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"*PAIJENBORCHELLINA*" *LIBYCA* SP.N. FROM THE UPPER MIOCENE OF LIBYA

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"*Paijenborchellina libyca*" sp.n., the first representative of this genus from the central part of northern Africa is described. The paleoecological and paleogeographical meaning of the group of ostracodes referred to by the author as "*Paijenborchellina*" and *Paijenborchellina s.s.* is considered.

K e y w o r d s: Ostracodes, Cytheracea, Neogene, N. Africa.

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INTRODUCTION

Ostracodes referred to as *Paijenborchellina* Kuznetsova (*in*: Mandelstam *et al.* 1957) are known from the Cretaceous up to the Recent. It seems, however, that they do not represent a uniform group. To explain the real systematic relation between the Cretaceous and younger forms, better knowledge of the former species assigned to *Paijenborchellina* from the USSR (where the type species of that genus was described) is needed; analysis of the internal morphological valve structure of some forms affiliated with that genus also appears to be helpful in solving this problem.

Generic assignement of the species referred to as *Paijenborchellina* is based only on their external valve morphology. This however, differs within the regarded species. Moreover there exist species, allotted to other genera, which — at least according to their external valve morphology — seem to be very close to *Paijenborchellina s.s.* For the above mentioned reasons it is proposed here to consider, for the present, all the *Paijenborchellina*-like forms as "*Paijenborchellina*".

The Tertiary and Quaternary species, referred to so far as *Paijenborchellina* (regarded here as "*Paijenborchellina*") were known, up to now, only from the eastern, peri-coastal region of Africa, from the peri-coastal,

western region of India, and from the Persian Gulf (see fig: 1), thus the newly stated occurrence of a representative of that genus, in the Upper Miocene deposits of Libya, makes its still discontinuous geographical extent more complete.

The described material is housed at the Institute of Paleobiology of the Polish Academy of Sciences in Warsaw (ZPAL).

The abbreviations used are: a — adult, j — juvenile, M — male, F — female, V — valve, C — carapace.

Acknowledgements. — SEM photographs were made in the Electron Microscopy Laboratory of the Nencki Institute of Experimental Biology in Warsaw.

MATERIAL

Ostracode-bearing samples were collected in the northern part of Central Libya. The material was found in an outcrop situated between Marada Oasis and Dahra Oil Field; approx. coordinates 18°47′00″ E and 29°27′00″ N. There, conglomerates with concretions and finely-crystalline-yellowish, somewhat silty limestone with fractures filled with salt and numerous oysters observable on weathered surfaces, are exposed. Conglomerates and limestones are 1,5 m thick and overlie calcareous siltstones with salt. The Miocene age of the samples was estimated by the present author on the basis of a foraminiferal assemblage comprising primairly: *Borelis melo* (Silv.), *Calcarina calcar* d'Orb., *Elphidium macellum* (Ficht. and Moll), *E. crispum* (Linné), *Rotalia papillosa* d'Orb. and *Ammonia beccari* Linné.

"*Paijenborchellina*" representatives are accompanied by the following ostracodes: *Aurila* sp., *Loxoconcha* sp., *Costa* sp. ?*Neomonoceratina* sp., *Hermanites* cf. *haidingeri* (Reuss), *Loculicytheretta libyca* Szczechura, *L. miocaenica* Szczechura, *Bosquetina* sp. etc.

The mentioned fauna, as well as the sediment, indicate shallow and warm-water, inner neritic environment.

DISCUSSION ON THE TAXONOMY OF THE *PAIJENBORCHELLINA*-LIKE FORMS

Paijenborchellina was erected by Kuznetsova (*in*: Mandelstam *et al.* 1957) for forms occurring in the Barremian of the peri-Caspian region (Azerbaijan and Caucasus), morphologically close to *Paijenborchella* Kingma, 1948. The type species of *Paijenborchellina* i.e. *P. excelens* Kuznetsova, 1957, besides its particular general appearance, is distinguished by bearing a transverse furrow, sometimes bifurcating, below which, in the middle part of the valve, a small depression with a longitudinal rib occurs. Spe-

cimens referred to as *P. excelens* are rather schematically figured making good orientation in the details of their morphology impossible. It is worth noting here that the other species described by Kuznetsova — also referred to as *Paijenborchellina* — i.e. *P. apscheroensis* — seems to differ distinctly from *P. excelens* not only by its general appearance but also by its external valve morphology. *Paijenborchellina* stated by Andreev and Mandelstam (1971) in the Cretaceous deposits of the so-called Mediterranean region of USSR is, unfortunatelly, neither described, nor figured.

In 1959 Reyment described *Paijenborchellina ijuensis* from the Lower Eocene of Nigeria and later, the same author (Reyment 1963) found Recent forms, similar to *P. ijuensis*, in Gabon. Existence of Recent representatives of *Paijenborchellina* was proved by Omatsola (1970), who described *P. kuznetsovai* [1] from Nigeria. The oldest form, assigned to *Paijenborchellina*, from the African continent, called *Paijenborchellina* GA B 5, is mentioned and digured by Grosdidier (1979) from the Cenomanian of Gabon.

Paijenborchellina is also recorded from the south-eastern coast of the Asiatic continent: Bate (1971) stated the presence of Recent *P.* sp in the Persian Gulf; Jain (1978) recorded this species near the coast in India.

Khosla (1978) described from the Lower Miocene of the north-eastern part of India two species, referring both to *Paijenborchella (Eupaijenborchella)* [2], of which one at least, i.e. *P.(E.) royi* seems to be congeneric with those formerly mentioned from Africa and India. The second species, named by this author (Khosla, *l.c.*) as *P.(E.) prona* Lubimova and Guha, 1960, according to its general shape, is more similar to *Paijenborchellina s.s.* than to *Paijenborchella (Eopaijenborchella)*, but at the same time, differs from the type-species of both genera in details of the external valve morphology; it bears a tubercle in the central and posteroventral parts of the valve.

Within the compared species assigned to *Paijenborchellina* remarkable uniformity of the external valve features applies to the African and the Asiatic forms; among the latter, however, the already mentioned *Paijenborchella (Eopaijenborchella) prona* is an exception. At the same time Cenomanian *Paijenborchellina* GA B5, of Gabon, seems to be different from *Paijenborchellina s.s.* in its general valve outline (especially its anterodorsal part) i.e. in being rather triangular instead of irregularly pear-like; this latter shape of the carapace is typical for specimens representing true *Paijenborchellina* from Crimea, as well as for *Paijenborchellina*-like forms from Asia and Africa.

All the above mentioned Asiatic and African forms, assigned to *Paijenborchellina* differ from its type species from the Barremian of the USSR in the absence of the transverse furrow and longitudinal rib. On the basis

[1] *kuznetsovae* according to the rules of *ICZN*.
[2] *P. (Eupaijenborchella)* — typographical error in spelling *P. (Eopaijenborchella)*.

of this difference Gründel (1976) erected *Gibborchella*, including all the described Caenozoic species assigned to *Paijenborchellina* from Africa. In accordance with the diagnostic features of *Gibborchella* it should also contain *Paijenborchellina* sp. (Bate 1971; Jain 1978), *Paijenborchella* (*Eopaijenborchella*) *royi* Khosla, 1978, and — tentatively — *Paijenborchellina* GA B5 (Grosdidier 1978). *Gibborchella* and *Paijenborchellina* are distinguished mostly on the basis of their external valve morphology. The variation of this latter within the above and below mentioned *Paijenborchellina*-like forms is so large, however, that the diagnostic criteria proposed by Gründel (1976) to distinguish proper genera within this group of ostracodes are not sufficient now.

Considering taxonomy — of the generic rank — of the discussed group of ostracodes, worth considering are the species referred to as *Paijenborchella* (*Eopaijenborchella*), described by Khosla (1972) from the Eocene of India. None of these species is similar to the true *Paijenborchella* (*Eopajenborchella*) and at the same time at least *P.(E.) indica* and *P.(E.) mohani*, by their lateral valve outline, seem to be congeneric with *Paijenborchellina s.s.* as well as with others species assigned to this genus, recorded from the Caenozoic deposits of southern hemisphere. The discussed species are, however, very unclearly figured, thus difficult to be regarded according to their generic assignement.

On appraising the taxonomic meaning of morphological features in *Paijenborchellina*-like forms one should remember the observation made by Bate (1971). According to this author (Bate, *l.c.*: 248) specimens belonging to *Paijenborchellina* sp. from the Persian Gulf change their external morphology according to the salinity of the environment; those living in higher salinity bear an alar projection "not obviously present in the specimens inhabiting the lower salinity environment outside the lagoon".

In light of the presented facts, the problem of the taxonomy of the *Paijenborchellina*-like forms seems to be still open; it seems to be more reasonable to name them "*Paijenborchellina*" instead of not sufficiently yet defined *Gibborchella*. Analysis of the morphological inner structures of the *Paijenborchellina*-like specimens, as well as the variation of their external valve morphology should allow more equivocal distinguishing of genera within the discussed group of ostracodes.

PALEOECOLOGICAL AND PALEOGEOGRAPHICAL MEANING OF THE REGARDED TAXONS

Paijenborchellina s.s. is recorded from the Lower Cretaceous deposits of the so called Mediterranean region of the USSR, containing southeastern part of Middle Asia, north Afghanistan, some parts of Caucasus

and Crimea (Andreev and Mandelstam 1971). *Paijenborchellina* occurs there in the shallow littoral carbonate terrigenous facies of marginal seas, in lagoon-like basins. Also a Recent species assigned to *Paijenborchellina*, stated by Bate (1971) in the Persian gulf, occurs in the Abu Dhabi lagoon. Other Recent species assigned to that genus, described from Africa, are also connected with its coastal region e.g. *P. kuznetsovae* from the Niger delta (Omatsola, 1970) or *P. ijuensis*, known from the beach sands of Gabon (Reyment, 1963). *"Paijenborchellina" libyca* sp.n. occurring in the shallow-water, pericoastal, Miocene deposits of Libya seems to prove not only its warm-and shallow-water preferences but also indicates paleogeographical membership of the genus to the Mediterranean (Tethyan) region (see fig.: 1).

African and Asiatic forms referred to *Paijenborchellina* or *Paijenborchella* (*Eopaijenborchella*), being congeneric with *"Paijenborchellina" libyca* sp.n., appeared first i.e. in the Lower Eocene (or even in Cretaceous) in western Africa, and then, in the late Tertiary in south-western Asia.

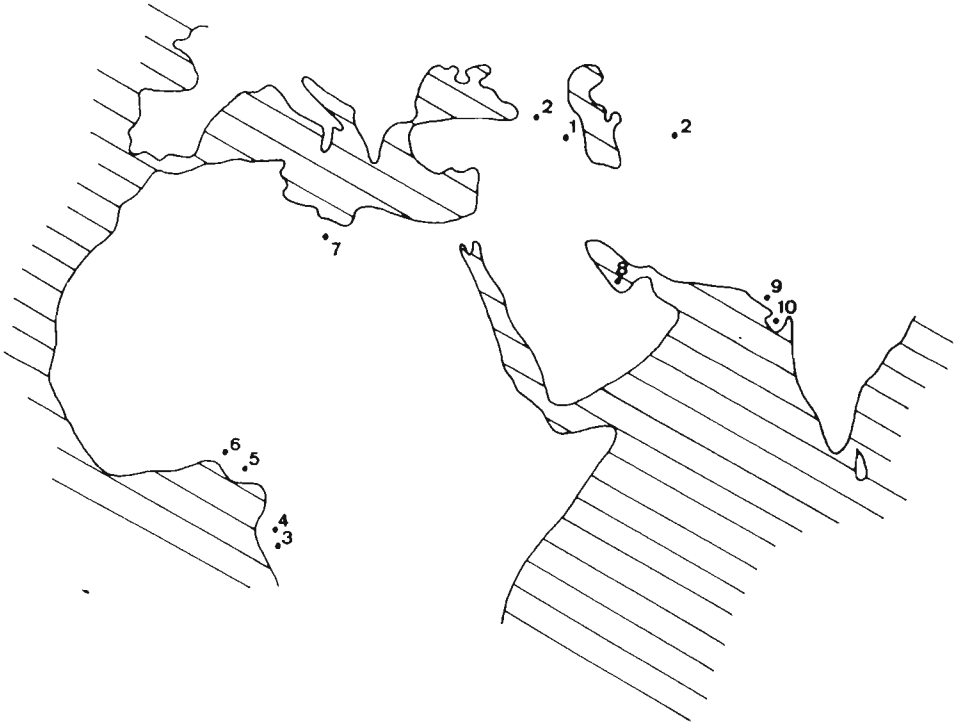

Fig. 1. Location of species referred to by the present author as *Paijenborchellina s.s.* and *"Paijenborchellina"*. *1 Paijenborchellina s.s.* — Kuznetsova (*in:* Mandelstam *et al.* 1957), Lower Cretaceous. *2 Paijenborchellina s.s.* — Andreev and Mandelstam (1971), Lower Cretaceous. *"Paijenborchellina"* — Grosdidier (1979), Upper Cretaceous. *4 "Paijenborchellina"* — Reyment (1963), Recent. *5 "Paijenborchellina"* — Reyment (1959), Lower Eocene. *6 "Paijenborchellina"* — Omatsola (1970), Recent. *7 "Paijenborchellina"* — Szczechura (present paper), Upper Miocene. *8 "Paijenborchellina"* — Bate (1971), Recent. *9 "Paijenborchellina"* — Jain (1978), Recent. *10 "Paijenborchellina"* — Khosla (1978), Lower Miocene.

It may be supposed that "*Paijenborchellina*" passed from Africa to Asia along the northern border of Africa i.e. along the southern boundary of the Tethys Sea, and that this happened before the closing of Tethys in the east i.e. before the late Miocene. According to this supposition the presence of living "*Paijenborchellina*" in south-western India and in the Persian Gulf is relic in nature.

If African "*Paijenborchellinia*" is a descendant of *Paijenborchellina s.s.* from the northern part of the Tethys Sea, then, taking into account its environmental requirements, the only way that it may have come to Africa is along the southern and southwestern coasts of Europe. In this way it could have circumvented the barrier of the then already deep Tethys Sea, which prevented *Paijenborchellina* from coming directly across to the central part of North Africa and even more so, to southern Asia.

DESCRIPTION

Superfamily **Cytheracea** Baird, 1850
Family **Palaeocytherideidae** Lubimova, 1955
Subfamily **Paijenborchellinae** Deroo, 1966
Tribus **Paijenborchellini** Deroo, 1966

Genus *Paijenborchellina* Kuznetsova (*in*: Mandelstam *et al.* 1957)
"Paijenborchellina" libyca sp.n.
(pl. 21; pl. 22)

Holotype: ZPAL O.XIX/4; pl. 21: 4.

Type locality: Northern part of Sirte Basin (Central Libya) between Marada Oasis and Dahra field.

Derivation of name: libyca — occurring in Libya.

Diagnosis. — Valve surface coarsely pitted, close to the anterior and ventral valve margin the pits are arranged in rows parallel to the valve margin.

Material. — 11 specimens, including complete carapaces and detached valves, belonging to juvenile and adult forms.

Dimension (in mm):

	ZPAL O.XIX/7 aFRV	O.XIX/5 aMRV	O.XIX/3 aMLV	O.XIX/8 aFLV
Length	0,56	0,60	0,65	0,61
Height	0,28	0,24	0,28	0,28

Description. — Carapace thick-shelled, pear-shaped in lateral outline, with well pronounced, long, tapering, downwards directed caudal proces. It is markedly inflated laterally, more posteriorly and has a weak depression close to the anterior margin, which is better developed in its upper part. Muscle field posteriorly bounded by a faint furrow. Left valve somewhat larger than the right one, overlapping the latter, especially along the anterodorsal margin. Dorsal margin rounded saddle-like,

ventral margin almost straight. Anterior margin obliquely rounded, posterior margin truncated, with caudal process in its lower part. Valve surface coarsely pitted, close to the anterior and ventral margin the pits are arranged in rows parallel to the valve outline.

Duplicature narrow, of the same width along the entire free margin; inner margin almost follows the valve outline. Vestibula absent (?). Marginal pore canals and muscle scars invisible. Hinge margin in the left valve consists of the median bar terminated by crenulate, elongate sockets.

Sexual dimorphism distinct; females are shorter and more inflated posteriorly than males. Juvenile forms have less differentiated external valve morphology than the adult ones.

Remarks. — *"Paijenborchellina" libyca* sp.n. resembles the Recent *Paijenborchellina kuznetsovae* Omatsola, 1970, from the Niger Delta, differing from it, however, by more coarse and more regularly arranged pits on the valve surface. In Libyan forms there is, moreover, a better marked muscle field.

Occurrence. — Upper Miocene of Libya (Sirte Basin).

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JANINA SZCZECHURA

"PAIJENBORCHELLINA" LIBYCA SP.N. Z GÓRNEGO MIOCENU LIBII

Streszczenie

"Paijenborchellina" libyca należy do grupy gatunków nazwanej tutaj *"Paijenborchellina"*. Znane są one od dolnego eocenu (ewentualnie już od kredy) do dziś, w Afryce zachodniej i w Azji. Analiza rozprzestrzenienia stratygraficznego i geograficznego tych gatunków pozwala wnioskować o ich preferencjach paleoekologicznych i kierunku migracji *"Paijenborchellina"*.

Aczkolwiek kształtem skorupki gatunki te są zbliżone do typowej *Paijenborchellina* (z dolnej kredy ZSRR), to różnią się one od niej morfologią zewnętrzną. Jednocześnie w obrębie gatunków zaliczonych tutaj do *"Paijenborchellina"* — i jej podobnych, morfologia skorupki jest na tyle zmienna iż na razie trudno stwierdzić czy reprezentują one jeden rodzaj czy więcej.

EXPLANATIONS OF THE PLATES 21, 22

All specimens are from the Upper Miocene of Sirte Basin (Libya)

Plate 21

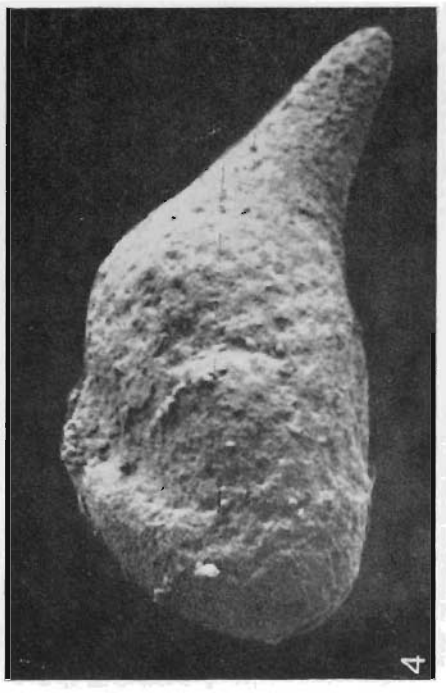
"Paijenborchellina" libyca sp.n.

1. Dorsal side, aFC, ZPAL O.XIX/1, × 125.
2. Outer side, jLV, ZPAL O.XIX/2, × 125.
3. Outer side, aMLV, ZPAL O.XIX/3, × 125.
4. Outer side, aFC, ZPAL O.XIX/4, × 125.

Plate 22

"Paijenborchellina" libyca sp.n.

1. Outer side, aMRV, O.XIX/5, × 125.
2. Outer side, jRV, O.XIX/6, × 125.
3. Outer side, aFRV, O.XIX/7, × 125.
4. Inner side, aFLV, O.XIX/8, × 125.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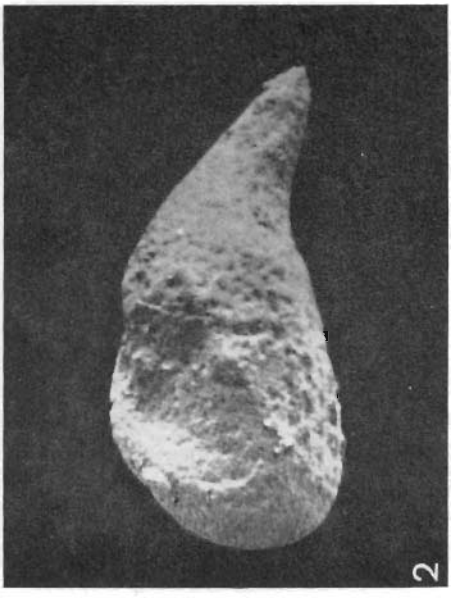
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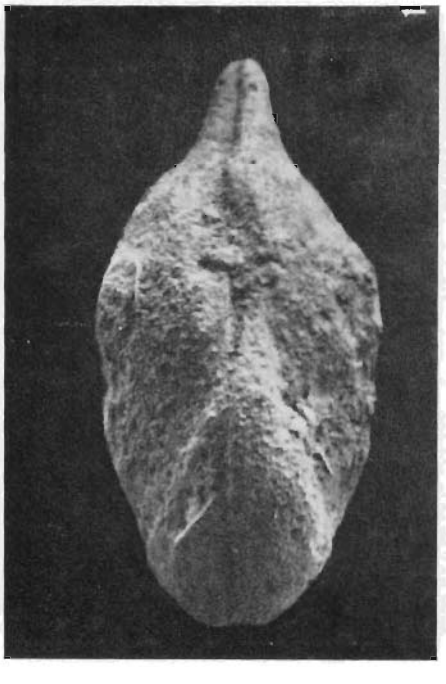
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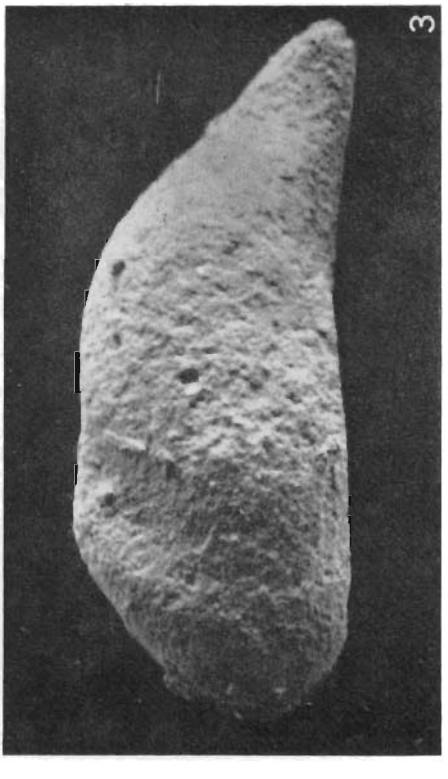
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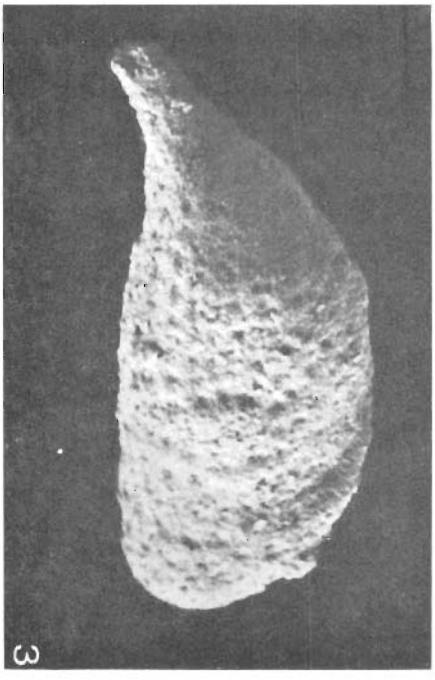
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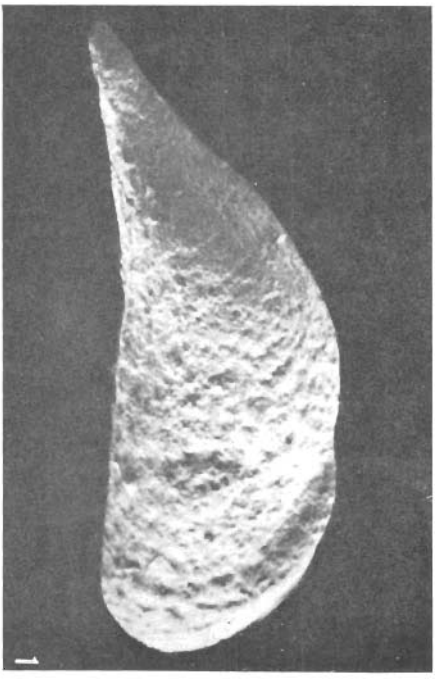
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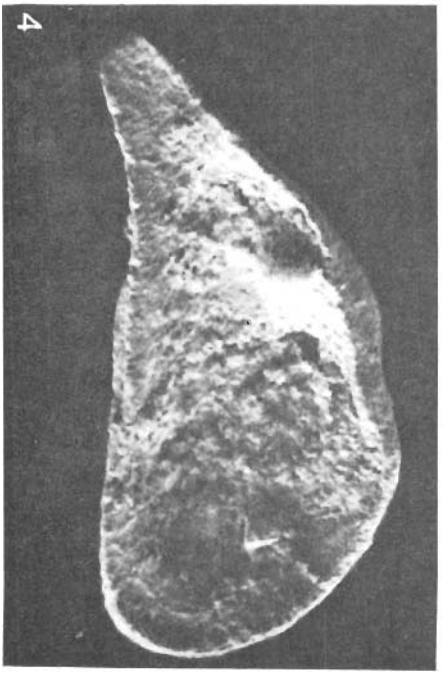
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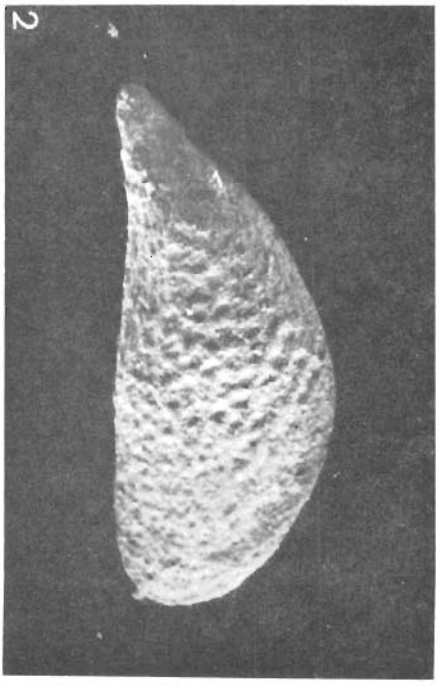
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