000 published by the Bundesamt für Eich- und Vermessungswesen, Vienna.

Überschüß Alm, only a few meters below the Schleimsattel (472810/113830).

5 Klammbach
ÖK 88 4734/1142

This locality is north of the Rofangebirge and can be reached from Achenkirchen via Achenwald. The beds are exposed partly in the creek. The sample was collected from the uppermost part of Koessen Facies, 41 meters above the top of Lithodendronkalk.

6 Ampelsbach
ÖK 88 4734/1146

Located at the northern flank of the Rofangebirge, it can be reached via Achenkirchen in the valley of Ampelsbach. The complete section is well exposed on the banks of the creek and consists of Hauptdolomit, Plattenkalk, Koessen Formation and Steinplattekalk. The sample point lies at the top of Swabian Facies, 39 meters above the first band of megalodont limestone of the underlying Plattenkalk.

7 Eiberg
ÖK 90 473430/1211

East of Kufstein, in the quarry of Eiberg, there are good exposures of the Koessen Formation consisting of Carpathian and Koessen Facies. The topmost beds of the Carpathian Facies are represented by a terrigenous variant of the Lithodendronkalk which is thinly developed. These are also found in the Koessen and Hochalm section.

Many samples were taken for conodont investigation out of which 6 samples yielded conodont faunas, as follows.

Eb 11A was taken from the base of the coral limestone,

Eb 11B from the basal beds of the Koessen Facies, 1.5 meters above the coral limestone,

Eb 12 from the lower part of Koessen Facies, 6 meters above the coral limestone,

Eb 18 of the calcareous sequence, which is intercalated with the muddy Koessen Facies, 18 meters above the coral limestone,

Eb 27 from the uppermost part of the Koessen Facies, 49 meters above the coral limestone.

Comparing the section with the section of Koessen it is suggested that this locality may be taken as a reference section of the Koessen Facies. In the Koessen locality the beds are tectonically disturbed and the topmost part of the Koessen Facies, about 15 meters, are missing, whereas the well exposed section of Eiberg quarry is complete and rich in conodont bearing beds as well as in ammonoid faunas of the genus *Choristoceras*.

8 Koessen
ÖK 91 4740/1227

A few kilometers east of the village of Koessen, on either side of the creek Weißloferbach, are outcrops of upper Swabian, Carpathian and Koessen Facies which are tectonically disturbed by sliding movements. The Carpathian Facies is terrigenous in character and ends with sequence of marly coral limestone, which is an unusual variation of the Lithodendronkalk (as reported from the Eiberg section).

The sample number KA 85/2 was taken from the base of Koessen Facies, 1.5 meters above the top of the coral limestone and KA 85/4 out of the coral limestone sequence, which is only 0.5 meters thick.

9 Steinplatte
ÖK 91

Outcrop Stp 1, 4738/1234, 1230 m (above sea level) is situated at the foothill of Scheiblberg and can be reached via Schwarzlofer Graben. The sample was taken from the base of the Koessen Formation (base of the Swabian Facies).

Outcrop Stp 2 is located at a road cut along the track between Stallenalml and Kammerköhralm, 4737/123430, 1470 m, where the base of the Koessen Facies is exposed, overlying the Lithodendronkalk. Outcrop Stp 3/2 is close to the top of Steinplatte, 473730/123430, 1570 m, at the base of the C-mound of the Steinplatte reef (OHLEN, 1959). The sample was taken from the terrigenous basal beds of the Lithodendronkalk below the C-mound.

10 Wemetaigenalm
ÖK 92 4736/1235, about 1600 m

The outcrops are southwest of the summit of the Steinplatte above Wemetaigenalm and can be reached by a footpath from the village Waidring. The sections at the foot of the cliffs consist of the uppermost parts of Carpathian Facies and the Koessen Facies overlain by Steinplattekalk.

W 85/17 was taken from a coral detritus limestone, 5 meters above the Lithodendronkalk.

W 83/ 2 comes from a terrigenous type of Koessen Facies, 39 meters below the base of Steinplattekalk

W 83/ 3 lies 15 meters upwards the previous sample, 24 meters below the base of the Steinplattekalk. These beds of the Koessen Facies are not so marly on the contrary they are already rich in reef detritus.

W 85/22 was taken from the Koessen Facies, 26 meters below the base of the Steinplattekalk. Although this sample point is south of the Wemetaigenalm the stratigraphical position of the beds are similar to W 83/3.

4.3. Salzburg

11 Hochalm
ÖK 92 m 4740/1242, 1650 m

This section is located northwest of the village Unken, on the ridge between Peitingköpfel and Sonntagshorn and contains good exposures of beds of the Plattenkalk and Koessen Formation. The Steinplattekalk close to the Hochalm section has no connection with the Koessen Formation. It is an isolated block moved northward by tectonic sliding. The sample was taken from the lower part of the Koessen Formation, 6 meters above the sequence of a coral detritus limestone with a muddy matrix. It is a terrigenous variant of the Lithodendronkalk, which is also reported from Eiberg and Koessen.

- 12 Adnet**
ÖK 94 **4742/1304**
 This locality lies southeast of the city of Salzburg. The sample belongs to the Koessen Facies and was taken from a small roadcut at the old road between Adnet and Krispel. This locality was first described by KRETSCHMER (1974) and later revisited by MOSTLER et al. (1978).
- 13 Gaissau**
ÖK 94 **4743/1311**
 It is a well known section and lies south of the Wiestal reservoir along the road of Mörtelbach. The well exposed beds consist of Carpathian and Koessen Facies, but the Swabian Facies and the topmost part (about 20 m) of this section is missing. The sample was taken 1.5 meters above the top of the Lithodendronkalk at the base of the Koessen Facies.
- 14 Rötelswand**
ÖK 94 **4742/1215, 1200 m**
 This locality is near by of Gaissau section and can be reached by following the valley of Mörtelbach upstream. The roadcut along a forest contains good outcrops of Steinplattekalk and secondary Koessen Formation. At this locality the facies distribution of a Rhaetian reef and the interfingering with the basal sediments of the upper Koessen Formation can be exceptionally well observed (SCHÄFER, 1979). The sample is from the Koessen Facies, taken near a hut with a spring.
- 15 Satzloch Graben**
ÖK 94 **4745/1319**
 The locality is situated south of the village of Hintersee, in a tributary entering the right bank of the Lämmerbach. This section consists of the upper half of the Koessen Formation (including the Lithodendronkalk and Koessen Facies) and is nearly similar, bed by bed to the Kendlbach section, which is along the strike on the other flank of the mountain ridge. The sample was collected from the lower Koessen Facies, 5 meters above the top of the Lithodendronkalk. The sample bed corresponds to the bed of number 111 of SUESS & MOJSISOVICS (1868) in the Kendlbach section.
- 16 Kendlbach**
ÖK 95 **474130/7312**
 It is situated in the Osterhorn mountains west of the Wolfgangsee. The locality can be reached via the valley of Zinkenbach and is a tributary entering on the right hand side of the Zinkenbach. This famous outcrop is a complete section of the Koessen Formation, overlying the Hauptdolomit and Plattenkalk and overlain by the lowermost Liassic Kendlbach-Schichten (PLÖCHINGER, 1982) and Adneter Kalk, etc. The sample K 83/29 was collected from the base of the Koessen Formation which corresponds to the bed 29 measured by SUESS & MOJSISOVICS (1868). Four additional samples below this level in the topmost sequence of Plattenkalk (between the beds 21 and 23 after SUESS & MOJSISOVICS) yielded no conodonts. The following sample K 85/111A was taken half a meter above the top of the Lithodendronkalk on the base of the Koessen Facies.

4.4. Upper Austria (Oberösterreich)

- 17 Eibenberg**
ÖK 66 **4747/1348, 1350 m**
 This locality is situated at the southern lake side of the Traunsee on the western flank of Eibenberg. The outcrop called Gschlif is a complete section and consists of beds e. g. Plattenkalk, Koessen Formation and Steinplattekalk. A description of the rich macrofauna collected from the Koessen Formation was given first by ZAPFE (1949). The sample was taken from the base of the Swabian Facies few meters above the top of Plattenkalk (106 meters below the base of the Steinplattekalk).
- 18 Pechgraben**
ÖK 69 **845430/1432**
 The section is a roadcut along the road between Großraming and Laussa. North of a large quarry there are outcrops of Carpathian Facies (including Lithodendronkalk) and Steinplattekalk. The sample was taken from the topmost level of the Carpathian Facies.

4.5. Styria (Steiermark)

- 19 Voralpe**
ÖK 100 **4745/14, 1720 m**
 The section is situated northeast of Altenmarkt at the river Enns, at the foothill of Stumpfmauer. The locality is called Voralpe (STUR, 1871) but the definitive name should be Tanzboden, a slope above the Eßlingalm. It can be reached via the hamlet Eßling by a forest road to Hinteralm. There are exposures of Plattenkalk, Koessen Formation and an eastern variant of Steinplattekalk. The sample was collected 62 meters below the base of the Steinplattekalk, 8 meters above the top of the Plattenkalk, from the lower Swabian Facies.

4.6. Lower Austria (Niederösterreich)

- 20 Neuhaus**
ÖK 72 **4747/1510**
 Near the small village Neuhaus there are large exposures at a roadcut along the road to the Lunzer See. The section consists of Hauptdolomit, overlain by Plattenkalk, Koessen Formation and an eastern variant of Steinplattekalk. The sample was collected from the Swabian Facies, 60 meters below the base of the Steinplattekalk.

5. Facies Interpretation of the Conodont Bearing Rocks

The presence of conodont bearing rocks in the Koessen Formation is related to the fact that there was a deepening of the area of the Hauptdolomit deposition in the Upper Norian. At the base of Swabian Facies the shallow water sediments of the Plattenkalk and northern flank of the Dachsteinkalk platform are overlain by dark bedded limestones, with conodonts in some layers. These conodont bearing sediments are mostly bioclastic wackestones as well as peloid

packstones with micritic matrix. This matrix is sometimes washed out and replaced by sparite. The bioclasts contain mostly shell fragments as well as debris of echinoderms and ostracodes. Burrow traces are quite common and indicate an environment characterized by bioturbation.

In some localities (Mahdgraben, Steinplatte 1, Vor-alpe and Neuhaus) a biomicritic type of limestones only yielded conodonts. These mudstones have sometimes unrhythmic thin sparite layers. According to KUSS (1983) the presence of these biosparitic thin layers with terrigenous quartz and sometimes with nearly 60 % fine grained biotrititic debris indicate episodic storm events which interrupt the mud-sedimentation.

The conodont bearing rocks as compared with the Standard Microfacies (SMF)-Types of WILSON (1975) and E. FLÜGEL (1972) belong to the SMF-Type 9 and rarely to the SMF-Type 10 and 2. These SMF-Types indicate the facies zonation (FZ) 7, a deep open platform or open lagoon behind the outer platform edge. In the Karpathian Facies conodont faunas have only been found in the Lithodendronkalk with reef-detritus-mud facies. This facies is composed of poorly sorted bioclastic wackestones with mainly coral talus and secondary fragments of echinoderms, molluscs and other framework organisms. Bioturbation and oncoidal encrusting of bioclasts is frequent. The SMF-Types 4, 5 and 10 indicate the facies zonation 4, fore slope*). The majority of the conodont faunas are found in the Koessen Facies. The increasing deepening process at the base of the Koessen Facies changed to open deep platform to a shallow basin. The basal sediments belong generally to a detritus-mud facies with medium to fine grained bioclastic wackestones or nearly unfossiliferous mudstones. The maximal representation of bioclastics can be nearly 70 % talus of echinoderms and 30 % of brachiopodes (KUSS, 1933). Bioturbation is frequent in biotrititic wackestones as well as in pelitic mudstones, indicating greater water depth and lower sedimentation rates. Only in the lowermost part of the Koessen Facies are conodonts present in coarse grained packstones with oncoidal encrusted talus. This type of lithology indicates the deepening of the shallow water areas to a basin. The increased deepening of the Koessen basin can also be recognised by the change of the SMF-Types. The conodont bearing rocks from the base of the Koessen Facies correspond to the SMF-Type 9 and 10, the lower part corresponds generally to the SMF-Type 9, while the upper part is corresponding to the SMF-Type 9, 8 and 2. After comparing these data with the facies model of WILSON (1975) the sediments belong to the facies zonation 2 to 3, which indicated the Koessen Facies as a shallow to intermediate basin.

In conclusion the conodont bearing rocks of the Koessen Formation must have been deposited in a basin or a deeper open platform, always below the zone of wave agitation. This type of lithology is suitable to the ecological condition of conodont faunas.

This is interesting to note that after macerating many rock samples conodont faunas were not found on the following lithological types:

*) This fore slope like sediments of the Lithodendronkalk are also deposited in the facies zonation 7.

- 1) Samples from higher energetic areas, such as wellsorted lumachell limestones (rudstones) and packstones or grainstones with ooids and oncoids (from the Swabian Facies).
- 2) Samples from basinal terrigenous sediments, like fine grained, sometimes laminated mudstones with high marly content (from the Koessen Facies).

6. Systematic descriptions

Genus *Misikella* KOZUR & MOCK, 1974

Misikella hernsteini (MOSTLER 1967)

(Pl. 1, Fig. 2)

- 1967 *Spathognathodus hernsteini* n. sp. MOSTLER, p. 182, text figs. 1a-e.
 1968 *Neospathodus lanceolatus* n. sp. MOSHER, p. 930-931, pl. 115, figs. 10-11, non figs. 7.
 1971 *Neospathodus hernsteini* (MOSTLER) - SWEET et al., pl. 1, figs. 2, 3.
 1974 *Misikella hernsteini* (MOSTLER) - KOZUR & MOCK, pl. 1, figs. 6-7.
 1978 *Misikella hernsteini* (MOSTLER) - MOSTLER et al., p. 1, figs. 10-19, pl. 2, figs. 5-7.
 1979 *Misikella hernsteini* (MOSTLER) - GAZDZICKI et al., pl. 5, figs. 3-7.
 1980 *Misikella hernsteini* (MOSTLER) - ISOZAKI & MATSUDA, pl. 1, fig. 12.
 1980 *Misikella hernsteini* (MOSTLER) - KOVACS & KOZUR, pl. 15, figs. 4-7.
 1980 *Misikella hernsteini* (MOSTLER) - KRYSZYN, pl. 14, fig. 10-12.
 1981 *Misikella hernsteini* (MOSTLER) - KOLKE, pl. 2, fig. 29.
 1982 *Misikella hernsteini* (MOSTLER) - ISOZAKI & MATSUDA, pl. 4, fig. 8.
 1982 *Misikella hernsteini* (MOSTLER) - MATSUDA & ISOZAKI, pl. 2, fig. 30.
 1982 *Misikella hernsteini* (MOSTLER) - NAGAO & MATSUDA, pl. 1, figs. 9-11.
 1983 *Misikella hernsteini* (MOSTLER) - ISOZAKI & MATSUDA, p. 66-67, pl. 1, fig. 1-7.

Diagnosis: A form species of *Misikella* characterized by flared oval to sub-oval shaped basal cavity with 5-6 average fused denticles, free at the tips. Expanded basal cavity, rounded at the posterior end.

Description: Spathognathoid elements, denticles fused at the base, pointed and free at the tips, basal cavity flared, straight to arcuate at the anterior end, sometimes basal cavity is of rectangular shape. Denticles 3-5 in number, in same forms, basal cavity of sigmoidal shape. It is deepest in the centre. Anterior margin of the unit slightly convex, posterior margin somewhat concave.

Remarks: The present specimens have a generally strong laterally expanded deep basal cavity. Number of denticles usually 4-5 in number. Majority of specimens are more long than broad in size, some are of equal size. The specimens of the present collection have akin complacent characters of *Misikella hernsteini* (MOSTLER).

Material: 67 specimens.

Occurrences

Austria:

- Steinbergkogel near Hallstatt, Salzburg. Hallstatt Limestone. 332-367 feet above base of section.
 Kendlbachgraben St. Wolfgangsee. Koessen Beds according to MOSHER (1968).
 Weissloferbach Section (MOSTLER et al., 1978)
 Gaissau Section (EXARCHOS, 1977, KRYSZYN, 1980).
 Uppermost (Rhaetian-Sevastian) reefal limestones of Gosaukamm with intercalations of Hallstatt Limestone between Mandlkogel and Großer Donnerkogel (SCHAUER, 1983).

Koessen Beds of Mahdgraben, Koessen, Steinplatte, Gaissau, Kendlbachgraben, Eibenberg, Voralpe, Neuhaus (from this paper).

Czechoslovakia:

Hybe, Bliskary Plannes, Mlynsky of Eastern Alps. Norian-Rhaetian Limestone of western Carpathians (GAZDZICKI et al., 1978).

North America:

New Pass Range. Middle member of the August Mountain Formation (MOSHER, 1968).

Japan:

From Hozuko and Inuyama, Areas in the Mino-Tamba Belt SW Japan (ISOZAKI & MATSUDA, 1983).

India:

Upper Norian in the Lachung-La, Zanskar-Region of Ladakh, Kashmir (GUPTA, 1981).

***Misikella posthernsteini* KOZUR & MOCK, 1974**

(Pl. 1, Figs. 4,5)

- 1968 *Neospathodus lanceolatus* n. sp. MOSHER, p. 930-931, pl. 115, non fig. 7, non figs. 10-11.
 1974 *Misikella posthernsteini* n. sp. KOZUR & MOCK, p. 247-249, text-fig. 1-4.
 1976 *Misikella posthernsteini* (KOZUR & MOCK) - SKWARKO et al., p. 222, text-fig. UA-H.
 1978 *Misikella posthernsteini* (KOZUR & MOCK) - GAZDZICKI, p. 346, pl. 38, figs. 1-3, pl. 39, figs. 1-4, pl. 40, fig. 3.
 1978 *Misikella posthernsteini* (KOZUR & MOCK) - MOSTLER et al., pl. 1, figs. 20-22.
 1979 *Misikella posthernsteini* (KOZUR & MOCK) - GAZDZICKI et al., pl. 5, figs. 1,2.
 1979 *Misikella posthernsteini* (KOZUR & MOCK) - ISHIDA, pl. 2, fig. 9.
 1980 *Misikella posthernsteini* (KOZUR & MOCK) - ISOZACKI & MATSUDA, pl. 1, figs. 14,15.
 1980 *Misikella posthernsteini* (KOZUR & MOCK) - KOVACS & KOZUR, pl. 15, fig. 10.
 1980 *Misikella posthernsteini* (KOZUR & MOCK) - KRYSSTYN, pl. 14, figs. 7-8.
 1981 *Misikella posthernsteini* (KOZUR & MOCK) - GAZDZICKI & GUPTA, text-fig. 1b.
 1982 *Misikella posthernsteini* (KOZUR & MOCK) - ISOZACKI & MATSUDA, pl. 4, fig. 9.
 1982 *Misikella posthernsteini* (KOZUR & MOCK) - MATSUDA & ISOZACKI, pl. 2, fig. 29.
 1982 *Misikella posthernsteini* (KOZUR & MOCK) - NAGAO & MATSUDA, pl. 1, figs. 12-15.
 1983 *Misikella posthernsteini* (KOZUR & MOCK) - ISOZACKI & MATSUDA, p. 67-69, pl. 1, figs. 8-13, pl. 2, figs. -7, pl. 3, figs. 1-7.

Diagnosis: A form species of *Misikella* characterized by heart shaped basal cavity, quiet deep in central portion. The number of denticles usually reduced to three in number. Unit generally much higher than long in size (0.3 mm high and 0.2 mm long).

Description: Small spathognathoid bladed elements. $\frac{2}{3}$ size long, denticles 3-5 in number; basal cavity heart shaped. The anterior part of cavity is bifid. In some forms cavity is square shaped. Main denticle makes an angle of 60° inclination with the basal margin. Denticles fused at the base but free at the tips and of about same size.

Remarks: Laterally extended basal cavity, deep and heart shaped. Number of denticles usually 3-5 but in some forms it goes up to 7 which is an exception. Denticles inclined more posteriorly. In some specimens main denticle makes 120° inclination with the basal margin.

Material: 82 specimens.

Occurrences

Austria:

Upper Triassic section of Steinbergkogel, Kendlbachgraben and Weissloferbach sections (MOSHER, 1968; KOZUR & MOCK, 1974; MOSTLER et al., 1978 and GAZDZICKI et al., 1978).

Gaissau section (EXARCHOS, 1977; KRYSSTYN, 1980, and in present paper).

Zlambach Beds (Limestone Bands) of Schneckengraben (SCHAUER, 1983).

Koessen Formation of Formariensee, Hintersee, Fonsjoch, Klammbach, Ampelsbach, Eiberg, Koessen, Hoch-Alm, Steinplatte, Wemetaigen-Alm, Adnet, Gaissau, Röttlwand, Schatzlochgraben, Kendlbachgraben, Pechgraben, Voralpe and Neuhaus (present paper).

Czechoslovakia:

Hybe and Malynskvrch Section in Slovakia (KOZUR & MOCK, 1974; MOSTLER et al., 1978; GAZDZICKI et al., 1978).

Poland:

Tatra Mountains, western Carpathians (GAZDZICKI, 1978).

India:

Lower part Kioto Limestone, Lachung-La (Ladakh) and Chota-Hoti Sections, (Kumaun) (GUPTA, 1981).

Papua New Guinea:

Kuta Formation of Triassic (SKWARKO et al., 1976).

Japan:

From Nagayasu-Guchi Dam Tokushima prefecture and Konose Valley in western Tokushima (ISHIDA, 1979, 1983).

From Late Triassic sections of Hozukyo and Inayama in the Mino-Tamba Belt SW Japan (ISOZACKI & MATSUDA, 1983).

Misikella rhaetica

(MOSTLER, SCHEURING & ULRICH, 1978)

(Pl. 2, Fig. 2)

- 1978 *Misikella rhaetica* n. sp. MOSTLER, SCHEURING & ULRICH - p. 152-153, pl. 2, figs. 1, 2, 4, text-fig. 2.
 1980 *Misikella rhaetica* (MOSTLER, SCHEURING & ULRICH) - KRYSSTYN, pl. 14, figs. 13-14.

Diagnosis: A form species of *Misikella* with 6-9 denticles, basal cavity straight to sub-straight at the posterior end. Main denticle after two posterior terminal denticles.

Description: Spathognathoid bladed elements, main denticle on the posterior margin. Denticles fused at the base but free at the tips. The basal cavity runs three fourth of the basal marginal space. Flaring of the basal cavity usually below the main denticle.

Remarks: Higher range bladed conodonts (Text-Fig. 2). Number of denticles more than other species of *Misikella*. The unit is more wide than high.

Material: 108 specimens.

Occurrences: This species is reported from Austria only.

The *Misikella rhaetica* was first described by MOSTLER et al. (1978) from Weissloferbach section.

From the Gaissau section (EXARCHOS, 1977; KRYSSTYN, 1980).

Koessen Beds of Hintersee, Fonsjoch, Eiberg, Koessen, Steinplatte, Wemetaigen-Alm, Adnet, Gaissau,

Rötlwand, Kendlbachgraben localities (from this paper).

Misikella koessenensis
(MOSTLER, SCHEURING & ULRICH, 1978)

1978 *Misikella koessenensis* n. sp. MOSTLER, SCHEURING & ULRICH, p. 153, pl. 2, fig. 3.

Diagnosis: A form species of *Misikella* characterized by pear shaped basal cavity. The cavity runs entire number of denticles range from 3–5. A short terminal denticle located posteriorly with the main denticle.

Description: Spathognathoid bladed elements. First described by MOSTLER et al. (1978). Basal cavity located in the posterior part. Main denticle always after the first short denticle in the posterior region. Basal cavity covers more of marginal area. Denticles 5 in number high, pointed at the tips. They stand erect and are perpendicular to the basal margin. Height of the unit is generally double the width of the unit. Basal cavity quite flared and margin of cavity form parapets, not found in other species of *Misikella*. The parapets are wider in the central portion. Main denticle is thicker and wider than rest of denticles.

Remarks: This form can be transitional between *Misikella hernsteini* and *M. posthernsteini*. It is closer to *M. hernsteini* due to the shape of basal cavity. Presence of a first short denticle located posteriorly, which is not found in other species of *Misikella*.

Material: 23 specimens.

Occurrence: This species is first described by MOSTLER et al. (1978) from the Weissloferbach Section/Austria.

The author has found this species from the Koessen Beds exposed at Hinterriss, Eiberg, Wemeteigenalm and the Adnet localities.

Ramiform Elements

Besides the forms of *Misikella* the samples of Koessen formations are also associated with Ramiform conodonts. The fauna is not so rich. In two samples from Fonsjoch (F11/1) and Voralpe (V5). These conodonts are without *Misikella*.

The Ramiform conodonts are broadly represented by *Hindeodella*.

The Ramiform conodonts found in several sections are as follows:

Hindeodella triassica MÜLLER
H. suevica TATGE
H. pectiniformis HUCKRIEDE
H. dropla SPASOV and GANEV
Cypridodella muelleri TATGE
Enentiognatus zieglerei DIEBEL
Hibbardella magnidentata TATGE
Cornudina sp.
Chirodella Dinodoides TATGE

The form of *Cornudina* sp. (from Steinplatte Stp 3/2) is found in a higher level of the Koessen Formation for the first time.

Acknowledgements

This work is part of the I. G. C. P. Project 4, Triassic of Tethys Realm.

The author is very much indebted to Prof. Dr. H. ZAPPE (Erdwissenschaftliche Kommission der Österreichischen Akademie der Wissenschaften, Vienna) under whose initiative and encouragement this research work was undertaken. Further he is grateful to Doz. Dr. L. KRYSZYN (Institut für Paläontologie der Universität Wien) for checking the material, his practical knowledge and valuable discussions during the course of work.

The author is also very thankful to Prof. Dr. F. STEININGER, Director of the Institute of Palaeontology of the Vienna University, for providing the necessary facilities.

Furthermore he is thankful to R. GOLEBIOWSKI for helping practically in the research field work and spending the time for discussions.

The author acknowledges gratefully the Bundesministerium für Wissenschaft und Forschung, Austria and the Ministry of Education and Culture, Govt. of India, New Delhi for granting him the postdoctoral scholarship under the Indo-Austrian cultural exchange program. Last not least the author wishes to thank the Panjab University, Chandigarh, India, for nominating him for this scholarship and granting him study leave to undertake this work.

Thanks are extended to A. DOSTAL (Institut für Humanbiologie der Universität Wien) for operating the SEM-photography and late Ch. REICHEL for making the photos.

Plate 1

- Fig. 1: *Misikella hernsteini* (MOSTLER).
Lateral view.
Section 9, Steinplatte Stp 2/1, basal Koessen Beds, Swabian facies (Scheibelberg).
- Fig. 2: *Misikella hernsteini* (MOSTLER).
View of basal cavity.
- Fig. 3: *Miskella posthernsteini* (KOZUR & MOCK).
Oral view.
Section 13, Gaisau, base of Koessen Beds, Koessen facies.
- Fig. 4: *Misikella posthernsteini* (KOZUR & MOCK).
Lateral view.
Same as Fig. 3.
- Fig. 5: *Misikella posthernsteini* (KOZUR & MOCK).
Lateral view.
Section 4, Fonsjoch F 1/1, topmost of Koessen Beds, Koessen facies.
- Fig. 6: *Misikella koessenensis* (MOSTLER, SCHEURING & ULRICH).
Lateral view.
Section 7, Eiberg, Koessen facies.

All figures ca. 340x.

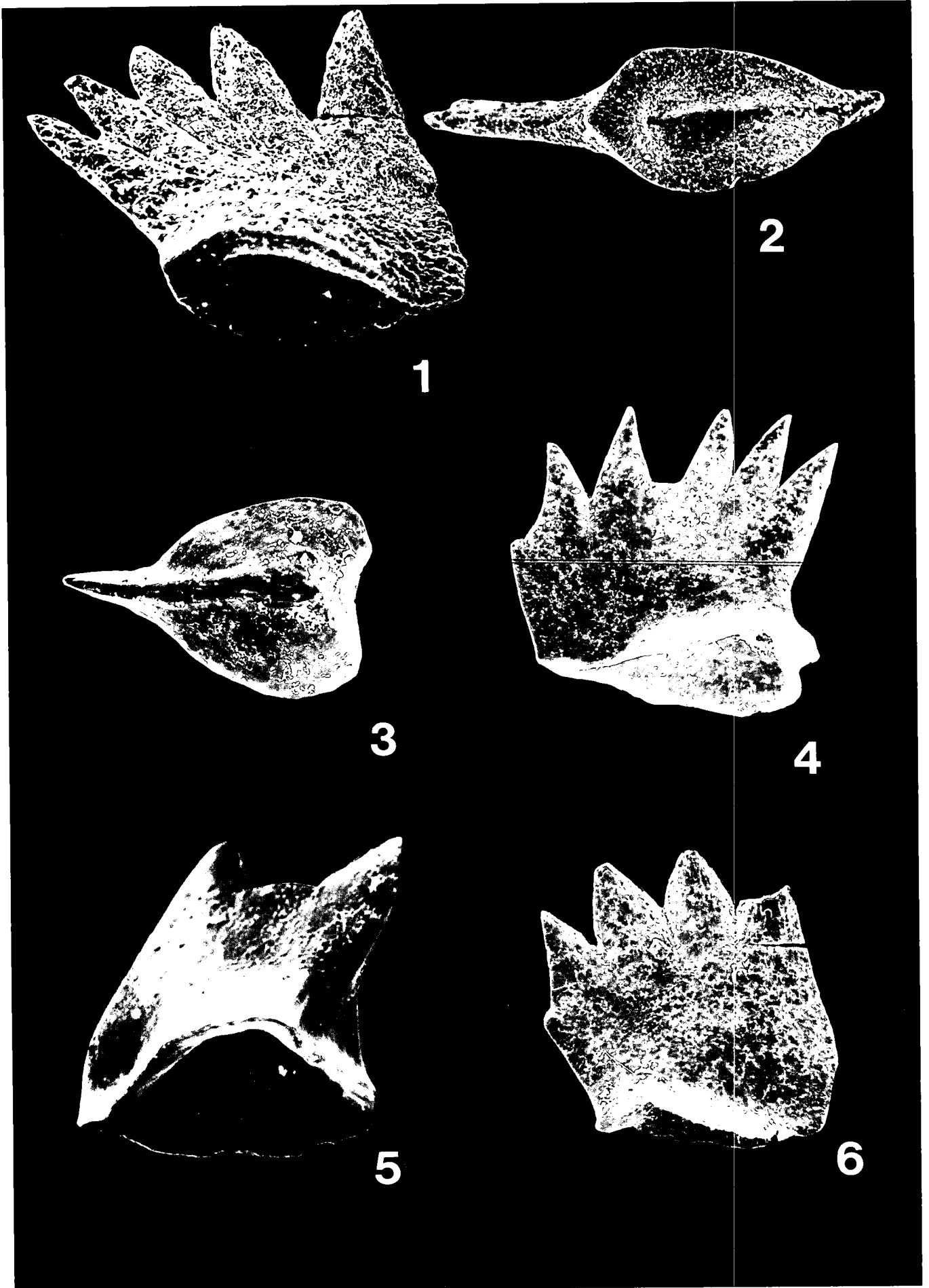
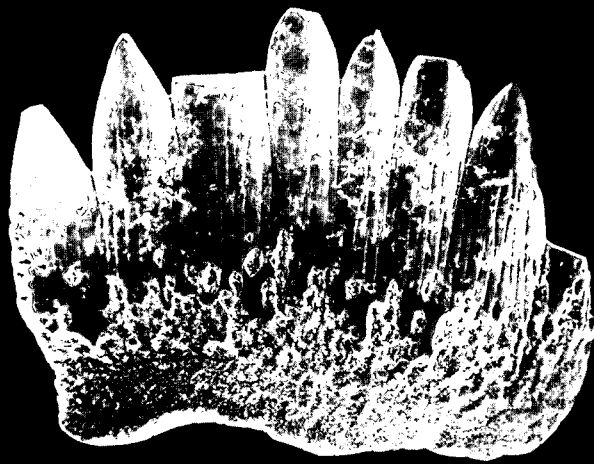
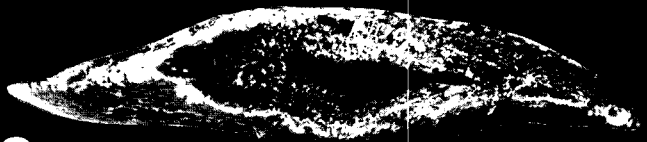


Plate 2

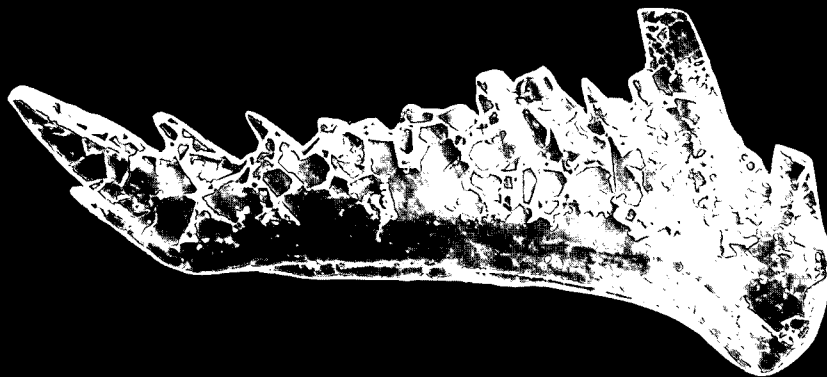
- Fig. 1: *Misikella rhaetica* (MOSTLER, SCHEURING & URLICHS).
Section 12, Adnet, Koessen facies, ca. 370×.
- Fig. 2: *Misikella rhaetica* (MOSTLER, SCHEURING & URLICHS).
View of basal cavity.
Section 12, Adnet, Koessen facies, ca. 370×.
- Fig. 3: *Hindeolella* sp.
Lateral view.
Section 4, Fonsjoch F 1/1, Koessen facies, ca. 37×.
- Fig. 4: One multiform element.
Lateral view.
Section 4, Fonsjoch F 1/1, Koessen facies, ca. 37×.



1



2



3



4

References

- CZURDA, K. & NICKLAS, C.: Zur Microfacies und Mikrostratigraphie der Hauptdolomit- und Plattenkalkniveaus der Klostertaler Alpen und Rhätikon. – Festband Geol. Inst. Univ. Innsbruck, 165–253, Innsbruck 1970.
- DÖSSEGER, R., FURRER, H. & MÜLLER, W. H.: Die Sedimentserien der Engadiner Dolomiten und ihre lithostratigraphische Gliederung (Teil 2). – *Eclogae geol. Helv.*, **75/2**, 303–330, Basel 1982.
- EXARCHOS, A.: Zur Mikropaläontologie und Sedimentologie der Kössener Schichten (Alpine Trias der Nördl. Kalkalpen). – Unveröff. Diss. Phil. Fak. Univ. Innsbruck 1977.
- FLÜGEL, E.: Mikrofazielle Untersuchungen in der alpinen Trias. – *Mitt. Ges. Geol. Bergbaustud.*, **21**, 9–64, Innsbruck 1972.
- GAZDZICKI, A.: Conodonts of the Genus *Misikella* (KOZUR & MOCK, 1974) from the Rhaetian of the Tatra Mountains (West Carpathians). – *Acta Palaeont. Polonica*, **23/3**, 341–350, Warszawa 1978.
- GAZDZICKI, A. & GUPTA, V.J.: Triassic Foraminiferas, Involutinidae from the Carpathians and Himalayas, its Stratigraphic and Palaeobiogeographic Implications; *Bull. Ind. Geol. Assoc.*, **14**, 101–106, Chandigarh 1981.
- GAZDZICKI, A. & MICHALIK, J.: Uppermost Triassic Sequences of the Choe Nappe (Hronic) in the West Carpathians of Slovakia and Poland. – *Acta Geol. Polonica*, **30/1**, 61–65, Warszawa 1980.
- GAZDZICKI, A., KOZUR, H. & MOCK, R.: The Norian-Rhaetian Boundary in the Light of Micropalaeontological Data. – *Geologia-Razprave in Porocila*, **22/1**, 71–112, Ljubljana 1979.
- GÜMBEL, C.W.: Geognostische Beschreibung des Alpengebirges und seines Vorlandes. – 950 S., Gotah (Perthes) 1861.
- GUPTA, V.: Triassic Conodonts from the Himalayas and their stratigraphic and palaeobiogeographic Implications. – *Riv. Ital. Palaeont.*, Vol. **87/1**, 23–40, Milano 1981.
- ISHIDA, K.: Stratigraphy and Structure around Nagayasu-Guchidam, Tokushima. – *Jour. Sci. Coll. Gen. Educ.*, Tokushima Univ., **12**, 61–92, Tokushima 1979.
- ISHIDA, K.: Stratigraphy and Radiolarian Assemblages of the Triassic and Jurassic siliceous sedimentary Rocks in the Konose Valley, Tokushima. – *Jour. Sci. Coll. Gen. Educ.*, Tokushima Univ., **14**, 111–141, Tokushima 1983.
- ISOZAKI, Y. & MATSUDA, T.: Middle and Late Triassic Conodonts from bedded Chertsequences in the Mino-Tamba Belt South-West Japan, Part 2: *Misikella* and *Parvigondolella*. – *Jour. Geol. Soc. Osaka City Univ.*, **26/3**, 65–86, Osaka 1983.
- KÖHLER, A.: Mikrofazielle Untersuchungen von Plattenkalk und Koessener Schichten in den Gailtaler Alpen. – Veröffentlichung der Univ. Innsbruck (Heissel Festschrift), Bd. **86**, Innsbruck 1973.
- KOZUR, H. & MOCK, R.: *Misikella posthernsteini* n. sp., die jüngste Conodontenart der tethyalen Trias. – *Casopis pro Min. a. Geol.*, **19/2**, 245–250, Bratislava 1974a.
- KOZUR, H. & MOCK, R.: Zwei neue Conodontenarten aus der Trias des Slovakischen Karstes. – *Casopis pro Min. a. Geol.*, **19/3**, 135–139, Praha 1974b.
- KRETSCHMER, A.: Norische Conodonten aus den Koessener Schichten bei Adnet (Salzburg). – *Anzeiger Österr. Akad. Wiss.*, **1973/9**, 93–96, Wien 1974.
- KRYSTYN, L.: Stratigraphy of the Hallstatt Region. – In: SCHÖNLAUB, H. P.: *Second Europ. Conodont Symp.*, Guidebook, Fieldtrip B: Triassic conodont localities of the Salzkammergut Region, *Abh. Geol. B.-A.*, **35**, 93–96, Wien 1980.
- KUSS, I.: Faziesentwicklung in proximalen Intraplattformbecken: Sedimentation, Palökologie und Geochemie der Koessener Schichten. – *Facies*, **9**, 61–172, Erlangen 1983.
- MICHALIK, J.: Paläogeographische Untersuchungen der Fata-Schichten des nördlichen Teiles des Fatrikums in den West-Karpathen. – *Geologica Carpathica*, **28/1**, 71–74, Bratislava 1977.
- MOSHER, L. C.: Triassic conodonts from West-North America and Europe and their correlations. – *Jour. Palaeont.* **42/4**, 895–946, Tulsa 1968.
- MOSTLER, H.: Conodonten und Holothurien Sklerite aus den norischen Hallstätter Kalken von Hernstein (Niederösterreich). – *Verh. Geol. B.-A.*, **1/2**, 177–188, Wien 1967.
- MOSTLER, H., SCHEURING, B. & ULRICHS, M.: Zur Mega- und Mikrofauna und Mikroflora der Kössener Schichten (alpine Obertrias) vom Weisloferbach in Tirol unter besonderer Berücksichtigung der in der Suessi- und Marshi-Zone auftretenden Conodonten. – *Schriften der Erdwiss. Komm. Österr. Akad. Wiss.*, **4**, 127–137, Wien 1978.
- NAGAO, H. & MATSUDA, T.: Rhaetian problems in terms of conodont Biostratigraphy, a case study in bedded Sequence at Taganoo in northwest Kyoto Southwest Japan. – *First Japanese Radiolarian Symp.*, *News Osaka Micropalaeontologists. Spec. Vol.*, **5**, 469–478, Osaka 1983.
- ÖHLEN, H.R.: The Steinplatte Reef Complex of the alpine Triassic of Austria. – *Phil. Diss.*, Univ. of Princeton, 1225 p., Princeton/U. S. A., 1959.
- PLÖCHINGER, B.: Erläuterungen zur geol. Karte St. Wolfgang im Salzkammergut. – *Geol. B.-A.*, **22** S., Wien 1982.
- SCHÄFER, P.: Fazielle Entwicklung und Paläökologische Zonierung zweier obertriadischer Riffstrukturen in den Nördlichen Kalkalpen. – *Facies*, **1**, 245 S., Erlangen 1974.
- SCHAUER, M.: Zur Altersstellung obertriadischer Dachsteineriffkalke. – *Anz. Österr. Akad. Wiss.*, *Naturwiss.*, **8**, 127–137, Wien 1983.
- SCHLAGER, W. & SCHÖLLNERBERGER, W.: Das Prinzip stratigraphischer Wenden in der Schichtfolge der Nördlichen Kalkalpen. – *Mitt. Geol. Ges.*, **66–67**, 165–193, Wien 1975.
- ŠKIČIĆ, K. et al.: Mesozojske Naslage Papuckog Gorja. – *God. znanstr. skup. seke. geol. geot. geokem. Zanustr. Savjet. za. nafto.*, **3 AZU(A)**, **5**, 87–96, Zagreb 1975.
- SKWARKO, S. K., NICOLL, R. S. & CAMPBELL, K. S. W.: The late Triassic Molluscs, Conodontes and Brachiopods of the Kuta Formation, Papua New Guinea. – *B. M. R. J. Austral. Jour. Geol. and Geophys.*, **1**, 219–230, Canberra 1976.
- STUR, D. C.: Geologie der Steiermark. – Erläuterungen zur geologischen Übersichtskarte, 1865, Geogn. Mont. Verein Steiermark, 425–428, Graz 1871.
- SUESS, E. & MOJSISOVICS, E. V.: Studien über die Gliederung der Trias und Jurabildungen in den östlichen Alpen. – *Jb. k. k. Geol. R.-A.*, **18/2**, 168–200, Wien 1868.
- SWEET, W. C., MOSHER, L. C., CLARK, D. L., COLLINSON, J. W. & HASENMÜLLER, W. A.: Conodont Biostratigraphy of the Triassic. – *Geol. Soc. Amer. Mem.*, **127**, 441–465, Colorado/USA.
- TOZER, E. T.: A standard for Triassic time. – *Geol. Surv. Canada Bull.*, **156**, 103 p., Ottawa 1967.
- VEGH, S.: Geologie der rhätischen Bildungen des südlichen Bakonygebirges in Ungarn. – *Geologica Hungarica*, **14**, 57–87, Budapest 1964.
- WILSON, J. L.: Carbonate Facies in Geologic History. – 471 p., Berlin – Heidelberg – New York (Springer) 1975.
- ZAPFE, H.: Eine rhätische Fauna aus dem Gebiete des Eibenberges bei Ebensee in Oberösterreich. – *Jb. oberösterr. Mus. Verein.*, **94**, 235–257, Linz 1949.
- ZAPFE, H.: Trias in Österreich. – *Schriftenr. Erdwiss. Komm. Österr. Akad. Wiss.*, **2**, 245–250, Wien 1974.

Manuskript bei der Schriftleitung eingelangt am 12. Dezember 1988.

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Jahrbuch der Geologischen Bundesanstalt](#)

Jahr/Year: 1989

Band/Volume: [132](#)

Autor(en)/Author(s): Kachroo R.K.

Artikel/Article: [Uppermost Triassic Conodonts from the Kössen Formation of the Northern Calcareous Alps \(Austria\) 665-676](#)