Rivista Italiana di Paleontologia e Stratigrafia	volume 113	no. 2	4 pls.	pp. 167-190	July 2007

MIDDLE CARNIAN (LATE TRIASSIC) NASSELLARIA (RADIOLARIA) OF KÖSEYAHYA NAPPE FROM EASTERN TAURIDES, EASTERN TURKEY

UGUR KAGAN TEKIN [1] & YAVUZ BEDI [2]

Received: April 26, 2006; accepted: February 12, 2007

Key words: Radiolaria, Nassellaria, Taxonomy, middle Carnian, Eastern Turkey.

Abstract. Abundant, very diverse, and well-preserved Nassellarian fauna has been obtained from cherty/clayey limestone levels at the basal part of the "Köseyahya nappe east of the town of Elbistan", Eastern Taurides. A comparison with the radiolarian faunas of Austria, Japan and Turkey allows us to assign a middle Carnian age to this radiolarian fauna from the Elbistan region. This fauna contains Nassellaria that are typical for this time interval. Moreover, it contains *Tetraporobrachia haeckeli* Kozur & Mostler which is an index fossil that gives the name to the zone established by Kozur & Mostler. As a result of the taxonomic study of the Nassellarian fauna, thirty-nine taxa among which nine new species (*Goestlingella tueysuezi, Haeckelicyrtium planum, Hinedorcus koeseyahyaensis, Katroma* ? *ornata, K.* ? *proba, K.* ? *tunoglui, Syringocapsa firma, S. nuda, Sanfilippoella carterae*) and twelve taxa remained in open nomenclature are described and figured in this study.

Riassunto. Una fauna di Nassellaria (Radiolari), abbondante, molto diversificata e ben conservata è stata ricavata da livelli di calcari marnosi e selciosi affioranti nella parte inferiore della falda Köseyahya, affioranti ad Est della città di Elbistan, nei Tauri orientali. Il confronto con faune a Radiolari dell'Austria, Giappone e Turchia consente di attribuire un'età Carnica media a questa fauna, in quanto essa contiene Nassellaria tipici di questo intervallo. Inoltre contiene *Tetraporobrachia haeckeli* Kozur & Mostler, che è il taxon eponime di questa zona istituita da Kozur & Mostler. In seguito allo studio tassonomico dei Nassellaria, sono state riconosciute 39 specie tra cui nove sono nuove (*Goestlingella tueysuezi, Haeckelicyrtium planum, Hinedorcus koeseyahyaensis, Katroma* ? *ornata, K.* ? *proba, K.*? *tunoglui, Syringocapsa firma, S. nuda, Sanfilippoella carterae*), mentre 12 taxa, sia pur descritti e figurati, sono rimasti in nomenclatura aperta.

Introduction

Middle Carnian (early Late Triassic) radiolarians have been studied in detail since the 1970's especially in Austria, Japan and Turkey. Initial studies have been carried out from Göstling and Grossreifling material in Austria from where very well-preserved radiolarian faunas have been described in a series of articles by Kozur & Mostler (1972, 1978, 1979, 1981, 1983, 1994) and Lahm (1984). Among these articles, only two (Kozur & Mostler 1979, 1981) treat Nassellarian faunas. Middle Carnian radiolarians have also been investigated in Japan (Sato et al. 1986; Yoshida 1986; Sashida et al. 1993; Sugiyama 1997), USA (Yeh 1989), Philippines (Yeh 1990), and in the Fareast Russia (Bragin 1991). Therefore, at present we have rather good image of radiolarian fauna of this time interval. Middle Carnian interval used in this study is in the meaning of Julian as suggested by Kozur & Mostler (1994).

Previously, middle Carnian radiolarian faunas have been obtained from two different units in Turkey: the Huglu unit in Beysehir-Hoyran nappes, central Taurides and the Turunc unit of the Gülbahar nappe in the Lycian nappes, western Taurides. In both units, radiolaria bearing limestones are associated with volcanic and volcanoclastic rock units (Tekin 1999; Tekin & Goncuoglu 2002).

The middle Carnian radiolarians from the limestone beds at the basal part of the Köseyahya nappe cropping out at the east of the town of Elbistan, eastern Turkey contain highly abundant, well-preserved and diverse Nassellarians. The aim of this study is to document these Nassellarian fauna and to describe and illustrate new taxa. A part of this fauna (family Ruesticyrtiidae) made the subject of another article (Tekin & Bedi 2007). The Nassellarian faunas of this locality are com-

1 Hacettepe Üniversitesi, Jeoloji Mühendisligi Bölümü, 06532 Beytepe, Ankara, Turkey. E-mail: uktekin@hacettepe.edu.tr
2 Jeoloji Etüdleri Dairesi, Maden Tetkik ve Arama Genel Müdürlügü, Eskisehir Yolu, 06520 Balgat, Ankara, Turkey. E-mail: y.bedi@mta.gov.tr

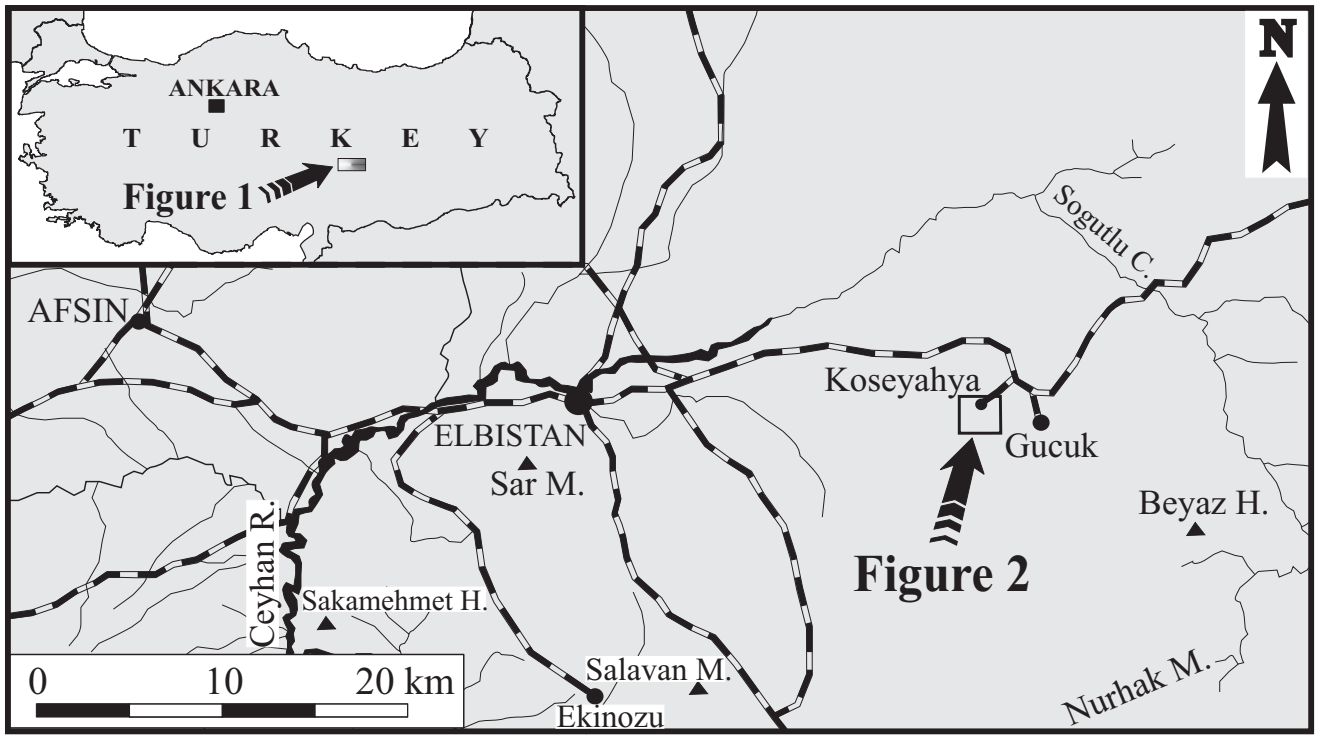


Fig. 1 - Geographic map showing the location of the study area. Inset map shows the locality of the main map.

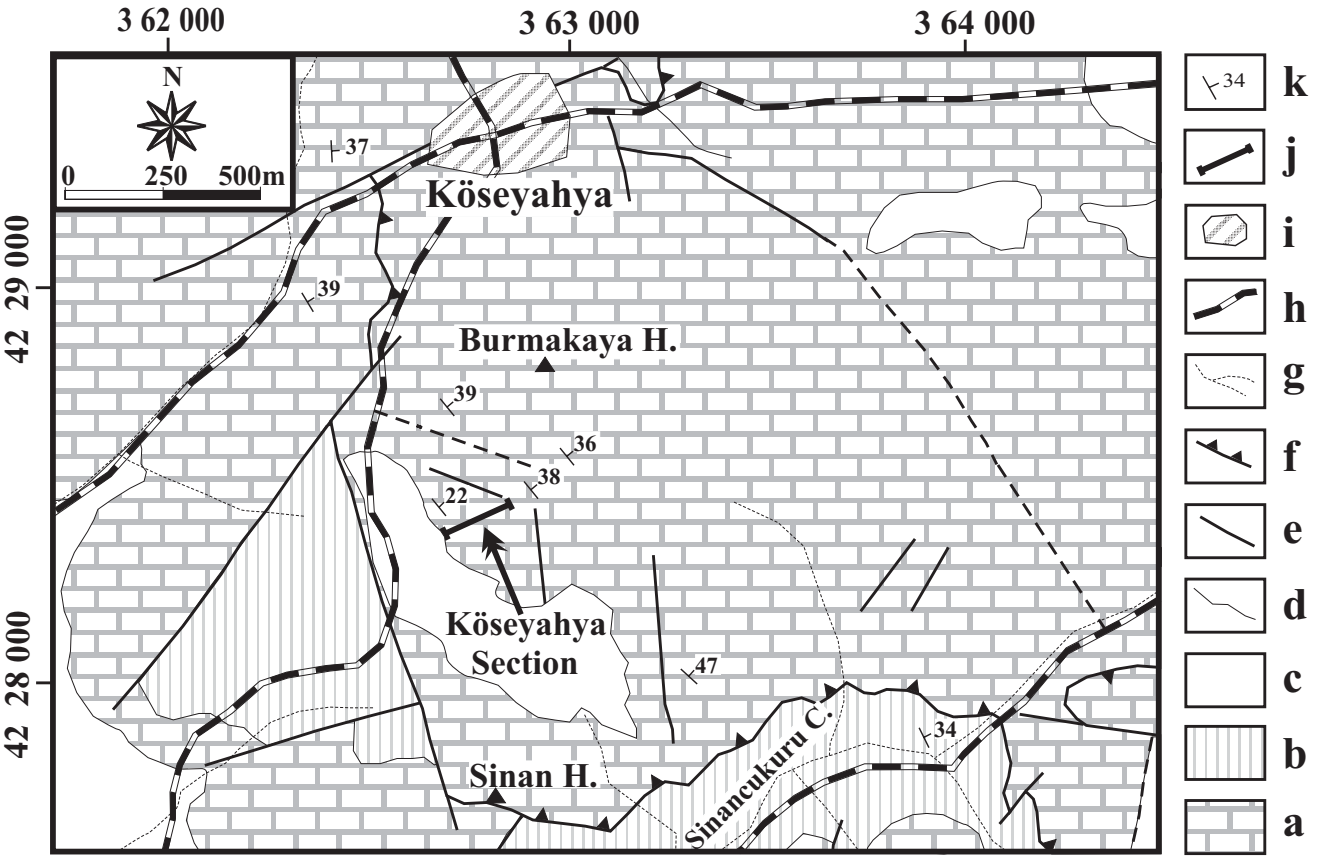


Fig. 2 - Geological map of the study area showing the location of the Köseyahya section. Legend: a, Triassic to Early Cretaceous carbonates of the Köseyahya nappe. b, Late Cretaceous pelagic sediments of the Köseyahya nappe. c, post Mesozoic rock units. d, boundary. e, fault. f, thrust. g, drainage system. h, main roads. i, settlements. j, location of the Köseyahya section. k, dip and strike (simplified and revised after Bedi 2004).

pared to the described faunas from Austria, Japan and Turkey.

Geological Setting of the Study Area

The study area is located in the Eastern Taurides and at approximately 22 km east of town of Elbistan (Fig. 1). Around this town, there are many allochthonous sequences (for brief review see Bedi et al. 2005) and their features have been studied in detail by Ayaslioglu (1970), Perincek & Kozlu (1984), Yilmaz et al. (1987), Pehlivan et al. (1991), Yilmaz et al. (1993) and Bedi et al. (2004, 2005). Binboga metamorphics constitute the lowermost tectonic unit of this area and it is tectonically overlain by the Gülbahar nappe composed of Triassic cherty pelagic limestones, volcanics and clastics in the basal part, cherty limestones of Jurassic-Cretaceous age in the central part and flyschoidal rocks with blocks of Late Cretaceous age at the top (Bedi et al. 2005; Tekin & Bedi 2007). This unit is tectonically overlain by the Köseyahya nappe (Fig. 2) defined by Bedi et al. (2005) which is characterized by clastic sediments overlain by radiolarian rich clayey, cherty limestones, marl and mudstone alternation at the base. Higher in the sequence, there are ammonoid bearing nodular limestones with tuff interlayers and subsequently "Hallstatt limestones" with abundant ammonoids and middle Upper Triassic – Lower Cretaceous neritic carbonates and calciturbidites (Fig. 3). The uppermost part of this nappe consists of Upper Cretaceous pelagic cherty limestones (Bedi et al. 2005). The middle Carnian to Norian sequences of this nappe has been measured for this study along the Köseyahya section (Fig. 3).

General Characteristics and Lithostratigraphy of the Köseyahya Section

The Köseyahya section is measured from the one of the slices of the Köseyahya nappe (Fig. 2). It is located at one km south of Köseyahya village (at L38 C2 quadrangle sheet, between 42.28.^{360}N/3.62.^{755}E and 42.28.^{484} N/3.62.^{872} E UTM coordinates). The basal part of this section is covered by slope debris, and the top is bounded by a fault (Fig. 2).

Total thickness of the section is about 118 meters and it can be subdivided into following eight units, bottom to top (Fig. 3): 5 meters of sandstone – marl alternation (unit 1), 7 meters of clayey limestone – marl – mudstone alternation (unit 2), 2.3 meters of clayey limestone with chert nodules – marl – mudstone alternation (unit 3), 1.2 meters of clastic free limestone with chert bands and nodules (unit 4), 1.15 meters of nodular limestone with tuff intercalation (unit 5), 2.9 meters of nodular limestone, marl alternation with tuff intercalation (unit 6), 4.6 meters of Hallstatt limestone (unit 7), and 94 meters of chert and clastic free limestone (unit 8). Detail lithological characteristics of this unit were presented in Tekin & Bedi (in press). Determinable radi-

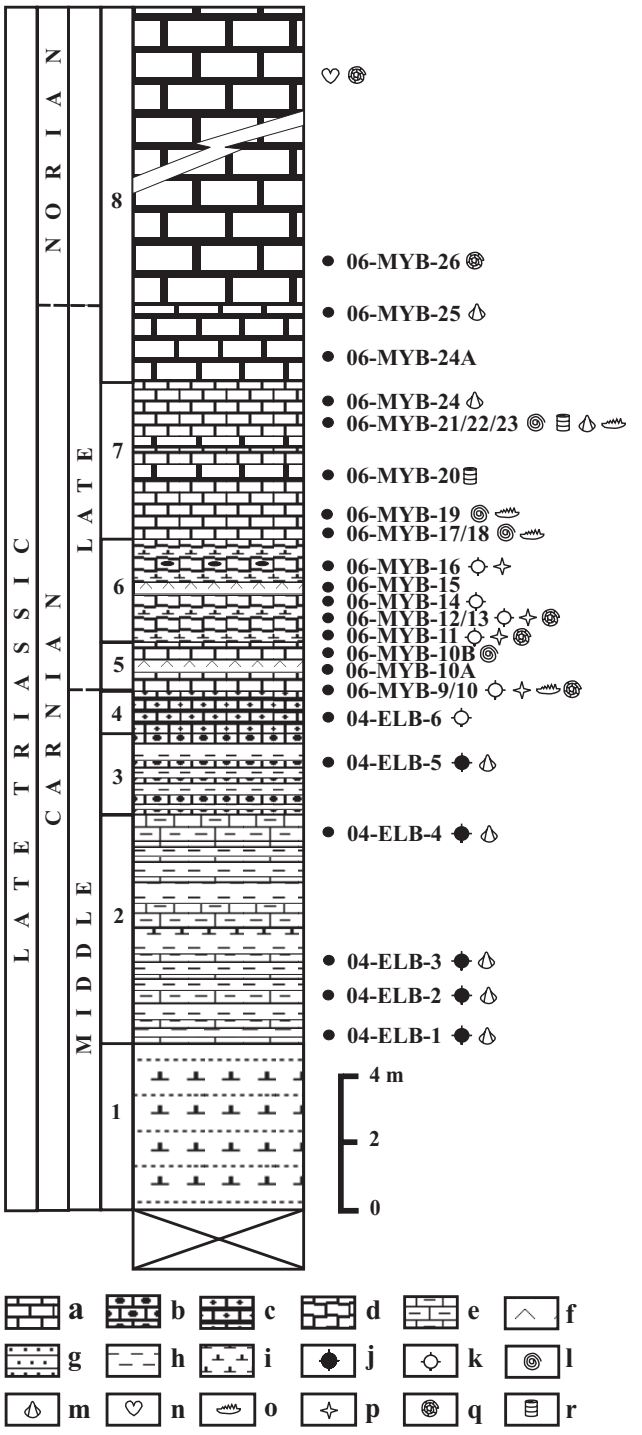


Fig. 3 - Log of the Köseyahya section. Legend: a, limestone. b, limestone with chert nodules. c, limestone with chert nodules and bands. d, nodular limestone. e, clayey limestone. f, tuff. g, sandstone. h, mudstone. i, marl. j, determinable Radiolaria. k, indeterminable Radiolaria. l, ammonoid. m, *Halobia*. n, megalodont. o, conodont. p, sponge spicule. q, foraminifera. r, crinoid.

olarians are obtained from samples taken from unit 2 and 3.

Radiolarian Fauna of the Köseyahya Section

Although 27 samples have been collected from the Köseyahya section in two field sessions (2004 and 2006), well-preserved and diverse radiolarians have been recovered only from five samples (04-ELB-1 to 04-ELB-5). Radiolarian fauna of sample 04-ELB-1 is not as abundant and diverse as that of the other samples but it contains well-preserved specimens (Fig. 4). Some of the samples (04-ELB-6, 06-MYB-9, 06-MYB-10, 06-MYB-11, 06-MYB-12, 06-MYB-13, 06-MYB-14 and 06-MYB-16) from section include remains of radiolarians, but they are not determinable due to poor preservation.

Thirty-nine taxa belonging to Nassellaria are determined and figured in this study. Fourteen species from other regions previously described are recognized in the faunas of the Köseyahya section. Among the Nassellarian faunas, nine species (*Goestlingella tueysuezi, Haeckelicyrtium planum, Hinedorcus koeseyahyaensis, Katroma*? *ornata, K.*? *proba, K.*? *tunoglui, Syringocapsa firma, S. nuda* and *Sanfilippoella carterae*) are described as new. In addition, short descriptions are also given of eleven taxa remained in open nomenclature.

Occurrence of the radiolarian taxa in the samples are shown in Fig. 4. Some taxa such as *Bulbocyritum cordevolicum* Kozur & Mostler, *Goestlingella tueysuezi* Tekin n. sp., *Pseudosaturniforma carnica* Kozur & Mostler and *Poulpus piabyx* De Wever are abundant and present in all samples. *Bulbocyrtium* sp. aff. *B. globosum* Tekin, *Hinedorcus* sp. A, *H.* sp. B, *Parapoulpus* sp. A, *Sanfilippoella* sp. A, *S.* sp. B, *Veghia*? sp. A, *Praeprotunuma* sp. A, *Tetraspinocyrtis* sp. A, *Castrum* sp. A, *Triassocyrtium* sp. aff. *T. hamatum* Kozur & Mostler and Nassellaria gen. and sp. indet. A are relatively rare.

It should be noted the presence of taxa belonging to the genus *Katroma* Pessagno & Poisson reported also from Rhaetian strata by Yeh & Cheng (1996). Species of *Katroma* have been mainly reported from Jurassic strata by Pessagno & Poisson (1981), De Wever (1982a, b), Yeh (1987), Whalen & Carter (1998). It results that *Katroma*? *ornata* n. sp., *K.* ? *proba* n. sp. and *K.* ? *tunoglui* n. sp. described from the Köseyahya section are probably the earliest representatives of this genus.

Radiolarian Taxa	04-Elb-1	04-Elb-2	04-Elb-3	04-Elb-4	04-Elb-5
Bulbocyritum cordevolicum Kozur & Mostler	X	X	X	X	X
Bulbocyrtium sp. aff. *B. globosum* Tekin		X			
Bulbocyrtium sp. cf. *B. reticulatum* Kozur & Mostler			X	X	X
Goestlingella tueysuezi Tekin n. sp.	X	X	X	X	X
Dreyercyrtium curvatum Kozur & Mostler		X		X	X
Haeckelicyrtium planum Tekin n. sp.		X			X
Haeckelicyrtium ? *spinosum* Kozur & Mostler		X	X	X	X
Spinotriassocampe carnica Kozur & Mostler		X			X
Hinedorcus koeseyahyaensis Tekin n. sp.		X	X		X
Hinedorcus sp. A				X	X
Hinedorcus ? sp. B		X			
Picapora robusta Kozur and Mostler		X	X	X	X
Picapora sp. A		X			
Silicarmiger curvatus (Kozur & Mostler)		X		X	X
Katroma ? *ornata* Tekin n. sp.				X	X
Katroma ? *proba* Tekin n. sp.		X	X	X	
Katroma ? *tunoglui* Tekin n. sp.		X		X	X
Syringocapsa firma Tekin n. sp.		X	X	X	X
Syringocapsa nuda Tekin n. sp.			X	X	X
Praeprotunuma sp. A				X	
Nabolella parvispinosa (Kozur & Mock)		X	X	X	X
Nabolella sp. A				X	X
Annulopoulpus parviaperturus (Kozur & Mostler)	X			X	X
Parapoulpus sp. A				X	
Poulpus piabyx De Wever	X	X	X	X	X
Veghia goestlingensis Kozur & Mostler		X	X	X	X
Veghia ? sp. A				X	
Pseudosaturniforma carnica Kozur & Mostler	X	X	X	X	X
Sanfilippoella carterae Tekin n. sp.		X	X		X
Sanfilippoella tortilis Kozur & Mostler		X	X	X	X
Sanfilippoella sp. A		X			
Sanfilippoella sp. B		X			
Castrum sp. aff. *C. perornatum* Blome		X			X
Castrum sp. A			X		
Castrum sp. B		X	X		X
Trialatus ? *panus* (De Wever)		X		X	X
Triassocyrtium sp. aff. *T. hamatum* Kozur & Mostler		X			
Nassellaria gen. and sp. indet. A		X			
Nassellaria gen. and sp. indet. B		X			X

Fig. 4 - Occurrence chart for the middle Carnian radiolarians from the Köseyahya section.

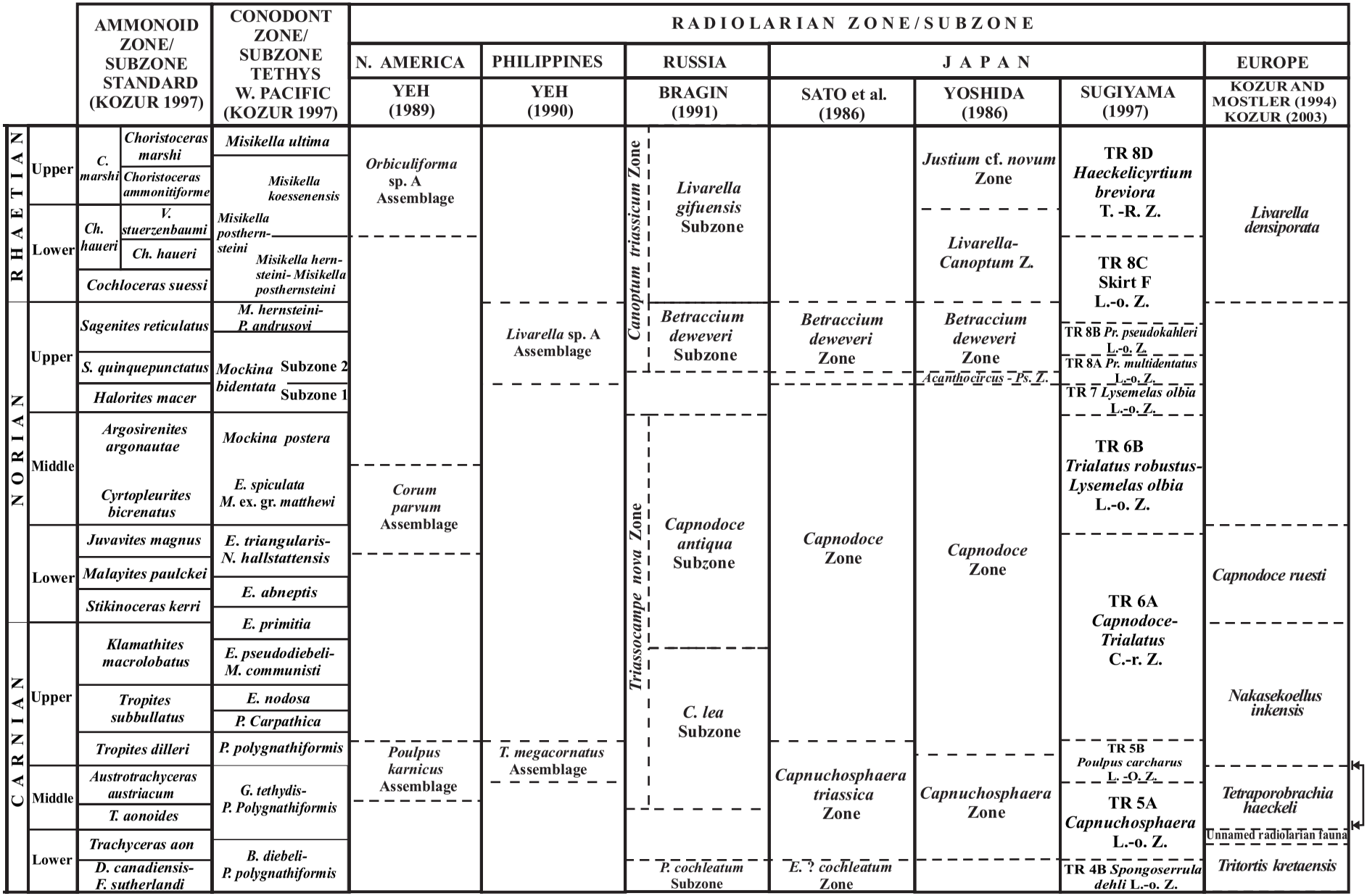


Fig. 5 - Integrated Late Triassic ammonoid, conodont and radiolarian zonations (after Sato et al. 1986; Yoshida 1986; Yeh 1989, 1990; Bragin 1991; Kozur & Mostler 1994; Sugiyama 1997; Kozur 1997, 2003). Bracket displays the approximate stratigraphic position of radiolarians from the basal part of the Köseyahya section.

Dating and Comparison of the Radiolarian Faunas

For dating the Nassellarian faunas of the Köseyahya section, we compared them to the radiolarian faunas from Grossreifling and Göstling in Austria which are well-dated based on the co-occurrence of ammonoids and conodonts (Kozur & Mostler 1979, 1981, 1994). According to Kozur & Mostler (1994), the radiolarian faunas of these two localities belong to the *Austrotrachyceras austriacum* Ammonoid Zone of the middle Carnian (Fig. 5), which corresponds to the *Gladigondolella tethydis – Paragondolella polygnathiformis* Conodont Zone and the *Tetraporobrachia haeckeli* Radiolarian Zone (Kozur & Mostler 1994).

The following species are common both in Grossreifling and Göstling from Austria and the Köseyahya section from Turkey: *Bulbocyritum cordevolicum* Kozur & Mostler, *Haeckelicyrtium*? *spinosum* Kozur & Mostler, *Spinotriassocampe carnica* Kozur & Mostler, *Picapora robusta* Kozur & Mostler, *Annulopoulpus parviaperturus* (Kozur & Mostler), *Sanfilippoella tortilis* Kozur & Mostler and *Veghia goestlingensis* Kozur & Mostler. These species are only-known from middle Carnian strata (Kozur & Mostler 1979, 1981; Tekin 1999).

Due to the occurrence of new taxa of the genera *Goestlingella* Kozur & Mostler, *Haeckelicyrtium* Kozur & Mostler, *Hinedorcus* Dumitrica, Kozur & Mostler, *Sanfilippoella* Kozur & Mostler, *Katroma* Pessagno & Poisson and *Syringocapsa* Neviani, it can be suggested that the radiolarian fauna of the Köseyahya section is slightly younger than that in Grossreifling and Göstling in Austria, but should correspond to the same radiolarian zone (Fig. 5). Furthermore, radiolarian fauna of the Köseyahya section also consists of characteristic middle Carnian Spumellaria and Entactinaria such as *Divatella spinosa* Kozur & Mostler, *Weverella tetrabrachiata tetrabrachiata* Kozur & Mostler, *Palaeosaturnalis hugluensis* Tekin and *Tetraporobrachia haeckeli* Kozur & Mostler which have been illustrated in Tekin & Bedi (2007). These taxa have also been previously reported only from middle Carnian strata in Austria and Turkey (Kozur & Mostler 1979, 1981; Tekin 1999; Tekin & Goncuoglu 2002).

According to the zonation by Sugiyama (1997), the radiolarian fauna of the Köseyahya section can be assigned to TR 5A "*Capnuchosphaera* Lowest-occurrence Zone" (Fig. 5). The co-occurrence of *Xiphotheca karpenissionensis* De Wever (in Tekin & Bedi 2007) with species of *Capnuchosphaera* De Wever is indicative of this zone. According to Sugiyama (1997), the FAD of some characteristic species of *Capnuchosphaera* such as *C. lea* De Wever, *C. theloides* De Wever and *C. tricornis* De Wever are at the base of TR 5B "*Poulpus carcharus* lowest-occurrence Zone". These taxa are present in the faunas from the Köseyahya section, but some characteristic taxa of this zone such as *Japonocampe nova* (Yao), *Xipha nodosa* Sugiyama and *Poulpus carcharus* Sugiyama are missing. Both *Xipha nodosa* Sugiyama and *Poulpus carcharus* Sugiyama have their FAD in the upper part of this zone, possibly corresponding to late Carnian according to Sugiyama (1997). Based on these facts, the fauna of the Köseyahya section corresponds to lower part of TR 5B "*Poulpus carcharus* lowest-occurrence Zone" indicating a middle Carnian age. Radiolarian faunas of the Köseyahya section are partly comparable to "*Poulpus karnicus* Assemblage" of Yeh (1989), "*Trialatus megacornatus* Assemblage" of Yeh (1990), "*Capnuchosphaera lea* subzone of *Triassocampe nova* Zone" of Bragin (1991), "*Capnuchosphaera triassica* Zone" of Sato et al. (1986) and "*Capnuchosphaera* Zone" of Yoshida (1986).

PLATE 1

Scanning electron micrographs of the Middle Carnian Nassellaria from the Köseyahya nappe. Length of scale bar = number of micrometers (μm) for each figure.

Figs. 1, 2 - *Bulbocyrtium cordevolicum* Kozur & Mostler. Fig. 1 is from sample 04-ELB-2 and fig. 2 is from sample 04-ELB-4, scale bar for both specimens= 75 μm.

Fig. 3 - *Bulbocyrtium* sp. aff. *B. globosum* Tekin. Sample 04-ELB-2, scale bar = 90 μm.

Fig. 4 - *Bulbocyrtium* sp. cf. *B. reticulatum* Kozur & Mostler. Sample 04-ELB-5, scale bar = 95 μm.

Figs. 5, 6, 7, 8 - *Goestlingella tueysuezi* Tekin n. sp. 5. Holotype. Sample 04-ELB-2. 6-8 Paratypes. Fig. 6 is from sample 04-ELB-4, side view. Fig. 7 is from sample 04-ELB-5, side view. Fig. 8 is from sample 04-ELB-2, view from apical side, scale bar for all figures = 100 μm.

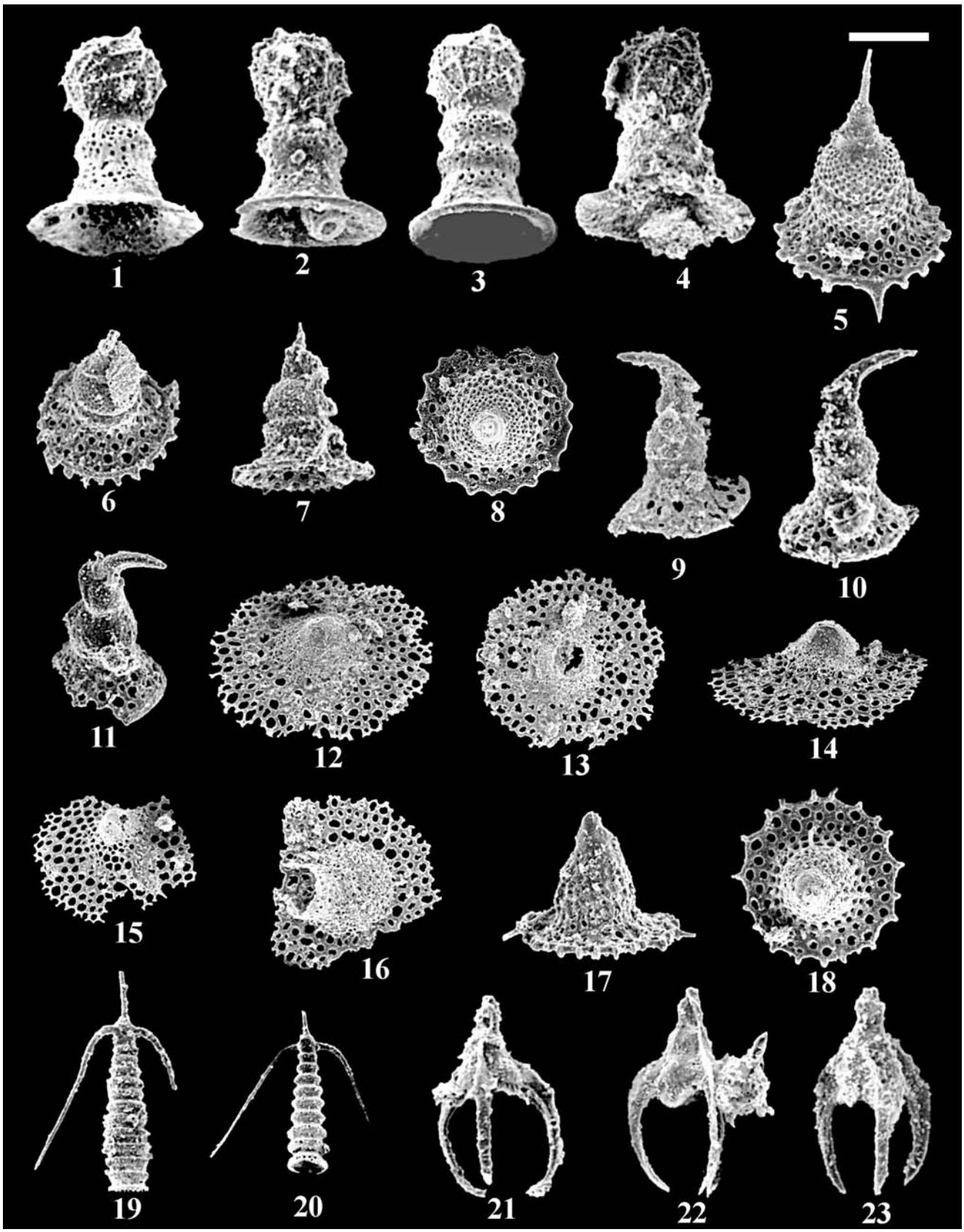
Figs. 9, 10, 11 - *Deflandrecyrtium curvatum* (Kozur & Mostler). All figures are from sample 04-ELB-5, scale bar for all figures = 100 μm.

Figs. 12, 13, 14, 15, 16 - *Haeckelicyrtium planum* Tekin n. sp. 12. Holotype. Sample 04-ELB-5, side view. 13-16. Paratypes. Fig. 13 is from sample 04-ELB-2, view from apical side. Fig. 14 is from sample 04-ELB-5, side view. Fig. 15 is from sample 04-ELB-5, view from apical side. Fig. 16 is from sample 04-ELB-5, view from aperture, scale bar for all figures = 220 μm.

Figs. 17, 18 - *Haeckelicyrtium*? *spinosum* Kozur & Mostler. Fig. 17 is from sample 04-ELB-5 and fig. 18 is from sample 04-ELB-2, scale bar for both figures = 130 μm.

Figs. 19, 20 - *Spinotriassocampe carnica* Kozur & Mostler. Fig. 19 is from sample 04-ELB-5 and fig. 20 is from sample 04-ELB-2, scale bar for both figures = 140 μm.

Figs. 21, 22, 23 - *Hinedorcus koeseyahyaensis* Tekin n. sp. 21. Holotype, sample 04-ELB-5. 22-23. Paratypes. Fig. 22 is from sample 04-ELB-2 and fig. 23 is from sample 04-ELB-5, scale bar for all figures = 80 μm.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Furthermore, the ammonoid species *Tropites* cf. *subbulatus*, (det. by Leopold Krystyn, Vienna, Austria) found in the sample 06-MYB-10B, in the unit 5 (Fig. 3), indicates a middle Late Carnian age (Fig. 5) for unit 5. Based on this fact, it can be suggested that the age of the underlying radiolarian bearing levels (units 2 & 3) are middle Carnian in age.

Repository

Holotypes and some of paratypes are housed at Palaeontology Laboratory of Geological Engineering Department, Hacettepe University, Ankara (Turkey) with catalogue number from HU.JMB.0058 to HU.JMB.0090.

Systematic Palaeontology

Nassellarian taxonomy follows the classifications of Pessagno (1969), Foreman (1973), Kozur & Mostler (1979, 1981), Dumitrica, Kozur & Mostler (1980), Kozur (1984) and mainly De Wever et al. (2001). For the measurements of taxa, following abbreviations are used: HT: Holotype, Min.: Minimum, Max.: Maximum and Av.: Average.

Phylum **Protozoa**

Subclass **Radiolaria** Müller, 1858

Order **Polycystina** Ehrenberg,1875

Suborder **Nassellariina** Ehrenberg, 1875

Family Bulbocyrtidae Kozur & Mostler, 1981

Genus *Bulbocyrtium* Kozur & Mostler, 1981 emend. Tekin, 1999

Type species: *Bulbocyrtium reticulatum* Kozur & Mostler, 1981.

Bulbocyrtium cordevolicum Kozur & Mostler, 1981

Pl. 1, figs 1, 2

1981 *Bulbocyrtium cordevolicum* Kozur & Mostler, p. 107, pl. 11, fig. 2; pl. 13, fig. 1.

Range. Middle Carnian.

Occurrence. Göstling, Austria; Köseyahya nappe, Elbistan, southeastern Turkey.

Bulbocyrtium sp. aff. **B. globosum** Tekin, 1999

Pl. 1, fig. 3

aff. 1999 *Bulbocyrtium globosum* Tekin, p. 135, pl. 28, figs 3-4.

Remarks. This specimen differs from the *Bulbocyrtium globosum* Tekin by having a smaller cephalis, two segmented thorax and wider, brimmed distal end.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Bulbocyrtium sp. cf. **B. reticulatum** Kozur & Mostler, 1981

Pl. 1, fig. 4

cf. 1981 *Bulbocyrtium reticulatum* Kozur & Mostler, pp. 106-107, pl. 11, fig. 1.

cf. 1999 *Bulbocyrtium reticulatum* - Tekin, p. 136, pl. 28, figs 6-7.

cf. 2000 *Bulbocyrtium reticulatum* - Carter & Orchard, pl. 2, fig. 3.

Remarks. Our specimen is similar to the holotype of *Bulbocyrtium reticulatum* Kozur & Mostler, but our specimen is not well-preserved and the former can be differentiated from the latter by having more irregular polygonal pore frames on the cephalis.

Range. Middle Carnian.

Occurrence. Grossreifling, Austria; Queen Charlotte Islands, British Columbia; Kemer, Antalya and Köseyahya nappe, Elbistan, Turkey.

Family Cuniculiformidae De Wever, 1982a, emend. Dumitrica *in* De Wever et al., 2001

Genus *Goestlingella* Kozur & Mostler, 1979

Type species: *Goestlingella cordevolica* Kozur & Mostler, 1979.

Goestlingella tueysuezi Tekin n. sp.

Pl. 1, figs 5 - 8

Etymology. This species is dedicated to Prof. Dr. Okan Tüysüz, Istanbul Technical University, Istanbul in honour of his great contributions to the knowledge of Turkish geology.

Types. Holotype, HU.JMB.0058 (Pl. 1, Fig. 5); paratypes, HU.JMB.0059 (Pl. 1, Fig. 6), HU.JMB.0060 (Pl. 1, Fig. 7), HU.JMB.0061 (Pl. 1, Fig. 8).

Type locality. One km south of Köseyahya village, east of Elbistan town, southeastern Turkey.

Description. Tetracyrtid test approximately bell-shaped with post-abdominal skirt. Cephalis subconical, mainly poreless with thin, long, needle-like, pointed apical horn. Ventral spine short, needle-like and pointed. Collar stricture not prominent represented by a very shallow depression. Thorax much bigger than cephalis, subspherical with net-like, hexagonal pore frames and subcircular pores that become wider distally. Small nodes present at pore frame vertices. Lumbar stricture more prominent than collar stricture, characterized by narrow, deep, poreless stricture. Abdomen short with same pore frames as thorax. Abdomen flaring to broad post-abdominal skirt possessing net-like pore frames with subspherical to subelliptical, mainly larger pores, slightly increasing in size distally. Distalmost part

of post-abdominal skirts with small, triangular projections, nine to ten visible on one side of test.

Remarks. *Goestlingella tueysuezi* Tekin n. sp. can be differentiated from *G. subsphaerica* Kozur & Mostler, 1981 by having a smaller size of test, longer and thinner apical horn, distally much broader thorax, less broader abdomen and triangular projections at the periphery of post-abdominal skirt. It differs from *Goestlingella cordevolica* Kozur & Mostler, 1979 by possessing a shorter test, less wider thorax, larger pores on the post-abdominal skirt and triangular projections at the periphery of post-abdominal skirt.

Measurements (μm). (Based on four specimens)

	HT	Min.	Max.	Av.
Length of test (excluding horn)	180	171	180	176
Width of distal end	220	190	226	207

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Family Deflandrecyrtiidae Kozur & Mostler, 1979

Genus *Deflandrecyrtium* Kozur & Mostler, 1979

Type species: *Deflandrecyrtium popofskyi* Kozur & Mostler, 1979.

Deflandrecyrtium curvatum (Kozur & Mostler, 1979)

Pl. 1, figs 9 - 11

1979 *Dreyercyrtium curvatum* Kozur & Mostler, p. 97, pl. 13, fig. 9.

1981 *Deflandrecyrtium curvatum* (Kozur & Mostler) - Kozur & Mostler, p. 89, pl. 34, fig. 2; pl. 35, fig. 1.

1999 *Deflandrecyrtium curvatum* - Tekin, p. 140, pl. 30, fig. 3.

Range. Middle Carnian - early Norian.

Occurrence. Göstling, Austria; Kemer, Antalya and Köseyahya nappe, Elbistan, Turkey.

Genus *Haeckelicyrtium* Kozur & Mostler, 1979

Type species: *Haeckelicyrtium austriacum* Kozur & Mostler, 1979

Haeckelicyrtium planum Tekin n. sp.

Pl. 1, figs 12 - 16

Etymology. Planum (Latin, adj.), flat, plain.

Types. Holotype, HU.JMB.0062 (Pl. 1, Fig. 12); paratypes, HU.JMB.0063 (Pl. 1, Fig. 13), HU.JMB.0064 (Pl. 1, Fig. 14), HU.JMB.0065 (Pl. 1, Fig. 15), HU.JMB.0066 (Pl. 1, Fig. 16).

Type locality. One km south of Köseyahya village, east of Elbistan town, southeastern Turkey.

Description. Cephalis small, hemispherical and mainly poreless without horn. Both collar and lumbar strictures indistinct only marked by very shallow depressions. Thorax wider than cephalis, bonnet-shaped with irregularly arranged small pores. Abdomen short with small and scattered pores. Abdominal skirt nearly flat, very wide, subcircular to subellipsoidal in outline with six to seven rows of pores. Pores on proximal part of abdominal skirt small, subcircular to subelliptical, medium to big pores present at medial and distal parts of abdominal skirt. Distal end of the abdominal skirt not brimmed. Aperture large, mainly covered by a convex cap with scattered, circular to subelliptical pores (pl. 1, fig. 16). A circular opening present at one side of the apertural cap.

Remarks. *Haeckelicyrtium planum* Tekin n. sp. differs from both *H. austriacum* Kozur & Mostler, 1979 and *H.? spinosum* Kozur & Mostler, 1979 by having a very short proximal part (cephalis, thorax and abdomen), subelliptical, much wider abdominal skirt and presence of an apertural cap.

Measurements (μm). (Based on five specimens)

	HT	Min.	Max.	Av.
Length of test	120	120	143	132
Width of distal end	620	532	620	569

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Haeckelicyrtium? spinosum Kozur & Mostler, 1979

Pl. 1, figs 17, 18

1979 *Haeckelicyrtium? spinosum* Kozur & Mostler, p. 99, pl. 18, fig. 4.

Range. Middle Carnian.

Occurrence. Göstling, Austria; Köseyahya nappe, Elbistan, southeastern Turkey.

Family Planispinocyrtiidae Kozur & Mostler, 1981

Genus *Spinotriassocampe* Kozur, 1984

Type species: *Spinotriassocampe hungarica* Kozur, 1984.

Spinotriassocampe carnica Kozur & Mostler, 1994

Pl. 1, figs 19, 20

1994 *Spinotriassocampe carnica* Kozur & Mostler, p. 105, pl. 26, fig. 7.

non 1997 *Spinotriassocampe carnica* - Sugiyama, p. 187, fig. 49-3 (?= *S. longobardica* Kozur & Mostler).

1999 *Spinotriassocampe carnica* - Tekin, p. 151, pl. 34, fig. 4.

Range. Middle Carnian.

Occurrence. Sosio Valley, Sicily, Italy; Huglu unit, Beysehir - Hoyran nappe, Bozkir and Köseyahya nappe, Elbistan, Turkey.

Family Ultranaporidae Pessagno, 1977

Genus *Hinedorcus* Dumitrica, Kozur & Mostler, 1980

Type species: *Hinedorcus alatus* Dumitrica, Kozur & Mostler, 1980

Hinedorcus koeseyahyaensis Tekin n. sp.

Pl. 1, figs 21 - 23

Etymology. The species is named after the type locality, Köseyahya village of Elbistan town.

Types. Holotype, HU.JMB.0067 (Pl. 1, Fig. 21); paratypes, HU.JMB.0068 (Pl. 1, Fig. 22), HU.JMB.0069 (Pl. 1, Fig. 23).

Type locality. One km south of Köseyahya village, east of Elbistan town, southeastern Turkey.

Description. Shell dicyrtid. Cephalis mainly poreless, sometimes with rare, scattered, small pores, hemispherical to dome-shaped with robust apical horn. Apical horn sinistrially twisted, triradiate with thin ridges and deep, wide furrows. Collar stricture marked by a shallow depression. Thorax pyramidal, mainly poreless with undulation at basal part. Three long feet run from thorax, and curved inwardly at the distal part. Feet triradiate with thin ridges and wide, deep furrows, thick at the base and gradually decreasing in width distally.

Remarks. *Hinedorcus koeseyahyaensis* Tekin n. sp. is differentiated from *Hinedorcus alatus* Dumitrica, Kozur & Mostler, 1980 in possessing a twisted apical horn, much bigger cephalis, poreless thorax and longer feet. It differs from *Sanfilippoella lengeranlii* Tekin, 1999 by having a test without lateral horn and velum at the end. It can be differentiated from *Hinedorcus* sp. A in possessing a twisted and shorter apical horn, less prominent lateral horn, shorter and poreless thorax and poreless ridges on feet.

Measurements (μm). (Based on four specimens)

	HT	Min.	Max.	Av.
Length of test (excl. horn and feet)	67	67	86	74
Length of feet	113	113	128	121
Width of thorax	67	64	71	67

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Hinedorcus sp. A

Pl. 2, fig. 1

Description. Test dicyrtid with three long feet. Cephalis small, hemispherical and poreless with short, triradiate lateral horn and proximally wide, solid, distally triradiate, and long apical horn. Thorax pyramidal, sparsely porous with long, slightly inwardly curved triradiate feet. Ridges on the feet sparsely porous. Aperture large and subcircular.

Remarks. This form differs from *Hinedorcus gibber* Tekin, 1999 by possessing a wide, solid, distally triradiate, long apical horn, more prominent ventral horn, longer feet with pores on the ridges. It is compared to *Hinedorcus koeseyahyaensis* Tekin n. sp. under latter species.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Hinedorcus? sp. B

Pl. 2, fig. 2

Description. Test dicyrtid with velum at the end of test. Cephalis small, hemispherical, porous with small, proximally wide, medially triradiate, distally needle-like lateral spine and long and proximally wide, solid, distally triradiate apical horn. Thorax subspherical, porous with three, long, and triradiate feet. Ridges on

PLATE 2

Scanning electron micrographs of the Middle Carnian Nassellaria from the Köseyahya nappe. Length of scale bar = number of micrometers (μm) for each figure.

Fig. 1 - *Hinedorcus* sp. A. Sample 04-ELB-4, scale bar = 90 μm.

Fig. 2 - *Hinedorcus* sp. B. Sample 04-ELB-2, scale bar = 115 μm.

Figs. 3, 4, 5 - *Picapora robusta* Kozur & Mostler. Fig. 3 is from sample 04-ELB-3 and figs. 4 and 5 are from sample 04-ELB-5, scale bar for all figures = 110 μm.

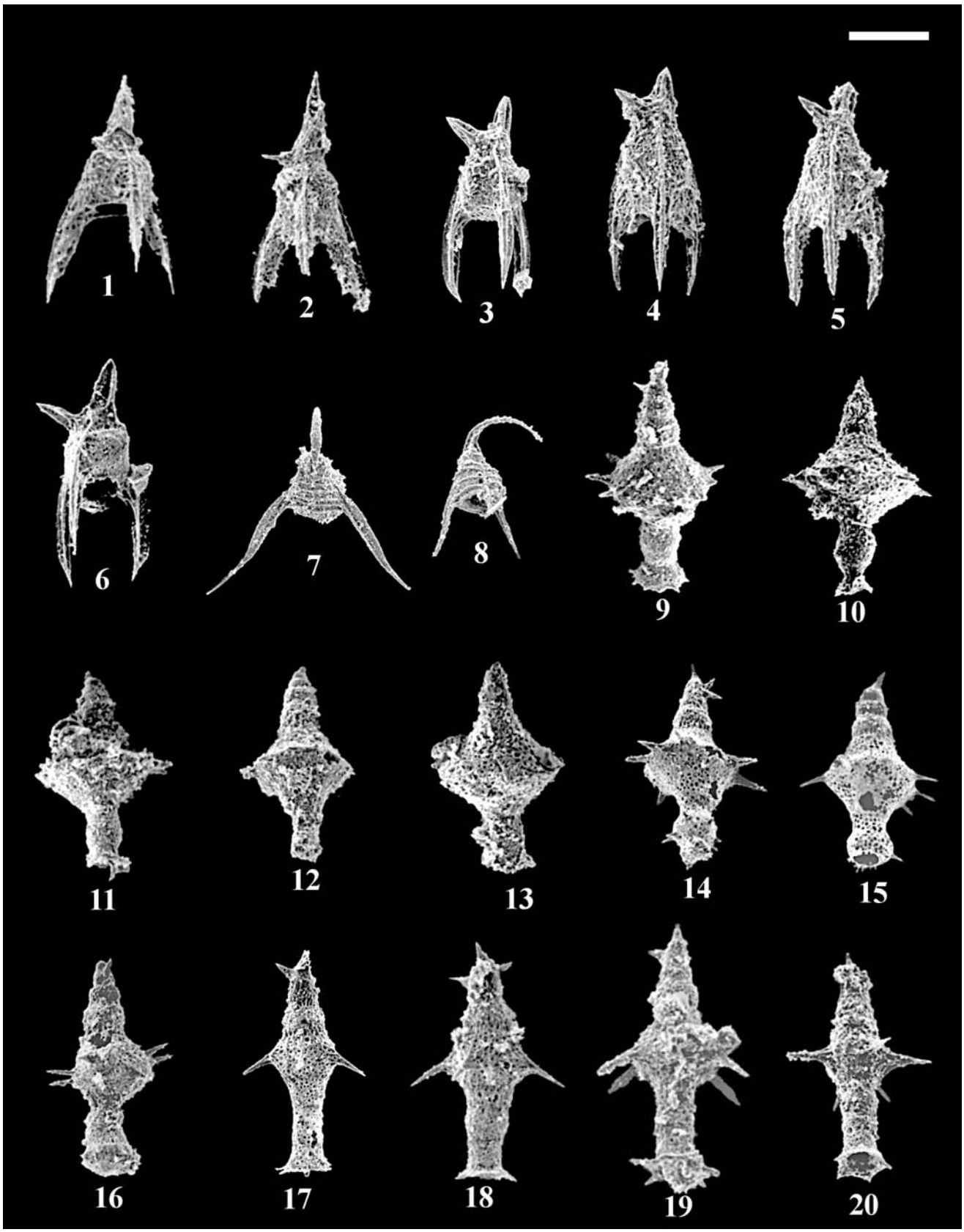
Fig. 6 - *Picapora* sp. A. Sample 04-ELB-2, scale bar = 95 μm.

Figs. 7, 8 - *Silicarmiger curvatus* (Kozur & Mostler). Fig. 7 is from sample 04-ELB-5 and fig. 8 is from sample 04-ELB-4, scale bar for both figures = 190 μm.

Figs. 9, 10, 11, 12, 13 - *Katroma* ? *ornata* Tekin n. sp. 9. Holotype, sample 04-ELB-4. 10-13. Paratypes. Fig. 10 is from sample 04-ELB-5 and figs. 11, 12, 13 are from sample 04-ELB-4, scale bar for all figures = 120 μm.

Figs. 14, 15, 16 - *Katroma*? *proba* Tekin n. sp. 14. Holotype, sample 04-ELB-2. 15-16 Paratypes. Fig. 15 is from sample 04-ELB-2 and fig. 16 is from sample 04-ELB-4, scale bar for all figures = 120 μm.

Figs. 17, 18, 19, 20 - *Katroma? tunoglui* Tekin n. sp. 17. Holotype, sample 04-ELB-2. 18-20 Paratypes. Fig. 18 is from sample 04-ELB-2 and figs. 19, 20 are from sample 04-ELB-5, scale bar for all figures = 120 μm.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

the feet porous. Porous velum present at the end of test between feet.

Remarks. It can be differentiated all species of *Hinedorcus* Dumitrica, Kozur & Mostler by possessing a velum at the end of test. Due to the presence of velum, it is presumably assigned to *Hinedorcus* Dumitrica, Kozur & Mostler.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Genus *Picapora* Kozur & Mostler, 1981

Type species: *Picapora robusta* Kozur & Mostler, 1981

Picapora robusta Kozur & Mostler, 1981

Pl. 2, figs 3 - 5

1981 *Picapora robusta* Kozur & Mostler, p. 110, pl. 7, figs 1, 2.
1999 *Picapora robusta* - Tekin, pp. 147-148, pl. 32, figs 8, 9.

Range. Middle Carnian.

Occurrence. Göstling, Grossreifling, Austria; Huglu unit, Beysehir-Hoyran nappe, Bozkir, Konya and Köseyahya nappe, Elbistan, Turkey.

Picapora sp. A

Pl. 2, fig. 6

Description. Test dicyrtid. Cephalis small and hemispherical with irregular, subcircular to subelliptical pores in different sizes. Apical horn stout and triradiate with thin ridges and wide furrows. Lateral horn smaller than the apical horn, triradiate. Collar stricture very distinct, marked by relatively deep depression. Thorax larger than the cephalis, truncated pyramidal in outline with sharp edges. Irregular, subcircular pores present at the surface of thorax. Feet mainly long, slender, triradiate and slightly inwardly curved distally.

Remarks. This specimen differs from *Picapora robusta* Kozur & Mostler, 1981 by possessing a distinct collar stricture and truncated pyramidal thorax with sharp edges.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Genus *Silicarmiger* Dumitrica, Kozur & Mostler, 1980

Type species: *Silicarmiger costatus* Dumitrica, Kozur & Mostler, 1980

Silicarmiger curvatus (Kozur & Mostler, 1979)

Pl. 2, figs 7, 8

1979 *Eonapora curvata* Kozur & Mostler, pp. 90-91, pl. 13, fig. 5.
1984 *Silicarmiger curvatus* (Kozur & Mostler) - Kozur, p. 63, pl. 4, fig. 3.
1994 *Silicarmiger curvatus* - Kozur & Mostler, p. 119, pl. 33, figs 11, 12, 14.
1999 *Silicarmiger curvatus* - Tekin, p. 162, pl. 38, figs 12-13.

Range. Late Ladinian - early Norian.

Occurrence. Grossreifling, Austria; Koveskal, Hungary; Alakircay nappe, Antalya nappes, Kemer, Antalya and Köseyahya nappe, Elbistan, Turkey.

Family Syringocapsidae Foreman, 1973

Genus *Katroma* Pessagno & Poisson, 1981 emend. De Wever, 1982a, emend. Whalen & Carter, 1998

Type species: *Katroma neagui* Pessagno & Poisson, 1981

Remarks. According to Pessagno & Poisson (1981), *Katroma* can be differentiated from *Podobursa* by having an open tube at the end of post-abdominal chamber. However, De Wever (1982a, b) suggested that most of the species of the *Katroma* include closed tubes. It results that the terminal structure of the tube is not an important character to differentiate *Katroma* from *Podobursa*. In this situation, *Katroma* differs from *Podobursa* by having branched apical spines and lateral spines. The specimens belonging to the three new species (*K.* ? *ornata*, *K.*? *proba* and *K.*? *tunoglui*) described in this study do not contain branched apical spines, but have prominent lateral spine/spines. Because of this fact, they resemble to *Katroma* and are tentatively assigned to it.

Katroma? ornata Tekin n. sp.

Pl. 2, figs 9 - 13

Etymology. Ornata (Latin, adj.), ornate.

Types. Holotype, HU.JMB.0070 (Pl. 2, Fig. 9); paratypes, HU.JMB.0071 (Pl. 2, Fig. 10), HU.JMB.0072 (Pl. 2, Fig. 11), HU.JMB.0073 (Pl. 2, Fig. 12), HU.JMB.0074 (Pl. 2, Fig. 13).

Type locality. One km south of Köseyahya village, east of Elbistan town, southeastern Turkey.

Description. Test composed of four segments and a tube at the distal end. Cephalis hemispherical, mainly poreless with short, inclined apical horn and ventral horn. Thorax subtrapezoidal in outline with polygonal pore frames and subcircular to subelliptical pores. Collar and lumbar strictures less distinct and marked by only shallow depressions. Abdomen wider than thorax, barrel to subtrapezoidal in outline with same pore frames as thorax. Post-abdominal segment inflated, much larger than the previous chambers and ellipsoidal in outline with slightly sharp edge at medial part. It possesses polygonal (tetragonal to hexagonal) pore frames with very small nodes at pore frame vertices and triradiate, pointed, short to moderately long spines,

seven or eight of them visible at one side of the test, at the medial part. Tube at the end of test barrel-shaped with widened distal end. It possesses same pore styles as post-abdominal segment and bears small, triangular spines, six visible at one side of test on the distal border.

Remarks. *Katroma*? *ornata* Tekin n. sp. differs from *Podobursa galeata* Tekin, 1999 by possessing shorter test, ventral horn, barrel-shaped tube with widened distal end and triangular projections. It can be differentiated from the Liassic species *Katroma bicornus* De Wever, 1982a in having a single apical spine, less distinct ventral spine, longer proximal part (cephalis to abdomen), irregular and smaller pores on test, more and shorter medial spines on post-abdominal segment, broader and distally expanding tube with small triangular spines. It can also be distinguished from *Katroma*? *proba* Tekin n. sp. by having longer test, more and shorter medial spines on post-abdominal segment and distally expanding tube with regularly arranged triangular distal projections. It is also differentiated from *Katroma* ? *tunoglui* Tekin n. sp. in possessing fewer lateral horns, much inflated post-abdominal segment, more and shorter medial spines on post-abdominal segment, shorter tube with more and shorter distal projections.

Measurements (μm). (Based on seven specimens)

	HT	Min.	Max.	Av.
Length of test (excluding horn)	333	269	350	307
Max. width of test	155	146	182	161

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Katroma? proba Tekin n. sp.

Pl. 2, figs 14 - 16

Etymology. Proba (Latin, adj.), good, excellent.

Types. Holotype, HU.JMB.0075 (Pl. 2, Fig. 14); paratypes, HU.JMB.0076 (Pl. 2, Fig. 15), HU.JMB.0077 (Pl. 2, Fig. 16).

Type locality. One km south of Köseyahya village, east of Elbistan town, southeastern Turkey.

Description. Test with four segments and tube at distal end. Cephalis hemispherical, mainly poreless with inclined, rudimentary apical horn and two prominent lateral horns. Thorax and abdomen hoop-like. They possess polygonal (tetragonal to hexagonal) pore frames with small to medium sized subcircular to subelliptical pores. Collar and lumbar strictures marked by shallow depressions. Test gradually increasing in width up to abdomen. Post-abdominal segment much larger than the previous segments. It is ellipsoidal in outline with slightly acute edge at the medial part which bears six, long, triradiate spines perpendicular to main axis on the half of the perimeter. Post-abdominal segment possesses polygonal (trigonal to hexagonal) pore frames with subcircular to elliptical pores of different sizes and small nodes at pore frame vertices. Tube has long constriction at the proximal part then become bulbous. It possesses same pore frames as abdomen and usually five small to moderately long, irregularly arranged, triradiate, pointed spines visible on one side.

Remarks. *Katroma*? *proba* Tekin n. sp. differs from *Podobursa galeata* Tekin, 1999 by possessing shorter test, two prominent lateral horns and medially inflated tube with distal spines. It differs from the Liassic species *Katroma kurusuensis* Hori, 1988 by having an apical spine without branches, well-separated and broader proximal part (cephalis to abdomen), fewer and longer medial spines on post-abdominal segment and slightly bulbous tube with smaller pores. It is compared to *Katroma*? *ornata* Tekin n. sp. under the latter species. It differs also from *Katroma*? *tunoglui* Tekin n. sp. by having fewer lateral spines, much inflated post-abdominal segment, more and shorter medial spines and shorter, distally bulbous tube with irregular spines.

Measurements (μm). (Based on four specimens)

	HT	Min.	Max.	Av.
Length of test (excluding horn)	271	267	278	272
Max. width of test	136	128	142	135

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Katroma? tunoglui Tekin n. sp.

Pl. 2, figs 17 - 20

Etymology. This species is dedicated to Prof. Dr. Cemal Tunoglu, Hacettepe University, Ankara in honour of his contributions to the study of Tertiary Ostracoda biostratigraphy.

Types. Holotype, HU.JMB.0078 (Pl. 2, Fig. 17); paratypes, HU.JMB.0079 (Pl. 2, Fig. 18), HU.JMB.0080 (Pl. 2, Fig. 19), HU.JMB.0081 (Pl. 2, Fig. 20).

Type locality. One km south of Köseyahya village, east of Elbistan town, southeastern Turkey.

Description. Test long with four segments and long tube. Cephalis hemispherical with rare scattered pores, triradiate, short apical horn, and three lateral spines in the prolongations of 2l and V. Thorax and abdomen subtrapezoidal in outline with polygonal (trigonal to hexagonal) pore frames and subcircular to subelliptical pores and small nodes at pore frame vertices. Collar stricture less distinct but lumbar stricture more prominent and marked by a relatively deep depression. Post-abdominal segment broader than previous seg-

ments, subellipsoidal in outline with three or four, long, inclined, triradiate and pointed medial spines on one side of the test. Tube at the end of test long, slightly decreasing in width at medial part than slightly expanding distally. Both post-abdominal segment and tube with same pore frames as abdomen. Distal end of tube expanded with six, thorn-like, triangular projections.

Remarks. *Katroma*? *tunoglui* Tekin n. sp. differs from *Podobursa turriformis* Tekin, 1999 by possessing a shorter test, less prominent apical horn, three lateral horns on cephalis, inclined medial spines on post-abdominal segment and tube with thorn-like projections. It differs also from the Liassic species *Katroma bicornus* De Wever, 1982a by having a simple apical spine, less distinct lateral horns, separated and longer proximal part (cephalis to abdomen), irregular pore frames on test, less bulbous post-abdominal segment, and distally expanding tube with small, triangular projections. It is compared to *Katroma*? *ornata* Tekin n. sp. and *K. proba* Tekin n. sp. under the latter species.

Measurements (μm). (Based on five specimens)

	HT	Min.	Max.	Av.
Length of test (excluding horn)	300	300	344	319
Max. width of test	92	91	120	103

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Genus *Syringocapsa* Neviani, 1900

Type species: *Theosyringium robustum* Vinassa, 1901.

Syringocapsa firma Tekin n. sp.

Pl. 3, figs 1 - 3

Etymology. Firma (Latin, adj.) - strong, firm.

Types. Holotype, HU.JMB.0082 (Pl. 3, Fig. 1); paratypes, HU.JMB.0083 (Pl. 3, Fig. 2), HU.JMB.0084 (Pl. 3, Fig. 3).

Type locality. One km south of Köseyahya village, east of Elbistan town, southeastern Turkey.

Description. Test with four segments with long, thin tube. Cephalis hemispherical with rudimentary, pointed and needle-like horn. Thorax and abdomen subtrapezoidal in outline. Proximal part (cephalis to abdomen) overall broadly conical, mainly poreless or with rare, scattered pores. Lumbar and collar strictures indistinct. Post-abdominal segment bulbous, subspherical to subellipsoidal with four, very short, triradiate, medial spines visible on one side. It consists of irregular, polygonal (trigonal to hexagonal) pore frames with subcircular to subelliptical pores of different sizes and small nodes at pore frame vertices. Tube long, slightly narrowing distally with scattered pores of different sizes.

Remarks. *Syringocapsa firma* Tekin n. sp. differs from *Syringocapsa batodes* De Wever *in* De Wever et al., 1979 in having apical horn, much longer and less wide post-abdominal segment, irregular pore frames, and smaller pores of different sizes. It differs also from *Podobursa yazgani* Tekin, 1999 by possessing shorter test, less prominent apical horn, less bulbous post-abdominal segment with rudimentary medial spines, less wide and longer tube and no triangular projections. It differs from *Syringocapsa nuda* Tekin n. sp. by having longer test, subspherical to subelliptical, large pores on the post-abdominal segment, medial spines and wider tube.

PLATE 3

Scanning electron micrographs of the Middle Carnian Nassellaria from the Köseyahya nappe.
Length of scale bar = number of micrometers (μm) for each figure.

Figs. 1, 2, 3 - *Syringocapsa firma* Tekin n. sp. 1. Holotype, sample 04-ELB-2. 2-3 Paratypes. Fig. 2 is from sample 04-ELB-3 and fig. 3 is from sample 04-ELB-2, scale bar for all figures = 90 μm.

Figs. 4, 5, 6 - *Syringocapsa nuda* Tekin n. sp. 4. Holotype, sample 04-ELB-4. 5-6 Paratypes. Fig. 5 is from sample 04-ELB-3 and fig. 6 is from sample 04-ELB-4, scale bar for all figures = 70 μm.

Fig. 7 - *Praeprotunuma* sp. A. Sample 04-ELB-4, scale bar = 65 μm.

Figs. 8, 9, 10 - *Nabolella parvispinosa* (Kozur & Mock). Fig. 8 is from sample 04-ELB-2, fig. 9 is from sample 04-ELB-5 and fig. 10 is from sample 04-ELB- 3, scale bar for all figures = 130 μm.

Figs. 11, 12 - *Nabolella* sp. A. Fig. 11 is from sample 04-ELB-4 and fig. 12 is from sample 04-ELB-5, scale bar for both figures = 130 μm.

Figs. 13, 14 - *Annulopoulpus parviaperturus* (Kozur & Mostler). Fig. 13 is from sample 04-ELB-5 and fig. 14 is from sample 04-ELB-4, scale bar for both figures = 110 μm.

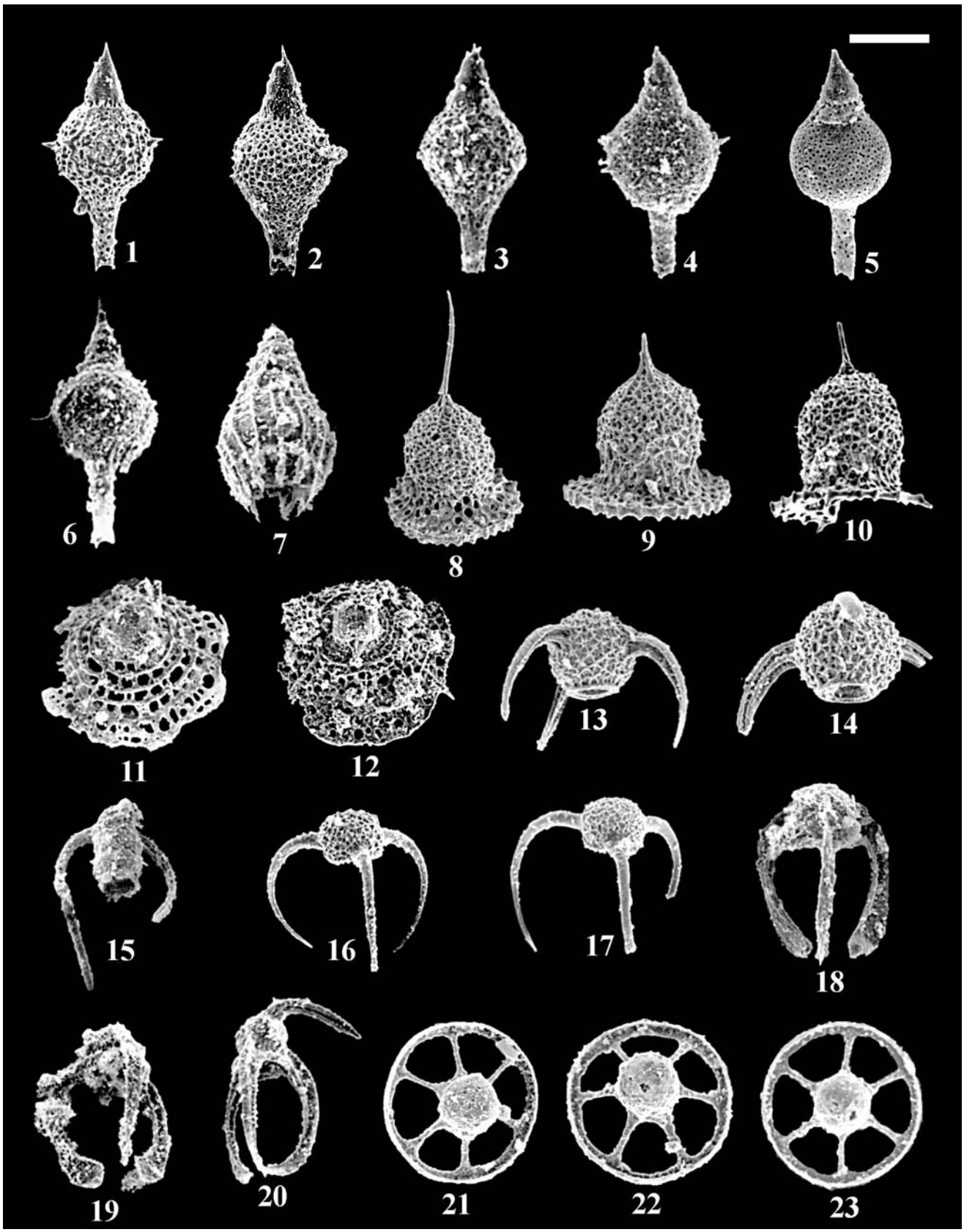
Fig. 15 - *Parapoulpus* sp. A. Sample 04-ELB-4, scale bar = 150 μm.

Figs. 16, 17 - *Poulpus piabyx* De Wever. Both figures are from sample 04-ELB-2, scale bar for both figures = 150 μm.

Figs. 18, 19 - *Veghia goestlingensis* Kozur & Mostler. Fig. 18 is from sample 04-ELB-5 and fig. 19 is from sample 04-ELB-3, scale bar for both figures = 90 μm.

Fig. 20 - *Veghia*? sp. A. Sample 04-ELB-4, scale bar = 95 μm.

Figs. 21, 22, 23 - *Pseudosaturniforma carnica* Kozur & Mostler. Figs. 21 and 22 are from sample 04-ELB-3, and fig. 23 is from sample 04-ELB-5, scale bar for all figures = 100 μm.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Measurements (μm). (Based on four specimens)

	HT	Min.	Max.	Av.
Length of test (excluding horn)	269	218	269	240
Max. width of test	118	106	135	119

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Syringocapsa nuda Tekin n. sp.

Pl. 3, figs 4 - 6

Etymology. Nuda (Latin, adj.), naked, bare.

Types. Holotype, HU.JMB.0085 (Pl. 3, Fig. 4); paratypes, HU.JMB.0086 (Pl. 3, Fig. 5), HU.JMB.0087 (Pl. 3, Fig. 6).

Type locality. One km south of Köseyahya village, east of Elbistan town, southeastern Turkey.

Description. Cephalis hemispherical, poreless with very short apical spine. Collar stricture indistinct. Thorax subtrapezoidal in outline, poreless. Lumbar stricture more distinct than collar stricture, with a row of circular pores, when not covered by microgranular silica (pl. 3, fig. 5). Abdomen also subtrapezoidal in outline with rare scattered pores. Post-abdominal segment bulbous with small polygonal (trigonal to hexagonal) pore frames and small, commonly circular to subcircular pores. On medial part, it has three, short spines visible on one side. Tube at the end of the test slender, uniform in width, circular in axial section with small, scattered pores. End of tube without projections.

Remarks. *Syringocapsa nuda* Tekin n. sp. differs from *Syringocapsa batodes* De Wever *in* De Wever et al., 1979 by possessing shorter test, less wide post-abdominal segment, short spines and smaller, irregular pores. It differs from *Syringocapsa extensa* Tekin, 1999 in having a less prominent apical horn, more globular post-abdominal segment with rare, very short spines, and slender, prominent tube. It is compared to *Syringocapsa firma* Tekin n. sp. under latter species.

Measurements (μm). (Based on four specimens)

	HT	Min.	Max.	Av.
Length of test (excluding horn)	176	176	214	198
Max. width of test	94	90	100	95

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Superfamily Archaeodictyomitracea Pessagno, 1976

Family Unumidae Kozur, 1984

Genus *Praeprotunuma* Tekin, 1999

Type species: *Praeprotunuma antiqua* Tekin, 1999

Praeprotunuma sp. A

Pl. 3, fig. 7

Description. Test spindle-shaped with three post-abdominal segments. Test increasing in width until second post-abdominal segment then contracting. Cephalis small, hemispherical and mainly poreless with very rudimentary horn. Thorax, abdomen and first post-abdominal segment subtrapezoidal in outline. Thorax with rare, scattered pores without plicae. Abdomen also with rare, scattered pores and with plicae. Second post-abdominal segment barrel-shaped, third post-abdominal segment inverted subtrapezoidal in outline. Nine to ten plicae which are not straight, run mainly from abdomen to last post-abdominal segment. Rare, scattered, mainly subcircular to subelliptical pores present between plicae. Aperture large and subcircular.

Remarks. This specimen can be distinguished from *Praeprotunuma antiqua* Tekin, 1999 by having smaller test, more continuous costae, rare, scattered pores between costae and larger aperture at the end of the test.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Superfamily Uncertain

Family Squinabolellidae Kozur & Mostler, 1979

Genus *Nabolella* Petrushevskaya, 1981

Type species: *Squinabolella longispinosa* Kozur & Mostler, 1979

Nabolella parvispinosa (Kozur & Mock in Kozur & Mostler, 1981)

Pl. 3, figs 8 - 10

1981 *Squinabolella parvispinosa* Kozur & Mock in Kozur & Mostler, p. 103, pl. 41, figs 1, 3.

Range. Early Carnian - middle Carnian.

Occurrence. Sul'ov cesta, Westkarpathians; Göstling, Austria; Köseyahya nappe, Elbistan, southeastern Turkey.

Nabolella sp. A

Pl. 3, figs 11, 12

Description. Cephalis dome-shaped to hemispherical, mainly poreless without apical spine. Collar stricture distinct, marked by a relatively deep depression. Thorax hat-like with inflated proximal, depressed med-

ial and wide, skirt-like distal part. Wall of thorax with seven to ten rows of subcircular pores of different sizes. These rows of pores limited by continuous ridges. Rod-like, three long spines extend from proximal part of thorax and are completely incorporated into thoracic wall and extend beyond it into three, small, basal feet, circular in axial section.

Remarks. These specimens differ from *Nabolella trispinosa* Bragin *in* Bragin & Krylov, 1999 by possessing a dome-shaped to hemispherical cephalis, thoracic wall with seven to ten rows of subcircular pores limited by continuous ridges, rod-like spines completely incorporated into thoracic wall and shorter feet at the distal end of test.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Family Poulpidae De Wever, 1981

Genus *Annulopoulpus* Kozur & Mostler, 1981

Type species: *Annulopoulpus costatus* Kozur & Mostler, 1981

Annulopoulpus parviaperturus (Kozur & Mostler, 1979)

Pl. 3, figs 13, 14

1979 *Parapoulpus parviaperturus* Kozur & Mostler, p. 89, pl. 7, fig. 4; pl. 16, fig. 2.

1981 *Annulopoulpus parviaperturus* (Kozur & Mostler) - Kozur & Mostler, p. 84, pl. 32, fig. 1.

Range. Middle Carnian.

Occurrence. Göstling, Austria; Köseyahya nappe, Elbistan, southeastern Turkey.

Genus *Parapoulpus* Kozur & Mostler, 1979

Type species: *Parapoulpus oertlii* Kozur & Mostler, 1979

Parapoulpus sp. A

Pl. 3, fig. 15

Description. Monocyrtid test with thick, spongy skeletons. Cephalis hemispherical with three feet. Feet very long, slender, triradiate with wide grooves and shallow furrows, proximally curved outside then curved inside distally. Velum after cephalis long, decreasing in width distally. Aperture large and subcircular.

Remarks. This form differs from *Parapoulpus oertlii* Kozur & Mostler, 1979 by possessing a slender, much longer feet and longer, slender velum.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Genus *Poulpus* De Wever *in* De Wever et al., 1979

Type species: *Poulpus piabyx* De Wever *in* De Wever et al., 1979

Poulpus piabyx De Wever *in* De Wever et al., 1979

Pl. 3, figs 16, 17

1979 *Poulpus piabyx* De Wever *in* De Wever, Sanfilippo, Riedel & Gruber, pp. 61-62, pl. 7, figs. 12, 13.

1979 *Poulpus piabyx* - Kozur & Mostler, p. 87, pl. 4, fig. 3.

1981 *Poulpus piabyx* - Kozur & Mostler, p. 80, pl. 30, fig. 5.

1982b *Poulpus piabyx* - De Wever, pp. 328-329, pl. 48, figs. 5-6.

1984 *Poulpus piabyx* - De Wever, pl. 3, figs. 3, 4.

1990 *Poulpus piabyx* - Yeh, p. 27, pl. 8, figs. 3, 7, 9.

1997 *Poulpus piabyx* - Sugiyama, p. 185, fig. 49-15.

1999 *Poulpus piabyx* - Tekin, p. 160, pl. 38, figs. 3-4.

1999 *Poulpus piabyx* - Bragin & Krylov, p. 558, figs. 10. A-C.

2002 *Poulpus piabyx* - Wang, Wang & Pei, p. 331, pl. 2, figs. 30-34.

Range. Early Carnian - early Norian.

Occurrence. Karpenission, Greece; Göstling, Austria; Westkarpathians; Hungary; Busuanga Island, Philippines; Mino Terrane, Central Japan; Mamonia Complex, Cyprus; Tibet, China; Huglu unit, Beysehir-Hoyran nappe, Bozkir; Alakircay nappe, Antalya nappes, Kemer, Antalya and Köseyahya nappe, Elbistan, Turkey.

Genus *Veghia* Kozur & Mostler, 1981

Type species: *Veghia goestlingensis* Kozur & Mostler, 1981

Veghia goestlingensis Kozur & Mostler, 1981

Pl. 3, figs 18, 19

1981 *Veghia goestlingensis* Kozur & Mostler, pp. 86-87, pl. 30, fig. 1.

Range. Middle Carnian.

Occurrence. Göstling, Austria; Köseyahya nappe, Elbistan, southeastern Turkey.

Veghia? sp. A

Pl. 3, fig. 20

Description. Cephalis subspherical with long, curved and triradiate horn. Feet long, inwardly curved distally, triradiate with thin, elevated ridges and deep, wide furrows.

Remarks. This form differs from all species of *Veghia* Kozur & Mostler by possessing a long, curved and triradiate horn. Due to presence of horn, it is tentatively assigned to *Veghia* Kozur & Mostler.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Family Pseudosaturniformidae Kozur & Mostler, 1979

Genus *Pseudosaturniforma* Kozur & Mostler, 1979

Type species: *Pseudosaturniforma latimarginata* Kozur & Mostler, 1979

Pseudosaturniforma carnica Kozur & Mostler, 1979

Pl. 3, figs 21 - 23

1979 *Pseudosaturniforma carnica* Kozur & Mostler, p. 92, pl. 17, fig. 3.

1981 *Pseudosaturniforma carnica* - Kozur & Mostler, p. 93, pl. 22, fig. 3; pl. 25, fig. 1.

1984 *Pseudosaturniforma carnica* - Blome, p. 52, pl. 13, figs. 5, 9, 11, 18.

1999 *Pseudosaturniforma carnica* - Tekin, p. 156, pl. 34, figs. 7-10.

1999 *Pseudosaturniforma carnica* - Bragin & Krylov, p. 558, figs. 10. I, K, L.

Range. Middle Carnian - early Norian - ?late middle Norian.

Occurrence. Göstling and Grossreifling, Austria; East-Central Oregon, USA; Mamonia Complex, Cyprus; Antalya nappes, Kemer, Antalya and Köseyahya nappe, Elbistan, Turkey.

Family Sanfilippoellidae Kozur & Mostler, 1979

Genus *Sanfilippoella* Kozur & Mostler, 1979

Type species: *Sanfilippoella tortilis* Kozur & Mostler, 1979

Sanfilippoella carterae Tekin n. sp.

Pl. 4, figs 1 - 3

Etymology. This species is named after Dr. Elizabeth S. Carter, Portland State University, Portland, USA, in honour of her contributions to the study of Triassic and Jurassic radiolarian biostratigraphy.

Types. Holotype, HU.JMB.0088 (Pl. 4, Fig. 1); paratypes, HU.JMB.0089 (Pl. 4, Fig. 2), HU.JMB.0090 (Pl. 4, Fig. 3).

Type locality. One km south of Köseyahya village, east of Elbistan town, southeastern Turkey.

Description. Cephalis very large, broadly pyramidal with sharp edges. It consists of small, polygonal (trigonal to pentagonal) pore frames with small nodes at pore frame vertices. Apical horn triradiate at the base and needle-like distally. Thorax subpyramidal with same pore frames as cephalis at proximal part and with rare, scattered small pores at distal part. Three feet mainly unequal, triradiate with thin ridges and wide, deep furrows. Feet wide at the base then contracting distally. Velum at the end of thorax as wide as thorax at the base and flaring distally with irregularly arranged, small to medium sized subcircular to subelliptical pores.

Remarks. *Sanfilippoella carterae* Tekin n. sp. can be differentiated from *Sanfilippoella tortilis* Kozur & Mostler, 1979 by having a much broader cephalis with two sharp edges, relatively small feet and shorter, wider velum at the end of thorax. It is distinguished from *Sanfilippoella* sp. A in having a wider cephalis with sharp edge, longer and slender feet. It differs also from *Sanfilippoella* sp. B in possessing a straight, basally triradiate and distally needle-like apical horn, sharp-edged larger cephalis and with basally polygonal pore frames and distally with rare, scattered small pores and basally wider, small feet.

Measurements (μm). (Based on four specimens)

	HT	Min.	Max.	Av.
Length of test (incl. velum and excl. horn)	329	329	347	338
Length of longest feet	175	125	200	167
Width of thorax	170	133	170	151

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

PLATE 4

Scanning electron micrographs of the Middle Carnian Nassellaria from the Köseyahya nappe. Length of scale bar = number of micrometers (μm) for each figure.

Figs. 1, 2, 3 - *Sanfilippoella carterae* Tekin n. sp. 1. Holotype, sample 04-ELB-5. 2-3 Paratypes. Fig. 2 is from sample 04-ELB-2 and fig. 3 is from sample 04-ELB-5, scale bar for all figures = 150 μm.

Figs. 4, 5, 6 - *Sanfilippoella tortilis* Kozur & Mostler. Figs. 4, 6 are from sample 04-ELB-5 and fig. 5 is from sample 04-ELB-2, scale bar = 140, 140 and 220 μm, respectively.

Fig. 7 - *Sanfilippoella* sp. A. Sample 04-ELB-2, scale bar = 165 μm.

Fig. 8 - *Sanfilippoella* sp. B. Sample 04-ELB-2, scale bar = 175 μm.

Figs. 9, 10 - *Castrum* sp. aff. *C. perornatum* Blome. Fig. 9 is from sample 04-ELB-2 and fig. 10 is from sample 04-ELB-5, scale bar for both figures = 120 μm.

Figs. 11, 12 - *Castrum* sp. A. Fig. 11 is from sample 04-ELB-2 and fig. 12 is from sample 04-ELB-5, scale bar for both figures = 130 μm.

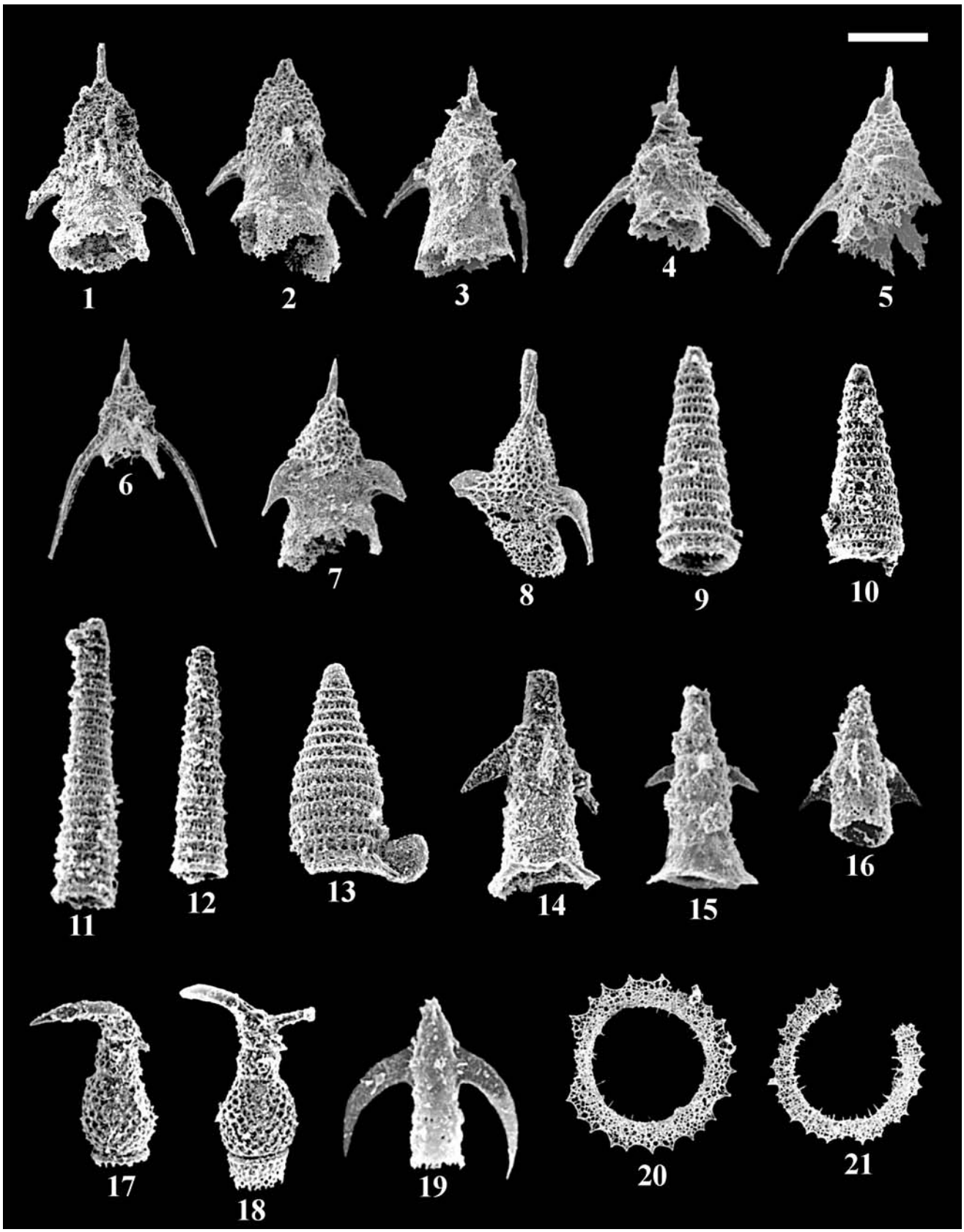
Fig. 13 - *Castrum* sp. B. Sample 04-ELB-3, scale bar = 120 μm.

Figs. 14, 15, 16 - *Trialatus*? *panus* (De Wever). Figs. 14 and 15 are from sample 04-ELB-5 and fig. 16 is from sample 04-ELB-2, scale bar for all figures = 110 μm.

Figs. 17, 18 - *Triassocyrtium* sp. aff. *T. hamatum* Kozur & Mostler. Both figures are from sample 04-ELB-2., scale bar for both figures = 150 μm.

Fig. 19 - *Tetraspinocyrtis* sp. A. Sample 04-ELB-2, scale bar = 60 μm.

Figs. 20, 21 - Nassellaria gen. and sp. indet. A. Fig. 20 is from sample 04-ELB-2 and fig. 21 is from sample 04-ELB-5, scale bar for both figures = 230 μm.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21

Sanfilippoella tortilis Kozur & Mostler, 1979

Pl. 4, figs 4 - 6

1979 *Sanfilippoella tortilis* Kozur & Mostler, p. 93, pl. 17, fig. 6.
1981 *Sanfilippoella tortilis* - Kozur & Mostler, p. 101, pl. 23, fig. 1; pl. 25, fig. 2.

Range. Middle Carnian.

Occurrence. Göstling, Austria; Köseyahya nappe, Elbistan, southeastern Turkey.

Sanfilippoella sp. A

Pl. 4, fig. 7

Description. Cephalis broadly conical with triradiate tapering horn and polygonal pore frames with nodes at pore frame vertices. Thorax subpyramidal with same pore frames as cephalis at proximal part and with rare scattered pores at the distal part. Thorax with three short, approximately equal feet. Feet wide at the base then decreasing in width distally and curving inwardly, triradiate with thin ridges and wide furrows. Velum at the end of test increasing in width distally with scattered, small pores.

Remarks. This form can be distinguished from *Sanfilippoella tortilis* Kozur & Mostler, 1979 by having a shorter cephalis with straight horn, much shorter feet and shorter velum. It differs from *Sanfilippoella* sp. B by having a shorter and straight horn, two different pore styles and shorter, wider feet. It is compared to *Sanfilippoella carterae* Tekin n. sp under the latter species.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Sanfilippoella sp. B

Pl. 4, fig. 8

Description. Test with two segments and a distally widened velum. Cephalis conical with robust, dextrally twisted, triradiate and long apical horn. Cephalis with polygonal pore frames and subcircular to subelliptical pores of different sizes. Thorax subpyramidal with same pore frames as cephalis and three moderately long, triradiate feet. Feet pointed, proximally curved outwardly then inwardly curved in medial and distal parts. Velum slightly widened distally with small and subcircular to subelliptical pores.

Remarks. This form differs from *Sanfilippoella costata* Kozur & Mostler, 1981 by possessing a longer and slender horn, smaller pores on cephalis, polygonal pore frames on thorax and distally contracting, curved feet. It is compared to *Sanfilippoella carterae* Tekin n. sp and *Sanfilippoella* sp. A under the latter taxa.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Family Tetraspinocyrtiidae Kozur & Mostler, 1994

Genus *Tetraspinocyrtis* Kozur & Mostler, 1994

Type species: *Tetraspinocyrtis laevis* Kozur & Mostler, 1994

Tetraspinocyrtis sp. A

Pl. 4, fig. 19

Description. Test with three post-abdominal segments. Cephalis hemispherical to dome-shaped, poreless with short, tetraradiate and pointed apical horn. Thorax to third post-abdominal segment hoop-like and commonly poreless, sometimes sparsely porous. Thorax with two blade-like wings which are inwardly curved, narrowing distally, pointed.

Remarks. This form can be distinguished from species of *Trialatus* Yeh, 1990 by having a tetraradiate horn, poreless segments and thorax with two wings instead of three wings. It can also be differentiated from species of *Spinotriassocampe* Kozur, 1984 by having a short, tetraradiate apical horn instead of needle-like apical horn and thorax with two blade-like wings instead of cephalis with two, needle-like wings.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Nassellaria Incertae Sedis

Genus *Castrum* Blome, 1984

Type species: *Castrum perornatum* Blome, 1984.

Castrum sp. aff. **C. perornatum** Blome, 1984

Pl. 4, figs 9, 10

aff. 1984 *Castrum perornatum* Blome, p. 54, pl. 14, figs. 4, 9, 12, 14, 18; pl. 17, fig. 14.
aff. 1989 *Castrum perornatum* - Yeh, p. 71, pl. 8, fig. 9.
aff. 2000 *Castrum perornatum* - Carter & Orchard, pl. 2, fig. 9.

Remarks. These specimens differ from the holotype by having a longer test with more segments.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Castrum sp. A

Pl. 4, figs 11, 12

? 1979 *Dictyomitrella* sp. B De Wever *in* De Wever, Sanfilippo, Riedel & Gruber, p. 90, pl. 5, fig. 17.
? 1982b *Dictyomitrella* sp. B De Wever, p. 299, pl. 47, fig. 10.
2005 *Castrum* sp. Tekin & Mostler, p. 19, fig. 10.14.

Description. Test slender, very long, subconical and gradually increasing in width distally with eighteen to twenty-five post-abdominal segments. Cephalis hemispherical, imperforate and hornless. Thorax to last post-abdominal segment inverted subtrapezoidal in outline. Two different types of pore styles between circumferential ridges: smaller polygonal pore frames with small, subcircular pores and larger, non-uniform and mainly tetragonal pore frames with elliptical pores.

Remarks. This form differs from *Castrum perornatum* Blome, 1984 by possessing a very long, slender test with more segments and non-uniform, irregular pore frames with elliptical pores together with smaller pore frames. It can be differentiated from *Castrum* sp. B in having a slender, longer test with more segments.

Range. Late Ladinian - middle Carnian.

Occurrence. ?Karpenission, Greece; Bosnia and Herzegovina; Köseyahya nappe, Elbistan, southeastern Turkey.

Castrum sp. B

Pl. 4, fig. 13

Description. Test long, spindle-shaped with twelve post-abdominal segments. Cephalothorax dome-shaped, poreless, without horn. Abdomen to last post-abdominal segment inverse subtrapezoidal in outline. Between circumferential ridges, two different types of pore frames present; smaller, polygonal pore frames with small subcircular pores and larger, polygonal (mainly tetragonal) pore frames and subelliptical pores.

Remarks. This form differs from *Castrum perornatum* Blome, 1984 by having a spindle-shaped test and less long segments. It is compared to *Castrum* sp. A under the latter taxon.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Genus *Trialatus* Yeh, 1990

Type species: *Trialatus megacornatus* Yeh, 1990

Trialatus? panus (De Wever *in* De Wever et al., 1979) emended herein

Pl. 4, figs 14 - 16

1979 *Lithomelissa* (?) *panus* De Wever *in* De Wever, Sanfilippo, Riedel & Gruber, p. 90, pl. 6, figs 4, 8.

Emended description. Test with four segments. Cephalis small, hemispherical, sparsely perforate with wide, solid, long, slightly tapering horn, subcircular in axial section and small, triradiate, pointed, ventral spine. Collar stricture and the other strictures marked by moderately deep strictures. Thorax hoop-like with irregular, unequal and circular to subelliptical pores. Three wings arising from thorax, wide at the base, narrowing distally, short to moderately long, curved inwardly and pointed. Abdomen hoop-like with same pore frames as thorax. Post-abdominal segment long, broadly subcylindrical, sparsely perforated with expanded distal end.

Remarks. Although specimens belonging to this taxon include main characteristic features of *Trialatus* such as prominent horn and thorax with three wings, it is tentatively assigned to this genus due to presence of a solid horn instead of triradiate, usually twisted one and a small ventral spine.

Range. Carnian - early Norian.

Occurrence. Karpenission, Greece; Köseyahya nappe, Elbistan, southeastern Turkey.

Genus *Triassocyrtium* Kozur & Mostler, 1979

Type species: *Triassocyrtium hamatum* Kozur & Mostler, 1979.

Triassocyrtium sp. aff. **T. hamatum** Kozur & Mostler, 1979

Pl. 4, figs 17, 18

aff. 1979 *Triassocyrtium hamatum* Kozur & Mostler, p. 102, pl. 16, fig. 5.

Remarks. These specimens differ from the holotype in having a test with fewer segments and big, cylindrical-shaped abdominal segment instead of small, hoop-shaped abdominal segment.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Nassellaria genus and species indetermined

Nassellaria gen. and sp. indet. A

Pl. 4, figs 20, 21

Description. Test with thick, circular, porous rim. Rim with subcircular to subelliptical pores of different sizes. Very small, porous and triangular projections present at periphery of rim.

Remarks. Although these specimens resemble the species of *Praecitriduma* Kozur, 1984, their determination is impossible because inner part is always broken out.

Range. Middle Carnian.

Occurrence. Köseyahya nappe, Elbistan, southeastern Turkey.

Acknowledgements. The authors wish to thank Dogan Usta, Metin Beyazpirinç, Mustafa Kemal Özkan, Cengiz Okuyucu and Mustafa Senel from the General Directorate of Mineral Research and Exploration (MTA) for their kind contributions during the field work. The authors gratefully acknowledge Marta Marcucci, Spela Gorican, Paulian Dumitrica for their comments on the manuscript and Leopold Krystyn for his ammonoid identification. Cengiz Tan and Metehan Erdogan are also gratefully acknowledged for their helps during SEM imaging in METU, Department of Metallogeny Engineering, Ankara.

REFERENCES

Ayaslioglu Y. (1970) - Berke projesi-Berke Baraji. *Archive of DSI* , Ankara (unpublished) (in Turkish).

Bedi Y. (2004) - 1/25.000 scale Turkish geological maps, L38c2 Quadrangle. *Archive of the Geol. Res. Depart., Gen. Direc. of Min. Res. and Expl.*, Ankara (unpublished).

Bedi Y., Senel M., Usta D., Ozkan M. K. & Beyazpirinc M. (2004) - The geological properties of Binboga Mountains and their correlation with similar units in west-Central Taurides. *57th Geol. Cong. of Turkey, Abstracts*: 270-271, Ankara.

Bedi Y., Usta D., Ozkan M. K., Beyazpirinc M., Yildiz H. & Yusufoglu H. (2005) - The tectono-stratigraphic characteristics of allochthonous sequences in Eastern Taurides. *58th Geol. Cong. of Turkey, Abstracts*: 262-263, Ankara.

Blome C. D. (1984) - Upper Triassic Radiolaria and Radiolarian zonation from western North America. *Bull. Am. Paleont.*, 85(318): 1-88, New York.

Bragin N. Yu. (1991) - Radiolaria and Lower Mesozoic Units of the USSR, east regions. *Trans. Acad. Sci. USSR*, 469: 1-123, Moscow (in Russian with English summary).

Bragin N. Yu. & Krylov K. A. (1999) - Early Norian Radiolaria from Cyprus. *Geodiversitas*, 21(4): 539-569, Paris.

Carter E. S. & Orchard M. J. (2000) - Intercalibrated conodont-radiolarian biostratigraphy and potential datums for the Carnian-Norian boundary within the Upper Triassic Peril Formation, Queen Charlotte Islands, British Columbia. *Geol. Surv. Canada, Current Research*, 2000- A-7: 1-11, Ottawa.

De Wever P. (1981) - Une nouvelle sous-famille, les Poulpinae, et quatre nouvelles espèces de *Saitoum* Radiolaries Mésozoïques Téthysiens. *Geobios*, 14(1): 5-15, Lyon.

De Wever P. (1982a) - Nassellaria (Radiolaires Polycystines) du Lias de Turquie. *Rev. Micropaléont.*, 24(4): 189-232, Paris.

De Wever P. (1982b) - Radiolaires du Trias et du Lias de la Téthys (Systématique, Stratigraphie). *Soc. Géol. Nord*, 7(1-2): 1-599, Villeneuve.

De Wever P. (1984) - Triassic Radiolarians from Darno Area, Hungary. *Acta Geologica Hungarica*, 27(3-4): 295-306, Budapest.

De Wever E. A., Sanfilippo A., Riedel W. R. & Gruber B. (1979) - Triassic Radiolaria from Greece, Sicily and Turkey. *Micropaleontology*, 25(1): 75-110, New York.

De Wever P., Dumitrica P., Caulet J. P., Nigrini C. & Caridroit M. (2001) - Radiolarians in the sedimentary record. *Gordon and Breach Science Publ.*: 1-524, London.

Dumitrica P., Kozur H. & Mostler H. (1980) - Contribution to the Radiolarian fauna of the Middle Triassic of the Southern Alps. *Geol.-Paläont. Mitt. Innsbruck*, 10 (1): 1-46, Innsbruck.

Foreman H. P. (1973) - Radiolaria from DSDP Leg 20. In: Heezen B. C., Mac Gregor J. D. et al. (Eds) – Initial Reports of the Deep Sea Drilling Project, *U. S. Government Printing Office, Washington D. C.*, 20: 249-305, Washington.

Hori R. S. (1988) - Some characteristic radiolarians from Lower Jurassic bedded cherts of the Inuyama area, Southwest Japan. *Trans. Proc. Palaeont. Soc. Japan, N. S.*, 151: 543-563, Tokyo.

Kozur H. (1984) - New Radiolarian taxa from the Triassic and Jurassic. *Geol.-Paläont. Mitt. Innsbruck*, 13(2): 49-88, Innsbruck.

Kozur H. (1997) - Pelagic Permian and Triassic of the Western Tethys and its palaeogeographic and stratigraphic significance. *48 Berg und Huttenmännischer Tag, Kolloquium 1, Stratigraphie, Sedimentation und Beckenentwicklung in Karbon und Perm*: 21-25, Berlin.

Kozur H. (2003) - Recovery of the radiolarians after the Permian-Triassic biotic crisis and integrated radiolarian zonation of the Middle Triassic. *Tenth Meet. of the Inter. Assoc. Rad. Palaeontologists,* Abstracts: 73-74, Blairsden.

Kozur H. & Mostler H. (1972) - Beiträge zur Erforschung der mesozoischen Radiolarien. Teil. 1, Revision der Oberfamilie Coccodiscacea HAECKEL, 1862 emend. und Beschreibung ihrer triassischen Vertreter. *Geol.-Paläont. Mitt. Innsbruck*, 2(8/9): 1-60, Innsbruck.

Kozur H. & Mostler H. (1978) - Beiträge zur Erforschung der mesozoichen radiolarien Teil II: Oberfamilie Trematodiscacea HAECKEL, 1862 emend. und Beschreibung ihrer triassischen Vertreter. *Geol.-Paläont. Mitt. Innsbruck*, 8: 123-182, Innsbruck.

Kozur H. & Mostler H. (1979) - Beiträge zur Erforschung der mesozoischen Radiolarien. Teil III. Die oberfami-

lien Actinommacea HAECKEL, 1862 emend., Artiscacea HAECKEL, 1882, Multiarcusallacea nov. Der Spumellaria und triassische Nassellaria. *Geol.-Paläont. Mitt. Innsbruck*, 9(1, 2): 1-132, Innsbruck.

Kozur H. & Mostler H. (1981) - Beiträge zur Erforschung der mesozoischen Radiolarien. Teil IV. Thalassosphaeracea HAECKEL, 1862, Hexastylacea HAECKEL, 1862 emend Petrushevskaya 1979, Sponguracea HAECKEL, 1862 emend. und weitere triassische Lithocycliacea, Trematodiscacea, Actinommacea und Nassellaria. *Geol.-Paläont. Mitt. Innsbruck*, 1: 1-208, Innsbruck.

Kozur H. & Mostler H. (1983) - The polyphyletic origin and the classification of the Mesozoic saturnalids (Radiolaria). *Geol.-Paläont. Mitt. Innsbruck*, 13: 1-47, Innsbruck.

Kozur H. & Mostler H. (1994) - Anisian to Middle Carnian Radiolarian zonation and description of some stratigraphically important Radiolarians. *Geol.-Paläont. Mitt. Innsbruck*, 3: 39-255, Innsbruck.

Lahm B. (1984) - Spumellarienfauna (Radiolaria) aus dem mitteltriassichen Buchensteiner-Schichten von Recoaro (Norditalien) und den obertriassichen Reiflingerkalken von Grossreifling (Österreich). *Systematik-Stratigraphie-Münchener Geowissen. Abh*. Series A, 1:1-161, Munich.

Neviani A. (1900) - Supplemento alla fauna a radiolari delle rocce Mesozoiche del Bolognese. *Boll. Soc. Geol. It.*, 19: 645-671, Cagliari.

Pehlivan S., Barkurt M. Y., Bilginer E., Kurt Z., Sutcu Y. F., Can B., Bilgi C., Orcen S., Suer T. & Karabiyikoglu M. (1991) - Elbistan-Nurhak (Kahramanmaras) dolayinin jeolojisi. *Publ. of Gen.Direc. of the Min. Res. and Expl,* Report No: 9423: 1-60, Ankara (unpublished) (in Turkish).

Perincek D. & Kozlu H. (1984) - Stratigraphy and structural relations of the units in the Afsin-Elbistan-Doganse-hir region (Eastern Taurus). In: Tekeli O. & Goncuoglu M. C. (Eds) – Geology of the Taurus Belt, *Publ. of Publ. of Gen. Direc. of the Min. Res. and Expl.*: 181-198, Ankara.

Pessagno E. A. Jr. (1969) - Mesozoic planktonic foraminifera and radiolaria. *Initial reports of the Deep Sea Drilling Project*, 1: 607-623, Washington.

Pessagno E. A. Jr. (1976) - Radiolarian zonation and stratigraphy of the Upper Cretaceous portion of the Great Valley Sequence, California Coast Ranges. *Spec. Publ. in Micropaleontology*, 2: 1-95, New York.

Pessagno E. A. Jr. (1977) - Lower Cretaceous radiolarian biostratigraphy of the Great Valley Sequence and Franciscan Complex, California Coast Ranges. *Cushman Found. Foram. Res., Spec. Pub.*, 15: 1-87, Washington.

Pessagno E. A. Jr. & Poisson A. (1981) - Lower Jurassic Radiolaria from the Gümüslü Allochthon of Southwestern Turkey (Taurides Occidentales). *Bull. of the Min. Res. Expl. Inst. of Turkey*, 92: 47-69, Ankara.

Petrushevskaya M. G. (1981) - Nassellarian radiolarians from the world oceans. In. Desciption of the Fauna of the USSR, *Publ. of the Zool. Inst. Acad. of Sci. of the USSR. - Nauka, Leningradskoe Otdelenie*, 128: 1-405, Leningrad (in Russian).

Sashida K., Nishimura H., Igo H., Kazamo S. & Kamata Y. (1993) - Triassic Radiolarian faunas from Kiso-fukushima, Kiso Mountains, central Japan. *Sci. Rep. Inst. Geoscience, Univ. of Tsukuba, Section B, Geol. Sci.*, 14: 77-97, Tsukuba.

Sato T., Murata M. & Yoshida H. (1986) - Triassic to Jurassic radiolarian biostratigraphy in the southern part of Chichibu terrane of Kyushu, Japan. *News Osaka Micropal.*, Spec. Vol., 7: 9-23, Osaka.

Sugiyama K. (1997) - Triassic and Lower Jurassic Radiolarian biostratigraphy in the siliceous claystone and bedded chert units of the southeastern Mino Terrane, Central Japan. *Bull. Mizunami Fossil Museum*, 24: 79-193, Mizunami.

Tekin U. K. (1999) - Biostratigraphy and systematics of late Middle to Late Triassic radiolarians from the Taurus Mountains and Ankara Region, Turkey. *Geol.-Paläont. Mitt. Innsbruck*, 5: 1-297, Innsbruck..

Tekin U. K. & Bedi Y. (2007) - Ruesticyrtiidae (Radiolaria) from the middle Carnian (Late Triassic) of Köseyahya nappe, Elbistan, eastern Turkey. *Geologica Carpathica*, 58(2): 153-167, Bratislava.

Tekin U. K. & Goncuoglu M. C. (2002) - Middle Carnian radiolarians from the intra-pillow limestones of the Turunç Unit within the Gülbahar nappe (Lycian nappes, Marmaris, southern Turkey); Geodynamic implications. *First Inter. Symp. Fac. Mines (ITÜ) Earth Sci. Eng., Spec. Ses.-C: Regional Geology and Geophysics: The Evolution of Orogenic Belts and Surroundings*, Abstracts: 84, Istanbul.

Tekin U. K. & Mostler H. (2005) - Longobardian (Middle Triassic) Entactinarian and Nassellarian Radiolaria from the Dinarides of Bosnia and Herzegovina. *J. Paleont.,* 79 (1): 1-20, Iowa.

Vinassa De Regny P. E. (1901) - Radiolari Cretacei dell'isola di Karpathos. *Mem. R. Acad. Sci. Ser.,* 5(9): 1-497, Bologna.

Wang Y., Wang J. & Pei F. (2002) - A Late Triassic radiolarian fauna in the Dingqing ophiolite Belt, Xizang (Tibet). *Acta Micropal. Sinica,* 19(4): 323-336, Beijing.

Whalen P. A. & Carter E. S. (1998) - Systematic Paleontology. In: Carter, E. S., Whalen, P. A. and Guex, J. Biochronology and paleontology of Lower Jurassic (Hettangian and Sinemurian) radiolarians, Queen Charlotte Islands, British Columbia. *Geol. Survey Canada Bull.*, 496: 1-147, Ottowa.

Yeh K. (1987) - Taxonomic studies of Lower Jurassic Radiolaria from East-Central Oregon. *Bull. of the Nat. Mus. of Nat. Sci.*, 2: 1-169, Taiwan.

Yeh K. (1989) - Studies of Radiolaria from the Fields Creek Formation, East-Central Oregon, USA. *Bull. Nat. Mus. Nat. Sci.*, 1: 43-110, Taiwan.

Yeh K. (1990) - Taxonomic studies of Triassic Radiolaria from Busuanga Island, Philippines. *Bull. Nat. Mus. Nat. Sci.*, 2: 1-63, Taiwan.

Yeh K. & Cheng Y. (1996) - An Upper Triassic (Rhaetian) radiolarian assemblage from Busuanga Island. Philip-

pines. *Bull. of the Nat. Mus. of Nat. Sci.*, 7: 1-43, Taiwan.

Yilmaz A., Bedi Y., Uysal S., Yusufoglu H., & Aydin N. (1993) - Dogu Toroslar'da Uzunyayla ile Beritdagi arasinin jeolojik yapisi. *Turkish Assoc. Petr. Geol. Bull.*, 5(1): 69-87, Ankara (in Turkish with English abstract).

Yilmaz Y., Gurpinar O., Kozlu H., Gul M. A., Yigitbas E., Yildirim M., Genc C. & Keskin M. (1987) - Maras kuzeyinin jeolojisi (Andirin, Berit, Engizek-Nurhak-Binboga Daglari) yapi ve jeolojik evrimi). *Publ. Istanbul Univer., Eng. Fac.*: 1-97, Istanbul (in Turkish).

Yoshida A. (1986) - Upper Triassic to Lower Jurassic radiolarian biostratigraphy in Kagamigahara City, Gifu Prefecture, Central Japan. *J. Earth Sci., Nagoya Univ.*, 34: 1-21, Nagoya.