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THE BIVALVIA AND GASTROPODA FAUNA OF THE AMMONITICO ROSSO FACIES OF LATE SINEMURIAN-EARLY PLIENSBACHIAN OF THE KÖSRELİK REGION (NE ANKARA-TURKEY); FIRST RECORD OF ANNELID POLYCHAETE SPECIES AND THEIR PALEOGEOGRAPHIC AND PALEOECOLOGIC CHARACTERISTICS

Yavuz OKAN* and İzzet HOŞGÖR*

ABSTRACT.- The nodular limestones of the Ammonitico Rosso facies of the Ankara region of the Central Anatolia, deposited during the Early-Middle Jurassic and show similar paleontological and sedimentological characteristics to those of the red nodular limestones of the northern and southern Alps. In particular, bivalves, gastropods, annelid, crinoid, brachiopod, belemnit and other cephalopods were sampled from the Ammonitico rosso facies sediments cropping out in the northwest of the Bağlum village in the north of Ankara. The following species have been described; four bivalv taxa (*Parainoceramus bileciki* Conti and Monari 1991, *Parainoceramus nicosiai* Conti and Monari 1991, *Mytilioides* sp. and *Palaeonucula* sp), three species of gastropods (*Pleurotomaria suessii* Hörnes 1853, *Pleurotomaria* sp. and *Eucyclus* (*Eucyclus*) sp.) and annelid polycahete *Glomerula gordialis* (Schlotheim 1820). They have been identified for the first time in the Early Jurassic sequences of Turkey and their paleogeographic characteristics are discussed.

Anahtar Kelimeler: Ammonitiko rosso, Bivalvia, Gastropoda, Annelid, paleoekoloji, paleocoğrafya.

INTRODUCTION

Many Jurassic successions in the Northern and Southern Alpine region consist of red marls and noduler limestones of the type known as Ammonitico Rosso (Hallam, 1969; Galacz, 1984; Varol and Gökten, 1994; Soussi et al., 1998, 1999). Facies of Ammonitico Rosso type sedimentation are widespread in Turkey; in general, Ammonitico Rosso type outcrops are seen in the following regions in the northwest Anatolia: Halılar, Bursa-Bilecik, Mudurnu-Baypazarı and Aktaş (Altıner et al., 1991; Koçyiğit et al., 1991; Nicosia et al., 1991), from central Anatolia: Ankara region, Hasanoğlan (Alkaya, 1991), Yakacık and Bağlum-Kösrelik (Pompeckj, 1897; Gugenberger, 1929; Bremer, 1965; Varol and Gökten, 1994; Alkaya and Meister, 1995; Kuznetsova et al., 2001) (Figure 1).

Clayey and marly Ammonitico Rosso and their nodular limestones, in our study area range from Lias to Dogger. The Liassic carbonate succession, exposed around the Kösrelik region consists of conglomera, sandstones, red marls, noduler limestones, pelagic limestones from bottom to top; and disconformably overlies the Triassic metasediments (Gökten et al., 1988; Varol and Gökten, 1994). In this region, Ammonitico Rosso type sediments, and the other parts of the whole Jurassic succession contain fossils in all levels. While the densely sedimented red-marly section of the succession is especially rich in ammonites, the sandy limestones are rich in crinoids, brachiopods, belemnits, bivalus and gastropods (Varol and Gökten, 1994).

SYSTEMATIC PALEONTOLOGY

Middle Jurassic bivalve and gastropod faunas are well recorded in the related literature, but Lower Liassic bivalve and gastropods faunas have rarely been mentioned. The informations about the Liassic bivalve and gastropods of the Alpine and Mediterranean regions, have been given by the more recent papers of Damborenea (1987*a*, 1987*b*), Szabo (1979, 1984, 1995), Conti and Monari (1991), Szente and Vörös (1992)

*Ankara Üniversitesi, Mühendislik Fakültesi, Jeoloji Mühendisliği, 06100, Tandoğan, Ankara.
E-posta: Yavuz.Okan@eng.ankara.edu.tr

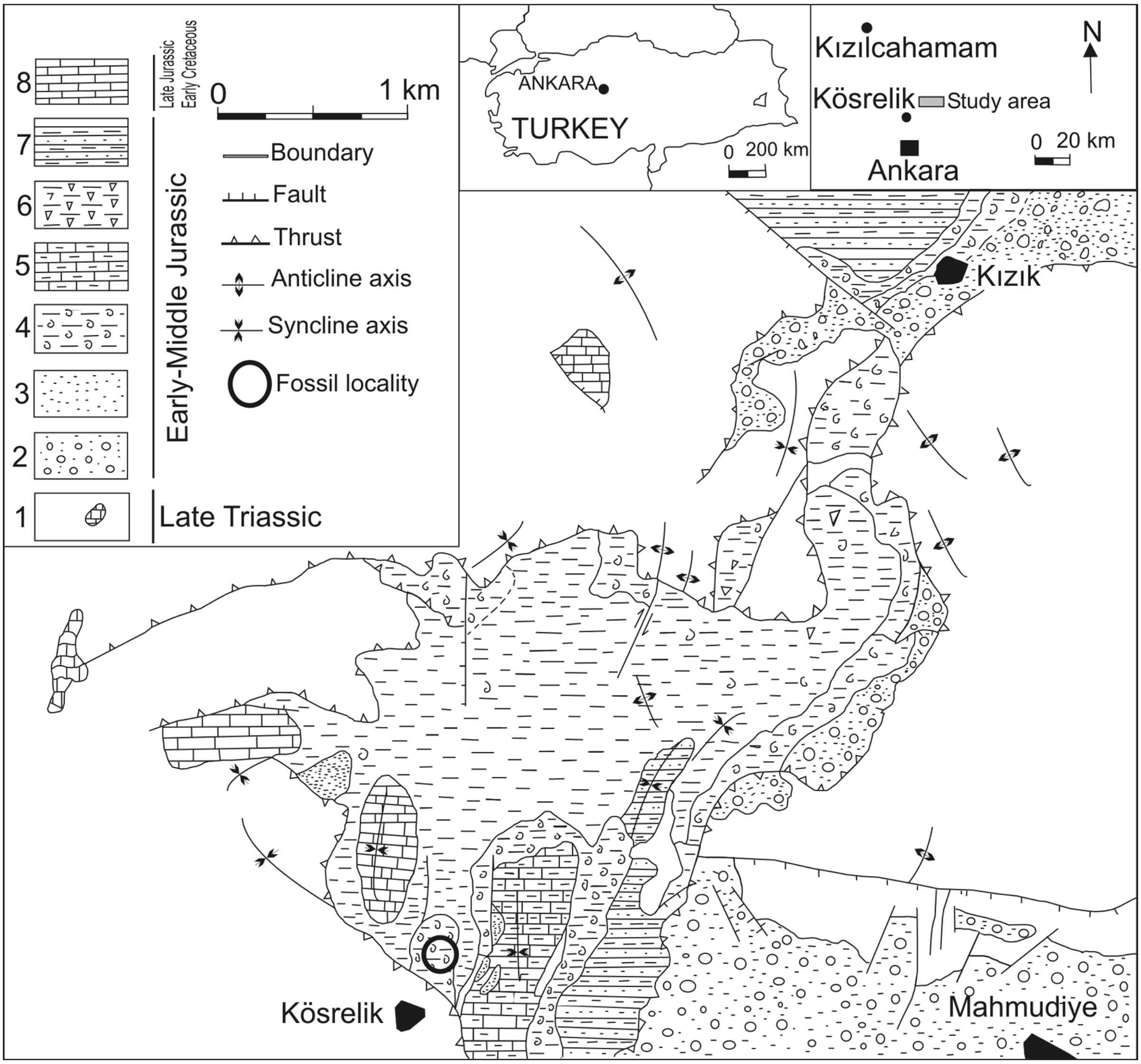


Figure 1 - Geological map of the study area, 1- Metasediment, 2- Conglomerate, 3- Sandstone, 4- Red marly limestone, 5- Nodular limestone, 6- Red and grey marly limestone, 7- Turbiditic sediment, 8- Pelagic limestone (modifeid from Varol and Gökten, 1994).

and Valls et al. (2004). Classification of the bivalv species in this study follows that of Bieler and Mikkelsen (2006) and the gastropods species follows that of Wenz (1938-44) and Knight et al. (1964). In the classification of the *Eucyclus* (*Eucyclus*) sp. the Hickman and McLean (1990)'s study have been taken in to consider in this study. The superfamily name was proposed by Golikov and Starobogatov (1975). Cossmann (1916) and Wenz (1938) established the Amberleyidae and Littorinidae families where *Euscyclus* is only a subgenus of *Amberleya*. Golikov and Strobogatov (1975) recognized that inclusion of *Eucyclus* as a subgenus in *Amberleya* is erroneous, and that is why they proposed usage of Eucyclidae as family name

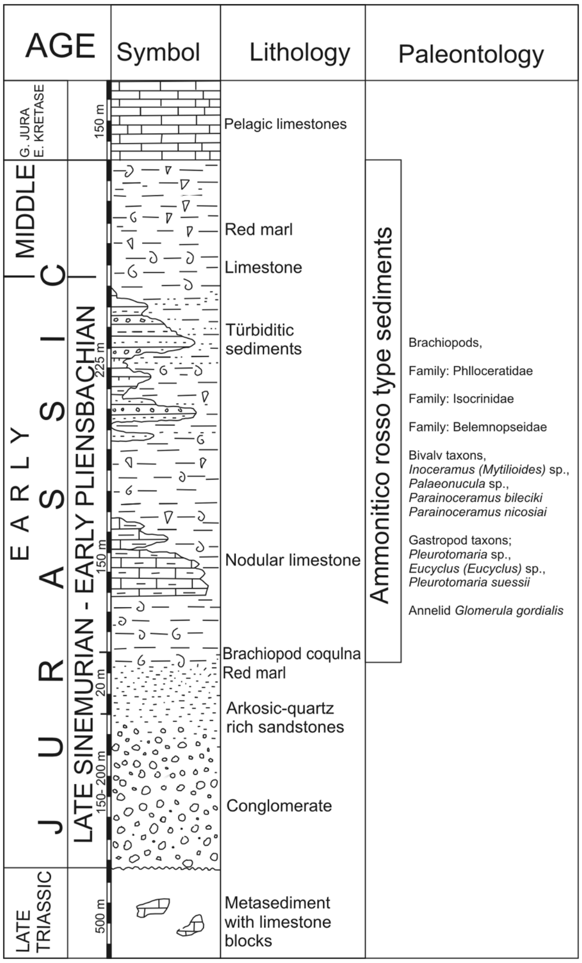


Figure 2 - General stratigraphic column of the Ammonitico-bearing Jurassic sequence, Kösrelik area (modifeid from Varol and Gökten, 1994).

and Eucycloidea Koken as superfamily name respectively (Hickman and McLean 1990; Szabo, 1995; Conti and Monari, 2001). Our fauna consisting of bivalves and gastropods have very similar to the species described from the Lower Jurassic of the Bilecik area (Conti and Monari 1991).

The annelid of the genus *Rotularia* is a common element of Jurassic to Early Tertiary shallow marine faunas but their palaeoecologic and stratigraphic significance have rarely been subjected in the related studies. The polychaete annelids species have been reported first time from the Early Eocene of the Çankırı Basin by Hoşgör and Okan (2006). In this study, the polychaete annelids species from the Lower Jurassic of the study area have been determined and the characteristics have been studied by electron microscope (SEM). Classification of the annelids in this study follows that of Nielsen (1931), Regenhardt (1961) and Radwanska (2004).

Class : Bivalvia Linne, 1758
Subclass : Palaeotaxodonta Korobkov, 1954
Order : Nuculoida Dall, 1889
Superfamily : Nuculoidea Gray, 1824
Family : Nuculidae Gray, 1824
Genus : *Palaeonucula* Quenstedt, 1930

Palaeonucula sp.
Plate-1, figure 1, 1a

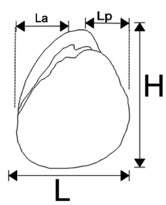
Description.- Small-sized shell, subtrigonal-quadrangular in shape, quite inflated and with umbones posteriorly placed. Anterior region elongated, ornamentation formed by a slightly growth striae. (Measurements, see Figure. 3).

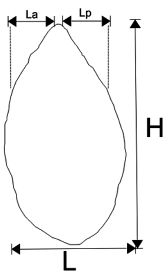
Remarks.- The Hungarian species *Palaeonucula* Quenstedt (Szente 1995, p. 60, pl. 6, figures 1-2) and the Jurassic from Bilecik species (Conti and Monari 1991, p. 247, pl. 1, figures3-4) are a similar species described from the study area. *Nuculoma* Cossmann (Cox et al., 1969, p. 231, figure A3-6) is a very similar species. It is differentiated from *Palaeonucula* Quenstedt by an elongated posterior margin and heavily growth striae.

Paleoecologic and Paleogeographic implications.- *Palaeonucula* forms have probably evolved many strategies of life behaviour from the Triassic to Late Jurassic. The main trophic groups of this species include infaunal detritivores. Many Palaeonucula species described from the Triassic to Jurassic of Asia, North America, Jurassic Eurapean localities (Germany, Hungary, Frace and Span) (Cox et al., 1969;

Bivalvia

Family Nuculidae **Family Inoceramidae**





Dimensions (mm)

Palaeonucula sp.

Specimen	H	L	La	Lp
AJK AU 01	11	9	4	3

Inoceramus (Inoceramus) sp.

Specimen	H	L	La	Lp
AJK AU 02	11	9	4	3

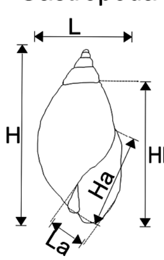
Parainoceramus bileciki

Specimen	H	L	La	Lp
AJK AU 03	39	24	10	5
AJK AU 04	29	19	7	3
AJK AU 05	-	26	-	-
AJK AU 06	-	19	6	4

Parainoceramus nicosiai

Specimen	H	L	La	Lp
AJK AU 07	35	25	6	5
AJK AU 08	29	19	8	6
AJK AU 09	18	12	7	3

Gastropoda



Pleurotomaria sp.

Specimen	H	L	Hl	Ha	La
AJK AU G1	5	7	2	-	-

Pleurotomaria suessii

Specimen	H	L	Hl	Ha	La
AJK AU G2	9	11	4	3	2

Eucyclus (Eucyclus) sp. s

Specimen	H	L	Hl	Ha	La
AJK AU G3	-	14	-	-	-

Figure 3 - Measurements taken from the bivalvs and gastropods species, H- Height, L- Length, La- Length of the anterior margin, Lp- Length of the posterior margin, Hl- Height of the last whorl, Ha- Height of the aperture, La- Length of the aperture.

Szente, 1995; Fürsich et al., 2001; Delvene, 2003), and from the Turkey, Liassic of Bilecik-Günören (Conti and Monari, 1991).

Order : Pterioida Newell, 1965
Suborder : Pteriina Newell, 1965
Superfamily : Pterioidea Gray, 1847
Family : Inoceramidae Giebel, 1852
Genus : *Inoceramus* Sowerby, 1814
Subgenus : *Mytiloides* Brongniart, 1822

Inoceramus (*Mytiloides*) sp.
Plate-1, figure 2

Description.- Medium-sized shell, inequilateral, mytiliform, moderately inflated with maxiumum inflation placed in the dorsal half of the valve below the rounded umbonal area. Anterior margin quite elongated, posterior margin weakly convex. Ornamentation formed by about a strongly concentric plicae (Measurements, see Figure 3).

Remarks.- This species does not well show generic characters well. The species merely exhibits some general likeness with *Inoceramus hamadae* Hayami 1960 (p. 302, pl. 15, figure 14) from Japan of the Middle Jurassic. It is differentiated from *Inoceramus* (*Mytiloides*) sp. by a large shell, narrow ligamental area and strongly concentric plicae.

Paleoecologic and Paleogeographic implications.- Species of *Inoceramus* (*Mytiloides*) sp. are epifaunal suspension feeders and lives on sandy bottom. (Fürsich, 1977; Fürsich et al., 2001; Delvene, 2003). *Inoceramus* (*Mytiloides*) sp. species described from the Early Jurassic-Late Cretaceous of European, and from the Turkey, Liassic of Bilecik-Günören (Conti and Monari, 1991).

Genus: *Parainoceramus* Voronetz, 1936

Parainoceramus bileciki Conti and Monari, 1991
Plate-1, figure 3, 3a

1991 Parainoceramus bileciki Conti and Monari, p. 251-252, pl. 3, figures. 5-10.

Description.- Small-sized shell, equivalve, elongated with ventral direction, umbonal area narrow, beaks curved (Plate 1, figure 4a), anterior margin elongated and straight than posterior margin, ornamentation formed by about a slightly concentric plicae (Measurements, see Figure 3).

Remarks.- This species was first described from from Turkey, the Liassic of Bilecik-Günören (Conti and Monari, 1991). It is a very similar species described from the Liassic of the Bağlum-Kösrelik region. Additionally, the main similiar character between these species is the ligamen area with elongated posterior teeth.

Parainoceramus bileciki Conti and Monari are very similar to *Parainoceramus pinnaeformis*= *Gervilla pinnaeformis* (Dunker, 1851) (p. 179, pl. 25, figures 10-11) a German species of the Early Liassic age. But our sipecies has extreme ligamental area.

Paleoecologic and Paleogeographic implications.- Species of *Parainoceramus bileciki* Conti and Monari are epifaunal suspension feeders and lives on sandy bottom. (Fürsich, 1977; Fürsich et al., 2001; Delvene, 2003). In Turkey it occurs in the Liassic of the Bilecik-Günören (Conti and Monari, 1991).

Parainoceramus nicosiai Conti and Monari 1991
Plate-1, figures. 4, 4a, 5

1991 *Parainoceramus nicosiai* Conti and Monari, p. 253-254, pl. 2, figures. 4-10.

Descirption.- Species of small size, equivalve, mytiliform, shell wall of reduced thickness. Umbonal area narrow, inflated, slightly curved beak, anterior margin straight and slightly more elongated than the posterior margin. External surfaces commonly smooth with slightly concentric plicae (Measurements, see Figure. 3).

Remarks.- This is the first record of species from Bilecik-Günören, where it is the most characteristic umbonal area of the Liassic. *Parainoceramus altineri* Conti and Monari 1991 (p. 250-251, pl. 2, figures. 11-17) is a very similar species first described from the Jurassic of Bilecik. It is differentiated from *Parainoceramus nicosiai* Conti and Monari by narrow-sharp umbonal area. Most of the English Jurassic species have been assigned to Pseudomytiloides dubius (Sowerby) (Cox et al., 1969, p. 320, figure C49 2). The main distinguishing character between these species is the more concentric plicae of *Parainoceramus nicosiai* Conti and Monari and its less convex shell.

Paleoecologic and Paleogeographic implications.- Species of *Parainoceramus nicosiai* Conti and Monari are usually considered byssally attached suspension feeding, a part of some Jurassic Inocemid groups that could have developed as free-resting on the sandy bottom (Fürsich, 1977; Fürsich et al., 2001; Delvene, 2003). In Turkey it occurs in the Liassic of the Bilecik-Günören (Conti and Monari, 1991).

Class	: Gastropoda Cuvier, 1797
Subclass	: Prosobranchia Edwards, 1848
Order	: Archaeogastropoda Thiele, 1925
Suborder	: Pleurotomariina Cox ve Knight, 1960
Superfamliy	: Pleurotomarioidea Swainson,1840
Family	: Pleurotomariidae Swainson, 1840
Genus	: *Pleurotomaria* Defrance, 1826

Pleurotomaria sp.
Plate-1, figure 6

Description.- Shell with gradated spire, trochoid forms, number of whorls about 4-5, sunken sutures, slightly high spire, subquadrangular whorl section (Measurements, see Figure 3).

Remarks.- The shell shape and position of the trochoid-selenizone are typical of the genus *Pleurotomaria*, due to the lack of the whole shell morphologic characters. *Pleurotomaria* sp., (Conti and Monari, 1992, p. 264, pl. 5, figures. 14-15) is a very similar species from the Jurassic of Bilecik. It is differentiated from our species by high trochoid-selenizone form.

Paleoecologic and Paleogeographic implications.- Species of *Pleurotomaria* sp., are epifaunal suspension feeders (Fürsich, 1977; Fürsich et al., 2001; Delvene, 2003). *Pleurotomaria* sp., species described from the Early Jurassic (France and Spanin) and Early Cretaceous (Aptian) of European (Knight et al., 1969; Fürsich et al., 2001), and from the Turkey, the Liassic of Bilecik-Günören (Conti and Monari, 1991).

Pleurotomaria suessii Hörnes 1853
Plate-1, figure 7, 7a

1853 *Pleurotomaria suessii* Hörnes, Hauer, p. 762.

1911 *Pleurotomaria suessii* Hörnes, Gemmellaro, p. 213, pl. 10, figure 10-12.

1991 *Pleurotomaria*? cfr. *suessii* Hörnes, Conti and Monari, p. 263, pl. 5, figure 1-4.

Description.- Shell small with depressed spire, number of whorls about 3-4, sunken suture, section of the whorl differentiated from the last whorl with elevation (Measurements, see Figure 3).

Remarks.- In the specimens we posses the collabral with literatures, and our specimen are very similar to those coming from Gemmellaro (1911). Our meterial is represented by at a low whorl number, but *Pleurotomaria* cfr. *platyspira* Eudes-Deslongchamps (Conti and Monari, 1991, p. 263, pl. 4, figure 12-15) is a very similar species from the Jurassic of Bilecik.

Paleoecologic and Paleogeographic implications.- Species of *Pleurotomaria suessii* Hörnes 1853 are epifaunal suspension feeders (Fürsich, 1977; Fürsich et al., 2001; Delvene, 2003). *Pleurotomaria suessii* Hörnes 1853 species described from the Early Jurassic of Italy (Gemmellaro, 1911), and from Turkey, Liassic of Bilecik-Günören (Conti and Monari, 1991).

Suborder : Trochina Cox and Knight, 1960
Superfamily : Eucycloidea Koken, 1897
Family : Eucyclidae Koken, 1897
Subfamily : Eucyclinae Koken, 1897
Genus : Eucyclus Eudes-Deslongchamps, 1860
Subgenus : Eucyclus Eudes-Deslongchamps, 1860

Eucyclus (*Eucyclus*) sp.
Plate-1, figure 8

Description.- Shell medium size, high spire, number of whorls about 4-5, whorl convex and separared by deep channel of suture (Measurements, see Figure 3).

Remarks.- Eucyclus (*Eucyclus*) sp., (Szabo, 1995; p. 68-71, pl. 7, figures. 4-6, 10-13, Conti and Monari, 2001; p. 190-199, pl. 6, figures. 6-26) is a very similar species from the Jurassic, due to the lack of the last whole shell morphologic characters.

Paleoecologic and Paleogeographic implications.- Species of *Eucyclus* (*Eucyclus*) sp., are epifaunal suspension feeders (Fürsich, 1977; Fürsich et al., 2001; Delvene, 2003). In Europe it occurs from the Triassic to Oligocene of the Germany and Hungary (Szabo, 1995).

Class : Polychaeta Grube 1850
Order : Sedentaria Lamarck 1818
Family : Serpulidae Rafinesque 1815
Subfamily : Filograninae Rioja 1923
Genus : *Glomerula* Nielsen 1931

Glomerula gordialis (Schlotheim 1820)
Plate-2, figure 1, 2, 2a

1831 *Serpula gordialis* Schlotheim, Goldfuss, p. 234, pl. 69, figure 8.

1931 *Glomerula gordialis* (Schlotheim), Nielsen, p. 88, pl. 1, figures 9-11.

1956 *Serpula* (Cycloserpula) *gordialis* (Schlotheim), Parsch, p. 214, pl. 20, figures 15-16.

1961 *Glomerula gordialis* (Schlotheim), Regenhardt, p. 26, pl. 1, figure 2.

1965 *Glomerula gordialis* (Schlotheim), Nestler, p. 74, pl. 4, figures 6, 8-10.

1968 *Glomerula gordialis* (Schlotheim), Bignot, p. 18, pl. 1, figure 1; pl. 2, figures 1-4.

1973 *Glomerula gordialis* (Schlotheim), Pasternak, p. 9, pl. 1, figures 3-5.

1983 *Glomerula gordialis* (Schlotheim), Jager, p. 26, pl. 2, figures 1-18.

1987 *Glomerula gordialis* (Schlotheim), Jager, p. 40, pl. 1, figures 17-20.

2004 *Glomerula gordialis* (Schlotheim), Radwanska, p. 38-39, pl. 1, figures 1-10.

2006 *Cycloserpula gordialis* (Schlotheim), Zitt et al. figure 15 I.

Description.- The solitary tube attached to the substrate is composed of few whorls. The tube is either regularly coiled planispirally. The outer surface of the tube is sculptured by bioerozion (Plate 2, figure 1).

Remarks.- Most of the jurassic polychaete species have been assigned to *Glomerula gordiali*s. The main generic character of this species is the solitary tube and its joining with another tube.

Paleoecologic and Paleogeographic implications.- Species of *Glomerula gordiali* are semiinfaunal suspension feeders on the sandy bottom of shallow water condition (Hoşgör and Okan, 2006). *Glomerula gordialis* is a stratigraphically and geographically widely distributed species. In Turkey, it exists in the Early Jurassic of the Ankara region. It is also described from the Jurassic to Early Tertiary of Europe, for example, from the Early-Middle Jurassic of Germany (Parsch, 1956), from the Middle-Late Jurassic of the Germany, Poland and central Rusia (Goldfuss, 1831; Radwanska, 2004; Ippolitov, 2007), the Late Cretaceos of the Germany (Regenhardt, 1961; Nestler, 1965; Pasternak, 1973; Jager, 1983, 1987), Denmark (Nielsen, 1931), and the Czech Republic (Zitt et al., 2006) and, the Early Tertiary (Danian) of the Denmark (Nielsen, 1931).

DISCUSSION AND CONCLUSIONS

The nodular limestones and red marls of the Bilecik and Ankara regions, deposited during the Early to Middle Jurassic are known as Ammonitico Rosso facies. Many Jurassic successions in the Alpine-Mediterranean region consist of ammonitico rosso and are subdivided into the following two types; calcareous ammonitico rosso and marly ammonitico rosso. The facies and depositional environments of the ammonitico rosso are confined to seamount topographies in the Mediterranean region. Similar conditions have also been reported for the sequences of Jurassic. (Şengör and Yılmaz, 1981; Görür et al., 1983; Galacz, 1984; Nicosia et al., 1991; Koçyiğit and Altıner, 2002).

This is the first description of Early Jurassic (Late Sinemurian-Early Pliensbachian) bivalves, gastropods and one species of polychaete faunas from Kösrelik, central Anatolia. Four species of bivalves, *Parainoceramus bileciki* Conti and Monari 1991, *Parainoceramus nicosiai* Conti and Monari 1991, *Mytilioides* sp. and *Palaeonucula* sp., three species of gastropods, *Pleurotomaria suessii* Hörnes 1853, *Pleurotomaria* sp. and *Eucyclus* (*Eucyclus*) sp.,and one species of polychaete, *Glomerula gordialis* (Schlotheim 1820) are described from the Kösrelik region and its paleogeographic characteristics discussed.

Opening of the northern branch of the Neotethys affected large areas in the Mediterranean, except its southern and eastern coasts by the early Jurassic time, however Tekin et al (2004) proposed a Late Triassic opening for the northern branch of the Neotethys. Environmental analysis of the Liassic deposits in the Pontides show that the Bilecik to Ispir regions were characterized by rapidly subsiding seamounts (Şengör, 1979; Görür et al., 1983). The topography determined the tectonic characteristic of the northern margin of the Neotethys and controlled the sedimentation durin the Early-Middle Liassic time . So many different facies have been developed around the Mediterranean area. (Hallam, 1969; Görür et al., 1983; Galacz, 1984; Nicosia et al., 1991).

Finally, in the Early Jurassic time the Kösrelik fauna is very similar to the faunas of Bilecik. So the environmental conditions must have been essentially the same too.

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PLATES

PLATE I

Figure 1- *Palaeonucula* sp., left valve, AJK AU 01.

Figure 1a- *Palaeonucula* sp., ligamental area view, AJK AU 01.

Figure 2- *Inoceramus* (*Mytilioides*) sp., left valve, AJK AU 02.

Figure 3- *Parainoceramus bileciki* Conti and Monari 1991, right valve, AJK AU 03.

Figure 3a- *Parainoceramus bileciki* Conti and Monari 1991, right valve, AJK AU 04.

Figure 4- *Parainoceramus nicosiai* Conti and Monari 1911, left valve, AJK AU 07.

Figure 4a- *Parainoceramus nicosiai* Conti and Monari 1911,ligamental area view, AJK AU 07.

Figure 5- *Parainoceramus nicosiai* Conti and Monari 1911, left valve, AJK AU 08.

Figure 6- *Pleurotomaria* sp., dorsal view, AJK AU G1.

Figure 7- *Pleurotomaria suessi* Hörnes 1853, apertural view, AJK AU G2.

Figure 7a- *Pleurotomaria suessi* Hörnes 1853, apical view, AJK AU G2.

Figure 8- *Eucyclus* (*Eucyclus*) sp., dorsal view, AJK AU G3.

(scale: 10 mm)

PLATE - I

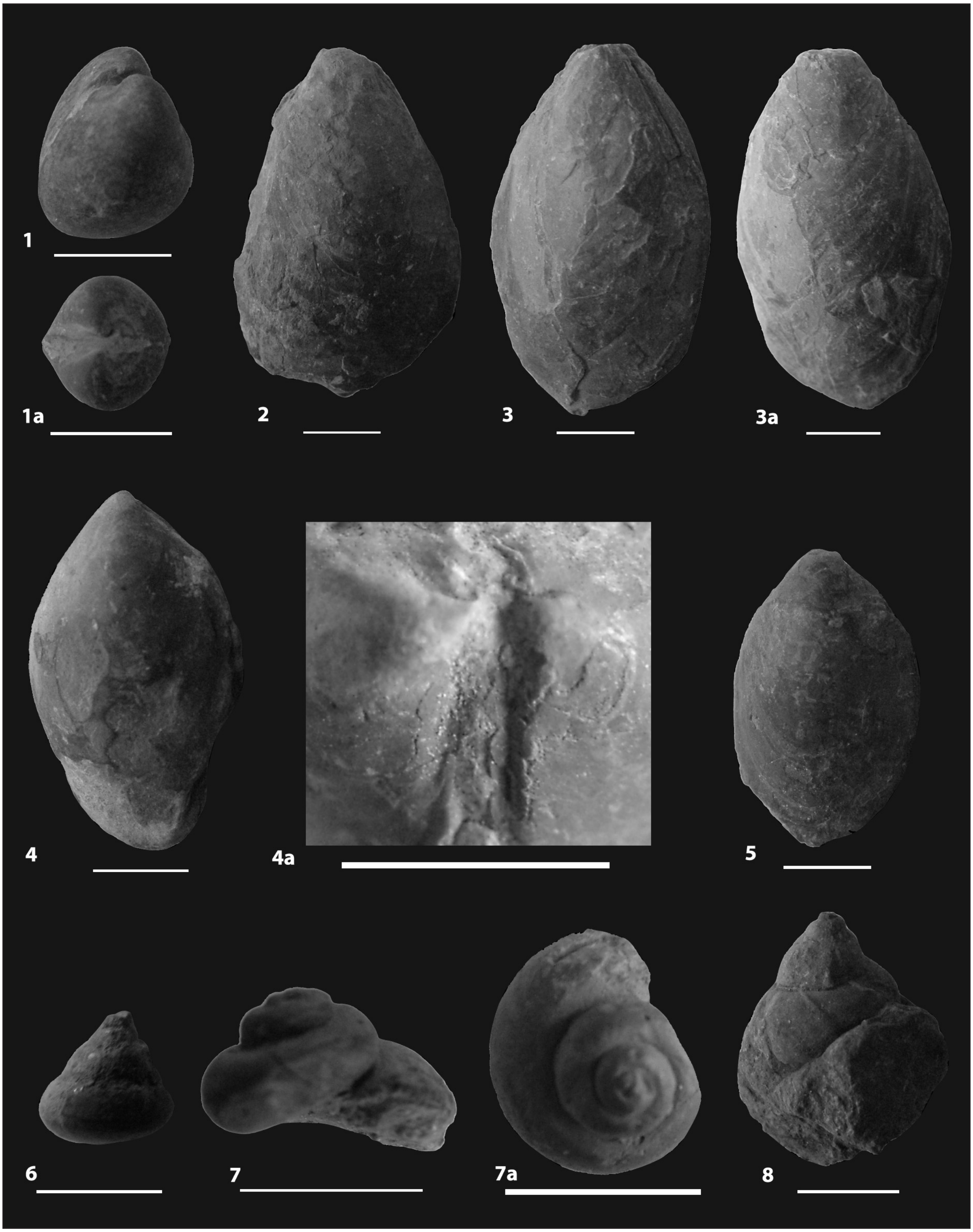

PLATE II

Figure 1- *Glomerula gordialis* (Schlotheim 1820), top view, to show the bioerosion of the solitary tube. (scale: 200 μm)

Figure 2- *Glomerula gordialis* (Schlotheim 1820), top view, the solitary tube and its joining with another tube. (scale: 200 μm)

Figure 2a- *Glomerula gordialis* (Schlotheim 1820), the solitary tube and its joining with another tube. (scale: 100 μm)

PLATE - II