EARLY JURASSIC MOLLUSCS FROM THE MECSEK MOUNTAINS, (S. HUNGARY). A PRELIMINARY STUDY.

by

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Abstract

The examined Hettangian bivalves and gastropods have been collected from a coal-bearing sequence. Freshwater and marginal marine assemblages are recognized. Distribution of molluscs in the sequence as well as sedimentological data suggest that sedimentation of the Mecsek Coal Fm. was influenced by eustatic sea-level changes.The fauna shows affinity to contemporaneous faunas of West and Central Europe.

Inroduction

Lower Liassic bivalves and gastropods from the Mecsek Coal Formation have been known since the beginning of extended mining i. e. the middle of the last century. However the fauna is very poorly documented, in spite of the abundance of molluscan remains in some places.

First report on molluscs of the coal-bearing sequence including descriptions was published by PETERS (1862). Important data on the distribution of fossils and figures on the most frequent forms were given by KLEIDORFER (1898). VADÁSZ (1935) in his monograph of the Mecsek Mountains gave an extended faunal list including several new species. The descriptions, however, have remained unfortunately unpublished. Except the work of NAGY (1970) no systematic work on the fauna has been published in this century.

Opening of coal pits during the last decade has provided favourable conditions for collection. The new collections, which were made recently in the Pécsbánya coal pit, may serve as a proper starting point for studying the Early Jurassic molluscan faunas of the Mecsek Mountains.

Geological setting

The Mecsek Coal Formation occupies the whole Hettangian and parts of the Upper Triassic and the Lower Sinemurian. The coal-bearing sequence lies conformably on the Karolinavölgy Sandstone Formation. Traditionally the basal junction i.e. the lowermost coal seam was regarded as the Triassic/Jurassic boundary. Palynological studies recently suggested to draw this boundary higher in the sequence (BÓNA 1983). The top of the Mecsek Coal Fm. is dated within the Sinemurian. In the lowermost sandstone beds of the overlying Vasas Marl Fm. ammonites indicating Upper Sinemurian, Obtusum Zone age appear. (FÖLDI 1967).

Fitting the Mecsek Coal Fm. into the standard system of Jurassic zones is, due to the scarcity of index fossils, rather difficult. NAGY and NAGY (1969) divided the formation into three informal members. The lower one consisting of continental – fluvial deposits belongs to the Triassic. The base of the upper member is formed by a characteristic sequence, the so-called "Upper Seamfree Leading Beds". The oldest Jurassic ammonites of the Mecsek came mainly from this important marker horizon and indicate Lower Sinemurian, Bucklandi and Semicostatum Zones age (NAGY 1967). Therefore the middle member roughly corresponds to the Hettangian Stage.

The thicknesses of "coal-measures" show marked variation: 120 m and up to 1200 m in the northern and southern regions, respectively. This pattern suggests deposition in a tectonic half-graben. The whole sequence is more or less folded.

The locality

The Pécsbánya coal pit is exploited about 4 km NNE of the centre of the town Pécs (Fünfkirchen), in the Karolina valley. A succession belonging to the middle member of the Mecsek Coal Fm. is exposed. The beds are steeply dipping east and south-east. The succession is complicated by several faults. Deposits of the Pécsbánya sequence are highly variable laterally as well as vertically. As the coal-it is worked extensively the exposures are rapidly changing.

Therefore a general model of sedimentology, partly based on studies of BIMBÓ (1971) is presented and illustrated in *Fig. 1.*

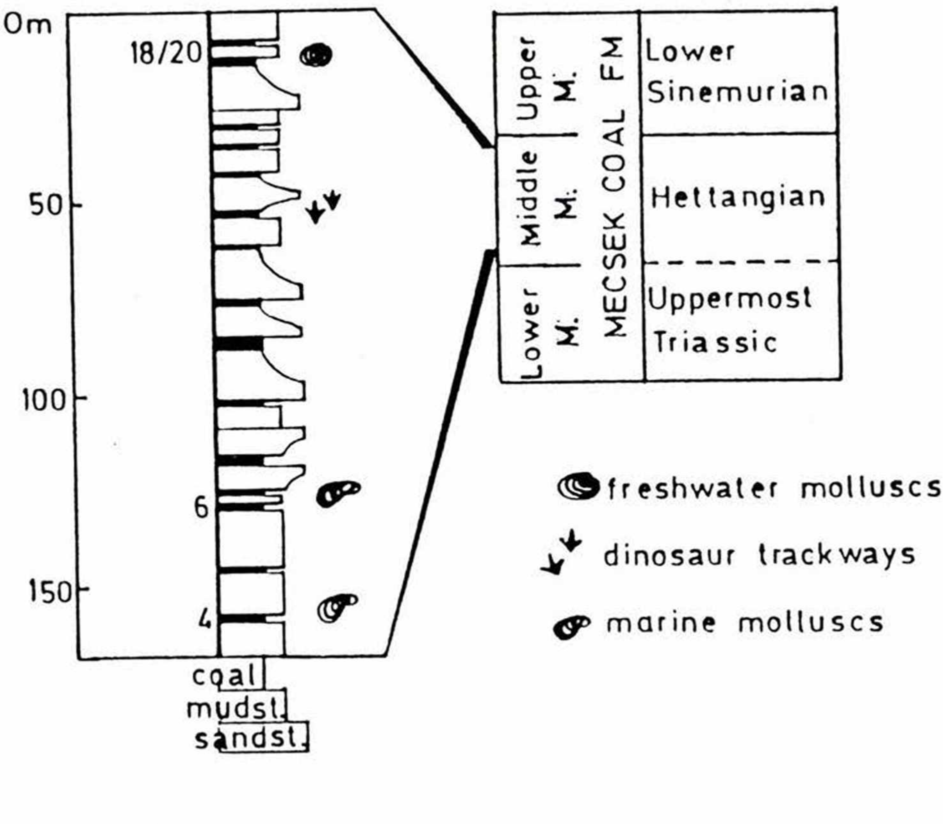

Fig. 1. Schematized section of the Pécsbánya coal pit. Numbers refer to coal seams beneath fossiliferous beds.

Lower part of the succession is dominated by argillaceous and marly siltstones and relatively thick (up to 2.4 m) coal seams. These beds overlie an unexposed sequence of fining upwards sandstone-clay-thin coal seam cycles.

Above seams Nos. 4 and 6 shell beds are frequent. These occurences and a preceding one ca. 10 m below contain the oldest known Jurassic macrofossils in the Mecsek.

Several thick (up to 12 m) sandstone beds characterize the middle part of the succession. Sandstones are often coarse-grained and rich in felspar. Upwards fine-grained sediments became dominant. Recently a rich ichnofauna consisting of dinosaur trackways and arthropod trails has been discovered.

Sedimentological and palaeontological data suggest that the lower part of the Pécsbánya coal pit sequence probably deposited in a lower delta plain environment while overlying rocks can be interpreted as fluvial and/or upper delta plain sediments.

The fauna

The mollusc fauna includes bivalves and gastropods. Phyllopods and ostracods are the only other invertebrate fossils. The bivalves represent nine superfamilies: Mytilacea, Pteriacea, Limacea, Ostreacea, Unionacea, Crassatellacea, Cardiacea, Arcticacea and Pholadomyacea. The gastropods are representatives of the superfamilies Euomphalacea, Pleurotomariacea, Neritacea, Loxonematacea, Cerithiacea, Littorinacea and Acteonacea. *(Fig. 2)*. Each genera are represented by one or a few species.

Short comments on the recently collected molluscs are given below. Identification has been made for all the molluscs though some of the names are provisional.

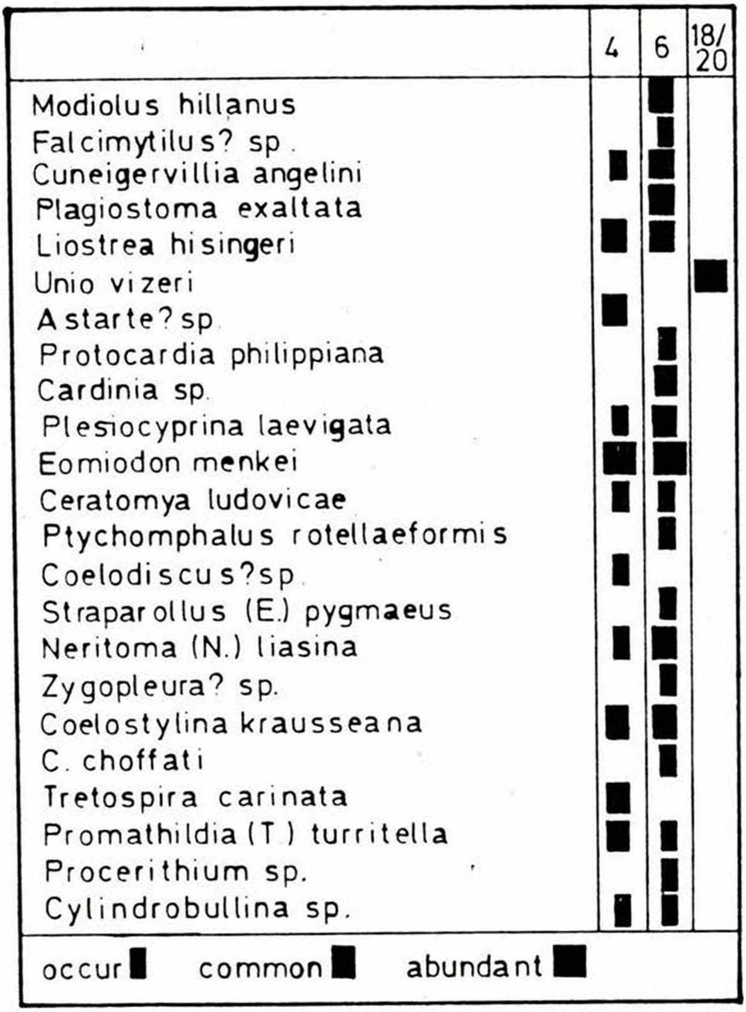

Fig. 2. Composition of the mollusc fauna from the Mecsek Coal Fm. at Pécsbánya. Numbers refer to coal seams in Fig. 1.

Modiolus hillanus SOWERBY 1818. Pl. I. fig. 1.

The shape and dimensions of the Pécsbánya specimens agree well those of the species figured in the literature. The agreement is especially good with the type.

? *Falcimytilus* sp. Pl. I. fig. 2.

The terminal beak and the blunt carina running from beak to ventral margin recall *Falcimytilus* COX 1937, though species ranged into this genus are characteristically sickle-shaped.

Modiolus LAMARCK 1799, as an other genus which may be taken into consideration is rounded anteriorly and more elongated. The shape of the specimens found at Pécsbánya is very similar to that of *Mytilus chartroni* COSSMANN 1904 though according to COSSMANN (1904) it possesses a rudimentary cardinal tooth which is not observable on the Mecsek specimens.

Cuneigervillia angelini (LUNDGREN 1878). Pl. I. fig. 3.

COX (1954) when erecting *Cuneigervillia* gave a list of Liassic species included into the new genus. One of them *C. conimbrica* (BÖHM 1901) seems to be a synonym of *C. angelini.*

The angle between dorsal margin and umbo (about 40°), the slightly concave posterior margin and the small anterior auricle, all characteristic of the species, are well visible. The Mecsek specimens agree well with the topotypes described and figured by TROEDSSON (1951).

Plagiostoma exaltata (TERQUEM 1855). Pl. I. fig. 4.

Shape and apical angle (approx. 80°) of the Mecsek specimens agree with *Plagiostoma exaltata* figured in the literature.

Liostrea hisingeri (NILSSON 1832). Pl. I. fig. 5.

Specimens of this very variable species have thick shell walls. According to STENZEL (1971) this feature is characteristic of the "southern" representatives of *L. hisingeri.*

In NW Europe the continuing Liassic transgression resulted in the replacement of *Liostrea* by the stenohaline *Gryphaea* (HUDSON and PALMER

1976). A similar situation is seen in the Mecsek succession where the Vasas Marl contains abundant *Gryphaea mcullochii* J. de C. SOWERBY.

Unio vizeri (VADÁSZ in NAGY 1970). Pl. I. fig. 6.

This species was previously ranged into *Trigonodus* SANDBERGER in ALBERTI 1864. Its shape and dentition, however, suggest that it belongs to *Unio s. l. instead Trigonodus* which did not persist into the Jurassic (HALLAM, 1981a).

? *Astarte* sp. Pl. I. fig. 7.

Very poorly preserved shells showing astarte-like strong concentric ribs. Internal characters are unknown.

Protocardia philippiana (DUNKER 1851). Pl. I. fig. 8.

The Pécsbánya specimens show all characteristic features of this widespread species.

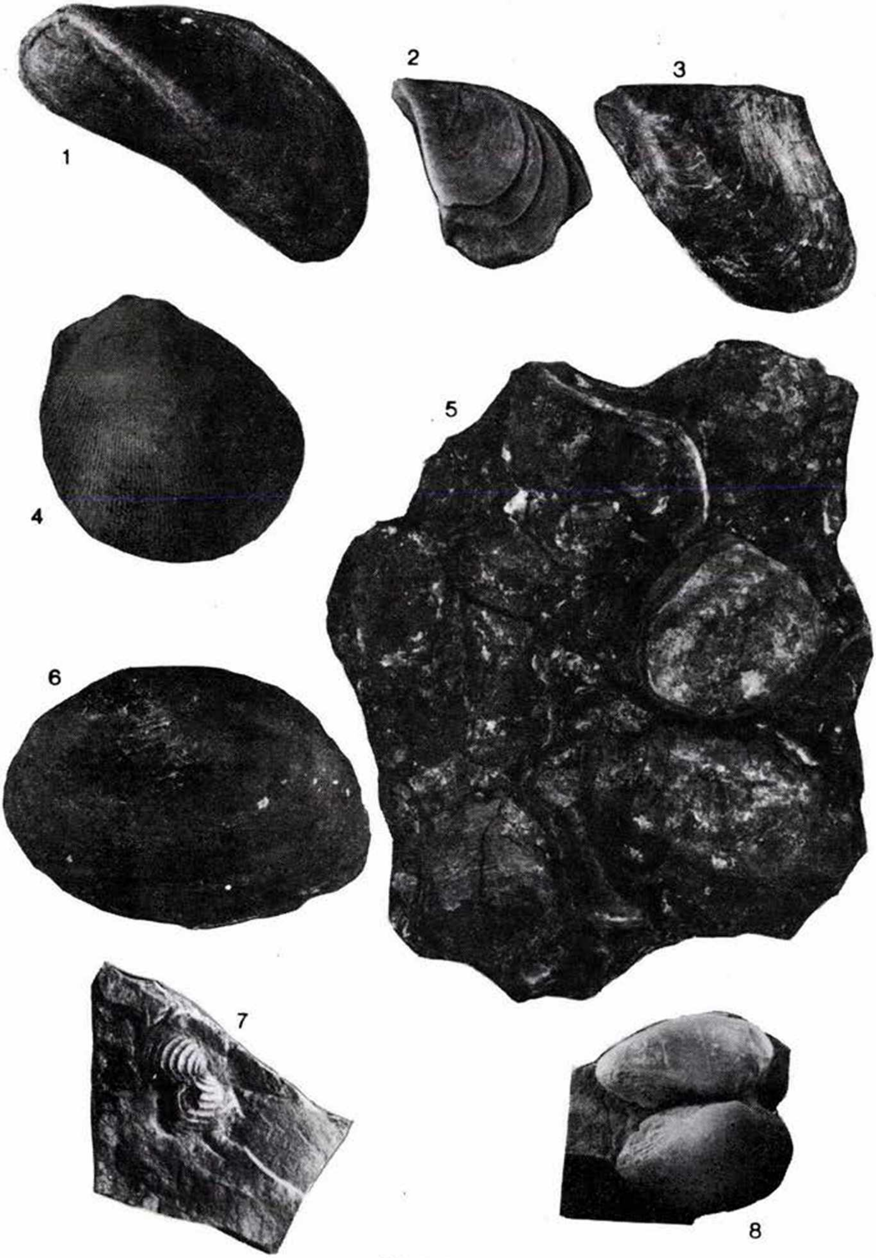

PLATE I.

Fig. 1. Modiolus hillanus SOWERBY, Fig. 2. ? Falcimytilus sp., Fig. 3. Cuneigervillia angelini (LUNDGREN), Fig. 4. Plagiostoma exaltata (TERQUEM) Fig. 5. Liostrea hisingeri (NILSSON), Fig. 6. Unio vizeri (VADÁSZ in NAGY), Fig. 7. ? Astarte sp., Fig. 8. Protocardia philippiana (DUNKER) (Figures are in natural size unless otherwise stated)

Cardinia sp. Pl. II. fig. 1.

Shells of small size for the genus. Outline is characteristically trapezoidal, dentition is of *Cardinia* -type.

Plesiocyprina laevigata (TERQUEM 1855). Pl. II. fig. 2.

Shape and dentition of the specimens collected at Pécsbánya agree well with those of specimens figured and described by COSSMANN (1904) from W France.

Eomiodon menkei (DUNKER 1851). Pl. II. figs. 3-5.

The most frequent bivalve species at Pécsbánya. The specimens show all characteristic features stated and illsutrated by HUCKRIEDE (1967). Outline and development of teeth are rather variable.

Ceratomya ludovicae (TERQUEM 1855). Pl. II. fig. 6.

Although the pallial line of available specimens is not observable, split extending back form beak on internal mold of right valve is rather short and shallow so this species can be ranged into *Ceratomya.* The specimens from the Mecsek are very similar to those described by JOLY (1907, 1936).

Ptychomphalus rotellaeformis (DUNKER 1851). Pl. II. figs. 7-8.

Two, somewhat crushed specimens were collected recently. The peripheral, subsutural selenizone, the lenticular form and the unornamented shell, all characteristic features to the species, are well visible.

? *Coelodiscus* sp. Pl. II. figs. 9-10.

The specimens of smooth, evolute shell, almost flat spiral face and wide umbilucus probably belong to the mixed group of species ranged to *Coelodiscus* BRÖSAMLEN 1909.

Straparollus (Euomphalus) pygmaeus (DUNKER 1851). Pl. II. figs. 11-13.

It is worthy to mention this small gastropod because this species is a very late representative of *Euomphalus.* A well preserved specimen came from borehole Rücker-31 and several specimens from Pécsbánya show all generic (subgeneric) characteristics summarized by YIN HONG-FU and YOCHELSON (1983): the discoidal shell with a keel on the upper face and a 2nd on base, the rounded outer face and the collabral and spiral threads. Growth lines of the Mecsek specimens are slightly opisthocline on upper whorl surface, curving to prosocline at keel, prosocline on outer whorl surface and slightly prosocline on basal surface. According to YIN HONG-FU and YOCHELSON (1983) a few of the Triassic species assigned to *Euomphalus* does really belong to this taxon. One can suppose that it persisted into the Early Jurassic.

Neritoma (Neridomus) liasina (DUNKER 1851). Pl. II. fig. 14.

A rather common species at Pécsbánya. Inner lip callous, not concave.

? *Zygopleura* sp. Pl. II. fig. 15.

A poorly preserved fragment showing axial ribs on its last whorl probably belongs to *Zygopleura* KOKEN 1892.

Coelostylina krausseana (DUNKER 1851). Pl. II. fig. 16.

A very frequent species at Pécsbánya. The specimens show some variability in shape though do not differ considerably from the lectotype and topotypes described and figured by HUCKRIEDE (1967).

Coelostylina choffati BÖHM 1901. Pl. II. fig. 17.

The Mecsek specimens show the same dimensions as the type although their apical angle may be somewhat smaller.

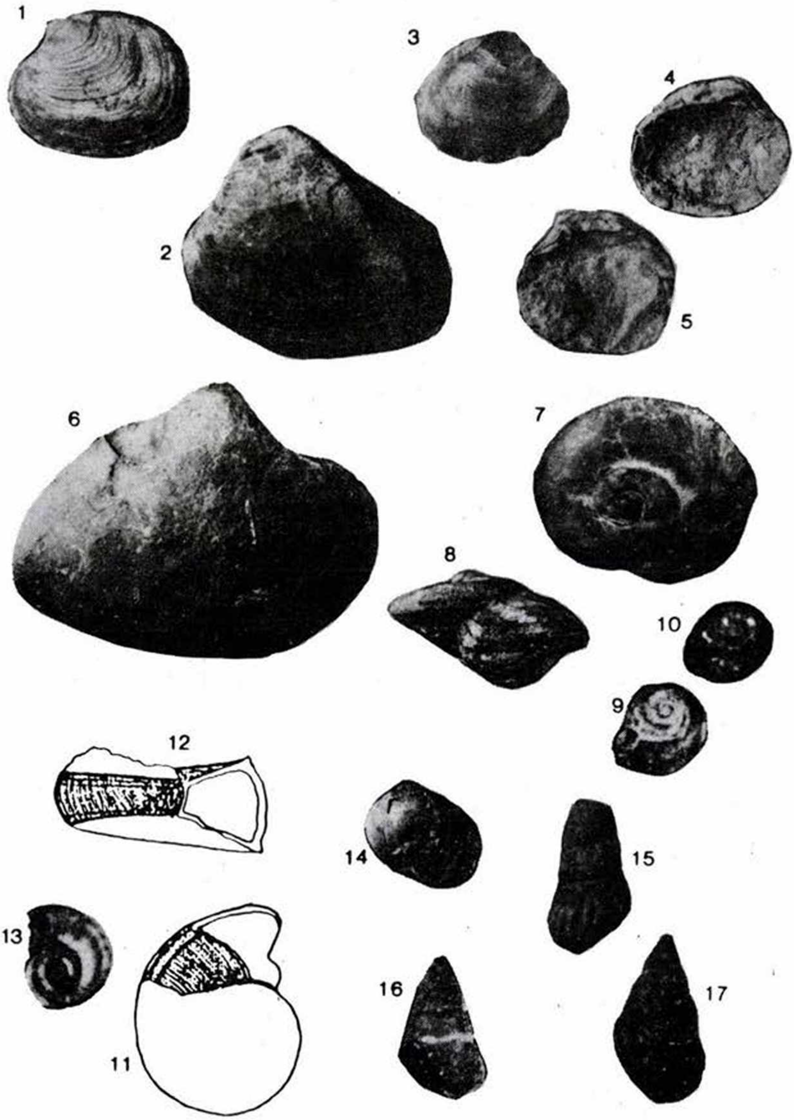

PLATE II.

Fig. 1. Cardinia sp., Fig. 2. Plesiocyprina laevigata (TERQUEM), Figs. 3-5. Eomiodon menkei (DUNKER). 3: external view, 4: internal view of left valve, 5: internal view of right valve., Fig. 6. Ceratomya ludovicae (TERQUEM), Figs. 7-8. Ptychomphalus rotellaeformis (DUNKER). 7: apical view, 8: apertural view., Figs. 9-10. ? Coelodiscus sp. (8x), Figs. 11-13. Straparollus (Euomphalus) pygmaeus (DUNKER) 11: apical view, 12: apertural view, 13: basal view. (10x) Fig. 14. Neritoma (Neridomus) liasina (DUNKER), Fig. 15. ? Zygopleura sp., Fig. 16. Coelostylina krausseana (DUNKER) (5x), Fig. 17. Coelostylina choffati (BÖHM)

Tretospira carinata (TERQUEM 1855). Pl. III. fig. 1.

Specimens collected from the Pécsbánya agree well with the strongly carinate topotype figured by COSSMANN (1913, Pl. X. fig. 16.).

Promathildia (Teretrina) turritella (DUNKER 1851). Pl. III. fig. 2.

The specimens from the Mecsek Coal Fm. at Pécsbánya shows the same shape and dimensions as the type. Growth lines are opisthocyrt.

Procerithium (Rhabdocolpus) sp. Pl. III. fig. 3.

Several fragmentary specimens are available showing slightly curved axial ribs and somewhat weaker four spiral threads. Aperture (broken in most specimen) apparently evenly rounded.

Cylindrobullina sp. Pl. III. fig. 4.

Small (up to 3mm) shells ornamented only by growth lines possessing heterostrophic embrional whorls.

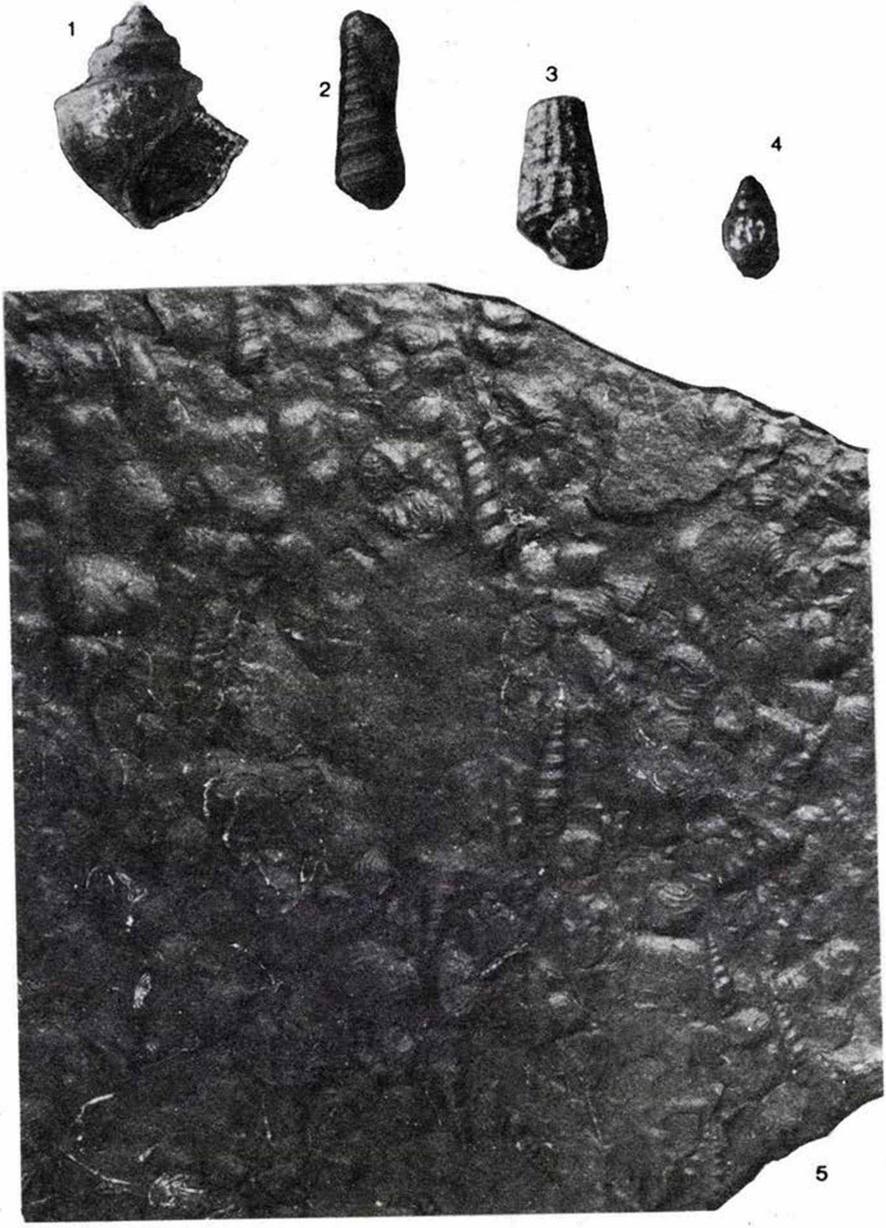

PLATE III.

Fig. 1. Tretospira carinata (TERQUEM), Fig. 2. Promathildia (Teretrina) turritella (DUNKER), Fig. 3. Procerithium (Rhabdocolpus) sp. (5x), Fig. 4. Cylindrobullina sp. (5x), Fig. 5. Bedding-plane view.

Palaeoecology

Lower Liassic molluscs collected at Pécsbánya belong to two ecological group.

Occurence of *Unio vizeri* in dark grey claystone and siderite beds near the top of the exposed sequence indicates freshwater environment. Phyllopods and darwinulid ostracods as associated faunal elements support this interpretation.

A realtively diverse marine gastropod and bivalve fauna came from the lower part of the Pécsbánya succession. Several associations can be distinguished whose studies are in progress so only a general palaeoecological evaluation is given here.

Fossils generally oscur as paucispecific shell beds and pavements (Pl. III. fig. 5.) in various sediments ranging from silty claystones to argillaceous or marly siltstones often immediately overlying coal seams.

The lack of stenohaline organisms and composition of the fauna point to lowered and/or fluctuating salinity environments in which these skeletal concentrations have been formed.

Among European Jurassic bivalve associations four main a ecological group can be distinguished (HALLAM 1976). All marine bivalve genera present in the Pécsbánya fauna are characteristic of lagoonal associations except Plagiostoma and Ceratomya which are abundant in the more stenohaline nearshore marine associations.

Jurassic gastropods are realtively neglected in palaeoecological studies. Species found at Pécsbánya have been recorded elsewhere from marginal marine sediments so they may indicate a similar environment as the bivalves.

In marginal marine environments salinity is often the dominant ecological factor. Lagoons and enclosed bays are especially characterized by short-term oscillations in salinity. Such oscillations may account for the occurence of relatively stenohaline forms such as *Ceratomya*, *Plagiostoma* and the eotomariid gastropod *Ptychomphalus* in association of euryhaline genera.

Environmental changes in the Lower Liassic of the Mecsek Mountains

The Jurassic System in the Mecsek Mountains is represented by a continuous sequence of marine deposits. The temporal change of depositional environments shows a general deepening tendency from the Early Jurassic fluvial – marginal marine setting to the Late Jurassic pelagic sedimentation. This trend may be considered as a succession of several minor shallowing and deepening episodes. Timing of transgressions recognized in the Lower Jurassic of the Mecsek Mountains suggests that some of them were caused by eustatic changes.

Several alternative sea-level curves are available for the Lower Jurassic, based on classical methods (HALLAM 1981b, 1987) and seismic stratigraphy (HAQ et al. 1987). Comparison of curves shows rather good agreement on the main eustatic changes so they may be acceptable as representations of real events. Stratigraphc column of the Mecsek Lower Liassic and sea-level curves after HALLAM (1987) and HAQ et al. (1987) are shown in *Fig. 3*.

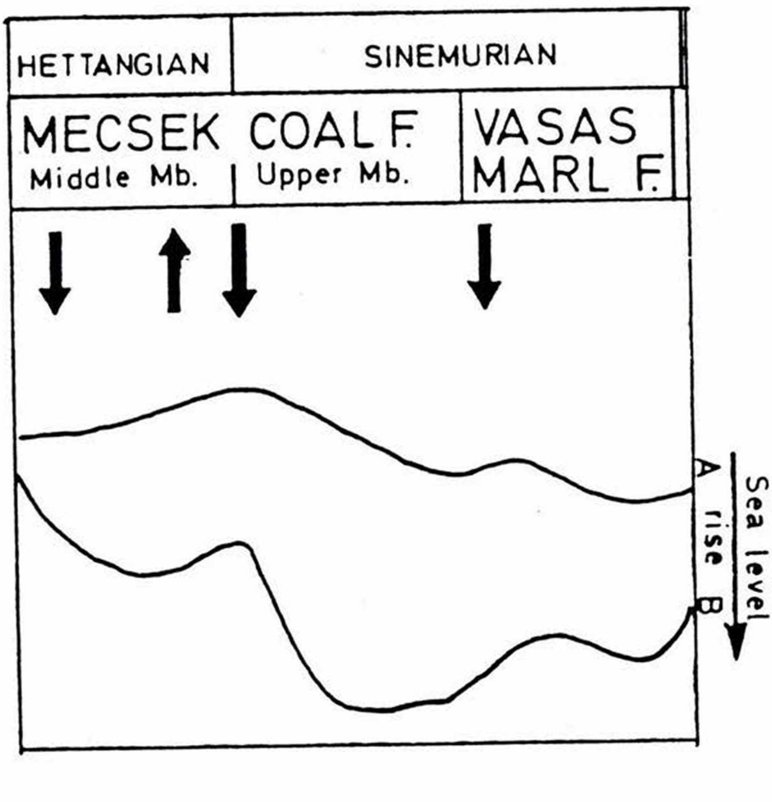

Fig. 3. Lower Liassic sequence of the Mecsek Mountains and sea-level curves. A, after HAQ et al. (1987); B, after HALLAM (1987). Arrows refer to transgressive (to the righ) and regressive (to the left) trends in the Mecsek Mountains.

Two transgressions have been observed in the Mecsek Coal Formation (NAGY and NAGY 1969). The first one resulted in the lowermost occurence of marginal marine sediments and fauna described above. Marine influences related to the second transgressive episode reached their maximum during deposition of the fully marine "Upper Seamfree Leading Beds".

Lower Sinemurian age of the latter corresponds well to a phase of sea-level rise which was one of the most important in the Jurassic (HALLAM 1981b, p. 739). Therefore the first transgression may correspond tot he Middle Hettangian rise suggested by HALLAM's curve.

Higher Sinemurian correlations seem to be not so clear as the Hettangian - Lower Sinemurian ones. The start of fully marine sedimentation in the Mecsek (Obtusum Zone) corresponds to episodic falling sea-level as suggested by both curves. Sedimentary evolution of the Mecsek basin was controlled by local tectonic activity at that time.

Palaeobiogeographical affinities of the mollusc fauna from the Mecsek Coal Fm. at Pécsbánya

The Permian - Mesozoic succession of the Mecsek Mountains and its subsurface continuation belong to the Tisza (Tisia) megatectonic unit. Tisza is one of the "suspect terranes" or "displaced blocks" of uncertain palaeogeographical setting which are scattered along the Alpine mobile belt. Although palaeobiogeographical studies of Jurassic ammonite and brachiopod faunas strongly suggest that the Mecsek (and the whole Tisza) was part of the north Tethyan (European) margin during the early and Middle Jurassic there are arguments for its southern origin. Because debates have not been concluded yet, palaeobiogeographical evaluation of the fauna collected at Pécsbánya may provide further arguments for solving the problem.

Table I. lists all species which were specifically identified from Pécsbánya and indicates the occurences in other Hettangian faunas of Europe. Of 16 species recognized, 1 is "endemic" to the Mecsek, 9 are known only from the epicontinental Jurassic of Europe (Neumayria faunal province as proposed by GÉCZY 1984a) and 6 have been recorded both from Neumayria and "Alpine" Europe. hence the mollusc fauna from the Mecsek Coal Fm. is a Neumayrian fauna suggesting that the mecsek was part of the European Margin of the Jurassic Tethys.

This agrees with results previously obtained for Liassic ammonites (GÉCZY 1973, 1984b), for Pliensbachian gastropods (SZABÓ 1988) and for Jurassic brachiopods (VÖRÖS 1984).

It is worthy to note, however, that benthonic molluscs seem to be less suitable for palaeobiogeographic analysis than other groups e.g. brachiopods.

According to HALLAM (1976) compositional differences between Jurassic bivalve faunas of NW Europe and south ("Alpine") Europe can be attributed to local environmental rather than province determining factors. The European Jurassic Bivalve Province of HALLAM (1977) involves areas both of Neumayria and the classical Mediterranean Province. According to SZABÓ (1980) Jurassic gastropods show stronger provinciality. The Souther Alps, which are regarded as part of the southern Tethyan margin, however, bear Neumayrian Hettangian gastropod faunas (SZABÓ 1980).

The relative uniformity of Hettangian betnhonic mollusc faunas indicates that bivalves and gastropods could migrate between the northern and southern shores of Tethys during the Early Jurassic.

Table 1.

	1.	2.	3.	4.	5.	6.
Modiolus hillanus	x	x	x	x		x
Cuneigervillia angelini	x			x		
Plagiostoma exaltata	?	x			x	x
Liostrea hisingeri		x	x	x	x	x
Unio vizeri						
Protocardia philippiana	x	x	x	x	x	x
Plesiocyprina laevigata		x				
Eomiodon menkei			x	?		
Ceratomya ludovicae		x	?			
Ptychomphalus rotellaeformis		x	x		x	
Straparollus (Euomphalus) pygmaeus			x			
Neritoma (Neridomus) liasina	x	x	x			
Coelostylina krausseana		?	x			
Coelostylina choffati	x					
Tretospira carinata		x				
Promathildia (Teretrina) turritella	x	x	x		x	

Table I. palaeobiogeographical comparison of the mollusc fauna from the Mecsek Coal Fm. at Pécsbánya. 1: Portugal (BÖHM 1901), 2: W and NE France (TERQUEM 1855, COSSMANN 1904), 3: Halberstadt, NW Germany (DUNKER 1851), 4: Scania (TROEDSSON 1951), 5: Southern Alps (BISTRAM 1903, GAETANI 1970), 6: NW Carpathians (KOCHANOVÁ 1961, 1967).

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