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FIRST RECORDS OF FOSSIL GYMNOSOMATOUS PROTOCONCHAE (PTEROPODA, GASTROPODA)

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ABSTRACT

Fossil protoconchae of an unknown gymnosomatous pteropod are described from Late Pleistocene sediments.

INTRODUCTION

Protoconchae of Gymnosomata are described by Lebour (1931) and Lalli & Conover (1976) from breeding experiments and from plankton samples. Lalli & Conover (1976: 239) stated: "However, Gymnosome shells are probably rare in sediment samples". This supposition is incorrect since these shells are as common in sediments as in plankton.

The examination of pteropod protoconchae from sediments collected off N.W. Africa and off Portugal yielded a number of gymnosomatous protoconchae which are described in this paper.

MATERIAL

The sediment samples studied are from: a) Meteor Exped. 25 core 12329-6, 19°22.0' N 19°55.8' W, 15-18 cm below sediment surface, bottom depth 3320 m, and b) Meteor Exped. 19, core 8058 B, 37°44.6' N 09°43.5' W, 340 cm below sediment surface, bottom depth 1819 m.

These samples show a layer extremely rich in pteropods just below the Pleistocene/Holocene boundary. Up to 35% of the sandy fraction (> 63 µm) consists of pteropod fragments, whereas the Pleistocene and Holocene sections of the cores do not contain any pteropod at all. The pteropod species of the two samples from which the gymnosomatous shells are studied are enumerated in table I together with the species composition in the plankton sample: Meteor Exped. 36, Station 60, sample

39-43 (21°21' N 17°40' W) also taken off N.W. Africa.

The protoconchae are studied by light microscopy with a maximum enlargement of 400x and superficial light only. Measurements are accurate down to 0.01 mm.

DISCUSSION

From table I it is clear that the representation of gymnosomatous shells in the sediment is comparable to that in plankton hauls. The samples are all from the tropical belt which, even in the Late Pleistocene, had no real Arctic or Subarctic pteropod fauna. Therefore, the two species *Clione limacina* (Phipps, 1774) and *Paedocliione dolliformis* Danforth, 1907, described by Lalli & Conover (1976) cannot be expected to occur in these samples. Only a few coldwater pteropods are found in the cores taken off Portugal. Subarctic planktonic Foraminifera become more common, however, in the layer rich in Pteropoda.

The gymnosomatous species in plankton samples from station 60 belong to the Pneumodermatidae. The specimens from the two sediment samples are indeed different from those illustrated by Lalli & Conover (1976). In shape the fossil protoconchae resemble most the cast veliger of *Paedocliione dolliformis*.

Clearly distinguishable are protoconch I (the embryonic shell) and protoconch II (the postembryonic shell). Growth rings in the protoconch II are absent; all the specimens studied had a very short protoconch II (see figure). The longitudinally arranged sculpture lines, also pictured by Lalli & Conover (1976, fig. 6), are present in the fossil specimens where the protoconch I merges into protoconch II. Sculpture on protoconch I is not found except for a vague granulation. The protoconch is not of the tight shape, as found in Euthecosomata, but has an uneven, bumpy surface. Protoconch I is nearly globular; in some specimens the cross-section is slightly elliptical as in the specimen figured. Protoconch II is more compressed so that the shell aperture is distinctly elliptical in all specimens. The aperture rim is so strongly undulated that it does not fit in one plane perpendicular to the shell axis. These characters prove that these fossil shells certainly belong to the Gymnosomata, which can be concluded also from their sizes as represented in table II.

The protoconchae which most resemble those of Gymnosomata are found in *Clio andreae* (Boas, 1886) [= *Cl. polita* (Pelseneer, 1888)], and of the *Diacria* species. These euthecosomatous protoconchae, however, are always larger than the fossil shells described; the very protoconch I of the Thecosomata is always larger than 0.23 mm and it never

TABLE I

SPECIES COMPOSITION OF PTEROPOD PROTOCONCHAE OF TWO LATE PLEISTOCENE CORES AND A PLANKTON SAMPLE

Sample	core		plankton
	Meteor: 12329-6	core 8058 B	
Gymnosomata	5 (1%)	3 (3%)	1 (4%)
<i>Cavolinia</i>	4 (1%)	- -	- -
<i>Diacria</i>	- -	2 (2%)	2 (7%)
<i>Clio</i>	18 (5%)	71 (73%)	2 (7%)
<i>Creseis</i>	9 (3%)	- -	- -
<i>Limacina inflata</i>	191 (54%)	15 (16%)	22 (82%)
<i>Limacina</i> other species	126 (36%)	6 (6%)	- -

shows an elliptical upper rim which is not in one plane perpendicular to the shell axis. The protoconch II in *Diacria* and *Clio* is never bending outwards like it does in the fossil Gymnosomata. Moreover, a narrow and deep incision without thickening of the shell wall is never found between the protoconch I and II of euthecosomatous species while it is typical for the fossil Gymnosomata.

The types of gymnosomatous protoconchae found

in the sediments off Portugal do not differ from the type found in the samples taken off N.W. Africa. As on the other hand they differ from protoconchae hitherto described, more accurate identification is not possible at the time being. With the present findings the normal occurrence of shells of Gymnosomata in sediments is proved but more attention should be given in the future to these fossils as they may be of value for paleoecological and paleoclimatic studies.

TABLE II

SHELL LENGTH AND DIAMETER OF PROTOCONCHAE OF THE FOSSIL GYMNOSOMATA

	length	dia- meter	source
<i>Clione limacina</i>	0.36	0.12	Maxima after Lalli & Conover
<i>Clione limacina</i>	0.16	0.11	Maxima after Lebour
<i>Paedoclione dolliformis</i>	0.28	0.18	Maxima after Lalli & Conover
<i>Pneumoderma atlanticum</i> (Oken, 1815)	0.10	0.10	After Lalli & Conover
fossil Gymnosomata	0.21	0.18	Meteor Exped. 19/8058B
fossil Gymnosomata	0.22	0.22	Meteor Exped. 25/12329-6
fossil Gymnosomata	0.22	0.20	Meteor Exped. 25/12329-6
fossil Gymnosomata	0.17	0.16	Meteor Exped. 25/12329-6
fossil Gymnosomata	0.17	0.17	Meteor Exped. 25/12329-6
fossil Gymnosomata	0.17	0.16	Meteor Exped. 25/12329-6

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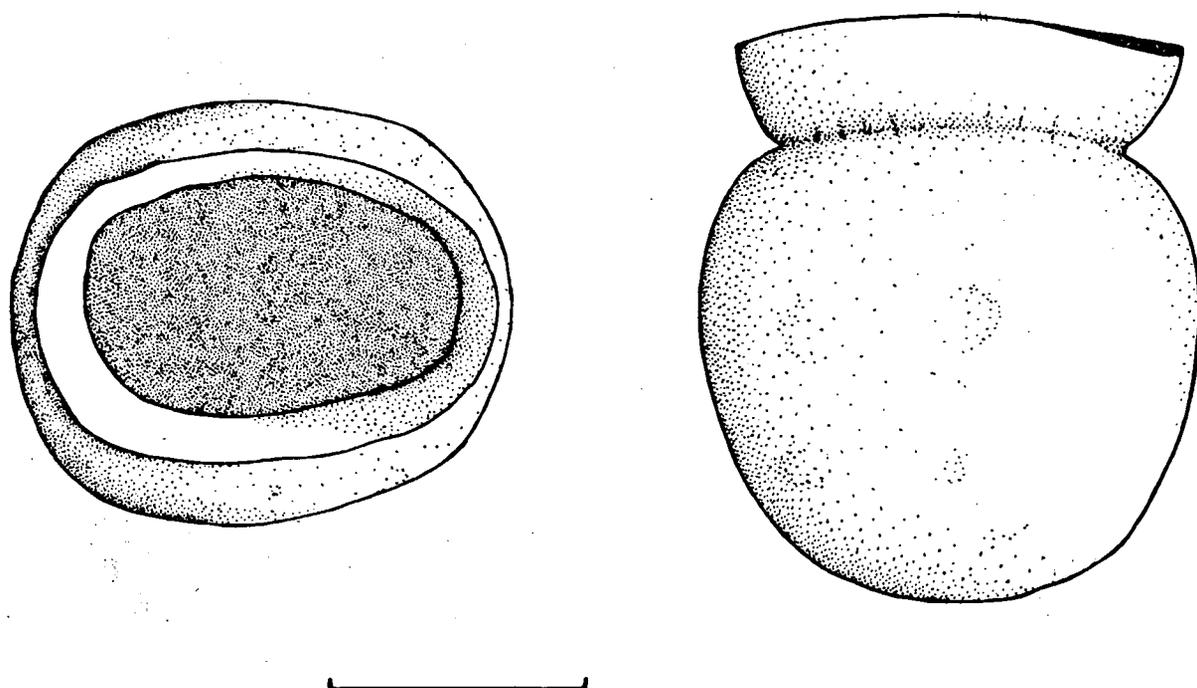
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Fossil protoconch of a gymnosomatous pteropod collected at $37^{\circ}44.6'N$ $09^{\circ}43.5'W$ from Late Pleistocene sediments, in posterior view (left) and lateral view (right) (scale 0.09 mm).