

# Predation by Naticid Gastropods on Late – Oligocene (Egerian) Molluscs Collected from Wind Brickyard, Eger, Hungary

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**Abstract:** Naticid boreholes observed on the shells of molluscs collected from three different layers of Wind Brickyard (Late - Oligocene / Egerian) have been examined. Traces of Naticid predation occurred on the tests of bivalves, gastropods and scaphopods.

Mode of life, feeding habit of molluscs, distribution of successful, unsuccessful and unfinished borings have been investigated and compared. Number of borings is low in the case of mollusc shells of the Molluscan Clay. Increasing number of borings can be observed in the case of the molluscs of the “x”-layer and the “k”-layer. Occurrence of multiplied borings and cannibalism also have been found. Regarding the feeding habit suspensionfeeders and scavengers are dominant among the prey species.

**Keywords:** Naticid predation, molluscs, Late-Oligocene, Egerian, Wind Brickyard, Hungary

## 1. Introduction

### 1.1. Geological background

The outcrop of Wind Brickyard at Eger (Fig. 1.) is well-known as the stratotype of the Egerian stage. The lithological sequence of the profile is as follows:

- glauconitic, tuffaceous sandstone,
- molluscan clay,
- layers of marine silty, finegrained sandstone („x” layer),
- layers of marine limonitic sandstone („k” layer),
- alternation of coarse sand, carbonaceous clay and a thin gravelly intercalation („c” layer).

The molluscan fossil content of the above mentioned formations is remarkable (Báldi, T. 1973).

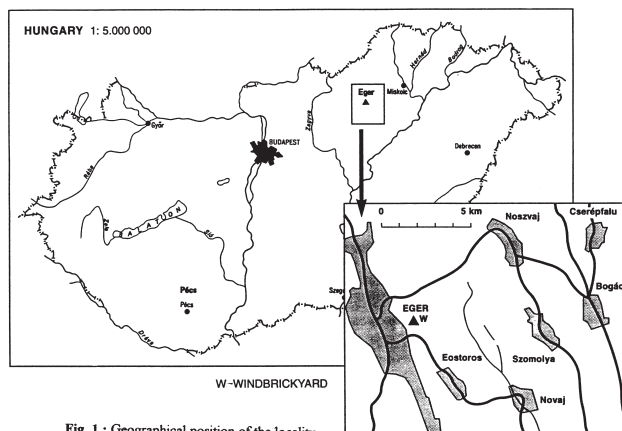


Fig. 1.: Geographical position of the locality

## 1.2. Predatory behaviour of Naticid gastropods

Boring activity of predatory gastropods can be traced back until the Lower-Jurassic. There are several families which prey upon shelly animals by hole-drilling. The first appearance of Naticidae were reported from the beginning of the Jurassic. Their holes are easily recognisable in fossil material (Bromley, R. G. 1970, 1981; Carriker, M. R. et al. 1968; Carter, R. M. 1968; Hoffman, A. et al. 1974; Sohl, F. 1969; Taylor, J. D. 1970, 1983)

Characteristic features of Naticids can be summarized in the following way:

- infaunal animals,
- prey mainly on living organisms,
- holes are bored by both mechanical and chemical activity,
- drilled holes are wide externally, narrow internally and have paraboloid walls,
- incomplete borings have a slight central boss,
- show preferred sites for boring on prey (Arua, J. 1989).

Gastropods of Wind Brickyard exposure belonging into the family of Naticidae:

*Polinices (Lunatia) catena helicina* (BROCCHI), *Polinices (Neverita) josephinia olla* (DE SERRES), *Natica millepunctata tigrina* DEFRANCE.

## 2. Methods

The number of examined specimens is 21. 243. These belong into 189 species. Sampling and washing on a 0,5 mm mesh were the methods of collecting. Beside collecting I have studied the fossil collection of Loránd Eötvös University, Department of Paleontology, Budapest; Lajos Kossuth University, Department of Geology, Debrecen; Geological Survey of Hungary, Budapest; Mátra Museum, Gyöngyös.

The complete shells and identifiable fragments have been inspected for the presence of Naticid drillholes. Tests of bivalves, gastropods and scaphopods showed sign of Naticid predation.

## 3. Description

The examined specimens are originated from the following layers of the exposure:

1. Molluscan clay,
2. Silty finegrained sandstone, (“x” layer),
3. Limonitic sandstone, (“k” layer).

### 3.1. Molluscan clay

5012 specimens of 106 species have been examined.

Their distribution according to molluscan classes is the following:

|             |            |                 |
|-------------|------------|-----------------|
| Bivalves    | 38 species | 817 specimens,  |
| Gastropods  | 59 species | 3440 specimens, |
| Scaphopods  | 8 species  | 754 specimens,  |
| Cephalopods | 1 species  | 1 specimen.     |

Naticid boreholes have been found on the shells of bivalves, gastropods and scaphopods. The number of borings is one hundred thirty-eight on 133 specimens of 17 species.

## Bivalves:

|  |    |         |
|--|----|---------|
| <i>Lymopsis anomala</i> (EICHWALD)     | 2  | 1/0/1   |
| <i>Crassatella bosqueti</i> KOENEN     | 30 | 24/2/4  |
| <i>Cardita ruginosa</i> (COSS. et. P.) | 1  | 1/0/0   |
| <i>Corbula basteroti</i> HÖRNES        | 1  | 1/2/1 m |
| <i>C. gibba</i> OLIVI                  | 3  | 3/1/0 m |

## Gastropods:

|   |    |           |
|---|----|-----------|
| <i>Teinostoma egerensis</i> (BÁLDI)           | 1  | 1/0/0     |
| <i>Bittium spina agriense</i> BÁLDI           | 2  | 1/1/0     |
| <i>Policines catena helicina</i> (BROCCHI)    | 12 | 10/2/1 m  |
| <i>Natica millepuntata tigrina</i> (DEFRANCE) | 1  | 1/0/0     |
| <i>Hinia schlotheimi</i> (BEYRICH)            | 65 | 46/19/2 m |
| <i>Volutilithes permulticostata</i> T-ROTH    | 1  | 0/0/1     |
| <i>Turris coronata</i> (MÜNSTER in GOLDFUSS)  | 1  | 1/0/0     |
| <i>Melanella naumanni</i> (KOENEN)            | 1  | 1/0/0     |
| <i>Syrnola laterariae</i> BÁLDI               | 2  | 1/1/0     |
| <i>Actaeon punctatosulcatus</i> (PHILIPPI)    | 1  | 1/0/0     |

## Scaphopods

|  |   |       |
|--|---|-------|
| <i>Dentalium simplex</i> MICHELOTTI    | 3 | 1/2/0 |
| <i>Fustiaria taurogracilis</i> (SACCO) | 6 | 5/0/1 |

(Number after the species name refers to the number of individuals bearing trace of Naticid predation. Combination of three numbers after it shows the occurrence of different boring types; successful/unsuccessful/unfinished.)

Species bearing traces of predation are dominantly infaunal.

Regarding the feeding habit suspensionfeeders /bivalves/ and scavengers /gastropods, scaphopods/ are the most frequent among the drilled species.

Number of successful borings are far more than the number of the other two boring types (Table 1.)

Table 1.: Distribution of Naticid boreholes according to molluscan classes  
(Molluscan clay)

|              | Number of species | Number of individuals | Number of borings |
|--------------|-------------------|-----------------------|-------------------|
| bivalves     | 5                 | 37                    | 30/5/5            |
| gastropods   | 10                | 87                    | 63/23/3           |
| scaphopods   | 2                 | 9                     | 6/2/1             |
| <b>Total</b> | 17                | 133                   | 99/30/9           |

Multiplied borings occurred on the shells of *Corbula* species and on the tests of the following gastropod species: *Polinices catena helicina* (BROCCHI) and *Hinia schlotheimi* (BEYRICH).

In the case of *Corbula basteroti* HÖRNES there are four borings can be observed on a single left valve; 1/2/1. There are two boreholes on a left valve of a *Corbula gibba* OLIVI specimen; 1/1/0.

Boring on the last whorl of *Polinices catena helicina* refers to cannibalism.

### 3.2. Silty finegrained sandstone (“x” layer)

7748 specimens of 122 species have been examined.

Distribution of the above mentioned specimens and species according to molluscan classes is the following:

|            |            |                 |
|------------|------------|-----------------|
| Bivalves   | 44 species | 913 specimens,  |
| Gastropods | 74 species | 6534 specimens, |
| Scaphopods | 4 species  | 301 specimens.  |

Naticid drillholes have been observed on the shells of bivalves, gastropods and scaphopods. The number of borings is threehundred-forty on 325 specimens of 34 species.

#### Bivalves:

|  |    |           |
|--|----|-----------|
| <i>Nuculana anticeplicata</i> (T.-ROTH)                      | 5  | 4/1/0     |
| <i>Glycymeris latiradiata</i><br>(SANDBERGER in GÜMBEL) s.l. | 1  | 1/0/0     |
| <i>Crassatella bosqueti</i> KOENEN                           | 3  | 1/1/1     |
| <i>Pitar polytropa</i> ANDERSON                              | 53 | 5/19/36 m |
| <i>Corbula basteroti</i> HÖRNES                              | 7  | 2/3/2     |
| <i>C. gibba</i> OLIVI  | 9  | 8/0/1     |

#### Gastropods:

|  |    |            |
|--|----|------------|
| <i>Teinostoma egerensis</i> (BÁLDI)                | 48 | 48/0/0     |
| <i>Turritella venus margarethae</i> GAÁL           | 69 | 50/11/10 m |
| <i>T. beyrichi percarinata</i> T.-ROTH             | 21 | 10/6/5     |
| <i>Cerithium egerense</i> GÁBOR                    | 1  | 1/0/0      |
| <i>Diastoma grateloupi turritoapenninica</i> SACCO | 1  | 1/0/0      |
| <i>Depanocheilus speciosus digitatus</i> (T.-ROTH) | 3  | 0/1/2      |
| <i>Polinices catena helicina</i> (BROCCHI)         | 5  | 2/1/2      |
| <i>P. josephinia olla</i> (DE SERRES)              | 8  | 5/1/2      |
| <i>Natica millepunctata tigrina</i> (DEFRANCE)     | 5  | 6/0/0 m    |
| <i>Ampullina crassatina</i> (LAMARCK)              | 2  | 0/1/1      |
| <i>Chicoreus trigonalis</i> GÁBOR                  | 1  | 1/0/0      |
| <i>Hadriana egerensis</i> GÁBOR                    | 1  | 1/0/0      |

|                                      |    |          |
|--------------------------------------|----|----------|
| Typhis pungens (SOL. in BRAND.)      | 1  | 1/0/0    |
| T. cuniculosus (NYST)                | 1  | 1/0/0    |
| Hinia schlotheimi (BEYRICH)          | 40 | 33/8/0 m |
| Bullia hungarica (GÁBOR)             | 1  | 0/1/0    |
| Athleta ficulina (LAMARCK)           | 2  | 2/0/0    |
| Turris duchasteli (NYST)             | 4  | 2/1/1    |
| T. coronata (MÜNSTER in. GOLDF.)     | 4  | 4/1/0 m  |
| Turricula regularis (KONINCK)        | 2  | 1/0/2 m  |
| T. telegdirothi (NOSZKY)             | 1  | 0/1/0    |
| Asthenotoma obliquinodosa SANDBERGER | 1  | 1/0/0    |
| Conus dujardini egerensis NOSZKY     | 1  | 1/0/0    |
| Terebra simplex T.-ROTH              | 5  | 0/0/5    |

### Scaphopods

|                                 |   |         |
|---------------------------------|---|---------|
| Dentalium fissura LAMARCK       | 8 | 6/3/0 m |
| D. simplex MICHELOTTI           | 5 | 6/0/0 m |
| Fustiaria taurogracilis (SACCO) | 5 | 4/1/0   |
| Cadulus gracilina (SACCO)       | 1 | 0/0/1   |

The dominance of infaunal elements undoubtful if number of individuals are taken into consideration. But in the case of gastropods there are more epifaunal species can be found in the examined material. As to the feeding habit the dominance of suspensionfeeders and scavengers can be observed.

The proportion of successful borings is high, but encrease of unfinished drillholes is also significant (Table 2.).

Table 2.: Distribution of Naticid boreholes according to molluscan classes  
/“x”-layer/

|              | Number of species | Number of individuals | Number of borings |
|--------------|-------------------|-----------------------|-------------------|
| bivalves     | 6                 | 78                    | 21/24/40          |
| gastropods   | 24                | 228                   | 171/33/30         |
| scaphopods   | 4                 | 19                    | 16/4/1            |
| <b>Total</b> | 34                | 325                   | 208/61/71         |

Multiplied borings occur on the shells of the representatives of each molluscan classes.

Cannibalism can be observed in the case of *Natica millepunctata tigrina* (DEFRANCE).

### 3.3. Limonitic sandstone (“k” layer)

8483 specimens of 113 species have been examined. These belong into the following molluscan classes:

|             |            |                 |
|-------------|------------|-----------------|
| Bivalves    | 42 species | 1858 specimens, |
| Gastropods  | 65 species | 6607 specimens, |
| Scaphopods  | 5 species  | 14 specimens,   |
| Cephalopods | 1 species  | 4 specimens.    |

Naticid drillholes have been found on the shells of bivalves, gastropods and scaphopods.

Sign of Naticid predation is born by 486 specimens of twenty species. The number of borings is 520.

#### Bivalves:

|  |     |            |
|--|-----|------------|
| <i>Glycymeris pilosa lunulata</i> (NYST)                 | 1   | 0/0/1      |
| <i>G. latiradiata subfichteli</i> BÁLDI                  | 1   | 0/0/1      |
| <i>Cyprina islandica rotundata</i><br>(BRAUN in AGASSIZ) | 2   | 0/0/2      |
| <i>Laevicardium cyprium</i> (BROCCHI)                    | 1   | 1/0/0      |
| <i>Pitar polytropha</i> ANDERSON                         | 110 | 37/28/60 m |
| <i>Corbula basteroti</i> HÖRNES                          | 6   | 2/0/4      |

#### Gastropods:

|   |     |             |
|---|-----|-------------|
| <i>Turritella venus margarethae</i> GAÁL            | 192 | 169/18/16 m |
| <i>Turritella beyrichi percarinata</i> T.-ROTH      | 128 | 81/26/26 m  |
| <i>Cerithium egerense</i> GÁBOR                     | 2   | 2/1/0 m     |
| <i>Diastoma grateloupi turritoapenninica</i> SACCO  | 6   | 6/0/0 m     |
| <i>Drepanocheilus speciosus digitatus</i> (T.-ROTH) | 2   | 0/0/2       |
| <i>Rostellaria dentata</i> GRATELOUP                | 1   | 0/1/0       |
| <i>Polinices catena helicina</i> (BROCCHI)          | 12  | 11/1/0      |
| <i>Polinices josephina olla</i> (DE SERRES)         | 4   | 3/0/2 m     |
| <i>Ampullina crassatina</i> (LAMARCK)               | 2   | 2/0/0       |
| <i>Hadriana egerensis</i> (GÁBOR)                   | 1   | 0/0/1       |
| <i>Euthriofusus burdigalensis</i> (DEFRANCE)        | 1   | 0/1/1 m     |
| <i>Terebra simplex</i> T.-ROTH                      | 1   | 1/0/0       |

#### Scaphopods

|                              |   |       |
|------------------------------|---|-------|
| <i>Dentalium kickxi</i> NYST | 1 | 1/0/0 |
|------------------------------|---|-------|

The number of infaunal species slightly higher than the number of epifaunal ones.

Leading position of suspensionfeeders and scavengers among the drilled species still remained.

Increase of unfinished borings and decrease of unsuccessful borings can be observed in this case (Table. 3.).

Table 3.: Distribution of Naticid boreholes according to molluscan classes  
/'k'-layer/

|              | Number of species | Number of individuals | Number of borings |
|--------------|-------------------|-----------------------|-------------------|
| bivalves     | 7                 | 133                   | 50/29/69          |
| gastropods   | 12                | 352                   | 275/48/48         |
| scaphopods   | 1                 | 1                     | 1/0/0             |
| <b>Total</b> | 20                | 486                   | 326/77/117        |

Occurrence of multiplied borings can be examined on the shells of bivalves and gastropods. Sign of cannibalism is also present on a test of a *Natica millepunctata* tigrina specimen.

#### 4. Conclusions

Presence of the activity of Naticid predatory gastropods can be traced on the shells of bivalves, gastropods and scaphopods. These molluscan fossils have been collected from three different layers of Wind Brickyard exposure. Body fossil of Naticids can be collected from each layers.

The number of boreholes is 998 on the shells of 944 specimens. The rate of bored specimens is 4,44 percent in the case of the collected material. The percentage of bored individuals is increasing going from the Molluscan clay to the "k"-layer (Dávid, Á. 1998):

- molluscan clay      2,65 percent,
- "x"-layer            4,38 percent,
- "k"-layer             5,72 percent.

Coarse bottom and shallow water is more favourable for the activity of Naticids.

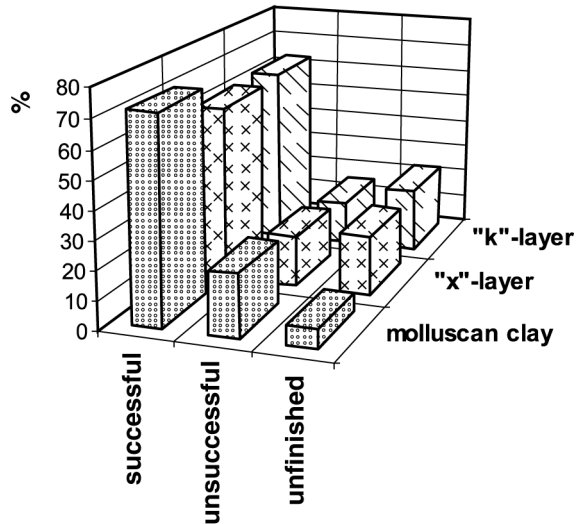
The distribution of different boring types also refer to the above mentioned observation. The proportion of successful borings is the highest in every case. The percentage of unsuccessful borings is decreasing. While the percentage of unfinished borings is increasing (fig. 2.).

Inbenthonic specimens bearing traces of Naticid predation are dominant. In some cases the number of epibenthonic species is higher (e.g.: gastropods, "x"-layer).

Suspensionfeeders (bivalves) and scavengers (gastropods, scaphopods) are the most common preys among the molluscs.

The high proportion of multiplied borings and the presence of cannibalism also refer to the fact that Naticid gastropods played important role in predation on molluscs during the Egerian stage.

Fig. 2.: Distribution of borehole types



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