APPLICATION OF CONODONTS TO TRIASSIC STRATIGRAPHY OF TEKE TAURUS (SE ANTALYA GULF, TURKEY)

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Önder, F., Şenel, M., Keskin, A., and Kiliç, A.M. 1998. Application of conodonts to Triassic stratigraphy of Teke Taurus (SE Antalya Gulf, Turkey). *In:* H. Szaniawski (ed.), Proceedings of the Sixth European Conodont Symposium (ECOS VI). — *Palaeontologia Polonica* **58**, 273–279.

In the Teke Taurus, southern Turkey (SE Antalya Gulf), Triassic formations provide sufficient micropaleontological data for a detailed biostratigraphic analysis. At the base of the succession, the sedimentary rocks are represented by variegated shales, claystones and clayey limestones which were deposited in a shallow marine environment. The overlying part of the sequence is characterized by vermicular and red nodular limestones, rich in marine fauna. These Middle–Upper Triassic limestones, typical for the Alpine-type Triassic, are thought to be consisted of pelagic sediments deposited on sea-mounts within an oceanic basin. The following conodonts have been found in the sequence: *Cratognathodus kochi, Cratognathodus* sp., *Enantiognathus petraeviridis, Enantiognathus* sp., *Epigondolella abneptis, Epigondolella triangularis, Epigondolella* sp., *Neogondolella* sp., and *Neohindeodella* sp.

K e y w o r d s : conodonts, Triassic, Antalya, Turkey.

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Received 7 July 1996, accepted 8 September 1997

INTRODUCTION

Although the first geological surveys in the Taurus Belt were undertaken already by BLUMENTHAL (1940), the knowledge of the Triassic rocks of Taurus Belt is still limited. The Taurides that consist of a number of allochthonous and autochtonous units extending along the southern part of Anatolia in Turkey contain only few sections in which the stratigraphic sequence of Triassic rocks without tectonic disruptions and abrupt facies changes can be observed. Therefore, only a few researchers have described and documented the stratigraphic, paleontologic and paleoecologic characteristics of the Triassic rocks in this area. ÖZGÜL (1976), MONOD (1977), MARCOUX (1979), ROBERTSON and WOODCOCK (1981a, b), and ŞENEL (1986) have undertaken a broad survey of the stratigraphy and tectonics of the Taurides. The surveys have concentrated on the ophiolitic and radiolaritic sequences, which are defined as the Antalya Nappes. They occur in the outer part of the autochthonous zone of the Taurids, and consist of sedimentary, igneous, and metamorphic rocks ranging in age from Cambrian to Tertiary. MARCOUX (1976) showed that, although the Triassic rocks in individual nappes belong usually to a single facies, sufficient facies changes exist throughout the Taurides and to make environmental reconstruction possible. Various geological aspects, including the Triassic rocks of Taurus, were also discussed at the "International Symposium of the Geology of the Taurus Belt" (TEKELI and GÖNCÜOGLU 1984).

Paleontological data concerning Triassic conodonts were described from the Hallstatt Limestone located within the Taurus Mountains by KRISTAN-TOLLMANN and KRYSTYN (1975). Also, GEDIK (1977, 1981) studied the Triassic conodonts of Taurus and their tectonic-paleogeographic significance. Other, more recent publications (ÖNDER 1982, 1984a, 1984b, 1984c, 1985, 1988) focused on the micropaleontologic, stratigraphic, and environmental interpretations of Triassic rocks throughout the Taurus Mountains.

In this study, seven limestone beds have been sampled and studied in an attempt to obtain conodonts for stratigraphic and paleontologic analyses. However, only three samples (Fig. 1) yielded conodont elements. The residues of the dissolved samples were washed through a 120 μm sieve. The collection is housed in the Cumhuriyet University Geology Department.

Acknowledgements. — The authors are grateful to the Geology Department of Southampton University for assistance with Scaning Electron Microscope. Dr. Ronald L. AUSTIN is warmly thanked for his helps. We also thank Dr. Mehmet ALTUNSOY (Cumhuriyet University, Sivas), Ahmet ISIK (MTA, Ankara), and Heinz KOZUR for their cooperation.

STRATIGRAPHY

In order to explain the stratigraphy of Taurus Belt, a geological survey of a large region that extends from west to east on Southern Anatolia, is necessary. In the Kemer area (southwest Turkey, see Fig. 1), there are blocks and other allochthonous rock units, both containing shallow and deep sea sediments, ophiolites, and submarine basic volcanic rocks that range in age from Cambrian to Upper Cretaceous. Some of these outcrops, exposed in Kemer, were refered to by previous workers as "Antalya Nappes" (ÖZGÜL 1976). The strata, older than Triassic in the study area, are represented by shales, quartzites, and diabase dikes of Ordovician age; sandstones, limestones, and dolomites of Silurian age; terrigenous Devonian deposits; and Permian sandstones overlain by shallow water limestones.

The Triassic succession in the western Kemer area is very well developed in the vicinity of Teke Mountain, and was studied by ÖNDER (1982) in Saklikent and Dömektepe regions. In the present study, several samples were collected and dissolved for conodonts from the Bölücektasi Hill, Katirgedii, and Hatice Hill locations (Fig. 1). The oolitic and stromatolitic limestones that form a basal Triassic unit throughout Taurus (ÖNDER 1982) are not present in the investigated area. Consequently, there is a discordance between Permian and Lower Triassic in the studied areas (Fig. 2). The Kesmeköprü Formation, which is Scythian–Anisian–Ladinian? in age, is represented by variegated shales, claystone, and gypsum at the base, and clayey limestones and limestones at the top. These limestones are biomicrite and locally intrabiomicrites and contain bivalves, gastropods, and foraminifers. In the present study, we have obtained some conodonts from the top part of the vermicular and nodular limestones that indicate

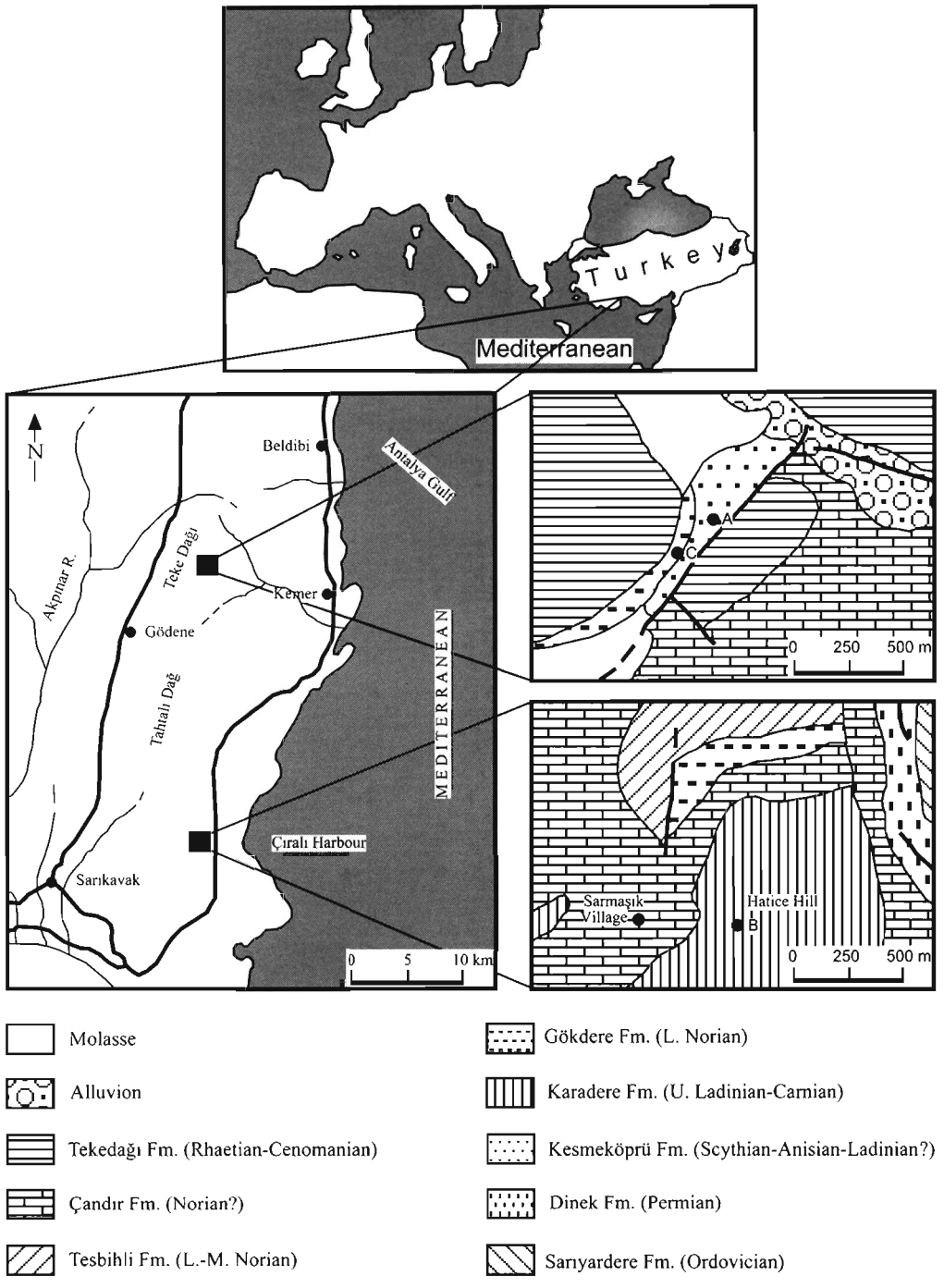

Fig. 1
Location and geological sketchmaps of the Kemer Region showing the study areas.

Lower–Middle Triassic age. These conodonts are *Cratognathodus kochi* (HUCKRIEDE), *Cratognathodus* sp., *Enantiognathus petraeviridis* (HUCKRIEDE), and *Enantiognathus* sp. (Fig. 3).

The Alakirçay Group that overlies Kesmeköprü Formation consists of four formations: Karadere, Gökdere, Tesbihli, and Çandir (Figs 1, 2). They show different stratigraphic positions in different areas.

Claystones, clayey limestones and limestone beds overlying pillow lavas belong to the Karadere Formation. Poorly fossiliferous limestones of this formation contain bivalves. The reddish nodular limestones were sampled from Hatice Hill, east of Sarmasik Mah. (Fig. 1). They contain the following conodonts: *Epigondolella* sp., *Neogondolella* sp., and *Neohindeodella* sp. (Fig. 3). According to these conodonts, the Karadere Formation is Upper Ladinian–Carnian in age.

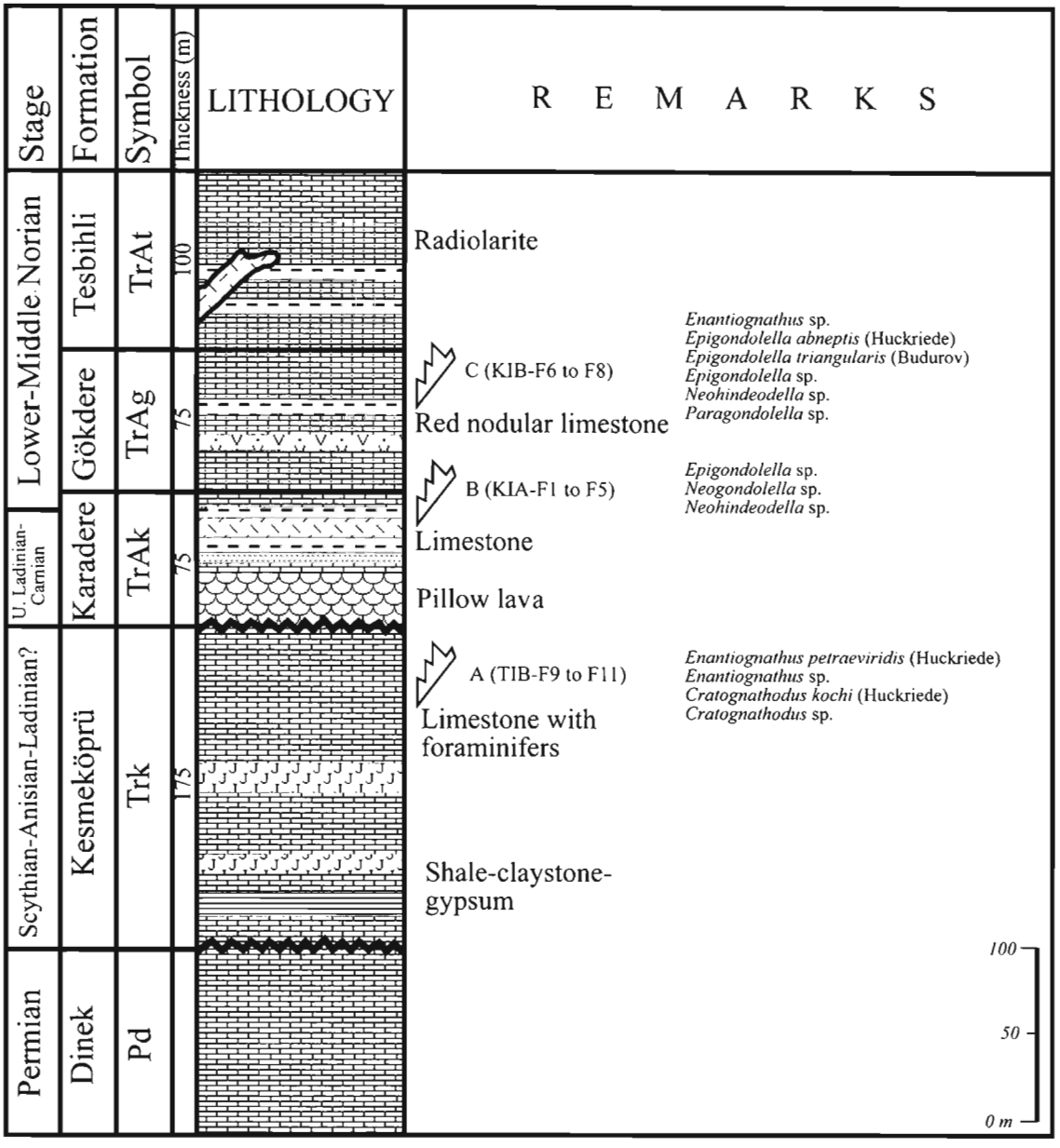

Fig. 2
Generalized stratigraphic columnar section showing the Triassic Formations in the study areas.

The Gökdere Formation is characterized by medium to thin bedded limestones containing locally radiolarians and ammonites. These reddish nodular limestones are biomicrites and intrabiomicrites rich in conodonts. The samples taken from the Katirgedigi region, east of Tekedagi (Fig. 1) contain the following conodonts indicating a Lower Norian age: *Enantiognathus* sp., *Epigondolella abneptis* (HUCKRIEDE), *Epigondolella triangularis* (BUDUROV), *Epigondolella* sp., *Neohindeodella* sp., *Paragondolella* sp. (Fig. 3). These rocks are followed upwards by the Tesbihli Formation (Lower–Middle Norian) which is characterized by thin to medium bedded radiolarites and cherts that have not yielded microfossils. The Tesbihli Formation is overlain by conglomerates, sandstones, claystones, and shales of the Çandir Formation (Norian?). Conodonts have not been found in the Çandir Formation.

The Kesmeköprü Formation was deposited in a shallow water, stable shelf environment as indicated by its lithology and its diverse fauna. The Karadere Formation shows intercalation with the other formations of Alakirçay Group and its basal contact can not be observed in the field. This contact was only described by ŞENEL (1986: p. 83) from the area between Balikdis and Karatepe. According to the fossil content, lithology, and stratigraphic position, the depositional environment changed during the deposition of the Alakirçay Group

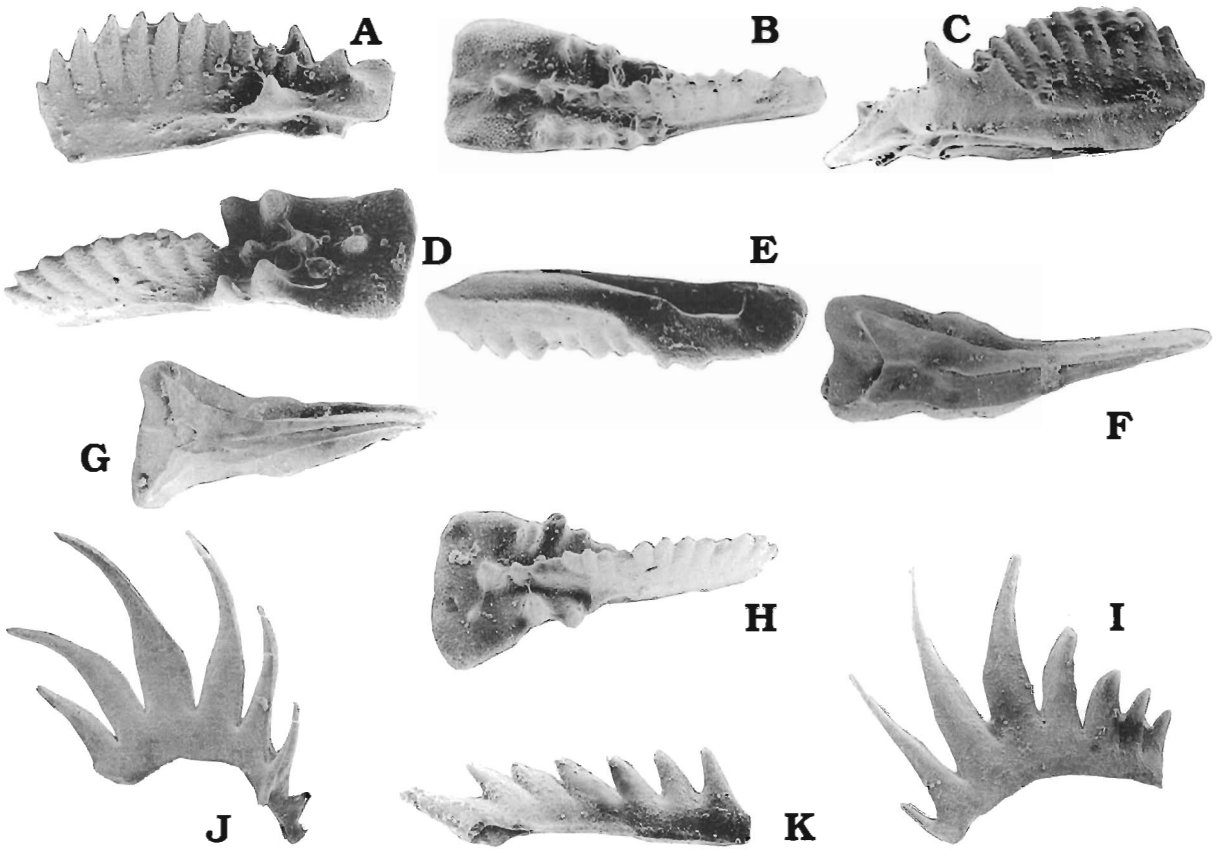

Fig. 3

A, C–E. *Epigondolella abneptis* (HUCKRIEDE), KIA-F1 in lateral view, × 150 (**A**); KIA-F3 in lateral view, × 140 (**C**); KIA-F4 in oral view, × 150 (**D**); KIA-F5 in aboral view, × 100 (**E**). **F–H.** *Epigondolella triangularis* (BUDUROV), KIB-F6 in aboral view, × 100 (**F**); KIB-F7 in aboral view, × 65 (**G**); KIB-F8 in oral view, × 100 (**H**). **I, J.** *Enantiognathus petraeviridis* (HUCKRIEDE), TIB-F11 in lateral view, × 90 (**I**); TIB-F10 in lateral view, × 90 (**J**). **K.** *Cratognathus kochi* (HUCKRIEDE), TIB-F9 in lateral view, × 120.

(Karadere, Gökdere, Tesbihli, and Çandir formations). In general, deposits of more pelagic character (radiolarites, cherts, limestones) replaced shallow-water facies. The Alakirçay Group records deep-water depositional environments and shows the evidence for any interuption due to volcanic activity.

SYSTEMATIC PALEONTOLOGY

Genus *Cratognathodus* MOSHER, 1968

Type species: *Prioniodina kochi* HUCKRIEDE, 1958.

Cratognathodus kochi (HUCKRIEDE, 1958)
(Fig. 3K)

1958. *Prioniodina kochi* sp. n. HUCKRIEDE: p. 159, pl. 11: 37, pl. 12: 11, 12, pl. 14: 4.
1968. *Cratognathodus kochi* (HUCKRIEDE); MOSHER: p. 919, pl. 113: 3, 4, 7.

Remarks. — A detailed synonymy was given by MOSHER (1968). He differentiated this species from others by the lack of white matter and by the relatively less pronounced inclination of the denticles. One specimen and some fragments were found.

Occurrence. — TIB-F9, Middle Triassic.

Genus *Enantiognathus* MOSHER *et* CLARK, 1965

Type species: *Enantiognathus inversus* (SANNEMANN, 1955).

Enantiognathus petraeviridis (HUCKRIEDE, 1958)
(Fig. 3I, J)

1958. *Hindeodella petrae-viridis* sp. n. HUCKRIEDE: p. 149, pl. 11: 26, pl. 13: 7–9, 11, 12, 14, pl. 14: 6.
1968. *Prioniodina petrae-viridis* (HUCKRIEDE); MOSHER: p. 934, pl. 116: 28–31.
1968. *Parachirognathus petrae-viridis* (HUCKRIEDE); BENDER: p. 524, pl. 5: 1–6, non 8, 9.
1972. *Enantiognathus petraeviridis* (HUCKRIEDE); KOZUR and MOSTLER: p. 9, pl. 10: 1–3, pl. 12: 16, pl. 14: 4, 5, 8, 12, 17, 18.

Remarks. — A revised description was given by MOSHER (1968). According to KOZUR and MOSTLER (1972) *E. abneptis* is the **Sb** element of *Gladigondolella tethydis* (HUCKRIEDE). Ten specimens, some of them broken, are included in our collection.

Occurrence. — TIB-F10, 11, Upper Scythian, Middle Carnian.

Genus *Epigondolella* MOSHER, 1968

Type species: *Polygnathus abneptis* HUCKRIEDE, 1958.

Remarks. — MOSHER (1968: p. 935) defined *Epigondolella* as a platform-like conodont with a high, anterior, free blade and with a marginal node-like projection on the platform.

Epigondolella abneptis (HUCKRIEDE, 1958)
(Fig. 3A, C–E)

1958. *Polygnathus abneptis* sp. n. HUCKRIEDE: p. 156, pl. 12: 30–34, pl. 14: 1, 2, 12, 13, 16–22, 27, 32, 47–57.
1965. *Gladigondolella abneptis* (HUCKRIEDE); ZANKL: pl. 1: 6g–i.
1968. *Epigondolella abneptis* (HUCKRIEDE); pars-MOSHER: p. 936, none of the figured forms belongs to *E. abneptis*.
1968. *Gladigondolella abneptis* (HUCKRIEDE); HAYASHI: p. 68, none of the figured forms belongs to *E. abneptis*.
1968. *Tardogondolella abneptis* (HUCKRIEDE); BENDER: p. 531, none of the figured forms belongs to *E. abneptis*.
1972. *Metapolygnathus abneptis abneptis* (HUCKRIEDE); KOZUR: p. 28, pl. 6: 10–21, pl. 7: 12–18.
1991. *Epigondolella quadrata* n. sp. ORCHARD: p. 311, pl. 2: 1–3, 7–9, ?10, ?12.

Remarks. — The elements of *E. abneptis*, are characterized by a broad platform, which varies in shape from square to rectangular, and by the nodes and denticles on the upper surface. Three specimens were found in the present samples.

Occurrence. — KIA-F1 to 5, Lower Norian.

Epigondolella triangularis (BUDUROV, 1972)
(Fig. 3F–H)

1968. *Epigondolella abneptis* (HUCKRIEDE); pars-MOSHER: p. 936, pl. 118: 22–27, 30: non 18, 20–21, 28, 29.
1972. *Ancyrogondolella triangularis* BUDUROV: p. 857, pl. 1: 3, 6.
1977. *Epigondolella triangularis* (BUDUROV); ZIEGLER: p. 203.

Remarks. — Two well preserved specimens with a characteristic ornamentation of nodes have been recovered in this study. The lower surface shows a keel which bifurcates posteriorly.

Occurence. — KIB-F6-8, Upper part of Lower Norian.

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