M A L A K O L Ó G I A I   T Á J É K O Z T A T Ó
MALACOLOGICAL NEWSLETTER
2001 19: 5–12

Macrobioerosion in the Shells of Early-Miocene Oysters of Two Localities – a Comparison (Hegyeskő road cut, Szarvaskő and abandoned limestone quarry, Nagyvisnyó; Bükk Mountains, Hungary)

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Abstract: Distribution and position of traces of bioerosion in oyster valves is compared in the case of two Early-Miocene (Carpathian) age localities. Activity of Clionid sponges, Polychaete worms, boring bivalves and Cirripeds have been observed. On the basis of higher diversity of ichnotaxa, higher proportion of Polychaete borings and lower rate of sponge activity we can conclude on shallower marine circumstances at the Nagyvisnyó locality.

Key–words: bioerosion, Ostrea valves, Carpathian, Bükk Mountains, Hungary

1. Introduction

The term "bioerosion" have been introduced by Conrad Neumann in 1966 as an abbreviated form of "biologic erosion". It has been used to identify the process by which animals, plants and microbes penetrate surfaces of hard substrates (Bromley, R. G. 1992).

In this case valves of epibenthic, suspensionfeeder bivalves (Ostrea) served as hard substrate for the larvae of different bioeroder organisms.

The aim of the investigation is to describe and compare the traces left by various marine invertebrates in the valves of oysters.

2. Geographical position oh the localities

2.1. Szarvaskő, Hegyeskő road cut

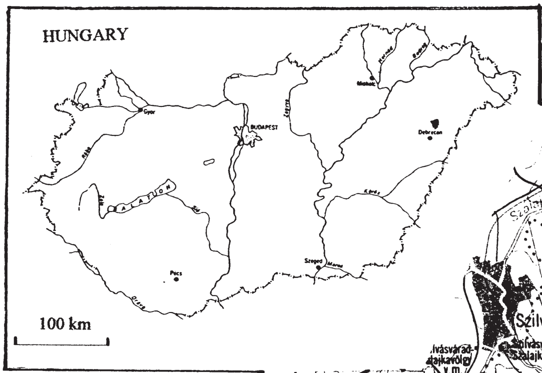
The locality is situated in North-Hungary at the southern slopes of Bükk Mountains. It lies six kilometers to the north from Eger. A small road cut exposes the Ostrea rich layer (Pelikán, P. 1998). (Fig. 1.).

2.2. Nagyvisnyó, abandoned limestone quarry

The locality can be found at the north-western edge of Bükk Mountains. It is situated 42 kilometers to the north from Eger. The exposure is approximately 1,5 km to the west from the middle of the village (Fig. 1.).

3. Geological setting

The age of the localities is the same. Both of them belong into the Carpathian stage within the Early-Miocene. Deposits of the Egyházasgerge Formation are exposed in the case of both localities (Hámor, G. 1998).



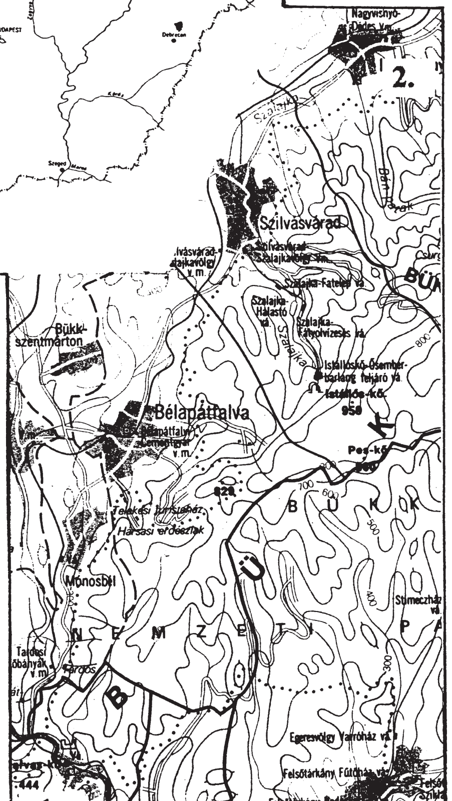


Fig. 1.:
Geographical position
of the localities

Legend:
1. Szarvaskő
2. Nagyvisnyó

Oyster valves occur in great quantity in the layer of greenish clayer sand and finegrained sandy pebbles at Szarvaskő (Fig. 2.).

The layer which contains the Ostrea remains at Nagyvisnyó is the following: „coarsegrained sand with pebbles“ (Fig. 2.).

4. Methods

100 oyster valves have been collected by sampling at both localities. After drying the valves were treated by H_2O_2 in order to remove all the small particles which filled in the holes and cavities within the substrate. The above mentioned processes have been repeated three times. After these all the valves were examined for the presence of traces of macrobioerosion. Position and distribution of the traces also have been examined. The valves have been divided into three equal parts: I. the umbo region; II. the middle of the valve; III. the distal end of the valve. (These region are marked as I., II. and II. in the figures number 7., 8., 9., 10.).

Epoxi casts, using ARALDIT AY 103 and HAERTER HY 956 components, also have been made. Identification of the different ichnotaxa have been carried out by the help of the following studies: Bromley, R. G. (1970, 1972); Bromley, R. G.–D'Alessandro, A. (1983, 1984); Ekdale, A. A.–Bromley, R. G.–Pemberton, S. G. (1984); Kelly, S. R. A.–Bromley, R. G. (1984); Warme, J. (1970).

Photographs were taken in the field and in the laboratory, too.

5. Discussion

5.1. Macrobioerosion in the valves of oysters collected at Szarvaskő, Hegyeskő road cut

Among the collected 100 *Ostrea* valves I found 90 specimens bearing traces of bioerosion. The number of right valves were 79 regarding the bioeroded specimens. Epoxi casts have been made from ten valves.

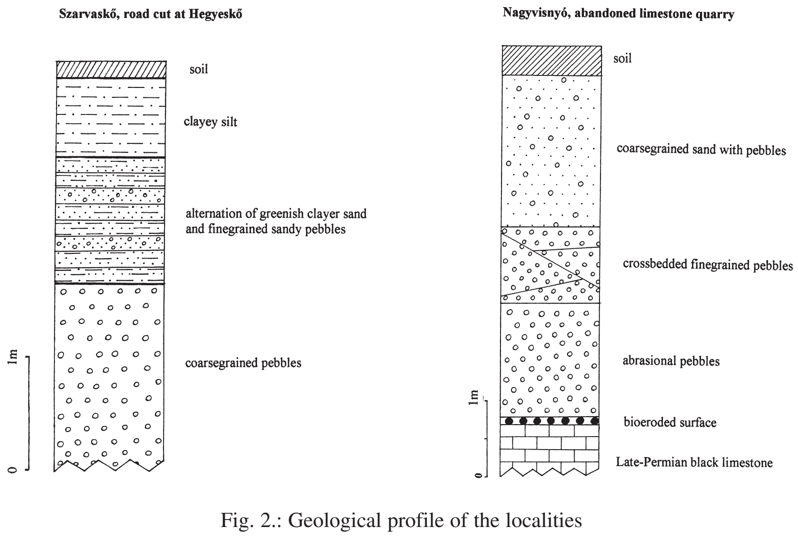


Fig. 2.: Geological profile of the localities

Ichnotaxa	Szarvaskõ	Nagyvisnyó
Entobia geometrica	X	X
Entobia laquea	X	X
Entobia cateniformis	X	X
Entobia megastoma		X
Entobia isp.	X	
Caulostrepsis taeniola	X	X
Caulostrepsis contorta		X
Maeandropolydora decipiens		X
Maeandropolydora sulcans		X
Maeandropolydora barocca		X
Trypanites weisei	X	
Trypanites isp.		X
Gastrochaenolites lapidicus	X	X
Gastrochaenolites torpedo	X	X
Gastrochaenolites isp.		X
Rogerella pattei		X
Rogerella isp.	X	

Fig. 3.: List of the observed ichnotaxa

Activity of Clionid sponges, *Polychaete* worms, boring bivalves and *Cirripeds* have been observed. List of identified ichnotaxa is shown by Fig. 3. According to the epoxi casts four Entobian ichnotaxa occur in the collected material. The growth phases refer to well developed *Clionid* colonies; D and C phases are dominant (Fig. 4.). Regarding the other ichnogenera *Caulostrepsis taeniola* and *Gastrochaenolites lapidicus* occur in great quantity (Fig. 6.). Traces of bioerosion are more common in the outer surface of the valves. The rate of *Gastrochaenolites* ichnogenera slightly increases towards the distal end of the valves. While the activity of *Polychaetes* is more significant at the umbo region. The rate of Entobians is almost the same in the three different parts of the valves (Fig. 7.) In the inner surface of the oyster valves the Entobians are dominant. *Polychaete* borings are most common in the distal part of the valves. The rate of *Gastrochaenolites* decreasing towards the distal part of the valves (Fig. 8.).

5.2. Macrobioerosion in the valves of oysters collected at Nagyvisnyó, abandoned limestone quarry

There were 100 *Ostrea* valves have been collected at the locality. The number of bioeroded specimens among them were 93. The number of right valves were 92.

Traces of bioerosion refer to the activity of Clionid sponges, Polychaete worms, boring bivalves and Cirripeds (Fig. 3.). On the basis of epoxi casts I managed to identify four *Entobian* ichnospecies. All growth phases are present. Dominant growth phases are “C” and “B” (Fig. 5.). Among the other ichnotaxa *Caulostrepsis* taeniola and unidentified bivalve borings (*Gastrochaenolites* isp.) are the most significant. But it worth mentioning about the high diversity of the different Maeandropolydora ichnotaxa (Fig. 6.).

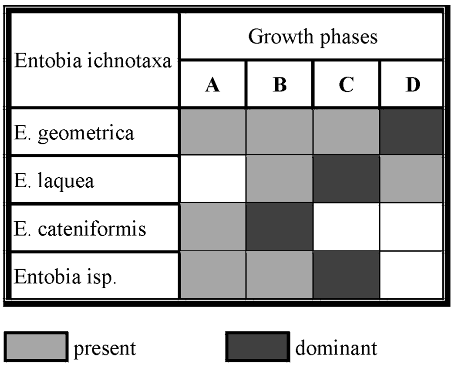


Fig. 4. Distribution of Entobia ichnotaxa according to growth phases in the Ostrea valves of Szarvaskő locality

The rate and density of macrobioerosion are more significant in the outer surface of the valves. *Polychaete* borings are dominant in the case of all segments. *Entobian* traces have the less importance (Fig. 9.).

Regarding the inner surface of the valves the dominance of *Polychaete* borings can be observed again. The rate of *Gastrochaenolites* ichnogenus decreaeses towards the distal end of the valves. The middle region of the valves are the richest in Entobians (Fig. 10.).

Entobia ichnotaxa	Growth phases			
	A	**B**	**C**	**D**
E. geometrica	present	present	dominant	present
E. laquea		present	present	
E. cateniformis	present			
Entobia megastoma.		dominant	present	

present   dominant

Fig 5. Distribution of Entobia ichnotaxa according to growth phases in the Ostrea valves of Nagyvisnyó locality

6. Summary and conclusions

On the basis of similarities and differences in the number, distribution and position of ichnotaxa occuring in the oyster valves of the two localities we can conclude on paleoenvironmental, bathymetric alterations.

Similarities:

– dominancy of *Caulostrepsis taeniola,*
– significant proportion of *Gastrochaenolites* ichnotaxa (Fig. 6.),
– law rate of *Rogerella* ichnotaxa (Fig. 6., 7., 9.).

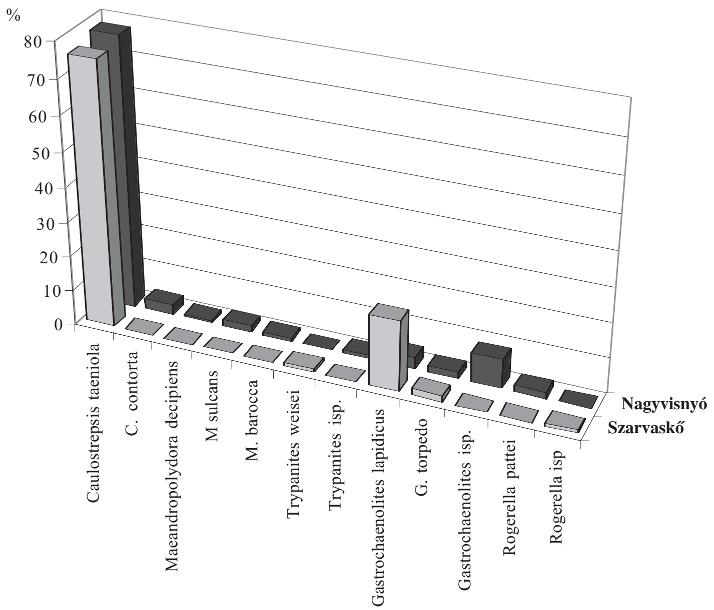


Fig. 6. Distribution of the observed ichnotaxa at the two localities (Entobia ichnogenus is excluded)

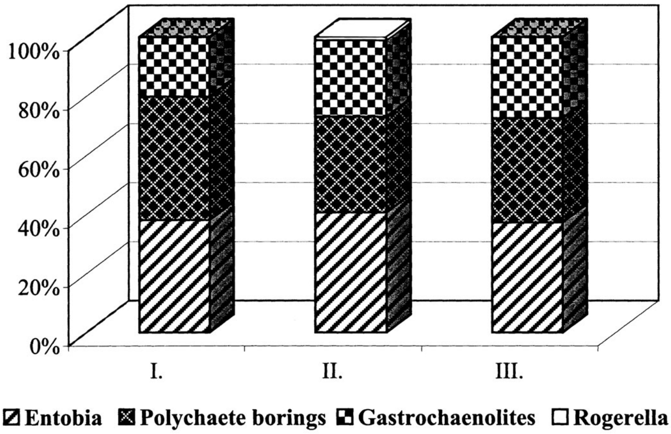


Fig. 7. Distribution of ichnogenera and traces of worms' activity found in the outer surface of the Ostrea valves of Szarvaskő locality

Differences:

- higher diversity of ichnotaxa in the case of the Nagyvisnyó locality (Fig. 3., 6.),
- higher rate of sponge activity in the case of the Szarvaskő locality (Fig. 4., 5.),
- higer proportion of *Polychaete* borings in the case of the Nagyvisnyó locality (Fig. 8., 10.),
- higher percentage of *Gastrochaenolites lapidicus* in the case of the Szarvaskő locality (Fig. 6.).

All these above mentioned observations refer to the fact that the sea where the oysters of the Nagyvisnyó locality lived and where the process of bioerosion took place in the Carpathian stage of the Early-Miocene were shallower comparing with the Szarvaskő locality.

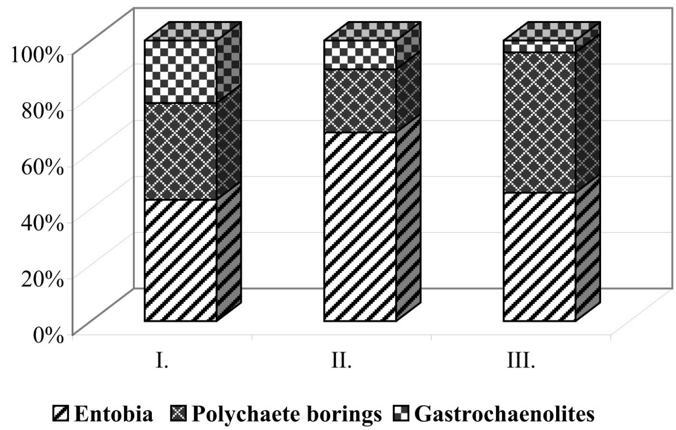


Fig. 8. Distribution of ichnogenera and traces of worms' activity found in the inner surface of the Ostrea valves of Szarvaskő locality

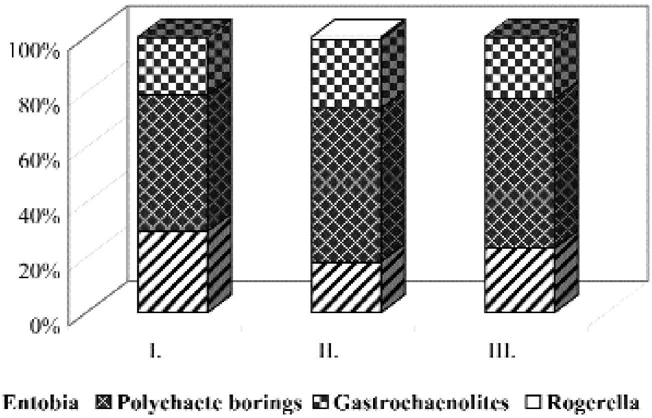


Fig. 9. Distribution of ichnogenera and traces of worms' activity found in the outer surface of the Ostrea valves of Nagyvisnyó locality

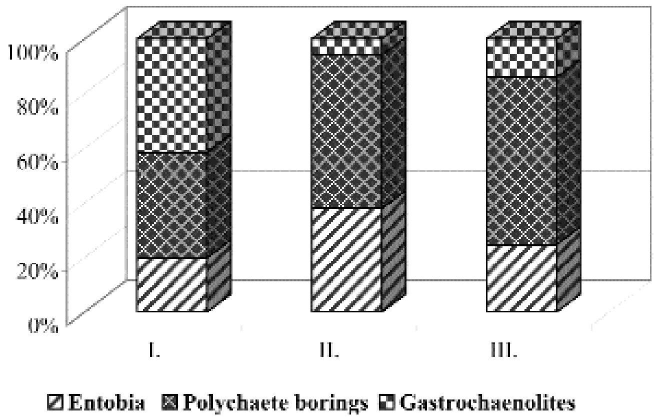


Fig. 10. Distribution of ichnogenera and traces of worms' activity found in the inner surface of the Ostrea valves of Nagyvisnyó locality

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