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CARNIAN CONODONTS FROM UPPER TRIASSIC STRATA OF TAMARIN SECTION (SAN CASSIANO FM., DOLOMITES, ITALY)

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Key-words: Conodonts, Taxonomy, Biostratigraphy, San Cassiano Fm., Upper Triassic (Carnian), Dolomites, Italy.

Riassunto. Viene descritta e illustrata per la prima volta una ricca fauna a Conodonti del Triassico superiore proveniente dalla Formazione di San Cassiano nelle Dolomiti orientali (Tamarin). La presenza di *Metapolygnathus auriformis*, insieme a *M. carnicus*, *M. baloghi*, *M. polygnathiformis*, *Gladigondolella tethydis*, *Gl. arcuata* e *Gl. malayensis malayensis* suggerisce l'appartenenza della fauna studiata allo Julico superiore e precisamente alla zona ad *auriformis* (zona ad Austriacum secondo la biostratigrafia ad Ammoniti). La fauna di Tamarin, a Conodonti pelagici, è caratteristica di acque relativamente profonde, e mostra forti affinità con le faune coeve della Tetide dell'area mediterranea (Austria, Ungheria, Turchia e Grecia) e dell'Himalaya (Kumaun).

Abstract. A Late Triassic conodont fauna is described and illustrated for the first time from the San Cassiano Formation of the eastern Dolomites (Tamarin). The co-occurrence of *Metapolygnathus auriformis*, *M. carnicus*, *M. baloghi*, *M. polygnathiformis*, *Gladigondolella tethydis*, *Gl. arcuata* and *Gl. malayensis malayensis* indicates a Late Julian age. The fauna corresponds to the *auriformis* Zone (Austriacum Zone according to ammonoid zones). This pelagic conodont fauna, characteristic of relatively deep water, shows strong faunal affinities with coeval faunas from European Tethyan regions (mainly Greece, Turkey, NE Hungary, and Alps) and northern Kumaun region of Tethys Himalaya.

Introduction.

The San Cassiano Formation was intensively investigated since the last century from a paleontological point of view because of its high fossil content and unusually good preservation of the original mineralogy of the skeletons.

The physical stratigraphy and geometry of the Cassian platforms prograding and interfingering with the coeval basinal San Cassiano Formation have been widely discussed by Bosellini (1984, 1988, 1989), Bosellini & Doglioni (1988), and De Zanche et al. (1993). According to the quoted authors, the Cassian succession is organized into two depositional sequences. The first sequence is Cordevolian in age (Aon Zone p.p.) while the second one starts at the end of the Aon Zone and includes the Julian Aonoides and Austriacum Zones.

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In both Badia and Ampezzo valleys the San Cassiano Fm. is poorly exposed, as it is covered by woodlands and frequently involved into landslides. However, segments of the lithological sequence outcrop in several localities. The main outcrops in the surroundings of Cortina d'Ampezzo are Campo, Costalares, Milieres, Staolin, Tamarin. All these outcrops are referred to the upper part of the Julian on the basis of ammonites and microcrinoids by Bizzarini et al. (1986, 1990), Bizzarini & Braga (1987); Russo et al. (1991).

This paper deals with Triassic conodont faunas from the Tamarin section and represents a contribution to the biostratigraphic knowledge of Triassic sediments in the area concerned.

Lithostratigraphy of the Tamarin section.

The Tamarin section is a tract about 70 m thick and is located in a woodland area northeast of Cortina d'Ampezzo (Belluno) (Fig. 1).

In common with all the San Cassiano outcrops in the area of Cortina, it is an isolated outcrop, in which it is not possible to observe the contacts with the underlying and the overlying formations (respectively Wengen Formation and Dürrenstein Dolomite). However, on the basis of a geologic investigation of the area, it is possible

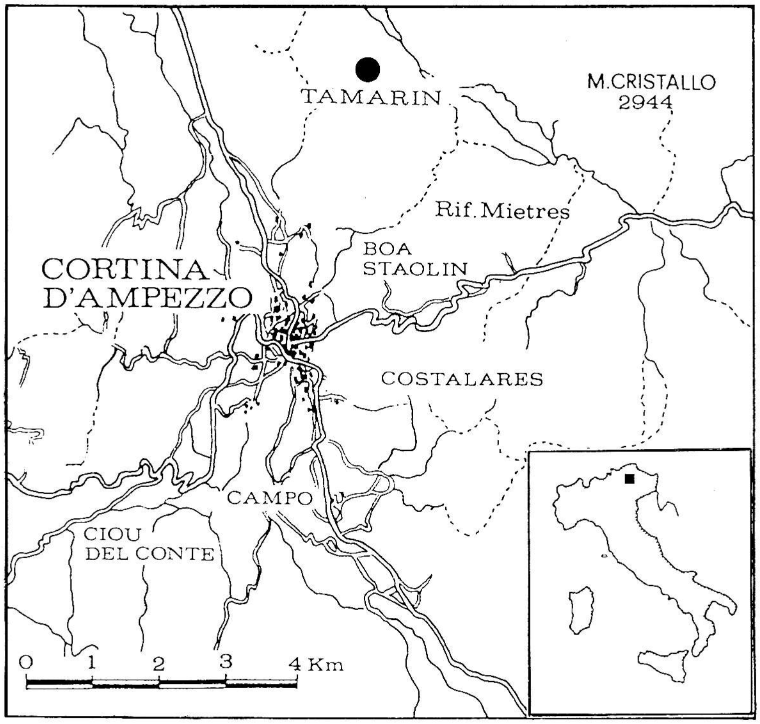

Fig. 1 - Sketch-map showing the location of the Tamarin section.

to state that the exposed top of the Tamarin section is separated from the base of Dürrenstein Dolomite by a few tens of metres of covered succession, and thus is quite "high" in the San Cassiano succession of Cortina (whose total thickness is estimated as several hundreds of metres).

The San Cassiano Formation of Tamarin (Fig. 2) consists predominantly of marls, grey and brown in colour, alternated with coarse biocalcarenite turbidites, bioclastic packstone and wackestone, and micritic limestones. Minor silicoclastic turbidites occur in the lower part of the section.

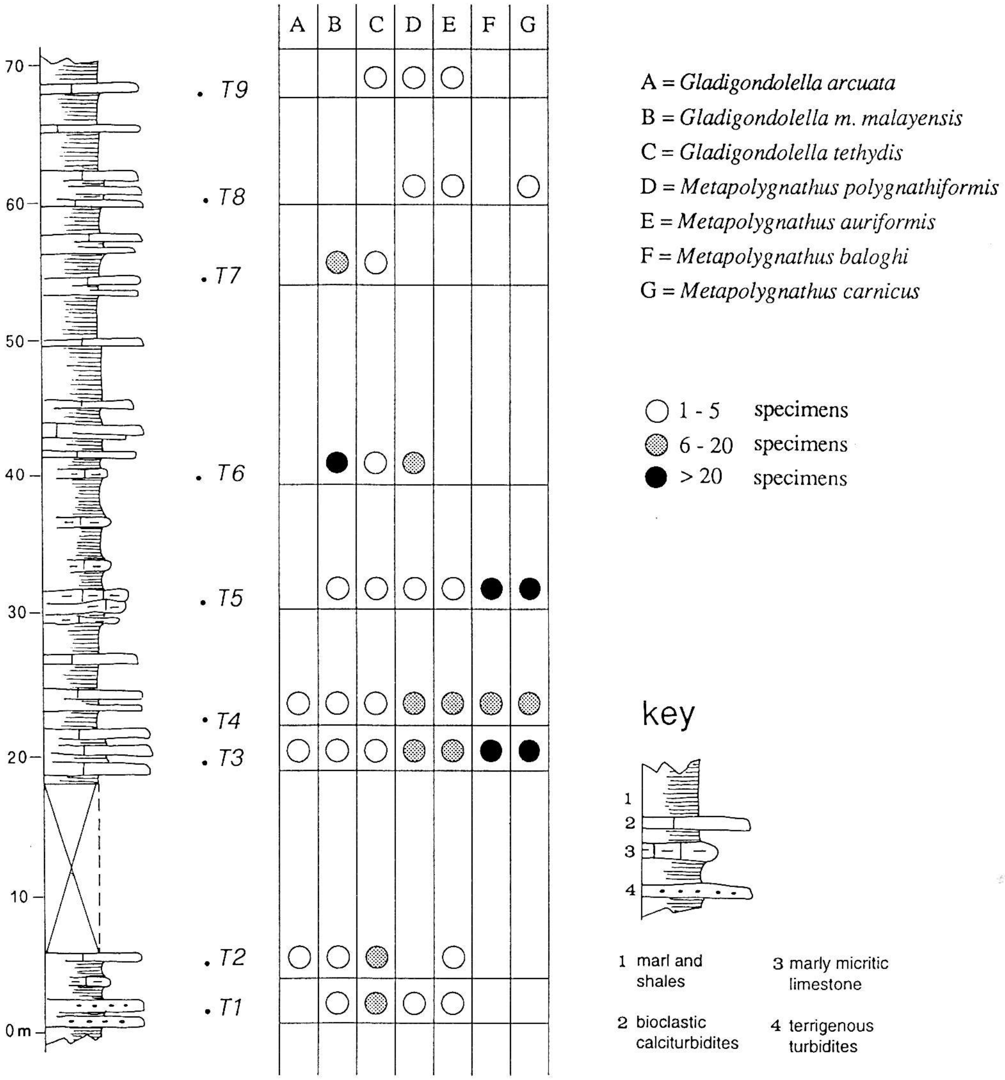

Fig. 2 - Schematic lithologic section of the Tamarin outcrop with location and distribution of conodont.

The outcrop is very rich in fossils, such as echinoid spines and other echinoderm remains, gastropods, bivalves, ostracods, foraminifera, microcrinoids, brachiopods and ammonoids. The ammonoid fauna has been referred to the Austriacum Zone by Bizzarini and Braga (1987), who unfortunately do not give a list of the species. Recently Urlichs (1994) illustrated several trachyceratids ammonoids from Tamarin, referring this locality to the upper part of the Aonoides Zone.

Conodont fauna and age.

Nine large samples (up to 10 kg) have been collected from the calcareous levels from which a rich conodont fauna (about 387 specimens) has been extracted (Fig. 2).

The conodonts are generally well preserved, apart from some ramiform elements that, being very fragile, are often broken. All conodonts show a colour alteration index (CAI) of 1 (Epstein et al., 1977).

The conodont association includes *Gladigondolella tethydis* (Huckriede), *Gl. arcuata* Budurov, *Gl. malayensis malayensis* Nogami, *Metapolygnathus polygnathiformis* (Budurov & Stefanov), *M. auriformis* (Kovacs), *M. baloghi* (Kovacs) and *M. carnicus* (Krystyn). In the following discussion are retained the binomial combinations used by the quoted authors.

Gladigondolella tethydis, *Gl. arcuata* and *Gl. malayensis malayensis* are relatively common in Tamarin section: *Gl. tethydis* and *Gl. arcuata* have been reported from the Late Anisian onward in Europe (Huckriede, 1958; Mosher, 1968; Krystyn, 1978, 1980), *Gl. malayensis malayensis* occurs in Turkey (Krystyn in Kristan-Tollmann & Krystyn, 1975) from the Upper Longobardian (Regoledanus Zone) and the Carnian (Aonoides-Austriacum Zone). Recently, Kolar-Jurkovsek (1991) has reported the presence of this species in Slovenia from Archelaus Zone. These *Gladigondolella* species become extinct at the end of the Julian.

Metapolygnathus polygnathiformis (Budurov & Stefanov) occurs from near top of the Late Ladinian Regoledanus Zone (Krystyn, 1980; Kovacs, 1983) in Europe. Later, a taxonomic revision of the Ladinian-Carnian taxa led Krystyn (1983, p. 253) to conclude that *Gondolella polygnathiformis* started from the base of the Carnian and its appearance should be used to define the Ladinian-Carnian boundary.

Recently, Kovacs et al. (1991) found *Gondolella polygnathiformis* and "*Metapolygnathus*" *diebeli* together with ammonoids belonging to genus *Frankites*. This demonstrates that the first appearance of *G. polygnathiformis* occurs into the Ladinian. In this paper, the authors proposed to include the Regoledanus Zone into the Carnian Stage so that the range of *G. polygnathiformis* corresponds to the whole Carnian Stage.

In North America this species is recorded from the Upper Ladinian (Sweet et al., 1971; Mosher, 1973) and Upper Carnian (Mosher, 1968; Orchard, 1991a, b).

Metapolygnathus baloghi and *Gondolella auriformis* were described by Kovacs (1977) from the uppermost Ladinian in the Rudabanya Mountains (North Hungary), later, (1986, 1991) he referred these species to the Julian age.

M. baloghi has been reported also from the Cordevolian of Slovenia (Kolar-Jurkovsek, 1991). Kozur (1989b), on the other hand, confined this species to latest Carnian.

In Greece, Krystyn (1983, p. 249) defined the base of *auriformis* Zone at the first appearance of *Gondolella auriformis* and, he recognized that the range of this species is limited to the Aonoides-Austriacum ammonoid zones.

Krystyn in Kristan-Tollmann & Krystyn (1975) erected the new species "*Epigondolella*" *carnica* from the bed 73/63/A in the Saklibeli section (Taurus Mts., Turkey) and he assigned this new species to Aon and/or Aonoides Zones dubitatively. Krystyn (1983, p. 242) recorded this species from the uppermost part of Epidaurus sequence in Greece, where he identifies a *carnica*-horizon within the *auriformis* Zone of Late Julian (Austriacum Zone) age. This age has also been confirmed by the re-examination of earlier material of Saklibeli and Feuerkogel (Krystyn, 1983, p. 242).

The presence of *M. carnicus* has also been reported from Lower Carnian in NE Hungary (Kovacs, 1991) and in Himalaya (Chhabra & Kumar, 1992).

In conclusion, following Krystyn (1983) the Tamarin conodont fauna can be referred to the Lower Carnian and precisely to the *auriformis* Zone.

The fauna shows strong affinities with the coeval pelagic faunas of the *auriformis* Zone from European Tethyan regions (mainly Greece, Turkey, NE Hungary, and Alps) and northern Kumaun region of Tethys Himalaya. Only *Neogondolella tadpole* Hayashi has not been found in Tamarin.

Systematic Paleontology

Only the species encountered for the first time in this area or stratigraphically important are here described, whereas ramiform elements are only illustrated.

Genera and species are arranged in alphabetic order.

Genus *Gladigondolella* Muller, 1962

Type species: *Polygnathus tethydis* Huckriede, 1958

Gladigondolella arcuata Budurov, 1973

Pl. 1, fig. 4,5

1973 *Gladigondolella arcuata* Budurov, p. 800, pl. 1 fig. 1-3.
1976 *Gadigondolella arcuata* - Budurov, p. 102, pl. 2, fig. 33,34.
1981 *Gladigondolella tethydis* - Koike, pl. 1, fig. 39.
1981 *Gladigondolella arcuata* - Mietto & Petroni, p. 550, pl. 57, fig. 7.
1982 *Gladigondolella tethydis* - Isozaki & Matsuda, pl. 5, fig. 2.
1986 *Gladigondolella tethydis* - Durkoop et al., pl. 18, fig. 7-11 (non fig. 5-7, 12-15 = *Gladigondolella tethydis*).
1987 *Gladigondolella arcuata* - Vrielynck, p. 127, pl. 2, fig. 4-9.

Remarks. Very few specimens belonging to this species have been found in the Tamarin section.

The main feature of *Gladigondolella arcuata* Budurov is the very narrow platform downturned at the posterior end.

The general shape of *Gladigondolella arcuata* is similar to that of *Gladigondolella tethydis* (Huckriede), but it differs in its smaller and more curved platform.

Gladigondolella malayensis malayensis Nogami, 1968

Pl. 1, fig. 1-3

1968 *Gladigondolella malayensis* Nogami, p. 122, pl. 9, fig. 11-18; pl. 11, fig. 7.
1987 *Gladigondolella malayensis malayensis* - Vrielynck, p. 129, pl. 1, fig. 16-18 (cum syn.).
1991 *Gladigondolella malayensis* - Kolar-Jurkovsek, p. 90, pl. 19, fig. 1,2.
1992 *Gladigondolella malayensis* - Chhabra & Kumar, p. 18, tab. 4.

Description of Pa element. The platform is ellipsoidal in shape and its broadest part is about two-thirds of the length.

In upper view the platform is gently curved laterally in mature specimens, almost straight in the small ones. The carina consists of eight to ten discrete denticles. The main cusp is distinct and close to the posterior end. The platform margins are upturned and possess a well-developed cancellated ornamentation. A short free rudimentary blade is often developed.

In lower view the keel is deeply excavated. The basal cavity, eye-shaped, lies close to the posterior platform end.

Remarks. *Gladigondolella malayensis malayensis* Nogami is very similar to *G. malayensis budurovi* Kovacs & Kozur but can be distinguished by its broader platform, a less prominent main cusp, and a less high carina.

Gladigondolella tethydis (Huckriede, 1958)

Pl. 2, fig. 1,2

1958 *Polygnathus tethydis* Huckriede, p. 157, pl. 11, fig. 39,40; pl. 12, fig. 38; pl. 13, fig. 2, 4, 5 (non pl. 12, fig. 1 = *Gladigondolella arcuata*).
1984 *Gladigondolella tethydis* - Vrielynck, p. 184, pl. 2, fig. 4 (cum syn.).
1986 *Gladigondolella tethydis* - Durkoop et al., pl. 18, fig. 5,6, 12-15 (non fig. 7-11 = *Gladigondolella arcuata*).
1986 *Gladigondolella tethydis* - Sudar, pl. 8, fig. 5, 6.
1987 *Gladigondolella tethydis* - Vrielynck, p. 130, pl. 1, fig. 19-21; pl. 2, fig. 1-3 (cum syn.).
1988 *Gladigondolella tethydis* - Pfeiffer, pl. 13, fig. 1-4.
1991 *Gladigondolella tethydis* - Kolar-Jurkovsek, p. 90, pl. 16, fig. 2, 5; pl. 24, fig. 1, 2.
1992 *Gladigondolella tethydis* - Chhabra & Kumar, p. 18, pl. 3, fig. 7.

Remarks. The Pa elements of *Gladigondolella tethydis* from Tamarin section show the typical morphology of the species: a very thick platform with a well-developed cancellated ornamentation and discrete denticles in the carina. A portion of the posterior platform is slightly curved downward and twisted laterally with respect to the basal pit. The keel extends throughout the entire length of the unit, and bears a narrow groove which expands into a small basal pit situated about one-third from posterior end.

G. malayensis malayensis differs to *Gladigondolella tethydis* in its larger platform and a basal cavity closer to the posterior end.

Genus *Metapolygnathus* Hayashi, 1968

Type species: *Metapolygnathus communisti* Hayashi, 1968

Remarks. Orchard (1991a,b) utilized node height, microreticulation, lower surface profile and mode of growth as diagnostic characters for the separation of *Metapolygnathus* and *Epigondolella* genera. He retained that all Carnian species should be regarded as belonging to this genus, whereas *Epigondolella* Mosher as wholly Norian genus. Following Orchard, the species described below are assigned to *Metapolygnathus*.

Metapolygnathus auriformis (Kovacs, 1977)

Pl. 1, fig. 6-9

1977 *Gondolella auriformis* Kovacs, p. 78, pl. 1, fig. 4, 5; pl. 2, fig. 1; pl. 3, fig. 1; pl. 8, fig. 1.
1980b *Gondolella auriformis* - Kovacs & Kozur, pl. 8 fig. 5, 6; pl. 9, fig. 1.
1983 *Gondolella auriformis* - Krystyn, p. 242, pl. 6, fig. 1 (non pl. 5, fig. 5, 6).
1986 *Gondolella auriformis* - Kovacs, p. 214, pl. 11, fig. 1, 2 (non fig. 4).
1989 *Gondolella auriformis* - Kovacs et al., p. 48, text-fig. 4a.
1992 *Neogondolella auriformis* - Chhabra & Kumar, pl. 4, fig. 12.

Description of Pa element. The anterior free blade is high and composed of fused denticles, discrete at their apices. The blade decreases in height posteriorly. The main denticle is stronger. The platform is short and close to the centre it reaches its widest point; the platform-end is rounded. The margins are upturned with honeycomb ornamentation and are usually abruptly downward stepping between the middle and posterior two-third of the unit.

Toward the platform end, some specimens show a more or less marked constriction at one or both sides. The keel is commonly broad, bearing a groove ending in a flaring pit beneath the main denticle.

Remarks. *Metapolygnathus auriformis* shows a short, ear-like upturned platform which is quite unique in Triassic metapolygnathid. Its platform outline is similar to that of *Metapolygnathus baloghi* but it differs for the absence of marginal nodes on the platform. However, forms with transitional characters may have a slight mark of nodes on one or both sides. Kozur (1989b, p. 422) regards "*Gondolella*" *auriformis* as a juvenile stage of *E. baloghi* and a synonym of this species. Krystyn (1983) and Kovacs et al. (1989) maintain that *G. auriformis* evolved from *Gondolella polygnathiformis* and through transitional forms leads to *E. baloghi.*

M. polygnathiformis differs from *M. auriformis* in having a much more elongated platform and the platform margins are relatively less high than those of *M. auriformis*.

M. auriformis is very similar to *M. stephanae* Orchard a small metapolygnathid characterized by "a short platform with upturned margins bearing low anterior nodes" from the Upper Carnian of British Columbia. In *M. auriformis* lack nodes on the anterior platform and a posterior platform constriction may be present.

Metapolygnathus baloghi Kovacs, 1977

Pl. 2, fig. 3-5, 7, 8

1975 *"Epigondolella" carnica* Krystyn in Kristan-Tollmann & Krystyn, p. 273, pl. 3, fig. 4 (non fig. 1-3).
1977 *Metapolygnathus baloghi* Kovacs, p. 79, pl. 3, fig. 2; pl. 4, fig. 1; pl. 5, fig. 1, 2; pl. 7, fig. 1, 2.
1980b *Metapolygnathus baloghi* - Kovacs & Kozur, pl. 9, fig. 2, 3.
1986 *Metapolygnathus baloghi* - Kovacs, p. 214, pl. 11, fig. 3.
1991 *Epigondolella baloghi* - Kolar-Jurkovsek, p. 94, pl. 23, fig. 4.

Description of Pa element. The unit is gently arched in lateral view. The platform is very wide, its widest part is in the middle of the posterior third and tapers posteriorly rapidly. The platform-margins are upturned, bearing two or more nodes on each sides. The nodes are never present on the platform end, which is usually rounded. The carina is highest in its anterior part and rapidly decreases. It consists of 10-11 fused denticles with the last denticle stronger. The keel is wide, flat, with a groove which terminates in a pit. The well-developed loop is oval-shaped or squared.

Remarks. *Metapolygnathus baloghi* Kovacs differs from all other species of *Epigondolella* for its very wide platform posteriorly tapering with upturned margins.

In Kozur opinion (1989b, p. 422) *E. baloghi* is a juvenile stage of a primitive *Epigondolella*, probably of the latest Carnian.

Budurov & Sudar (1990, p. 215) included *E. baloghi* (pars) in the *Epigondolella echinata* (Hayashi) synonymy. According to Kozur (1989b) and Orchard (1991b) this synonymy is not acceptable because the holotype of *E. echinata* is a juvenile form of *Metapolygnathus communisti*. *E. echinata* is quite different; it is characterized by a basal cavity still subterminal and a longer carina.

Vrielynck (1987, p. 166) regard *E. baloghi* as juvenile forms of *P. nodosa* (Hayashi) because he found this species in beds containing *P. nodosa* and *E. abneptis abneptis*.

Orchard (1991b) described a small metapolygnathid: *Metapolygnathus stephanae* from the Late Carnian of British Columbia. Viewed in profile, this species is very similar to *M. baloghi* for elevated and upturned margins. The nodes of *M. stephanae* are much lower and the platform margins are less incised than those of *M. baloghi*.

Metapolygnathus carnicus (Krystyn, 1975)

Pl. 2, fig. 6, 9-12

1975 *Epigondolella carnica* Krystyn in Kristan-Tollmann & Krystyn, p. 273, only pl. 3, fig. 1-3.
1983 *"Epigondolella" carnica* - Krystyn, p. 242, pl. 6, fig. 2-4.

1987 *Paragondolella nodosa* - Vrielynck, p. 165, only pl. 5, fig. 19-21.
1992 *Epigondolella carnica* - Chhabra & Kumar, pl. 4, fig. 14.

Description of Pa element. The unit is slightly arched in lateral view. The platform extends through two-thirds of the unit and tapers posteriorly. The platform-margins are parallel and upturned with three or four nodes on each side. The platform-end tends to be flattened, rounded or squared with rounded corners. Generally the posterior part of the platform, is without marginal nodes, some specimens show just a scalloping. Usually the honeycomb structure is restricted only to the posterior margin edges. The carina consists of seven to twelve fused denticles, highest in the anterior part, and decreasing posteriorly at the beginning of the platform. The last denticle, the main cusp, is considerably stronger. The keel is wide, with a deeply excavated groove, which terminates in a oval-shaped pit surrounded by a rounded or squared loop.

From the early ontogenetic to the mature stages the platform-margins become parallel and increase the number of nodes. The platform-end tends to be more squared.

Remarks. Kozur & Mock (1977), Kozur (1980a, b, 1989a, b), and Vrielynck (1987) regard *E. carnica* as younger synonym of *Metapolygnathus nodosus* Hayashi, except for the specimens figured by Krystyn in Kristan-Tollmann & Krystyn (1975) in pl. 3, fig. 4 = *Metapolygnathus baloghi* Kovacs and pl. 3 fig. 1 = *Metapolygnatus pseudodiebeli* Kozur. They maintained that *E. carnica* derives from condensed strata of Tuvalian age.

Metapolygnathus carnicus is closely related to *Metapolygnathus nodosus*, but it differs in the development of the anterior platform nodes. The nodes of *M. nodosus* are more irregular and less pronounced than in *M. carnicus*. Orchard (1991a, b) noted in *M. nodosus* a strong posterior platform constriction as typical of early growth stages and that in large specimens the nodes commonly coalesce and become indistinct. I observed an opposite ontogenetic trend: in early growth stages the posterior margins are rounded and the constriction, if present, is generally weak and occurs in large specimens where it is observable an increase of platform nodes toward the posterior direction.

As maintained by Krystyn (in Kristan-Tollmann & Krystyn, 1975; 1983) and after by Kovacs (1991) *M. carnicus* and *M. nodosus* are two species with different stratigraphical range.

In Tamarin section *M. carnicus* is associated with *Gl. tethydis*, *Gl. malayensis*. This suggests that the morphological analogy between the two species should be interpreted as a phenomenon of convergence, being these species very well separated stratigraphically.

Upper Carnian species as *Metapolygnathus zoae* and *Metapolygnathus samueli* described by Orchard (1991b) differ from *M. carnicus* in having a much more narrower and elongated platform. Further, *M. zoae* possesses more rounded anterior platform nodes, whereas *M. samueli* the nodes are sharper and the blade forms a convex profile much lower than that of *M. carnicus*.

The assignment of *M. carnicus* to *Metapolygnathus abneptis* (Huckriede) by Budurov & Sudar (1990) cannot be accepted. The species have different stratigraphic ranges and present different platform outlines. Furthermore, *E. abneptis* may be distinguished from *M. carnicus* for the posterior platform end: squared, flat, without marked margins and a more frequently bifurcated keel at the posterior end.

Metapolygnathus polygnathiformis (Budurov & Stefanov, 1965)

Pl. 1, fig. 10-13

1965 *Gondolella polygnathiformis* Budurov & Stefanov, p. 118, pl. 3, fig. 3, 7 (non pl. 3, fig. 4-6).
1983 *Gondolella polygnathiformis* - Kovacs, p. 112, pl. 2, fig. 5,6 (cum syn.)
1986 *Paragondolella polygnathiformis* - Sudar, pl. 9, fig. 1-8.
1986 *Gondolella polygnathiformis* - Durkoop et al., pl. 17, fig. 9; pl. 19, fig. 2-20, 22.
1987 *Paragondolella polygnathiformis* - Vrielynck, p. 167, pl. 5, fig. 7-15.
1990 *Paragondolella polygnathiformis* - Budurov & Sudar, p. 211, pl. 1, fig. 7, 8 (non fig. 9-19).
1991 *Neogondolella polygnathiformis* - Kolar-Jurkovsek, p. 99, pl. 24, fig. 3, 4; pl. 26, fig. 4 (non fig. 5).
1991 *Paragondolella polygnathiformis* - Martini et al., p. 135, pl. 18, fig. 1-15.
1992 *Neogondolella polygnathiformis* - Chhabra & Kumar, pl. 4, fig. 16.

Remarks. In lateral view this species is characterized by having an abrupt step of the platform and a short carina which is generally higher in its anterior part.

Kovacs (1983) maintained that *M. polygnathiformis* evolved from *Gondolella excelsa*-stock via *G. foliata inclinata* Kovacs at the beginning of the Carnian. All the types of *M. polygnathiformis* figured by Budurov & Stefanov (1965), except the holotype, belong to *G. foliata* s.l. From *G. foliata inclinata* evolved even *G. tadpole* Hayashi.

G. tadpole differs from *M. polygnathiformis* in having a shorter platform, a straighter basal edge and the denticles of carina stand perpendicular to the basal edge.

Budurov & Sudar (1990, p. 211) regard the morphologic characteristics of *G. tadpole* as specific variations of *M. polygnathiformis.*

Conclusion.

1) First record from the Dolomites of the species: *Metapolygnathus auriformis, M. carnicus, M. baloghi.*

2) The conodont association found in the Tamarin section is referable to the Early Carnian and precisely to the *auriformis* Zone.

3) The studied fauna shows strong affinities with the coeval faunas of *auriformis* Zone from the European Tethyan regions (mainly Greece, Turkey, NE Hungary, and Alps) and the northern Kumaun region of Tethys Himalaya.

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All figured specimens are stored in the Collections of the Institute of Paleontology, University of Modena (IPUM 24880-24909).

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PLATE 1

Fig. 1-3 - *Gladigondolella malayensis malayensis* Nogami. 1a,b) Upper and lower view, sample T1, IPUM 24887, x 130; 2) oblique upper view, sample T7, IPUM 24888, x 120; 3) lateral view, sample T3, IPUM 24889, x 130.

Fig. 4, 5 - *Gladigondolella arcuata* Budurov. 4) Upper view, sample T2, IPUM 24885, x 90; 5) oblique lateral view, sample T3, IPUM 24886, x 65.

Fig. 6-9 - *Metapolygnathus auriformis* (Kovacs). 6) Lateral view, sample T4, IPUM 24896, x 140; 7) upper view, sample T8, IPUM 24897, x 160; 8) lower view, sample T3, IPUM 24898, x 140; 9) upper view of a juvenile form, sample T5, IPUM 24899, x 170.

Fig. 10-13 - *Metapolygnathus polygnathiformis* (Budurov & Stefanov). 10) Upper view, sample T1, IPUM 24892, x 80; 11) lower view, sample T5, IPUM 24893, x 90; 12) oblique lateral view, sample T4, IPUM 24894, x 110; 13) lateral view, sample T9, IPUM 24895, x 100.

PLATE 2

Fig. 1, 2 - *Gladigondolella tethydis* (Huckriede). 1) Lower view, sample T2, IPUM 24890, x 80; 2) upper view, sample T1, IPUM 24891, x 60.

Fig. 3-5 - *Metapolygnathus baloghi* Kovacs. 3) Upper view, sample T3, IPUM 24900, x 160; 4) lower view, sample T5, IPUM 24901, x 140; 5) lateral view, sample T4, IPUM 24902, x 140.

Fig. 6, 9-12- *Metapolygnathus carnicus* (Krystyn). 6) Upper view, sample T4, IPUM 24903, x 120; 9) upper view, sample T8, IPUM 24904, x 110; 10) lateral view, sample T4, IPUM 24905, x 120; 11) oblique upper view, sample T3, IPUM 24906, x 140; 12) lower view, sample T5, IPUM 24907, x 100.

Fig. 7, 8 - *Metapolygnathus baloghi* Kovacs transitional to *Metapolygnathus carnicus* (Krystyn). 7) Upper view, sample T3, IPUM 24908, x 110; 8) lateral view, sample T4, IPUM 24909, x 150.

PLATE 3

Fig. 1,2 - *Enantiognathus petraeviridis* (Huckriede) "morphoelement". Lateral view of fragments anterior process. 1) Sample T1, x 70; 2) sample T2, x 70.

Fig. 3 - *Hindeodella spengleri* (Huckriede) "morphoelement". Sample T2, x 60.

Fig. 4-6 - *Didymodella alternata* (Mosher) "morphoelement". 4) Inner lateral view, sample T2, x 45; 5) upper view, sample T3, x 60; 6) inner lateral view, sample T6, x 100.

Fig. 7, 14 - *Hindeodella pectiniformis* (Huckriede) "morphoelement". 7) Lateral view of anterior process, sample T3, x 50; 14) lateral view, sample T8, x 90.

Fig. 8 - *Lonchodina? posterognathus* (Mosher). Sample T3, x 80.

Fig. 9 - *Prioniodina mediocris* (Tatge) "morphoelement". Lateral view, sample T4, x 80.

Fig. 10-12 - *Neohindeodella summesbergeri* Kozur & Mostler "morphoelement". Lateral views. 10) Sample T1, x 120; 11) sample T4, x 120; 12) sample T9, x 120.

Fig. 13 - *Hindeodella suevica* (Tatge) "morphoelement". Lateral view, sample T2, x 100.

PLATE 4

Fig. 1-5 - *Enantiognathus ziegleri* (Diebel) "morphoelement". Lateral views of anterior process. 1) Sample T3, x 110; 2) sample T4, x 110; 3) sample T9, x 120; 4) sample T2, x 110; 5) sample T6, x 110.

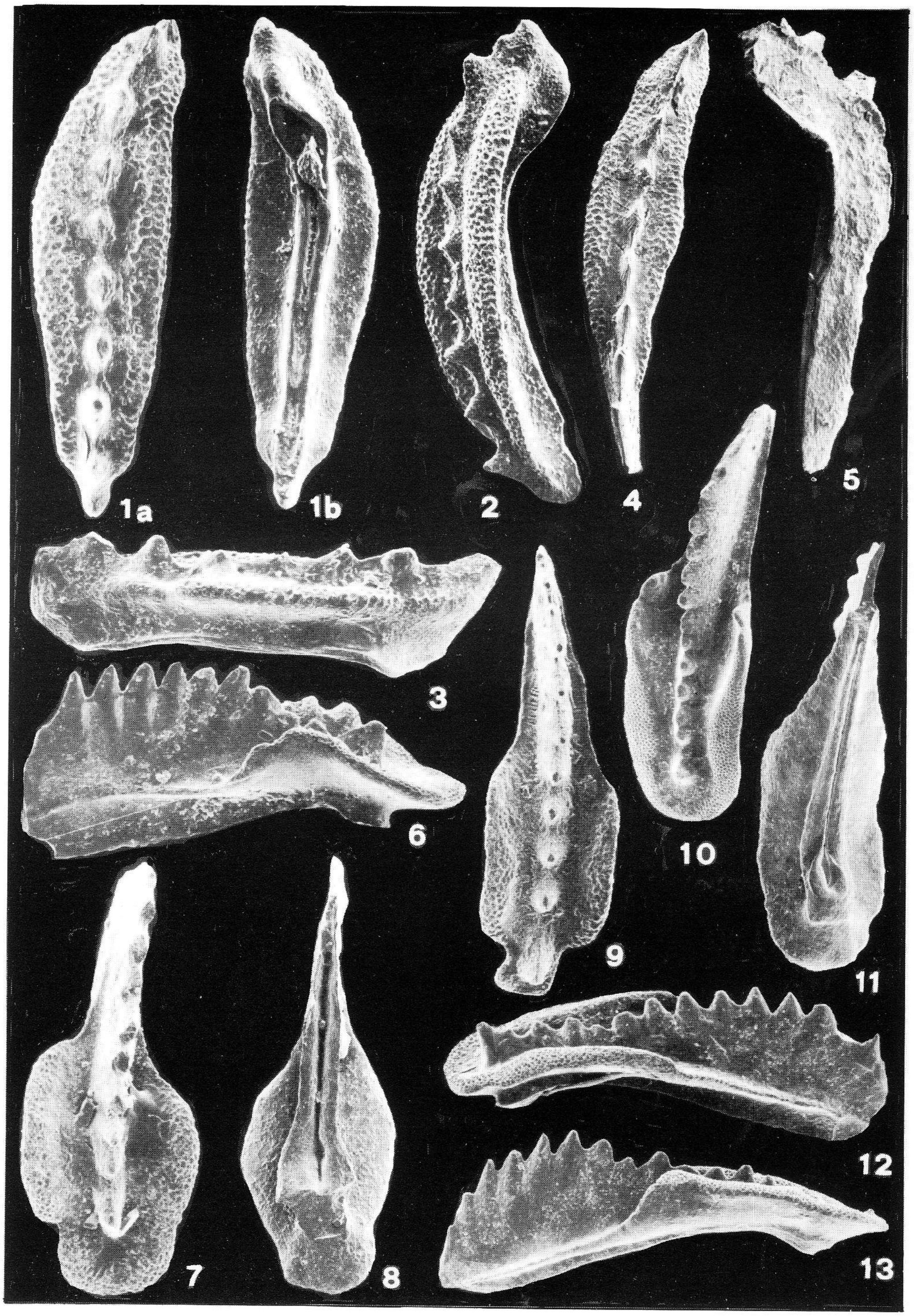
Fig. 6-9 - *Hibbardella magnidentata* (Tatge) "morphoelement". 6) Sample T2, x 130; 7) sample T4, x 160; 8) lateral view, sample T1, x 110; 9) lateral view, sample T5, x 110.

Fig. 10, 16 - *Prioniodina (Cypridodella) muelleri* (Tatge) "morphoelement". 10) A broken specimen with apical region, sample T3, x 120; 16) sample T4, x 120.

Fig. 11, 12 - *Prioniodina (Cypridodella) venusta* (Huckriede) "morphoelement". 11) Sample T3, x 85; 12) sample T1, x 85.

Fig. 13, 14 - *Neohindeodella triassica* (Müller) "morphoelement". 13) Sample T1, x 130; 14) sample T4, x 130.

Fig. 15 - *Hindeodella pectiniformis* (Huckriede) "morphoelement". Sample T3, x 90.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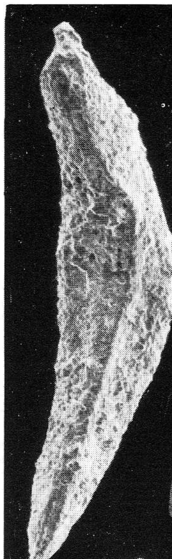
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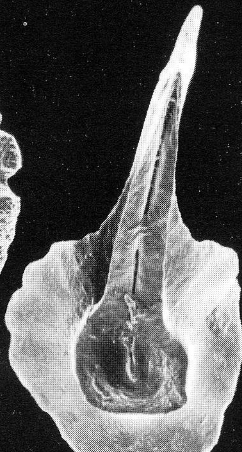
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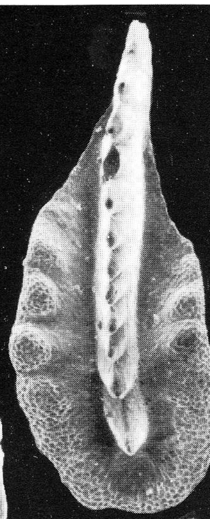
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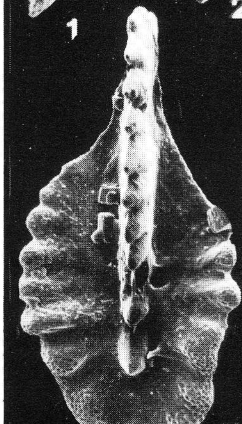
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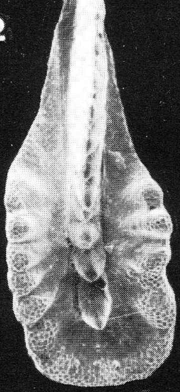
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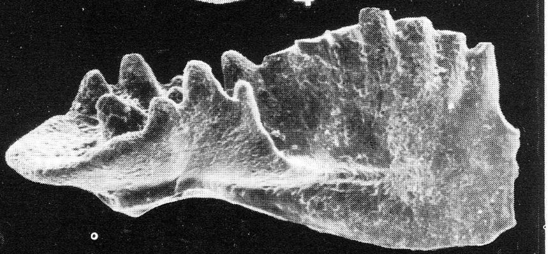
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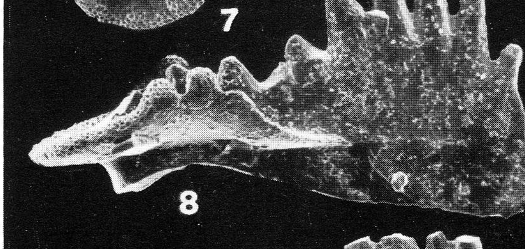
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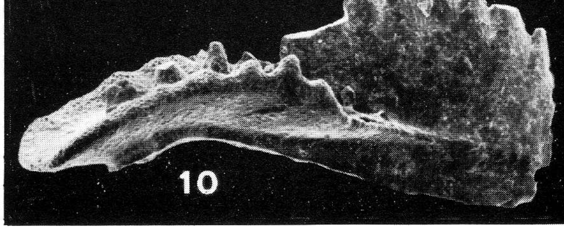
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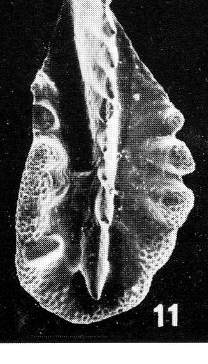
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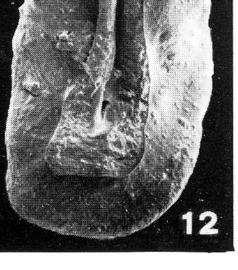
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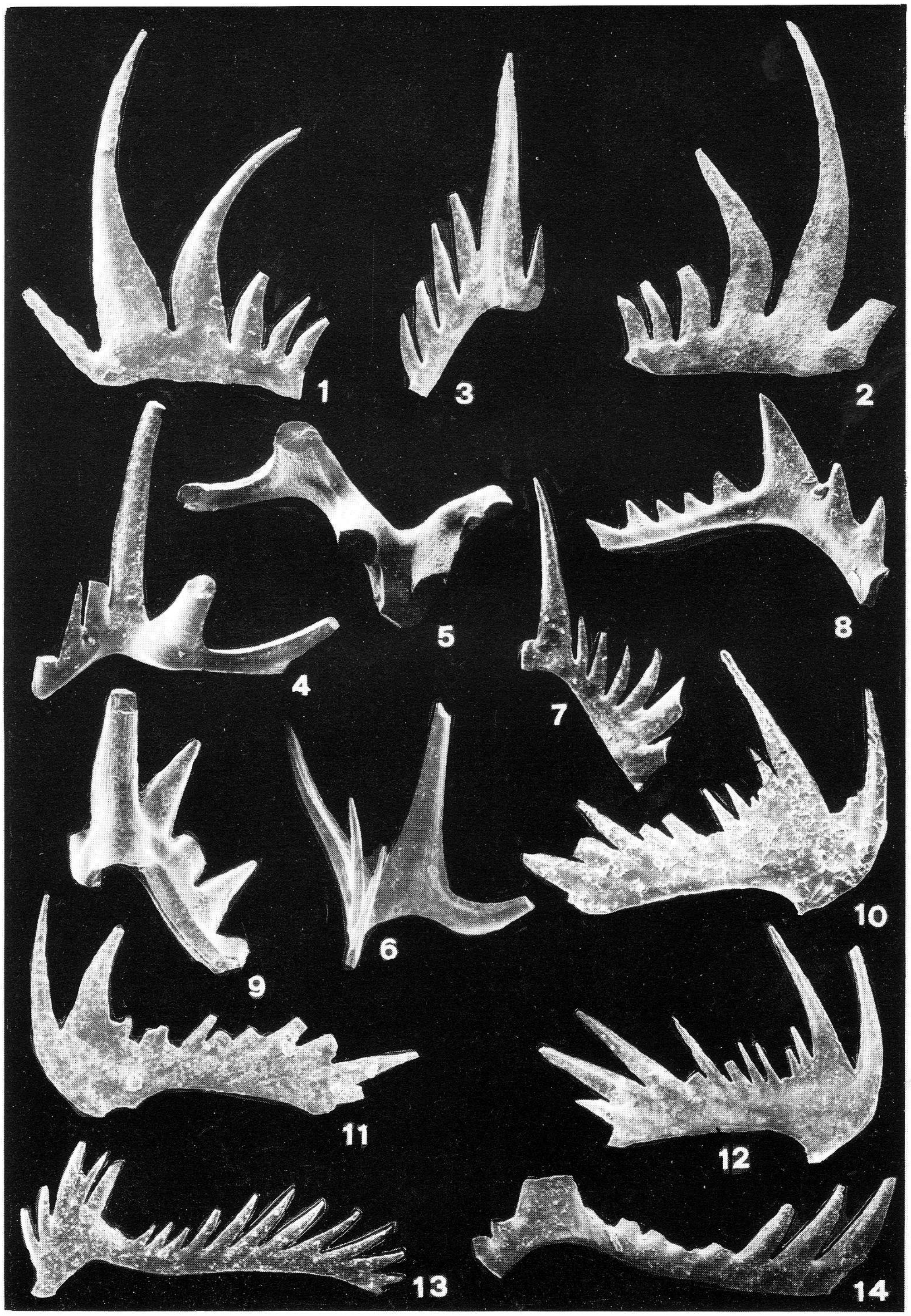
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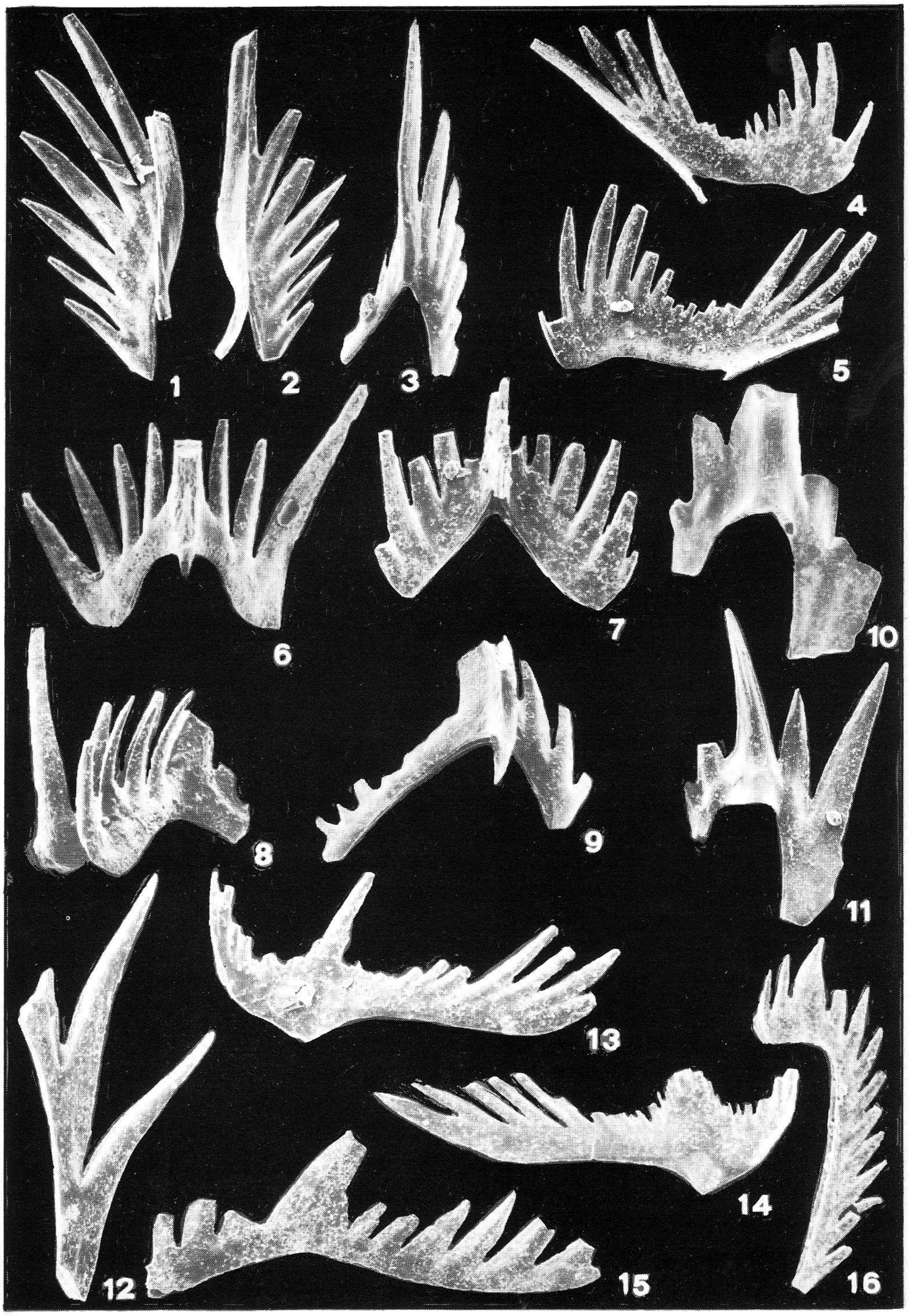
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