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Middle Triassic Conodonts from the Gartnerkofel – Zielkofel Area (Carnic Alps, Carinthia, Austria)

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2 Text-Figures and 3 Plates

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Österreich
Karnische Alpen
Mitteltrias
Conodonten
Stratigraphie

Dedicated to
Univ.-Prof. Dr. HELFRIED MOSTLER (Innsbruck)
on his 60th Birthday

Inhalt

Mitteltriadische Conodonten aus dem Gartnerkofel-Zielkofel-Gebiet (Karnische Alpen, Kärnten, Österreich)

Zusammenfassung

Im Gartnerkofel-Zielkofel-Gebiet der Karnischen Alpen (Kärnten, Österreich) besteht die südalpine Mitteltrias im Hangenden der Werfen-Formation aus der Uggowitzer Breccie, des Kühweg-Members und der Buchenstein-Livinallongo-Formation. Letztere wird vom Schlern-Dolomit überlagert bzw. verzahnt mit diesem.

Pelagische Knollenkalke der Buchenstein-Livinallongo Formation lieferten eine relativ reiche Conodontenfauna, die aufgrund des Auftretens von *Paragondolella trammeri* (KOZUR), *Neogondolella balkanica* BUDUROV & STEFANOV, *N. longa* BUDUROV & STEFANOV und *N. mesotriassica* (KOZUR & MOSTLER) in das Untere Ladin (Fassan) eingestuft werden kann.

Gerölle der Uggowitzer Breccie lieferten Flachwasserconodonten der Werfener Fazies (*Pachycladina* spp.), altersmäßig dem Unteren Olenekien zuzuordnen sowie Conodonten, die aus einem pelagischen Environment während der Val-Badia-Transgression in das flache Werfener Meer eingewandert und zeitlich in das Obere Olenekien zu stellen sind (*Neospathodus triangularis* (BENDER)). Es werden auch zwei neue Conodontentaxa aufgestellt und beschrieben.

Abstract

In the Gartnerkofel – Zielkofel area, Carnic Alps (Carinthia, Austria) the South Alpine Middle Triassic sequence between the underlying Werfen Formation and the overlying Schlern Dolomite is composed of the Uggowitz Breccia, the Kühweg Member and the Buchenstein – Livinallongo Formation. Pelagic nodular limestones of the Buchenstein – Livinallongo Formation yielded a relatively rich conodont fauna of Early Ladinian age indicated by the occurrence of *Paragondolella trammeri* (KOZUR), *Neogondolella balkanica* BUDUROV & STEFANOV, *N. longa* BUDUROV & STEFANOV and *N. mesotriassica* (KOZUR & MOSTLER).

Pebbles from the Uggowitz Breccia yielded Early Olenekian shallow water conodonts of the Werfen facies (*Pachycladina* spp.) and conodonts which immigrated from a pelagic environment during the Val Badia transgression (*Neospathodus triangularis* (BENDER)), indicating Late Olenekian age. Two new conodont taxa are established and described.

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1. Introduction

The conodont fauna desribed in this paper is derived from the Middle Triassic sequence of the Gartnerkofel – Zielkofel area in the Carnic Alps (Southern Alps), south of Hermagor (Carinthia, Austria). In the literature this Middle Triassic sequence, lying between the Werfen Formation at the base and the Schlern Dolomite on top is described and mapped as "Muschelkalkkonglomerat" and "Muschelkalk" (KAHLER & PREY, 1963; SCHÖNLAUB, 1987, 1989; SCHMIDT, 1987; PFEIFFER, 1988).

As "Muschelkalk" is an East Alpine stratigraphic terminus for the Middle Triassic sequences of the Northern Calcareous Alps and the Drau Range ("Alpine Muschelkalk"), this terminus should no longer be used in the South Alpine Triassic.

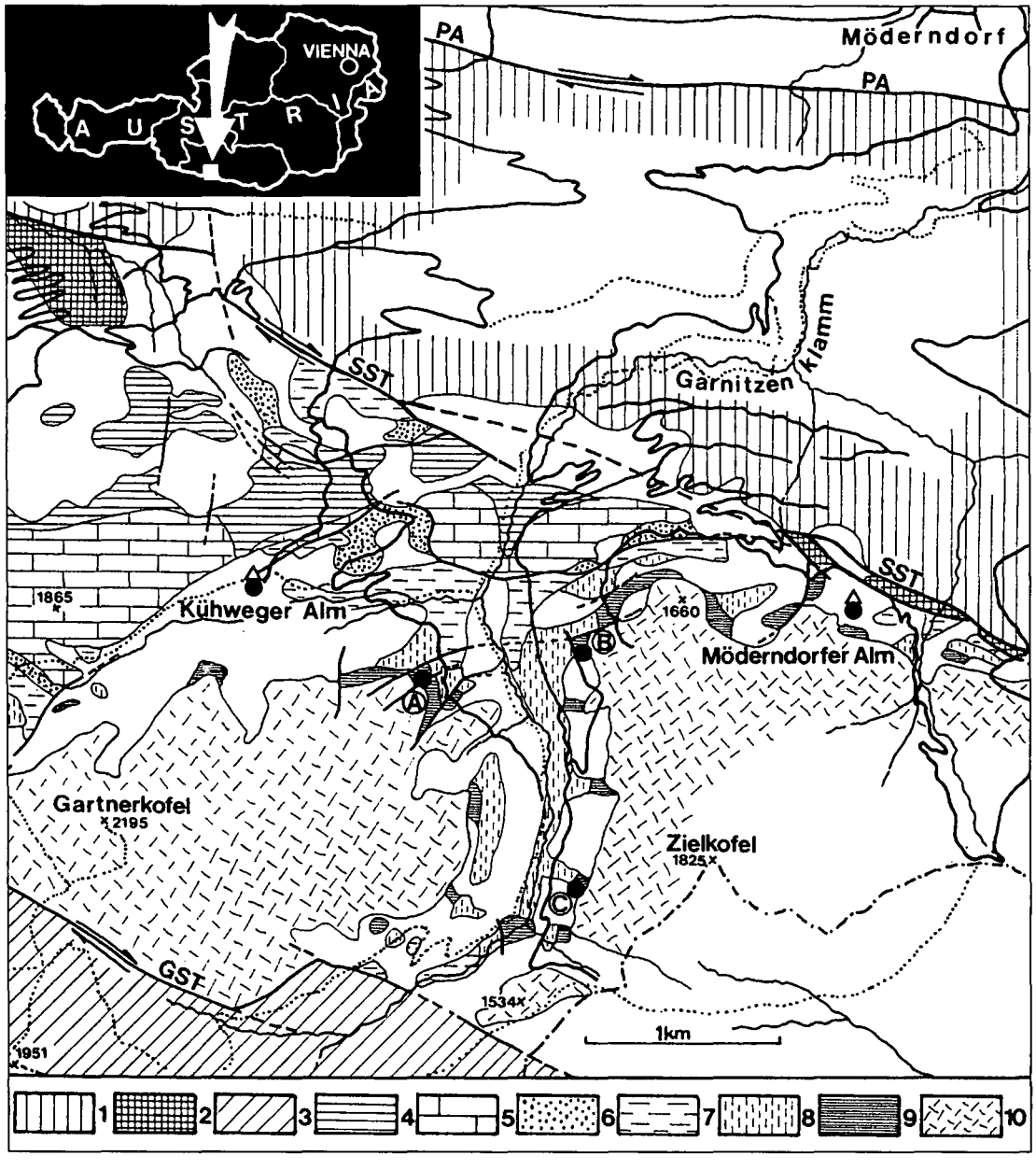
Therefore, we prefer the terminus "Uggowitz Breccia" for "Muschelkalkkonglomerat" and the new terminus Kühweg Member for the siltstone and sandstone unit overlying the Uggowitz Breccia. The nodular limestones with intercalated pyroclastic rocks (pietra verde) are an equivalent of the Buchenstein-Livinallongo Formation.

Kühweg Member and Buchenstein – Livinallongo Formation correspond to the Calcari di Pontebba sensu VENTURINI (1990). A detailed sedimentological description of the Kühweg Member as well as the Buchenstein-Livinallongo Formation of the Gartnerkofel – Zielkofel area will be given in a separate paper. This paper is an attempt to describe the conodont fauna and to discuss its stratigraphic significance.

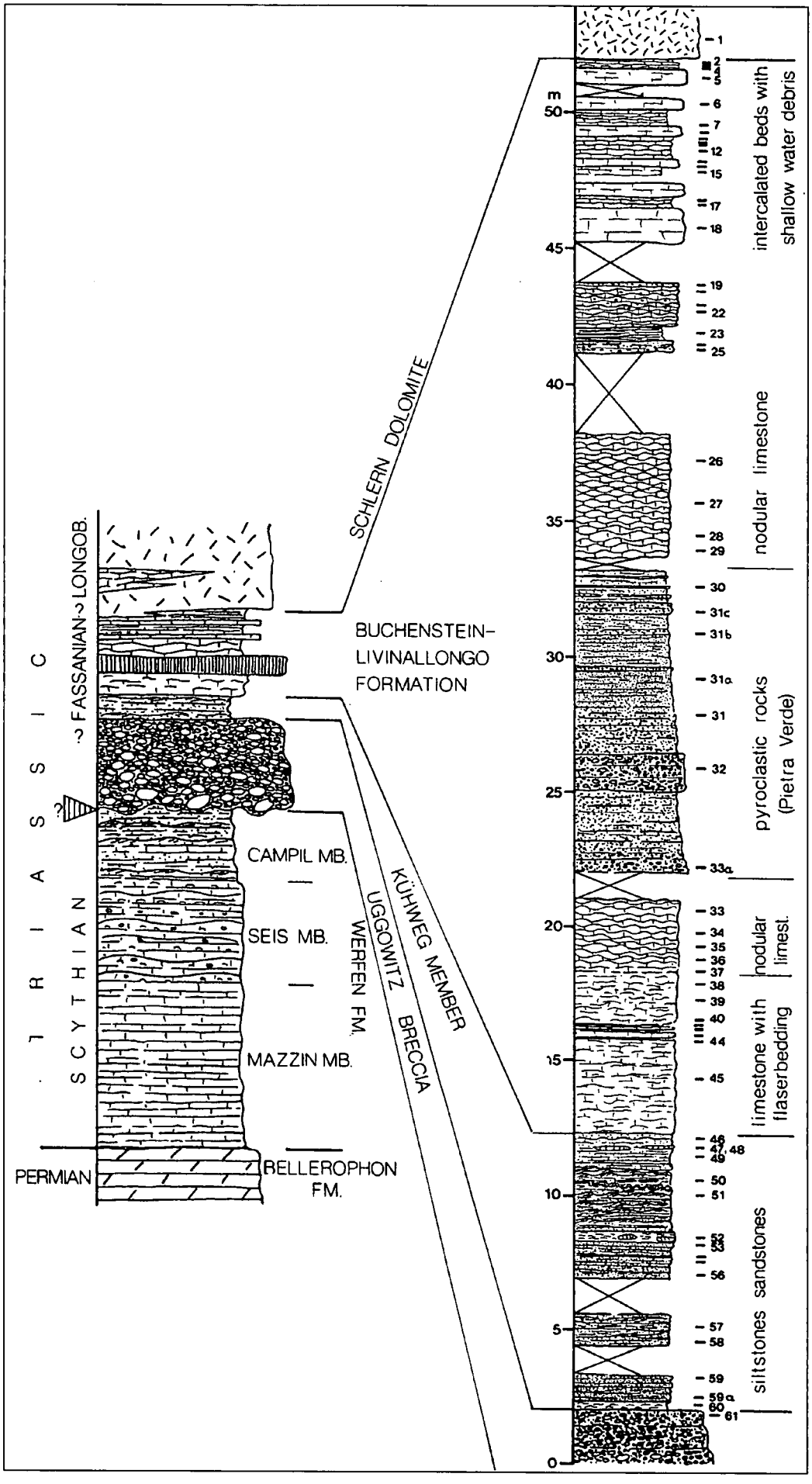
2. Geological Setting and Stratigraphy

The investigated outcrops are situated in the Carnic Alps (Carinthia) south of Hermagor, at both sides of the Garnitzengraben in the Gartnerkofel – Zielkofel area south of the Periadriatic Line which separates the Eastern Alps from the Southern Alps (Fig. 1).

The Gartnerkofel – Zielkofel block with a sedimentary sequence ranging from the Lower Permian Rattendorf Group up to the Middle Triassic Schlern Dolomite is downwarped along ESE–WNE-striking faults belonging to the



Text-Fig. 1.
Simplified geological map of the Gartnerkofel – Zielkofel area in the Carnic Alps.
1 = Early Paleozoic rocks (Ordovician–Devonian); 2 = Hochwipfel Fm. (Carboniferous); 3 = Auernig Group (Late Carboniferous); 4 = Rattendorf Group (Early Permian); 5 = Trogkofel Limestone (Middle Permian); 6 = Gröden Fm. (Late Permian); 7 = Bellerophon Fm. (Late Permian); 8 = Werfen Formation (Early Triassic); 9 = Uggowitz Breccia, Kühweg Member and Buchenstein/Livinallongo Fm. (Middle Triassic); 10 = Schlern Dolomite (Middle Triassic).
PA = Periadriatic Line; SST = Schwarzwipfelstörung (dextral fault); GST = Gartnerkofel Südrandstörung (dextral fault): A = section through the Kühweg Mb. and Buchenstein Fm. near the hunting hut SE of the Kühweger Alm (samples GK, see Text-Fig. 2); B = section with samples MP, C section with samples LZK.



Text-fig. 2.
Simplified section through the Early and Middle Triassic sequence in the Gartnerkofel – Zielkofel area (left) and detailed section through the Kühweg Member and Buchenstein/Livinallongo Formation near the hunting hut SE of the Kühweger Alm (locality A in Text-Fig. 1).

Periadriatic system: the "Gartnerkofel-Südrandstörung" in the south and the "Schwarzwipfelstörung" in the north (Text-Fig. 1). The Gartnerkofel – Zielkofel block therefore may be interpreted as a negative flower structure.

The Triassic sequence of the Gartnerkofel – Zielkofel block (Text-Fig. 2) starts with the Werfen Formation, which overlies the Late Permian Bellerophon Formation. Block faulting during the Anisian resulted in erosion of the upper parts of the Werfen Formation (Val Badia, Cencenighe and San Lucano Member), probably also of Early Anisian sediments, and to the formation of the Uggowitz Breccia ("Muschelkalkkonglomerat"), which recently has been studied by SCHMIDT (1987) (see also KAHLER & PREY, 1963).

The polymict Uggowitz Breccia has a maximum thickness of about 40 m at the Kammleiten (NW of the Gartnerkofel) and is overlain by an approximately 10 m thick sequence of thin bedded siltstones and fine-grained sandstones of the Kühweg Member. Horizontal lamination is the most frequent sedimentary structure of these silt- and sandstones. Small-scale current ripples and syn-sedimentary deforma-

tion structures have also been observed. The sediments are composed of siliciclastic material (detrital quartz, feldspars and micas) and dolomite and are rich in plant debris. The frequent occurrence of *Glomospira, Glomospirella* and *Earlandia*, observed in one of the investigated sections, points to a marine sedimentary environment.

This fine-grained clastic sediments of the Kühweg Member upward grade into dark grey fossiliferous marly limestones containing algae, gastropods, corals and foraminifers. These limestones are characterized by flaser bedding and intercalated thin marl layers, and are overlain by dark grey, bedded nodular, seldom slightly silicified pelagic limestones of the Buchenstein-Livinallongo Formation. In the lower part of this sequence up to about 10 m thick pyroclastic rocks (agglomerates and green tuffs of the Pietra Verde type; OBENHOLZNER, 1991; OBENHOLZNER & PFEIFFER, 1991) are intercalated. The upper part of the sequence is characterized by intercalations of up to 1.3 m thick limestone layers composed of detritus derived from platform carbonates of the Schlern Dolomite.

The pelagic sequence of the Buchenstein-Livinallongo Formation is overlain by massive carbonates of the Schlern Dolomite (see Text-Fig. 2).

KAHLER & PREY (1963) dated the "Muschelkalk" (Kühweg Member and Buchenstein-Livinallongo Formation) as Late Anisian (Illyrian) and the Schlern Dolomite as Ladinian due to the occurrence of *Diplopora annulata* in the intercalated bedded facies in the western flank of the Gartnerkofel.

According to PFEIFFER (1988) the conodont fauna of the bedded facies which is intercalated in the Schlern Dolomite in the western flank of the Gartnerkofel, indicates Fassanian (Early Ladinian) age and therefore PFEIFFER concluded that sedimentation of the Schlern Dolomite may already have started during the Late Anisian.

The conodonts described in this paper are derived from pebbles of the Uggowitz Breccia and from nodular limestones of the Buchenstein-Livinallongo Formation, above the Pietra Verde volcanics (see Text-Fig. 2).

3. Some Remarks on the Middle Triassic Conodont Stratigraphy

After KOZUR et al. (1994) distinct changes in all stratigraphically important microfaunas can be observed at the base of the *Reitziites reitzi* Zone (Ladinian boundary according to the more than 100 year old priority).

Among the conodonts this boundary is marked by the first appearance of long slender *Neogondolella* with forward-shifted basal cavity (*N. longa* BUDUROV & STEFANOV and near related forms), *N. balkanica* BUDUROV & STEFANOV, *N. cornuta ladinica* KRAINER, KOZUR & MOSTLER, *Paragondolella alpina* KOZUR & MOSTLER (junior synonym: *"Gondolella" szaboi* KOVÁCS).

The first appearance of *P. trammeri* at the base of the *Nevadites* fauna cannot be confirmed. This "event" was established by KRYSTYN (1983) in the Epidauros section where it is caused by extremely strong condension (the first appearance of *Nevadites* occurs immediately above a several cm thick layer of manganese oxide, KOZUR & MOCK in prep.).

P. trammeri appears already somewhat above the base of the *Reitzi* Zone, in the second of the four subzones of the *Reitzi* Zone.

The next younger distinct change in the conodont fauna of the Late Illyrian to Late Fassanian interval is in the Upper Fassanian, where the genus *Budurovignathodus* appears. This conodont event is not yet well dated, but lies seemingly within the *Eoprotrachyceras curionii* Zone. This is too high above the priority Anisian-Ladinian boundary, not far below the base of the Late Ladinian.

The conodont boundary at the base of the *Reitzi* Zone is accompanied by distinct changes in other microfaunas and microfloras at or near this boundary. Therefore there is no reason to abandon the priority Anisian-Ladinian boundary at the base of the *Reitziites reitzi* Zone. Using this boundary, all investigated conodont faunas from the pelagic Middle Triassic rocks of the Gartnerkofel – Zielkofel area are of Early Ladinian (Fassanian) age.

Because the Fassanian conodont fauna is rather uniform in the interval between the base of the *N. mesotriassica – P. alpina* Assemblage Zone (= base of the *R. reitzi* Zone) and the base of the Upper Fassanian *Budurovignathus truempyi* Zone most of the samples can only be assigned to the Fassanian.

The only stratigraphically important species that appears within this interval is *N. transita*. This is, however, a rare form that was not present in our material.

Some of the investigated samples belong to the Late Fassanian *B. truempyi* Zone, indicated by the presence of *N. bacalovi* BUDUROV & STEFANOV and *Budurovignathodus gabriellae* KRAINER, KOZUR & MOSTLER.

Pebbles of the Uggowitz Breccia contain conodonts from different Scythian levels.

4. Conodont Fauna – Systematic Part

Genus: *Neogondolella* BENDER & STOPPEL, 1965

Type species: *Gondolella mombergensis* TATGE.

Neogondolella aequidentata n. sp.

(Pl. 2, Figs. 5–9)

Derivatio nominis: According to the nearly uniform denticulation of the carina.

Holotypus: The specimen on Pl. 2, Fig. 6; rep.-no. 8–5/27/5/93.

Locus typicus: Buchenstein-Livinallongo Formation, section near the hunting hut south of the Kühweger Alm, Gartnerkofel East.

Stratum typicum: Sample GK 16, pelagic nodular limestone of the Buchenstein-Livinallongo Formation, Fassanian age, below the first appearance of *Budurovignathodus gabriellae*, probably middle Fassanian.

Material: 23 specimens.

Diagnosis: Slender, moderately large *Neogondolella*, in which the denticles have nearly the same size in the anterior and middle part of the carina, whereas the last three, rarely two denticles are smaller. No cusp. Basal cavity only a little foreward-shifted.

Description: Platform slender, moderately long, widest in or somewhat behind the mid-length; often parallel-sided throughout a longer middle part. Posterior margin of platform rounded, often somewhat asymmetric. In lateral view the platform is mostly distinctly arched, rarely almost straight. Marginal part of the platform with honeycomb microsculpture. Smooth furrows on both sides of the carina shallow and rather wide. Carina

with 15–18 separated denticles of nearly the same size in the middle and anterior part. The three, sometimes two posterior denticles are smaller. Upper line of the denticles mostly arched, rarely straight and only in the posterior third downward bent.

Keel narrow, with narrow basal furrow. Basal cavity only a little expanded, slightly forward-shifted with two pits connected by a bar (see Pl. 2, Fig. 9c). Posterior end of keel sometimes asymmetric and obliquely pointed, but generally broadly rounded.

Juvenile stages are of the *mombergensis* type with denticles of nearly the same size on the whole carina. Juvenile forms are mostly strongly constricted in the posterior part. Also medium ontogenetic stages display a distinct posterior constriction. In adult stages the constriction is mostly absent.

Occurrence: Fassanian of the Carnic Alps. The main occurrence lies below the first appearance of the Late Fassanian *Budurovignathus* and *Neogondolella bacalovi*. Only few specimens have been found in the basal part of the Late Fassanian.

Remarks: By the denticles of nearly equal size in the anterior and posterior part of the carina and the three, rarely two smaller posterior denticles *N. aequidentata* is easily to distinguish from other *Neogondolella* without cusp.

In *N. mombergensis* (TATGE, 1956) the denticles are lowest in the middle part of the carina and there mostly fused to a ridge. The last 3 denticles are always large.

N. media (KOZUR, 1968) is mostly somewhat smaller, the denticles have nearly the same size, the penultimate denticle is mostly somewhat larger than the other ones.

In *N. bacalovi* BUDUROV & STEFANOV, 1973 the basal cavity is strongly forward-shifted and the continuation of the keel after the basal cavity is long and lies on the lower side of the long upwards bent posterior part of the platform.

In *N. longa* BUDUROV & STEFANOV, 1973 the last denticle is the largest, forming an indistinct cusp. In late juvenile stages the next to the last denticle is largest and forming a cusp (modified *constricta* stage = *pseudolonga* stage).

At the moment two morphotypes can be distinguished. The typical forms are strongly arched in lateral view and also the upper line of the denticles is arched. Rare forms (Pl. 2, Fig. 7) display a nearly straight platform and the upper line of the denticles is only in the posterior part downward curved. If later investigations will show that these two morphotypes have different stratigraphic ranges, two subspecies or even species could be discriminated. At the moment the nearly straight forms are only known from one sample (GK 22). Therefore it is not clear, whether they indicate strong intraspecific variability or represent an independent taxon of different stratigraphic range.

Genus: *Paragondolella* MOSHER, 1968

Type species: *Paragondolella excelsa* MOSHER, 1968.

Paragondolella alpina postalpina n. sp.

(Pl. 1, Figs. 7, 8)

Derivatio nominis: According to the stratigraphic occurrence after *P. alpina alpina*.

Holotypus: The specimen on Pl. 1, Fig. 7, rep.-no. 6-6/27/5/93.

Locus typicus: Buchenstein-Livinallongo Formation, section near the hunting hut south of the Kühweger Alm, Gartnerkofel East.

Stratum typicum: Sample GK 13, pelagic nodular limestone of the Buchenstein-Livinallongo Formation, lower part of Late Fassanian, lower *B. truempyi* Zone.

Material: 12 specimens.

Diagnosis: Small platform conodont with long free blade, narrow to moderately wide platform that tapers rapidly towards the free blade. Posterior end rounded, mostly constricted. Conodont almost straight in lateral view. Upper line of denticles straight. Carina in subadult forms fused in the middle part to a ridge, in adult forms also the posterior part is often fused to a ridge.

Description: Conodont small. The slender to moderately wide platform is restricted to the posterior and middle third. Somewhat before the mid-length it tapers rapidly towards the long free blade that has only platform rudiments which are absent in the anteriormost part of the carina. Platform widest about in the mid-length. From there it tapers slowly against the rounded posterior end and rapidly against the anterior free blade. Posterior part of the platform mostly constricted. Platform margins with honeycomb microsculpture, moderately upturned. Carina highly fused, with 10–14, mostly 10–11 denticles that are already in subadult forms fused to a ridge in the middle part of the carina. In adult forms also the posterior carina is often fused to a ridge. Carina highest in the anterior part. Their height decreases slowly toward the posterior end. No distinct cusp, but the second tooth is often somewhat larger, if it is not fused. Keel narrow to moderately wide with wide basal furrow and slightly expanded basal cavity that is a little narrower than the surrounding keel. A distinct furrow continues after the small elongated pit at the anterior end of the basal cavity. The basal cavity is only a little forward-shifted.

Occurrence: So far only known from the lower part of the upper Fassanian together with most primitive *Budurovignathus* and *N. bacalovi*.

Remarks: *Paragondolella alpina alpina* (KOZUR & MOSTLER, 1982) with its junior synonym (*Gondolella szaboi* KOVÁCS, 1983) is larger and distinctly arched in lateral view. Also the upper line of the denticles is arched. The carina is highly fused, but even in adult specimens the tips of the denticles are free.

P. alpina alpina is very characteristic for the *Reitzi* Zone, whereas *P. alpina postalpina* is so far only known from the Late Fassanian. Therefore the transition between these two subspecies will be within the *Nevadites* faunas of the middle Fassanian.

5. Biostratigraphic Evaluation of the Conodont Fauna

All investigated pelagic limestones of the Buchenstein-Livinallongo Formation in the Gartnerkofel-Zielkofel area are of Fassanian age indicated by the common occurrence of *Paragondolella trammeri* (KOZUR), present nearly in all samples, and *Neogondolella balkanica* BUDUROV & STEFANOV, *N. longa* BUDUROV & STEFANOV, *N. mesotriassica* (KOZUR & MOSTLER), present in several samples.

All these species occur from the *Reitzi* Zone up to the Late Fassanian. Therefore for the most samples only a Fassanian age can be determined. However, sample GK 13

contains *Budurovignathus gabriellae* KOZUR, KRAINER & MOSTLER, a guideform for the Late Fassanian. Therefore, the typical Fassanian conodont fauna from this sample and from the younger samples GK 10, 2 and 1 (sample GK 1 is from the lowermost Schlern Dolomite, see fig. 2) belongs to the Late Fassanian.

Unfortunately, the most primitive *Budurovignathus* species, to which belongs *B. gabriellae*, in general are very rare. For this reason it cannot be excluded that the range of this species (and of the Late Fassanian) begins already earlier.

However, *B. gabriellae* from sample GK 13 is such a primitive *Budurovignathus* that it must derive from near the base of the *B. truempyi* Zone. The base of this zone is not well dated by ammonoids, but it lies inside the *Eoprotrachyceras* faunas of the Late Fassanian.

Samples MP 11 and MP 12 contain *N. bacalovi* BUDUROV & STEFANOV. Like primitive *Budurovignathus* of the *B. truempyi* group, also this species indicates Late Fassanian age. Therefore the characteristic Fassanian conodont faunas of these samples and all younger ones of the section Garnitzengraben south of the Kühweger Alm are of Late Fassanian age.

Guideforms of the *Reitzi* Zone such as *P. alpina alpina* (KOZUR & MOSTLER) have not been found. However, some *P. trammeri* of the oldest investigated samples are rather similar to *P. trammeri praetrammeri*. For this reason also the Early Fassanian may be present in the nodular limestones of the Buchenstein-Livinallongo Formation, although most part of the section is of Middle to Late Fassanian age.

From bedded limestones of a marginal basin facies, intercalated in the Schlern Dolomite in the western slope of the Gartnerkofel PFEIFFER (1988) described a small conodont fauna containing the following platform conodonts: *Gladigondolella tethydis* (HUCKRIEDE, 1958), *Gondolella constricta* MOSHER & CLARK, 1965 and *Gondolella trammeri* KOZUR, 1972. Due to the occurrence of *G. constricta* and *G. trammeri* PFEIFFER (1988) dated the fauna as Fassanian. But the specimens determined as *G. constricta* by PFEIFFER are no *G. constricta* in a strict sense, the specimens shown on Figs. 17–19 on Pl. 13 are very similar to *Neogondolella longa*, those on Figs. 4–6 on Pl. 14 to *Neogondolella mombergensis*.

However, the conodont fauna described by PFEIFFER (1988) is very different compared with the conodont fauna described in this paper, and most probably is younger, of Early Longobardian age.

Therefore, sedimentation of the Schlern Dolomite in the Gartnerkofel area started already near the Fassanian-Longobardian boundary (probably during the latest Fassanian), whereas in the Karawanken Mountains the Buchenstein-Livinallongo Formation ranges up to the Longobardian II (MOSTLER & KRAINER in prep.).

Besides the stratigraphically important conodont species also long-ranging conodonts are present like *Gladigondolella tethydis* (HUCKRIEDE), *Chirodella dinodoides* (TATGE), *Neohindeodella triassica* (MÜLLER), *N. dropla* (SPASOV & GANEV).

The above described new species have a good potential to become Fassanian guideforms of shorter stratigraphic range.

Ostracods are rare and will be described in a separate paper. They indicate only moderately deep water (water depth below the storm wave base, but not below 150–200 m).

From pebbles of the Uggowitz Breccia Scythian conodonts have been obtained. In samples LZK 27 C and MP 1 many *Pachycladina* spp. (*Pachycladina longispinosa* STAESCHE, *P. obliqua* STAESCHE and *P. tricuspidata* STAESCHE could be determined) are present, but most of them are only small broken pieces. However, these forms are easily determinable and their common occurrence indicates Early Olenekian (Smithian) age in a very shallow Werfen facies.

Sample LZK 27 A contains *Neospathodus triangularis* (BENDER), a guideform for the Late Olenekian (Spathian). The rich occurrence of this species and the absence of gondolellid platform conodonts indicate that the pebbles are derived from the upper part of the Werfen Formation, most probably from the Val Badia or Cencenighe Member, because this species immigrated from a pelagic environment into the shallow Werfen sea during the Val Badia transgression. Sample LZK 27 B contains a new species of *Neospathodus*, closely related to *N. triangularis*.

We wanted to describe this new species, but one of the authors (H.K.) has seen plates with *Neospathodus* prepared for press by M. ORCHARD that contain also this form. For this reason, we will not describe this form. It is also a guideform for the Late Olenekian (Spathian). In sample LZK 27 B it occurs together with *Pachycladina* sp. The facies is similar to that of sample LZK 27 C.

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Tafel 1

***Paragondolella trammeri trammeri* (KOZUR).**

Fig. 1: Adult specimen.
Lateral view, rep.-no. 5–5/27/5/93, sample GK 10.

Fig. 2: Adult specimen.
Lateral view, rep.-no. 4–5/27/5/93, sample GK 2, note the size reduction of this younger specimen.

Fig. 3: Juvenile specimen, rep.-no. 5–1/27/5/93.
a) Lateral view.
b) Upper view.
c) Oblique view.

Fig. 4: Adult specimen, rep.-no. 4–1/27/5/93.
a) Lateral view.
b) Oblique view.
c) Lower view.
Sample MP 12.

Fig. 5: Medium ontogenetic stage, Lateral view, rep.-no. 1–1/27/5/93.
Sample MP 15.

Fig. 6: Adult specimen, rep.-no. 3–1/27/5/93.
a) Lateral view.
b) Upper view.
c) Lower view.
Sample MD 12.

***Paragondolella alpina postalpina* n. sp..**

Fig. 7: Subadult specimen.
Holotype, rep.-no. 6–6/27/5/93.
a) Lateral view.
b) Lower view.
Sample GK 13.

Fig. 8: Adult specimen.
Free tips of the denticles in the anterior part of the carina broken away, middle and posterior part of the carina fused to a ridge, rep.-no. 7–6/27/5/93.
a) Lateral view.
b) Lower view.
Sample GK 10.

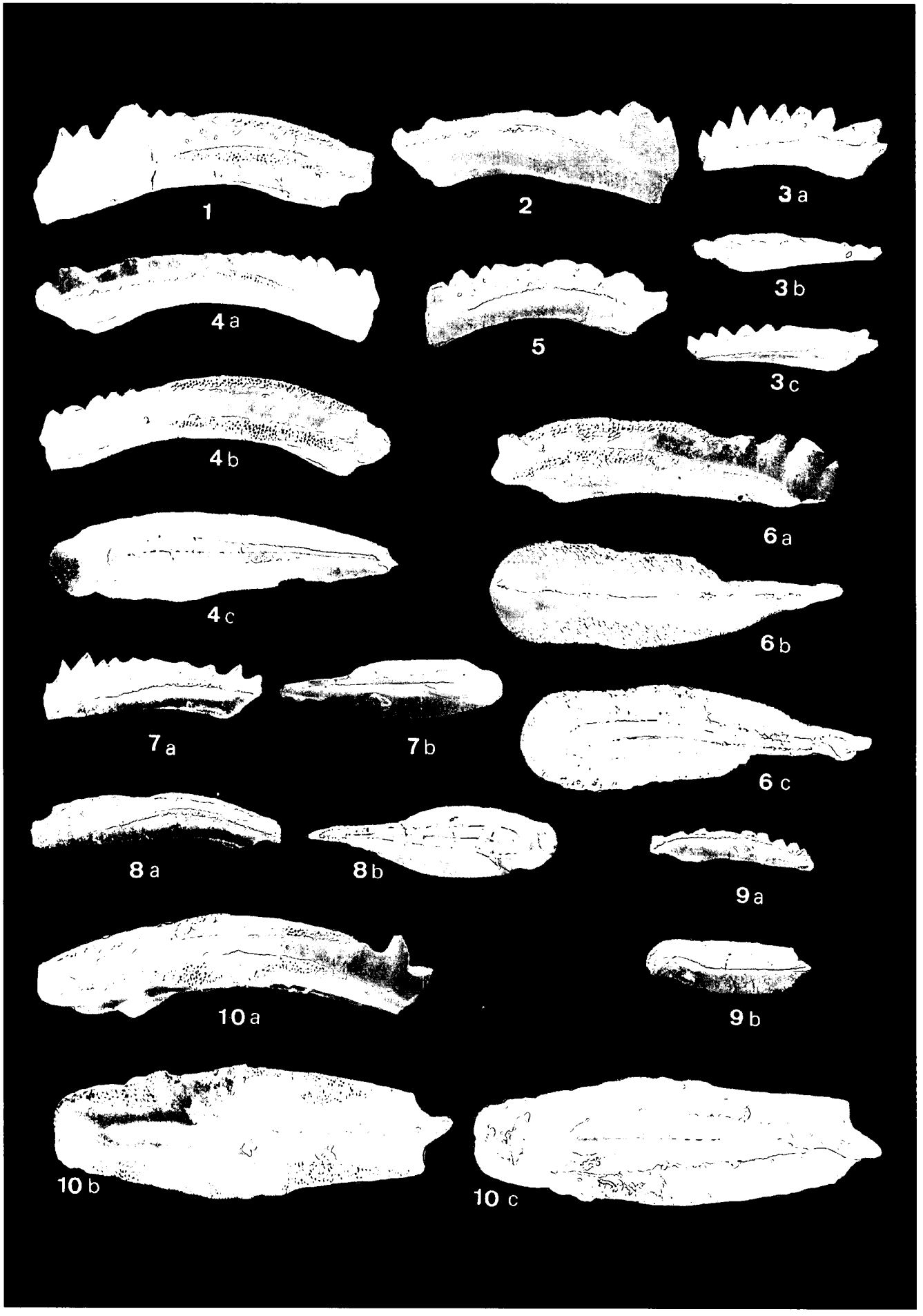
***Budurovignathus gabriellae* KOZUR, KRAINER & MOSTLER.**

Fig. 9: Rep.-no. 8–6/27/5/93.
a) Lateral view.
b) Lower view.
Sample GK 13.

***Neogondolella* cf. *mesotriassica* (KOZUR & MOSTLER).**

Fig. 10: Rep.-no. 6–5/27/5/93.
a) Lateral view.
b) Upper view.
c) Lower view.
Sample GK 13.

All figured specimens are derived from nodular limestones of the Fassanian Buchenstein-Livinallongo Formation of the Gartnerkofel – Zielkofel area, Carnic Alps, sections Gartnerkofel East (GK) and Garnitzen Graben (MP).
The magnification is ×100, except Fig. 9 = ×80.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9b
10b
10c

Tafel 2

***Neogondolella bacalovi* BUDUROV & STEFANOV.**

Fig. 1. Rep.-no. 7–1/27/5/93.
a) Lateral view.
b) Upper view.
c) Lower view.
Sample MP 11.

***Neogondolella balkanica* BUDUROV & STEFANOV.**

Fig. 2: Eearly juvenile specimen.
Transitional between the *constricta* and *mombergensis* morphotype.
Lateral view.
Rep.-no. 9–1/27/5/93.
Sample MP 10 A.

Fig. 3: Early juvenile specimen.
Transitional between the *constricta* and *mombergensis* morphotype.
Rep.-no. 8–1/27/5/93.
a) Lateral view.
b) Upper view.
c) Lower view.
Sample MP 10 A.

Fig. 4: Adult specimen.
Pronounced cusp partly broken.
Rep.-no. 11–1/27/5/93.
a) Lateral view.
b) Upper view.
c) Lower view.
Sample MP 10 A.

***Neogondolella aequidentata* n. sp.**

Fig. 5: Juvenile specimen.
Mombergensis stage.
Rep.-no. 11–5/27/5/93.
a) Lateral view.
b) Upper view.
c) Lower view.
Sample GK 22.

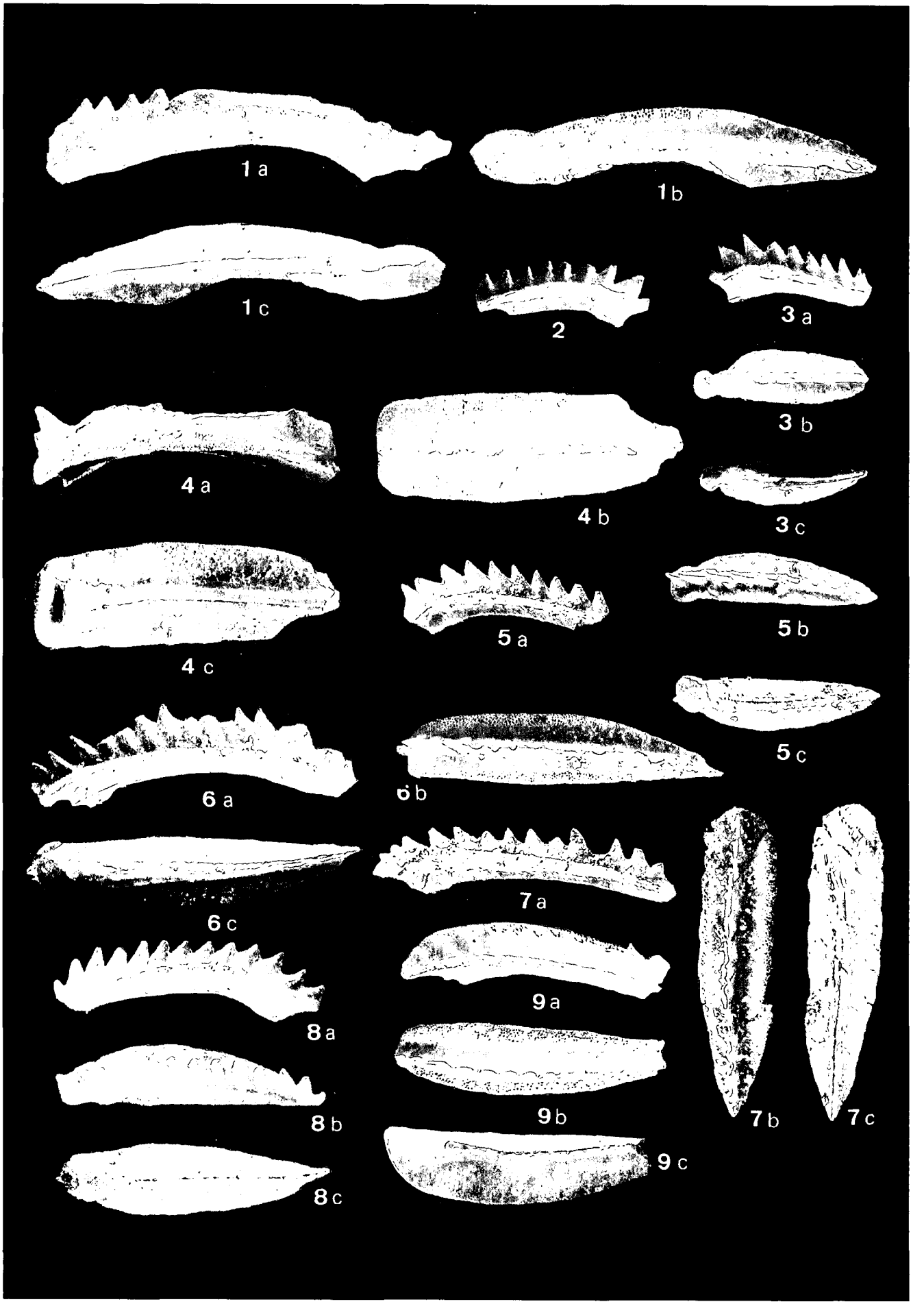
Fig. 6: Adult specimen.
Holotype.
Rep.-no. 8–5/27/5/93.
a) Lateral view.
b) Upper view.
c) Lower view.
Sample GK 16.

Fig. 7: Adult specimen.
Rep.-no. 10–5/27/5/93.
a) Lateral view.
b) Upper view.
c) Lower view.
Sample GK 22.

Fig. 8: Subadult specimen.
Rep.-no. 10–1/27/5/93.
a) Lateral view.
b) Oblique Upper view.
c) Lower view.
Sample MP 10 A.

Fig. 9: Adult specimen.
Rep.-no. 2–1/27/5/93.
a) Oblique lateral view.
b) Slightly oblique upper view.
c) Slightly oblique lower view.
Sample MP 12.

All figured specimens are derived from nodular limestones of the Buchenstein-Livinallongo Formation of the Gartnerkofel-Zielkofel area in the Carnic Alps, sections Gartnerkofel East (samples GK) and Garnitzen Graben (samples MP).
The magnification is x100.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7c
8a
8b
8c
9a
9b
9c

Tafel 3

Fig. 1. ***Neogondolella longa*** **BUDUROV & STEFANOV.**
Medium ontogenetic stage (*pseudolonga* stage).
Rep.-no. 6–1/27/5/93.
a) Lateral view.
b) Upper view.
c) Somewhat oblique lower view.
Sample MP 12.

Fig. 2: ***Neogondolella*** **cf.** ***aequidentata*** **n. sp.**
Strongly constricted, somewhat asymmetric form.
Rep.-no. 7–5/27/5/93.
a) Lateral view.
b) Upper view.
c) Lower view.
Sample GK 22.

Fig. 3: ***Pachycladina longispinosa*** **STAESCHE.**
Rep.-no. 15–1/27/5/93.
Sample LZK 27 C.
Age of the pebble: Early Olenekian, Werfen (shallow water) facies.

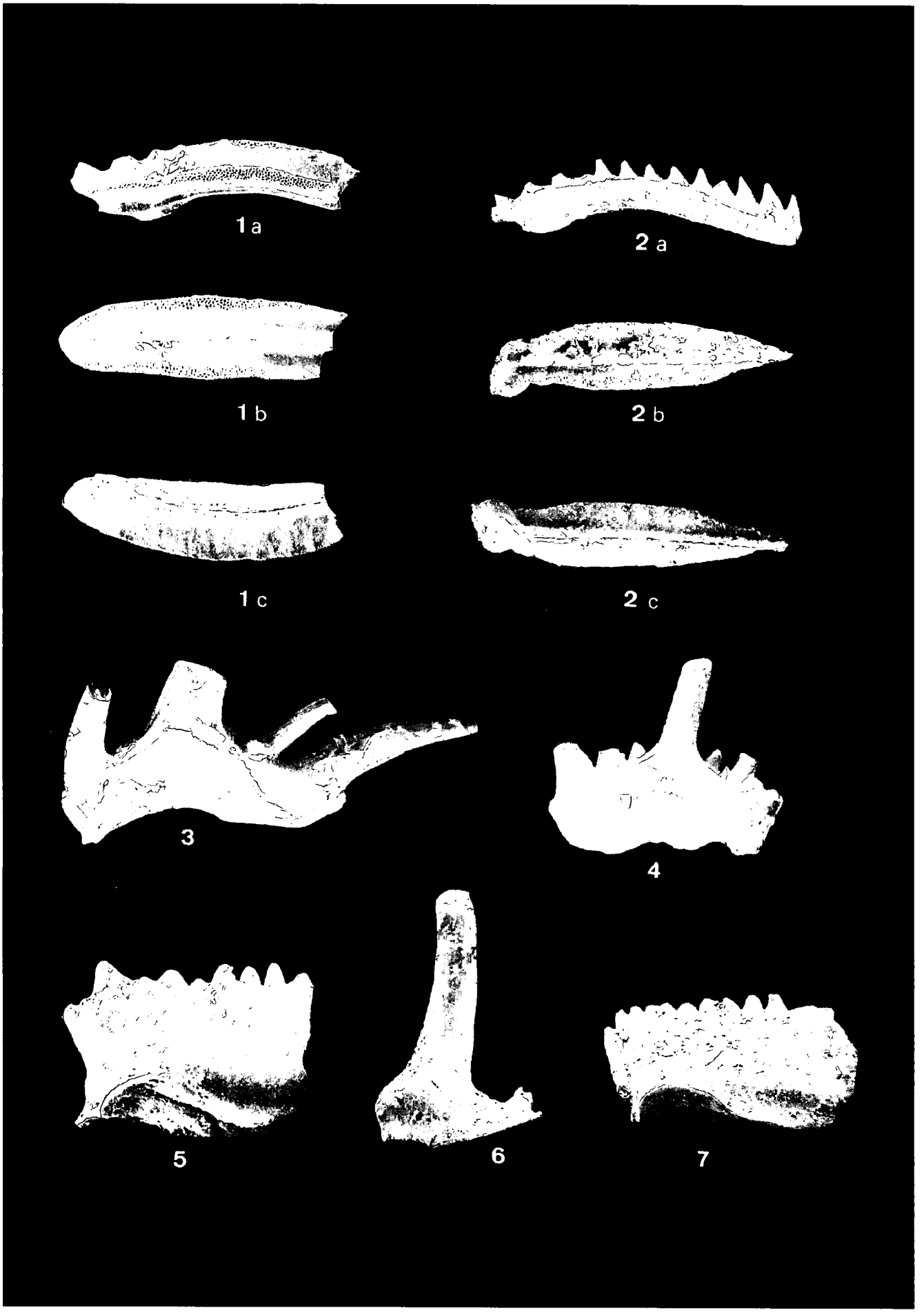
Fig. 4: ***Pachycladina tricuspidata*** **STAESCHE.**
Rep.-no. 14–1/27/5/93.
Sample LZK 27 C.
Age of the pebble: Early Olenekian (Smithian), Werfen (shallow water) facies.

Fig. 5: ***Neospathodus triangularis*** **(BENDER).**
Rep.-no. 12–1/27/5/93.
Sample LZK 27 A.
Age of the pebble: Late Olenekian (Spathian), Werfen Formation.
This conodont species immigrated into the shallow Werfen sea from a pelagic environment during the Val Badia transgression.

Fig. 6: ***Pachycladina obliqua*** **STAESCHE.**
Rep.-no. 16–1/27/5/93.
Sample MP 1A.
Age of the pebble: Early Olenekian (Smithian), Werfen (shallow water) facies.

Fig. 7: ***Neospathodus*** **n. sp. ex gr.** ***N. triangularis*** **(BENDER).**
Rep.-no. 13–1/27/5/93.
Sample LZK 27 B.
Age of the pebble: Late Olenekian (Spathian), Werfen Formation.

The specimens figured on Fig. 1 and 2 are derived from nodular limestones of the Fassanian Buchenstein-Livinallongo Formation of the Gartnerkofel-Zielkofel area, Carnic Alps, sections Gartnerkofel East (samples GK) and Garnitzen Graben (samples MP). The specimens on Figures 3–7 are derived from pebbles of the Uggowizza Breccia in the Garnitzen Graben.
The magnification of the specimens is x100.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