The Cainozoic palaeontology and stratigraphy of KwaZulu-Natal.


MICHAEL ROBERT COOPER
Dept. of Geology, University of Durban-Westville, Private Bag X54001, Durban, 4000 South Africa.

Summary

Cooper, M. R. 1996. The Cainozoic palaeontology and stratigraphy of KwaZulu-Natal. Part 1. The Mtunzini Formation. Stratigraphy and fauna. Durban Museum Novitates 21: 1-10. Unconsolidated, fossiliferous, late Quaternary sediments are described from the Mlalazi lagoon where they rest with a minor stratigraphic discontinuity on semi-consolidated silty clays believed to represent the Port Durnford Formation. These deposits, at an altitude of about 1.5m above current lagoon level, are assigned to the Mtunzini Formation (new lithostratigraphic unit) and are interpreted as estuarine lagoon or bay deposits related to a sea level 4-5m above present. The tropical Indian Ocean warm-water fauna is dominated by *Tellina (Tellinides) rousi* Sowerby, the index species *T. (Serratina) capsoides* Lamarck, *T. (Arcopagia) yemenensis* (Melvill), *Paphia (Paphia) textile* (Gmelin), *Dosinia (Dosinella) hepatica* (Lamarck), *Loripes (Loripes) clausus* (Philippi), *Anodontia (Anodontia) edentula* (Linné), *Solen cylindraceus* Hanley and *Diplodonta* sp. nov., with which are associated a number of other species.

KEYWORDS: KwaZulu-Natal, late Quaternary sediments, 4-5m sea level, Mtunzini Formation, palaeontology.

Introduction

Neogene sedimentation on the South Mozambique-Zululand coastal plain and the littoral of KwaZulu-Natal has long been a controversial issue. Sadly, many of the problems stem from the lack of a sound stratigraphical foundation on which to base correlation and interpretation. The purpose of this communication, therefore, is to document stratigraphical relationships and to introduce a new lithostratigraphical unit which may assist in clarifying Neogene coastal history along the KwaZulu-Natal littoral. The Mlalazi lagoon (Fig. 1) lies 1.5km to the east of Mtunzini in KwaZulu-Natal, at the mouth of the Mlalazi River. The present estuarine lagoon owes its origin to periodic and temporary closure of the river mouth by a beach spit resulting from longshore drift and the northeastward transport of sediment in the littoral zone. This spit, an extension of a forested foredune informally termed Cordon A, is backed on the western side of the lagoon by a second, possibly older, forested dune known as Cordon B. These two palaeodunes account for the final meander loop, for about 500m on either side of the slipway (Fig. 1). Along this exposure, lithostratigraphical relationships are clear and unambiguous immediately south of the slipway and for the first few hundred metres to the north (Figs 2-3), and are described below. For the purpose of description, lithological colours are derived from the Rock Colour Chart (Munsell colours) prepared by the Geological Society of America.

Stratigraphy

In the Mlalazi Nature Reserve, Quaternary lagoonal sediments are well exposed along the western bank of the final meander loop, for about 500m on either side of the slipway (Fig. 1). Along this exposure, lithostratigraphical relationships are clear and unambiguous immediately south of the slipway and for the first few hundred metres to the north (Figs 2-3), and are described below. For the purpose of description, lithological colours are derived from the Rock Colour Chart (Munsell colours) prepared by the Geological Society of America.

Unit I, at the base of the succession, is at least 1.05m thick and comprises unfossiliferous, sticky, semi-consolidated, mottled, olive-gray (5Y 5/2) to light olive-gray (5Y 5/2) silty clay with vertical jointing; this is unit II. Unit III follows with abrupt horizontal contact on unit II, the basal contact interpreted as a stratigraphical discontinuity. Unit III consists of about 17cm thick and comprises unfossiliferous, sticky, semi-consolidated silty clays believed to represent the Port Durnford Formation. These deposits, at an altitude of about 1.5m above current lagoon level, are assigned to the Mtunzini Formation (new lithostratigraphic unit) and are interpreted as estuarine lagoon or bay deposits related to a sea level 4-5m above present. The tropical Indian Ocean warm-water fauna is dominated by *Tellina (Tellinides) rousi* Sowerby, the index species *T. (Serratina) capsoides* Lamarck, *T. (Arcopagia) yemenensis* (Melvill), *Paphia (Paphia) textile* (Gmelin), *Dosinia (Dosinella) hepatica* (Lamarck), *Loripes (Loripes) clausus* (Philippi), *Anodontia (Anodontia) edentula* (Linné), *Solen cylindraceus* Hanley and *Diplodonta* sp. nov., with which are associated a number of other species.

Environmental interpretation

Unit I: Sieve analysis indicates this unit to be a silty clay suggesting deposition by suspension settling in a low-energy
environment; if the occasionally fossiliferous nodules which litter the foreshore are from this unit, a lagoonal environment with normal-marine salinities is indicated.

Unit II: Sieve analysis shows this unit to be a silty clay, the same as Unit I. The different physical characteristics, i.e. vertical jointing and colour, are interpreted as due to dehydration and desiccation in a subaerial environment.

Unit III: Sieve analysis indicates this unit to be a fairly well-sorted, medium-grained sand (Fig. 4). The presence of comminuted marine shells, in places horizontally aligned, together with upper flow-regime flat bedding, suggests deposition in a nearshore beach to very shallow subtidal environment.

Unit IV: Sieve analysis shows this to be a poorly sorted, immature, muddy, very fine-grained sand (Fig. 4). Abundant marine shells of predominantly burrowing species, including both disarticulated and conjoined valves, suggest deposition in a low-energy estuarine lagoon or bay under conditions of normal-marine salinity. The complete absence of primary sedimentary structures, and the random orientation of most of the shells, points to intense bioturbation.

**Stratigraphical interpretation**

Units I and II of the exposed section are believed to represent the upper part of the clay member of the early Pleistocene Port Durnford Formation, the stratigraphy of which was discussed most recently by Cooper and Kensley (1991). Units III and IV are younger estuarine lagoon or bay deposits which are assigned here to the Mtunzini Formation (new lithostratigraphic term); the stratigraphy of the holostratotype is shown as Figures 2-3. If the modern beach and dune deposits are excluded, the Mtunzini Formation is
Fig. 3 — Stratigraphical relationships at the Mtunzini stratotype; note the presence of flat-beded medium-grained sand at the base of the section in photograph (A) and its absence in (B); the bar scale is 10cm.
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Stratigraphical relationships

This species is reported from a Quaternary raised beach at Lake Nhlangeni, and from the Muinzini Formation. Although both deposits are Quaternary, precise relationships between the two are uncertain: the Lake Nhlangeni deposit occurs at +6-8m above present sea level and is believed to date to the late Pleistocene (Eemian) (Cooper et al. 1989). Saccostrea forskali (Gmelin) is a tropical Indian Ocean species which occurs living in estuaries and lagoons along the east coast of Africa as far south as the eastern Cape (R. N. Kilburn, pers comm., 1995).

Saccostrea forskali (Gmelin) is a tropical Indian Ocean species which occurs living in estuaries and lagoons along the east coast of Africa as far south as the eastern Cape (R. N. Kilburn, pers comm., 1995).

Anodontia (Anodontia) edentula (Linné, 1758)

Lucina edentula (Chenu) Prashad 1932: 154; Barnard 1964: 470.
Lucina globosa Forsskål; Bartsch 1915: 194; Braga 1952: 118, pl. 11, fig. 6.
Anodontia edentula (Linné) Kilburn and Rippey 1982: 173, pl. 39, fig. 5, text-fig. 145; Cooper et al. 1989: 78, fig. 5E.

Material

19 single valves, DNSM-PTZ5486-94, 5833, 6123-33, all from unit IV; a single specimen, DNSM-PTZ6134, has conjoined valves.

Stratigraphical range

Late Pleistocene of the southern and eastern Cape and late Quaternary of KwaZulu-Natal; living material extends south along the east coast only as far as Durban.

Family UNGULINIDAE Adams and Adams, 1857
Genus Diplodonta Bronn, 1831
**Diplodonta sp. nov.**  
Fig. 5D

Compare:  
*Diplodonta* *sansibarica* Jaeckel and Thiele 1931: 218, pl. 9, fig. 87.  
*Diplodonta* *sansibarica* cf. Jaeckel and Thiele; Barnard 1964: 468.  
*Diplodonta* sp., Cooper et al. 1989: 78, fig. 5F.

**(Material)**

70 single valves and several conjoined valves, DNSM-PTZ5657-5682, 6072-6122, all from unit IV.

**(Description)**

The present material is characterized by being moderately inflated, almost equilateral, with subcentrally positioned umbones and slightly prosogyrous beaks; it lacks a lunule. Internally, the left valve shows a weak, curved, hinge plate with a strongly opisthothecium, very fine, blade-like, posterior cardinal separated by a triangular socket from a slightly prosocline, bifid, anterior cardinal. The pallial line is entire, and the almost isomyarian adductor pads are tall, short and subcrescentic. Internally the commissural margin is finely and weakly crenulated. Dentition of the right valve comprises a lath-like, prosocline anterior cardinal separated by a triangular socket from the opisthothecium, bifid, posterior cardinal. Sometimes a narrow socket separates the posterior cardinal from the conspicuous, curved, trigonal, ligament nympha with its deep marginal groove.

**(Discussion)**

Shells from various localities along the east coast of Africa, perhaps conspecific with those from the Muizinni Formation, are reported variously as *D. rotundata* (Montagu) (Smith 1903) and *D. sansibarica* Jaeckel and Thiele (cf. Cooper et al. 1989). True *Diplodonta rotundata* (Montagu) (Chavan 1969: N515, fig. E20,10) is markedly inequilateral and unlike the present material. Cox (1929) recorded *Diplodonta incerta* d'Archiac and Haime from the Lower Miocene of southern Mozambique; the Mozambique material differs from that described here in having a different outline, with the anterior part of the shell produced. *Diplodonta almo* Bartsch (1915: 195, pl. 47, fig. 1, pl. 54, fig. 2) and *D. africana* Bartsch (1915: 195, pl. 47, fig. 5, pl. 53, figs 9-10) both differ in shape from the present material and do not warrant comparison. According to Dr R. N. Kilburn (pers. comm.), this is a new species of *Diplodonta* which he intends describing in the not too distant future.

**(Stratigraphical range)**

Quaternary (Lower Pleistocene to Recent) of KwaZulu-Natal; this is a widespread living Indo-Pacific species which ranges along the east coast from the Persian Gulf south as far as Durban.

Family SOLENIDAE Lamarck, 1809  
Genus *Solen* Linné, 1758

*Solen cylindraceus* Hanley, 1843  
Fig. 5P

*Solen acutangulus* (Dunker) Braga 1952: 115, pl. 11, fig. 1.  
*Solen cylindraceus* Hanley; Kilburn and Rippey 1982: 180, pl. 41, fig. 8, text-fig. 165; Cooper et al. 1989: 78, fig. 5G.

**(Material)**

16 specimens, DNSM-PTZ5500-03, 6153-67, and some fragments, all from unit IV; some specimens have conjoined valves.

**(Stratigraphical range)**

Quaternary (Lower Pleistocene to Recent) of KwaZulu-Natal; this is a widespread living Indo-Pacific species which ranges along the east coast of Africa as far south as Algoa Bay (Kilburn and Rippey 1982).

Family TELLINIDAE de Blainville, 1814  
Subfamily TELLININAE de Blainville, 1814  
Genus *Tellina* Linné, 1758  
Subgenus *Tellinides* Lamarck, 1818

*Tellina (Tellinides) rousi* Sowerby, 1892  
Fig. 5P

*Tellina rousi* Sowerby; Kilburn and Rippey 1982: 181, 217, pl. 42, fig. 3, text-fig. 171.  
*Tellina apelina* (Gmelin) Cooper 1990:541, fig. 2A.

**(Material)**

Over 100 specimens, including DNSM-PTZ5528-61, a number with conjoined valves, and all from unit IV.

**(Discussion)**

The material from the Port Durnford Formation identified...
with T. apelina Gmelin (Cooper 1990) lacks internal radial buttresses to the left valve and should be assigned to T. rouxi Sowerby.

**Stratigraphical range**

Quaternary (Lower Pleistocene to Recent) of KwaZulu-Natal; living material ranges from Mozambique to the southern Cape (Still Bay).

Subgenus Serratina Pallary, 1922

*Tellina (Serratina) capsoides* Lamarck, 1818

**Fig. 5M**

*Tellina pristis* (Lamarck) Braga 1952: 119, pl. 11, fig. 7.
*Tellina (Serratina) capsoides* Lamarck; Boss 1969: 113, pl. 6, fig. 4, pl. 8, figs 5-6, pl. 14, fig. 3 (cum synon.).
*Tellina capsoides* Lamarck; Kilburn and Rippey 1982: 187, pl. 42, fig. 9, text-fig. 176.

**Material**

40 single valves, DNSM-PTZ5504-26, 5834, 6135-6152, all from unit IV.

**Stratigraphical range**

Late Quaternary of KwaZulu-Natal; this is a widespread living Indo-Pacific species which ranges along the east coast from Aden to Durban.

Subgenus Arcopagia Brown, 1827

*Tellina (Arcopagia) yemenensis* (Melvill, 1898)

**Fig. 5J-K**

*Tellina (Arcopagia) yemenensis* (Melvill) Boss 1969: 106, pl. 7, figs 3-4, pl. 17, figs 5-6.

**Material**

63 single valves, DNSM-PTZ5563-76, 5998-6048, all from unit IV.

Discussion

The present material is very close to *T.* (*A.*) *bertini* (Joussseau) (Oliver 1992: 155, pl. 35, fig. 11) but the Red Sea species is said to be thicker shelled, more triangular, less compressed and with the pallial sinus angled close to the midline. Although *T.* (*A.*) *yemenensis* has been assigned to the subgenus Arcopagia (cf. Boss 1969), the type species of the latter taxon differs markedly in being subcircular, with two laterals in the right valve (in the present material the posterior lateral is very weak and indistinct), and a rounded pallial sinus which is not confluent and is well separated from the posterior adductor.

**Stratigraphical range**

Late Quaternary of KwaZulu-Natal; this is a living tropical Indian Ocean species which ranges along the east coast from Aden to Durban.

*Subfamily MACOMINAE Olsson, 1961

*Genus Macoma* Leach, 1819

*Subgenus Macoma* Leach, 1819

*Macoma (Macoma) reutersa* (Sowerby, 1897)

**Fig. 5E**

*Macoma reutersa* (Sowerby) Barnard 1964: 548, fig. 31G; Kilburn and Rippey 1982: 188, pl. 42, fig. 14, text-fig. 181.

**Material**

15 valves, DNSM-PTZ5577-8, 5934-47, all from unit IV.

**Stratigraphical range**

Late Quaternary of KwaZulu-Natal; a widespread living Indo-Pacific species which ranges along the east coast as far south as Port Alfred (Kilburn and Rippey 1982).

Family PSAMMOMIIDAE Fleming, 1828

Subfamily SANGUINOLARIINAE Grant and Gale, 1931

*Genus Hiatus* Modeer, 1793

*Hiatus lunulata* (Deshayes, 1855)

**Fig. 5A**

*Psammotaea lunulata* (Deshayes) Barnard 1964: 534.
*Hiatus lunulata* (Deshayes) Kilburn and Rippey 1982: 190, pl. 43, fig. 8, text-fig. 190.

**Material**

Three specimens, DNSM-PTZ5830, 5979-80, all from unit IV.

**Stratigraphical range**

Late Quaternary to Recent of KwaZulu-Natal; this is a widespread Indo-Pacific species which occurs living along the east coast, as far south as the eastern Cape; it is particularly abundant in Lake St Lucia.

Family VENERIDAE Rafinesque, 1815

Subfamily TAPETINAE Adams and Adams, 1857

*Genus Eumarcia* Iredale, 1924

*Eumarcia paupercula* (Holten, 1802)

**Fig. 5B**

*Eumarcia paupercula* (Holten, 1802) Cooper 1990: 543, fig. 2B (cum synon.)
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Material
40 single valves, DNSM-PTZ5687-97, 5948-78, all from unit IV.

Stratigraphical range
Miocene to Recent of east Africa, Lower Pleistocene to Recent of KwaZulu-Natal; living material ranges along the east coast from the Red Sea to the southern Cape (Still Bay).

Genus Paphia Röding, 1798
Subgenus Paphia (Paphia) textile (Gmelin, 1790)

Paphia (Paphia) textile (Gmelin, 1790)
Fig. 5C
Paphia (Paphia) textile (Gmelin) Cooper 1990: 543, fig. 2R (cum synon.)

Material
62 single and conjoined valves, DNSM-PTZ5625-5656, 5835, 6169-6202, all from unit IV.

Stratigraphical range
Pleistocene (Lower Quaternary to Recent) of KwaZulu-Natal; living material of this tropical Indian Ocean species which ranges south only as far as northern Mozambique (Cooper et al. 1989).

Subfamily DOSINIINAE Deshayes, 1853
Genus Dosinia Scopoli, 1777
Subgenus Dosinella Dall, 1902

Dosinia (Dosinella) hepatica (Lamarck, 1818)
Fig. 5L
Dosinia (Dosinella) hepatica (Lamarck) Cooper 1990: 543, figs 3N-O (cum synon.)

Material
Over 100 single valves and several specimens with conjoined valves, including DNSM-PTZ5579-5623, all from unit IV.

Stratigraphical range
Pliocene to Recent of the eastern Cape and Quaternary (Lower Pleistocene to Recent) of KwaZulu-Natal; this is a widespread tropical Indian Ocean species which ranges from the Red Sea south as far as the southern Cape (Still Bay).

Class GASTROPODA Cuvier, 1797
Order MESOGASTROPODA Thiele, 1925
Family POTAMIDIDAE Adams and Adams, 1854
Genus Cerithidea Swainson, 1840

Cerithidea decollata (Linné, 1767)
Fig. 6A
Cerithidea decollata (Linné) Kensley 1972: 85, fig. 294; Kilburn and Rippey 1982: 53, pl. 10, fig. 17.

Material
A single specimen, DNSM-PTZ6218, from unit IV.

Discussion
The presence of this species provides evidence for fringing mangrove communities at the time of deposition of the Mtunzini Formation.

Stratigraphical range
Late Quaternary of KwaZulu-Natal; this is a widespread Indo-Pacific species which ranges south along the east coast as far as the eastern Cape (Algoa Bay) (Kilburn and Rippey 1982).

Genus Terebralia Swainson, 1840

Terebralia palustris (Linné, 1767)
Fig. 6B
Terebralia palustris (Bruguière) Kensley 1972: 85, fig. 296; Terebralia palustris (Linné) Kilburn and Rippey 1982: 53, pl. 10, fig. 15.

Material
A single specimen, DNSM-PTZ6219, from unit IV.

Discussion
The presence of this species provides further evidence for fringing mangrove communities at the time of deposition of the Mtunzini Formation.

Stratigraphical range
Late Quaternary of KwaZulu-Natal; this is a widespread Indo-Pacific species which ranges south along the east coast as far as southern KwaZulu-Natal (Kilburn and Rippey 1982).

Family NATICIDAE Forbes, 1838
Subfamily POLINICINAE Gray, 1847
Genus Polinices Montfort, 1810
Subgenus Glossaulax Pilsbry, 1929

Polinices (Glossaulax) didyma (Röding, 1798)
Fig. 5G-H
Natica (Neverita) didyma (Bolten) Cox 1929: 86.
**Nassarius (Plicarcularia) kraussianus** (Dunker, 1846)

*Fig. 5V-W*

*Nassa kraussiana* (Dunker) Braga 1952: 75, pl. 3, fig. 3; Kensley 1973: 160, fig. 598.

*Nassarius kraussianus* (Dunker) Kilburn and Rippey 1982: 100, pl. 23, fig. 11; Wells and Kilburn 1985: 453, figs 1-2.

*Nassarius (Plicarcularia) kraussianus* (Dunker) Cooper *et al.* 1989: 78, fig. 4G.

**Material**

Eight specimens, DNSM-PTZ5704-5706, 6209-6213, all from unit IV.

**Stratigraphical range**

Upper Miocene and Pliocene of Java, Pliocene of Sumatra, Lower Pleistocene to Holocene of KwaZulu-Natal and southern Mozambique, Pleistocene of Algoa Bay; living material ranges throughout the Indian Ocean, as far south as southern Mozambique, with dead specimens recorded from coastal deposits as far south as Still Bay (Barnard 1963).

Order NEOGASTROPODA Wenz, 1938

Family NASSARIIDAE Iredale, 1916

Genus Nassarius Duméry, 1806

Subgenus Plicarcularia Thiele, 1929

**Volema pyrum** (Gmelin, 1791)

*Fig. 5T-U*

*Melengena paradiisaca* (Martini) Braga 1952: 73, pl. 2, fig. 4.

*Volema paradisaca* (Martini-Reeve) Kensley 1973: 560, fig. 569.

*Volema pyrum* (Gmelin) Kilburn and Rippey 1982: 101, pl. 23, fig. 16; Cooper *et al.* 1989: 78, fig. 4F.

**Material**

Four complete and two broken specimens, DNSM-PTZ5708-10, 5838, 6214-15, all from unit IV.

**Stratigraphical range**

Late Quaternary of KwaZulu-Natal. Although this tropical Indian Ocean species reached Algoa Bay during the Pleistocene (Cooper *et al.* 1989), living material ranges south along the east coast of Africa only as far as Durban.

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**Faunal affinities**

The Mtunzini fauna comprises extant euhaline molluscs with tropical Indian Ocean affinities and its “index fossil” is regarded as *Tellina (Serratina) capsoides* Lamarck, a distinctive species not yet recorded from any of the older Cainozoic deposits along the KwaZulu-Natal littoral. As a whole, the fauna displays marked similarities with largely undocumented faunas from Durban Bay (Barnard 1964, Kilburn and Rippey 1985) and, in all probability, identical deposits were/are present at this locality; unfortunately, recovered materials have been mixed with younger and older faunas by dredging activities.

The Mtunzini fauna also has a number of species in common with the +6-8m raised-beach deposits at Lake Nhlange which occur 5km inland in northern Zululand (Cooper *et al.* 1989). On the basis of elevation, the Nhlange deposit was correlated with the lithologically and faunally dissimilar false Bay Coral Limestone and assigned a late Pleistocene (Eemian) age (Cooper *et al.* 1989); this correlation is not supported here.

The Mtunzini and Port Durnford Formations also share a number of species. However, notable Mtunzini elements which are absent from the Port Durnford Formation include *Anodontia (Anodontia) edentula* (Linne), *Tellina (Serratina) capsoides* (Lamarck), and T. (Arcopagia) yemenensis (Melvill). Common Port Durnford elements which are absent from the Mtunzini Formation include *Chlamys fultoni* Sowerby, *Protapes gallus* (Gmelin), *Ostrea (Ostrea)* sp. and *Cronia heptagonalis* (Reeve). Probably some of these differences can be accounted for by the fact that the Port Durnford Formation records a muddy/silty lagoon behind an offshore barrier-island complex whereas the Mtunzini Formation records a silty/sandy estuarine lagoon or bay behind a river-mouth spit.

Extant species common to all the above three deposits (Port Durnford, Nhlange, Mtunzini) which, probably, span most of the Quaternary period are *Loripes (Loripes) clausus* (Philippi), *Dosinia (Dosinella) hepatica* (Lamarck), *Diplodonta* sp. nov., *Solen cylindraceus* Hanley, *Paphia (Paphia) textile* (Gmelin), *Polinices (Glossaulax) didyma* (Röding) and *Nassarius (Plicarcularia) kraussianus* (Dunker); probably *Eumarcia paupercula* (Holten) should be included here also.

**Age relationships**

All the marine Quaternary formations of the South Mozambique-Zululand coastal basin and the KwaZulu-Natal littoral have yielded extant faunas which, currently, do not allow for precise age determinations; as a result, speculative correlation is rife. The tendency has been to assign ages on the basis of the altitude of the raised beach; often this dangerous practise has led to spurious determinations. At present, the Mtunzini Formation is stratigraphically the youngest documented Quaternary fauna from KwaZulu-Natal. It rests disconformably on deposits correlated here with the early Pleistocene Port Durnford Formation, and is incised by geologically Recent deposits of the modern lagoon. The Mtunzini Formation is, therefore, late Quaternary in age and its deposition was a response to marine transgression and a sea-level which, ultimately, reached at least 4-5m above present; as the strandline facies of the Mtunzini Formation is undocumented the maximum inland extent and elevation of this transgression has still to be determined. It is likely, however, to be recorded in many of the estuarine lagoons along the east coast.

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**Natica ampla** Braga 1952: 89, pl. 5, fig. 10.


*Polinices (Glossaulax) didyma* (Röding) Kilburn 1976: 860 (cum synon.)

*Polinices didyma* (Röding), Kilburn and Rippey 1982: 71, pl. 16, fig. 5; Cooper *et al.* 1989: 78, fig. 4E.
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