EPIZOANS OF THE RUPELIAN BIVALVES PYCNODONTA (PYCNODONTA) GIGANTICA GIGANTICA (SOL.) LEVEL: THEIR RELATIONSHIPS TO THEIR HOST

MONICA VELCESCU

Abstract. More than 37 specimens of Pycnodonta (Pycnodonta) gigantica gigantica (SOLANDER, 1766), Crassostrea (Cubitostrea) flabelulla (LAMARCK, 1806) and Crassostrea (Crassostrea) cyathula multistrata (LAMARCK, 1806), collected from Rupelean deposits in the right slope of the Petreindu valley and near Sardu village, have been analyzed as to their palaeontological and paleoecological evidence. In a first part a detailed description of the epifauna is given, such as young oysters, brachiozoans, barnacles, serpulid worm tubes. In a second part the author tries to reveal the existing relationships between the epizoans and their hosts.

Keywords: Transylvanian Basin, Rupelean, epifauna: oysters, brachiozoans, barnacles, serpulids.

PRESENTATION OF THE EXAMINED BIVALVE POPULATION

During a brief interval of Early Oligocene, the sandy clay flats near the western edge of the Transylvanian Basin supported a community dominated by Pycnodonta (Pycnodonta) gigantica gigantica (SOLANDER, 1766), Crassostrea (Crassostrea) cyathula multistrata (LAMARCK, 1806) and Crassostrea (Cubitostrea) flabelulla (LAMARCK, 1806). These large bivalves served as host for numerous kinds of epizoans, most using the shell as available hard surface on which to settle. Our study is based on epifauna attached to 37 relatively well preserved specimens collected from Rupelean deposits in the right slope of the Petreindu valley and near Sardu village (Fig. 1).

From gray-yellowish, sandy clays, we separated 11 specimens of Pycnodonta (Pycnodonta) gigantica gigantica (Pl. I, fig. 1, 2, 3, 4, 6), 3 of which with both valves (Pl. I, fig. 1, 3), 1 specimen of Crassostrea (Cubitostrea) flabelulla (Pl. I, fig. 5, Pl. II, fig. 11) and 19 specimens of Crassostrea (Crassostrea) cyathula multistrata (Pl. II), 2 of which with both valves (Pl. II, fig. 15a, 15b, 17a, 17b).

All individuals have both epifauna and borings. The epifauna is represented by Oysters, cyclostome brachiozoans, barnacles of Class Cirripedia and tubes of polychet worms (Serpula and Spirorbis genera).

The percentages of epifauna specimens, according to Hary (1987), are calculated by reporting to the total number of collected specimens. According to the mentioned paper the percentage of specimens with epifauna is about 75.6%.

In detail, the distribution is shown in Table 1.

In the next part, the different kinds of epifaunal species are described in detail.

After these descriptions, the different representatives of the epifauna are reexamined in a paleoecological context.

EPIZOANS ON PYCNODONTA AND CRASSOSTREA GENERA

Only those invertebrates which exhibited clear evidence of self-cementation onto the host were interpreted as epizoans. A few other invertebrates were present on the surface of Pycnodonta specimens (Pl. I, fig. 2), but they appeared to be attached by matrix only and were not judged to have lived as epizoans.

Oysters

Young oysters represent one of the most important epizoans on the valves of both Pycnodonta and Crassostrea. The palaeontological study allowed us to say that they belong exclusively to Pycnodonta and Crassostrea genera. During the development of the

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Figure 1 – Geological map and location of the fossil bearing sites (F)

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1 S.C. PROSPECTIUNI S.A., Laboratory of Geological Analysis, Caransebes street, 1, RO, Bucharest
Table 1 - Epizoans and the frequency of their occurrence on 37 oysters’ hosts.

<table>
<thead>
<tr>
<th>Epifauna species</th>
<th>Number of hosts</th>
<th>% of hosts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bivalves: oysters</td>
<td>11</td>
<td>27.02</td>
</tr>
<tr>
<td>Cyclostome bryoza</td>
<td>24</td>
<td>62.16</td>
</tr>
<tr>
<td>Barnacles</td>
<td>1</td>
<td>2.7</td>
</tr>
<tr>
<td>Serpula</td>
<td>6</td>
<td>13.5</td>
</tr>
<tr>
<td>Polyclad worms: Spirorbis</td>
<td>3</td>
<td>5.4</td>
</tr>
<tr>
<td>Examined exampes</td>
<td>37</td>
<td>100</td>
</tr>
</tbody>
</table>

larvae to the adult stage the shape of the valve shows a great variability the typical shape of the genera developing slowly.

Some specimens with large attachment surfaces support this fact by their aberrant shapes. Especially the left valves, after detachment from the substratum, show the form of the object on which the young oyster was attached, either an echinoid radiola (Pl. I, fig. 5) or another Pycnodonta (Pl. I, fig. 2, 3, 4, 6). When the preservation is good, the same imprint is found on both valves, one of them being in an inverse relief. In exceptional cases, if the Pycnodonta detached very late, we found aberrant shapes.

This fact is better illustrated by some valves of Pycnodonta where two or three adults specimens remained attached to one another. We figured two such couples on Pl. I, fig. 2, 6.

Bryozoans

A percentage of 62.16 of the valves bear cyclostome bryozaoons. Many of them were difficult to separate into genera and species. Nevertheless, we could separate and figure 7 incrusting species (Pl. III): Puellina radiata MOLL, 1803 (fig. 2, Puellina simillitor CANU & BASSLER, 1920 (fig. 3), Smittina strunbecki REUSS, 1866 (fig. 4), Lichenopora goldfussi, REUSS, 1864 (fig. 5), Lichenopora verrucosa PHILIPPI, 1843 (fig. 6, 6b), Plagioeca discoidea CANU & BASSLER, 1920 (fig. 6, 6a), Plagioeca hirta CANU & BASSLER, 1920 (fig. 6c).

All these species correspond to the descriptions and figures given by CANU & BASSLER (1920).

Barnacles

Two of the Pycnodonta valves bear only the calcareous base of the thoracic barnacle Balanus (Pl. III, fig. 7). As the only species found in great number by Moisescu (1975) in Pycnodonta association is Balanus concavus concavus BRÖNNIMAN, 1968, we presumed that the bases belong to this species.

Serpulid worm tubes

Three almost complete and one fragment of calcareous tubes belonging to Serpula genera were found on three specimens of Pycnodonta. For the three complete tubes, the cemented, almost rectilinear tubes maintain a nearly uniform diameter of between 0.2 - 0.4 cm throughout their observed length. Some of them taper gently and coiled in a plan-spiral plane in their beginning area. The maximum observed length is about 2.0 cm, involving the coiled part. Tube exteriors bear faint annular ridges. An about 0.2 cm cementation band surrounds these tubes, excepting the ending part (Pl. III, fig. 8). As for the fragment, the diameter is 0.8 cm and the observed length is about 3.0 cm (Pl. III, fig. 9).

EPIZOAON-HOST RELATIONSHIPS

Reasons for settling on hosts

Through geologic ages shelled marine organisms as oysters have been utilized by other organisms for a variety of purposes. In general, these include:

1) Substrate. Most epizoans found on Pycnodonta and Crassostrea seem to have established themselves there because the oyster shell constituted hard surface needed for at least part of their ontogeny. Presumably, those larvae of these epizoans, which came to rest on the soft sea bottom, were soon casualties. We do not know if the successful colonizers actively sought the oyster host, but we suspect that settlement was, at least in part, accidental and a matter of chance.

2) Protection. It is well known that at least some bryozaoons (essentially the encrusting forms) prefers sheltered areas, without a very high degree of lightening, such as cryptically habitats, caves or the under part of rocks or shells. We can presume that the big, convex valves of this kind of oysters provided such shadowed habitats where encrusting bryozaoons could flourish.

3) Feeding advantage. Although other authors have pointed out epizoan benefits derived from feeding currents of the host, we find no support for this concept in our study. Epizoans are not concentrated on margins of the host’s shell, and appear to have flourished equally well on all areas.

4) Source for food. Insofar as we can interpret the record, none of the epizoans were parasitic, so it seems that neither the young oysters, bryozaoons, barnacles nor serpulids used these shells as source of food.

Life and death associations

In the majority of specimens, it is impossible to determine if the epizoan grew on a live or dead host or whether neighboring epizoans lived at the same time. If a colony of bryozaoons or other kind of epizoans are settled on the inner face of the valve, then clearly the host was dead at the time of encroachment. No conclusion can be reached from orientation of epizoans upon their host, because the shape of the host indicates that its adult life position was stable on the substrate (resting on the left valve). Some epizoan colonies extend into or on the living chambers of others, showing that late stages of colony extension by the former were accomplished after death of the latter; unanswered is the question of whether the two epizoans were living at the same time in earlier stages of development. Possible factors in interpretation of life and death associations are the distribution and uniformity of the hosts and the uninterrupted sequence of strata containing them. These factors could be regarded as indications that:

1) nearly all host individuals flourished and survived to old age;
2) sediments accumulated slowly enough that few if any Pycnodonta or Crassostrea individuals were smothered, but rapidly enough that only a few epizoans had time to cover all exposed shell area before entombment. Probably most epizoans and oyster hosts
lived during the same interval, and only rarely did an epizoan long survive its host.

Size of host

The size of the host might be expected to show direct relationship to the number of epizoan utilizing it, not only because of its larger surface area for settlement but also because of its presumed greater longevity.

Epizoan utilization of host

It is difficult to decide which epizoans utilized oyster hosts to the greatest extent for two reasons: first, the size of the epizoans varies greatly whether each is measured by its total volume or by the area occupied, and second, the unit for some epizoans (such as juvenile oysters, barnacles, serpulid worm tubes) is the individual, whereas the unit for other epizoans (such as bryozoans) is the colony. Hence, the successful utilization of the host could be assessed by the number of hosts bearing the epizoan, the number of individuals of the epizoan, or the area occupied by each kind of epizoan. The number of hosts bearing each kind of epizoan (Table 1) is only one measure of successful settlement.

The number of areas occupied by each epizoan is a better indicator of success in interspecific competition for space on the host. Rarely if ever was settlement achieved on an area of the host which was already occupied by a competitor, and epizoans seem to have settled on available areas of the host rather than upon one another.

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REFERENCES


PLATES

Plate I

Fig. 1 – Pycnodonta (Pycnodonta) gigantica gigantica (SOL., 1766), with both valves (X0.45)
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Plate II

Fig. 1, 2a, 2b, 3, 4 – Crassostrea (Crassostrea) cyathula (LMK., 1806) (X1)
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Fig. 4 – Smithina strombeckii REUSS, 1866 (X28)
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