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PLIOCENE MARINE INVERTEBRATES FROM
LANGEBAAWEG, CAPE PROVINCE

By
BRIAN KENSLEY

Cape Town Kaapstad

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BRIAN KENSLEY

South African Museum, Cape Town

(With 9 figures)

[MS. accepted 12 June 1972]

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INTRODUCTION

The deposits which are being commercially exploited for their phosphate content at Langebaanweg, 105 kilometres north-north-west of Cape Town, are of palaeontological significance mainly because of the unique assemblage of Pliocene mammals which they have yielded (Hendey 1970a). Non-mammalian vertebrate remains are not uncommon (e.g. Simpson 1971), but until recently invertebrate fossils were rare, although the occurrence of marine molluscs in the deposits had been noted (Hendey 1970a). During 1971 two assemblages of marine invertebrates were recovered from 'E' quarry, and it is this material which is here described.

The present paper is in the nature of an inconclusive report, mainly on the molluscs. In some cases specific identification is given with almost no uncertainty. In several cases, however, the generic and even the familial position of the specimens is in doubt. Where these have been speculated upon, it is quite possible that with further and more complete material becoming available, the taxonomic position of the specimens will be altered. In some cases, certainty may never be reached, as structures such as radulae and operculae, which are essential for an accurate identification, are not preserved. Whether further material will in fact become available is doubtful, considering the difficulties involved in obtaining fossiliferous phosphatic matrix, and in removing the fossils from this extremely resistant matrix.

The first series of specimens (South African Museum L14187) were recovered from an exposure near the south-western corner of 'E' quarry. These

fossils, which are very well preserved and show almost no sign of being beach-worn, were embedded in a cemented, fine-grained brown phosphate rock that was adhering to an older, water-worn and heavily indurated phosphate rock. A few isolated shark's teeth (*Odontaspis* sp.) occurred in association with the invertebrates.

The second assemblage (S.A.M. L14259) was recovered from a trench in the eastern part of the quarry (BDT 2/1971), and these specimens, of which only internal casts and external impressions were preserved, came from a consolidated non-phosphatic light-coloured silt that was also adhering to boulders of heavily indurated phosphate rock.

At both localities the indurated phosphate rock occurs as rounded water-worn boulders, cobbles, and pebbles, and these together with the deposit containing the invertebrate fossils, occur in a loose and non-phosphatic sand and silt. The latter deposit also contains the remains of marine vertebrates such as sharks, teleosts, and whales, and grades upwards into a non-marine deposit from which most of the 'E' quarry terrestrial fossils are recovered.

SYSTEMATICS

CEMENTED PHOSPHATIC MATRIX (L14187)

Phylum **MOLLUSCA**

Class **GASTROPODA**

Order **ASPIDBRANCHIA**

Family **Patellidae**

Cellana capensis (Gmelin)

Cellana capensis: Barnard, 1963b: 315.

Description

Shell somewhat domed, with apex anterior to midpoint, circumference narrower at anterior end. Apex eroded in all specimens. Sculpturing consisting of very fine radiating ridges, sometimes slightly granular, often reaching almost to apex.

Material

Numerous examples of external and internal casts. Several incomplete specimens up to 29 mm in diameter. S.A.M. L14187/A.

Remarks

Both sculpturing and general proportions, which have been assessed in some cases by means of silicone casts taken from external casts of shells, agree well with living material. The characteristic colour pattern of the species is naturally entirely lacking. The species occurs alive on the east coast of southern

Africa from East London to Moçambique, Malagasy, and has also been recorded from Pakistan.

Patella granularis Linnaeus

Patella granularis: Koch, 1949: 503. Barnard, 1962: 161.

Material

Several internal casts and several incomplete specimens up to 48 mm in diameter. S.A.M. L14187/B.

Remarks

The domed shape of the larger specimens and the fine radiating ribs bearing low blunt spines characterize this species, which has been recorded from the Pleistocene of the Namaqualand coast and the Saldanha Bay area. The species occurs alive from southern Angola to Natal.

Family **Fissurellidae**

Diodora parviforata (Sowerby)

Fig. 1

Diodora parviforata: Barnard, 1962: 191; 1963b: 294.

Description

Shell oval in circumference, narrower at posterior end. Foramen small, circular, situated posterior to and slightly below apex. Sculpture consisting of numerous radiating lirae reaching almost from apex to circumference; in upper region growth lines form cancellate pattern with lirae.

Material

One complete specimen, longer diameter 22,8 mm, shorter diameter 15,6 mm, altitude 11,0 mm. S.A.M. L14187/C.

Remarks

No differences can be detected between the present specimen and living material taken from the west coast. The species has been recorded from the Pleistocene of the Alexander Bay/Port Nolloth area, and living from the west coast of the Cape Peninsula to Port Alfred.

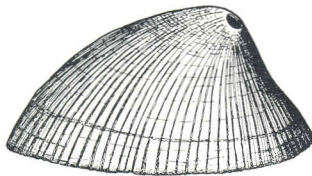


FIG 1. *Diodora parviforata*.

Family **Haliotidae*****Haliotis saldanhae*** n.sp.

Fig. 2

Description

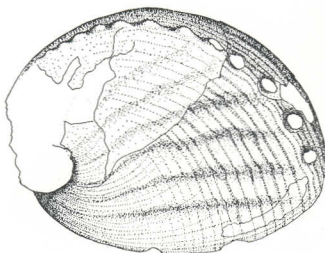
Outer lip of shell margin slightly convex. Four or five foramina present on distinct ridge between upper surface of body whorl and region between foramina and columella ridge. Distinct groove between columella and rest of shell. Body whorl with about 15 smoothly-rounded spiral lirae, some stronger than others. One or two lirae present between larger foramina, nine or ten lirae between foramina and columella, two stronger than rest. Faint growth-lines visible. Several strong smoothly-rounded undulations at angle of about 40° to growth-lines.

Material

HOLOTYPE: an almost complete specimen, 87×63 mm, S.A.M. L14187/D, 2 incomplete and eroded specimens, one with entire body whorl, 117×88 mm. From the second assemblage (see p. 186) a complete internal cast, agreeing well with present species 74×53 mm, S.A.M. L14259/D.

Remarks

Haliotis saldanhae bears some resemblance to both of the present-day species of *Haliotis* which occur around the Cape. In general shape, *H. saldanhae* more closely resembles *H. midae* which is a broader shell than *H. sanguineum*. The outer lip margin is slightly convex as in *H. midae*, rather than slightly concave as in *H. sanguineum*. The foramina of the present species would seem to be fewer in number (4 or 5) and larger than in *H. midae* or *H. sanguineum* of comparable size (8 or 9). The most obvious difference between *H. saldanhae* and the two present-day species lies in the nature of the sculpture; *H. sanguineum* possesses spiral lirae both above and below the foramina (but these are often evanescent in large specimens). This spiral sculpture is rather similar to the present material where it is somewhat stronger. *H. sanguineum* lacks any sculpture other than growth-lines and spiral lirae. *H. midae* characteristically lacks spiral sculpture, but possesses strong oblique undulating raised ridges, whereas the

FIG. 2. *Haliotis saldanhae* n.sp.

present species possesses more widely-spaced oblique undulations, which never reach the raised condition of *H. midae*. A groove is present between the columella and the body whorl in *H. saldanhae*, as in *H. midae*. This is never found in *H. sanguineum*, where the columella merges smoothly with the rest of the shell.

H. tuberculata of the Mediterranean and West Africa is a more elongate species, possesses numerous spiral striae, and lacks any oblique sculpture other than strong growth-lines.

As the present species cannot satisfactorily be reconciled with any fossil or living species of *Haliotis*, it is afforded separate specific status. *H. saldanhae* could perhaps be regarded as ancestral to *H. midae*, given a loss of spiral sculpture, or its obliteration by the oblique undulations, which would become stronger and more closely spaced. The specific name '*saldanhae*' is derived from Saldanha Bay, the Pliocene shore having been an extension of this bay.

Family **Trochidae**

Oxystele tigrina (Chemnitz)

Oxystele tigrina: Barnard, 1962: 191; 1963b: 267.

Description

Shell of four whorls, convex in profile, apex damaged or eroded in all specimens. Umbilicus closed. Outer shell layer almost smooth, but broken away in several cases, exposing 10–12 spiral lirae. Latter more distinct in upper whorls, second whorl with seven to nine, third with fewer.

Material

Numerous examples ranging in diameter from 10,0 mm to 31,5 mm (altitude difficult to measure due to damage). S.A.M. L14187/E.

Remarks

Because of the strength of and similarity in the number of the spiral lirae, the present material is thought to be closest to *O. tigrina*. The material also agrees in general proportions, i.e. altitude to diameter ratio, with this species. The possibility exists that the smaller specimens may belong to a different species, but these too agree well with living material of similar size of *O. tigrina*. The latter has been recorded from the Pleistocene of the Algoa Bay area, and occurs alive from Saldanha Bay to Natal.

Family **Phasianellidae**

Tricolia neritina (Dunker)

Tricolia neritina: Barnard, 1963b: 210.

Material

Numerous examples, largest specimen with diameter of 4,5 mm. S.A.M. L14187/F.

Remarks

No differences can be detected between the present material and living specimens, which occur from Lüderitzbucht to Algoa Bay.

? Family **Littorinidae**

? Genus LITTORINA

Fig. 3

Description

Shell squat, profile evenly convex, with simple protoconch of one whorl, plus $3\frac{1}{2}$ –4 postnatal whorls. Aperture broadly oval. Sculpturing either entirely absent, or with very faint spiral lirae visible on body whorl.

Remarks

The present species, with its lack of characters, could be placed in several families with equal lack of certainty, but would seem closest to *Littorina africana* in overall proportions, in the lack of a strong ridge on the body whorl, and in the faint spiral lirae. There is some superficial resemblance to *Phasianella capensis*, but the greater height of the spire in larger specimens of the latter species seems to discount this identification.

Material

Numerous examples ranging in altitude from 2,5 mm to 7,0 mm. S.A.M. L14187/G.

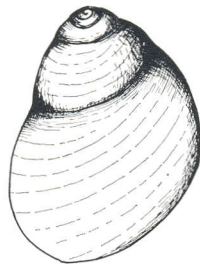


FIG. 3. ? *Littorina* sp.

Family **Muricidae**

Ocenebra scrobiculata (Dunker)

Tritonalia scrobiculata: Barnard, 1959: 212.

Material

One specimen, 6,3 mm altitude. S.A.M. L14187/H.

Remarks

The characteristic cancellate sculpture formed by strong spiral lirae, with nodules formed where these are crossed by axial ridges, agrees perfectly

with the shells of living examples of the species. The nodules do not show the squamae found in the 'crawfordi' form of the species. *T. scrobiculata* has been recorded alive from Saldanha Bay to Natal.

Family **Thaididae**

Thais dubia Krauss

Thais dubia: Barnard, 1959: 221; 1962: 190.

Material

One specimen, apex damaged, altitude 17 mm, diameter 11,0 mm. S.A.M. L14187/I.

Remarks

The general form and proportions, the extent of the callus, shape of the columella and the aperture, along with the faint spiral sculpture and obscured axial and growth lines agree well with many specimens of living material of this species. *T. dubia* has been recorded from the Pleistocene deposits of the Namaqualand coast, Knysna, and the Algoa Bay area.

Family **Nassariidae**

Bullia sp.

Material

Several damaged specimens and casts. Largest example altitude 26,8 mm. S.A.M. L14187/J.

Remarks

The present species belongs to the group of slender species in the genus, and is very close to *B. digitalis*. Unfortunately, as a callus is not visible on any of the specimens, further identification is not possible.

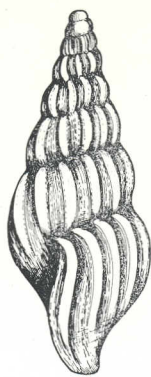
Family **Turridae**

'*Crassispira*' sp.

Fig. 4

Description

Protoconch $1\frac{1}{2}$ whorls, five postnatal whorls. Basal whorl bearing 15-16 slightly oblique smooth axial ridges, those on outer lip reflecting slight sinuosity of outer lip near suture. Fourth whorl with 12-13 axial ribs, reaching from suture to suture, third whorl with 9-11 axial ribs. Latter difficult to distinguish on earlier whorls due to matrix. Two or three very faint spiral lirae visible on base below axial ribs.

FIG. 4. '*Crassispira*' sp.*Material*

Two complete specimens, altitude 8,9 mm and 7,6 mm, diameter 3,7 mm and 3,5 mm respectively, one with damaged apex. S.A.M. L14187/K and A.

Remarks

In general proportions, number of whorls, and in the number of axial ribs per whorl, the present material agrees well with *Crassispira hottentota* (see Barnard 1958: 120, and Kilburn 1970: 40). Shells of *C. hottentota* have been collected from False Bay to East London.

'*Clavatula*' sp.

Fig. 5

Description

Shell of six whorls plus protoconch. Outer lip with broad, moderately deep sinus. Sculpturing consisting of oblique, smooth, axial ribs, 12 on basal whorl, 12-13 on fifth whorl, thereafter obscure. Spiral lirae faintly visible on base.

FIG. 5. '*Clavatula*' sp.

Material

Two complete specimens, altitude 9,4 mm and 9,1 mm, diameter 4,9 mm and 4,5 mm respectively. S.A.M. L14187/L.

Remarks

The generic position of the present material, as with the previous species, is speculative, only the shell being available. Nevertheless, the character of the outer lip sinus suggests a species of *Clavatula* close to *C. sinuata* and its variety *sigillata* (see Barnard 1958: 99).

'*Turris*' sp.

Description

Shell evenly conical, aperture less than half total length. Five whorls plus protoconch. No axial sculpture, basal whorl with 8–10 strong spiral lirae, following whorls each with seven spiral lirae.

Material

One specimen, base damaged, altitude 10,0 mm, diameter 4,4 mm. S.A.M. L14187/M.

Remarks

With only the shell available, the generic position of the present specimen cannot be verified. The specimen is, however, reminiscent of several species of the genus *Turris*, especially *T. cingulifera*, which it resembles in the spiral sculpture and the aperture shape.

Order OPISTHOBRANCHIATA

Family **Pyramidellidae***Turbonilla kraussi* Clessin

Turbonilla kraussi: Barnard, 1962: 190; 1963a: 84.

Description

Shell slender, tapering, of seven whorls, apical whorl absent. Each whorl bearing numerous smooth axial ridges, about 20 on base, 18–20 on previous whorl.

Material

Two specimens, altitude 5,0 mm and 4,8 mm, diameter 1,9 mm and 1,7 mm respectively, S.A.M. L14187/N.

Remarks

Because of the small size of the specimens and the hardness of the encrusting matrix, an accurate count of the axial ribs is difficult. Nevertheless, the specimens agree well with living material of similar size. The species has been recorded from the Pleistocene of Sedgefield and the Algoa Bay area, and alive from Saldanha Bay to Natal.

Material

Two complete specimens, altitude 9,4 mm and 9,1 mm, diameter 4,9 mm and 4,5 mm respectively. S.A.M. L14187/L.

Remarks

The generic position of the present material, as with the previous species, is speculative, only the shell being available. Nevertheless, the character of the outer lip sinus suggests a species of *Clavatula* close to *C. sinuata* and its variety *sigillata* (see Barnard 1958: 99).

'*Turris*' sp.

Description

Shell evenly conical, aperture less than half total length. Five whorls plus protoconch. No axial sculpture, basal whorl with 8–10 strong spiral lirae, following whorls each with seven spiral lirae.

Material

One specimen, base damaged, altitude 10,0 mm, diameter 4,4 mm. S.A.M. L14187/M.

Remarks

With only the shell available, the generic position of the present specimen cannot be verified. The specimen is, however, reminiscent of several species of the genus *Turris*, especially *T. cingulifera*, which it resembles in the spiral sculpture and the aperture shape.

Order OPISTHOBRANCHIATA

Family **Pyramidellidae***Turbonilla kraussi* Clessin

Turbonilla kraussi: Barnard, 1962: 190; 1963a: 84.

Description

Shell slender, tapering, of seven whorls, apical whorl absent. Each whorl bearing numerous smooth axial ridges, about 20 on base, 18–20 on previous whorl.

Material

Two specimens, altitude 5,0 mm and 4,8 mm, diameter 1,9 mm and 1,7 mm respectively, S.A.M. L14187/N.

Remarks

Because of the small size of the specimens and the hardness of the encrusting matrix, an accurate count of the axial ribs is difficult. Nevertheless, the specimens agree well with living material of similar size. The species has been recorded from the Pleistocene of Sedgefield and the Algoa Bay area, and alive from Saldanha Bay to Natal.

? Family **Pyramidellidae**? Genus **PYRAMIDELLA**

Fig. 6

Description

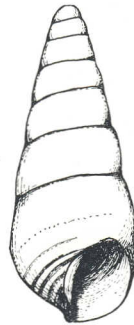
Shell elongate, smoothly conical, protoconch of one whorl, six postnatal whorls, profile of latter very slightly convex, sutures well marked. Aperture wide, columella simple, bearing well-defined callus. Two or three spiral lirae on base, rest of shell lacking sculpture.

Material

Numerous complete specimens up to altitude 9,0 mm, diameter 4,9 mm. S.A.M. L14187/O.

Remarks

In the simple columella and the general proportions the present material most closely approaches the genus *Turbonilla*, although the number of postnatal whorls (6) is low for the genus. The lack of sculpturing is also not characteristic of the genus, while several species of *Pyramidella* such as *P. ima* Bartsch, and *P. hera* Bartsch, do lack both axial and spiral ornamentation. None of the species, however, has spiral lirae on the base, as occurs in the present material.

FIG. 6. ? *Pyramidella* sp.

Order PULMONATA

Family **Siphonariidae***Siphonaria* sp.

Fig. 7

Description

Circumference of shell oval, outer surface bearing eight or nine strong radial ribs, with weaker ribs between them. Ribs extend beyond circumference of shell. Growth lines faintly visible. Ribs faintly reflected in internal casts, interior with central portion dome-like, with slight groove on one side.

Material

Five specimens, of similar size, largest with longest diameter 13,2 mm, altitude 5,0 mm. S.A.M. L14187/P.

Remarks

The possibility exists that the present material belongs to the Patellidae, but several factors give an impression of *Siphonaria* rather than *Patella*. These factors include the small size, the raised dome-like central portion with its faint groove possibly indicating the position of the siphon. Of the Patellidae the present material resembles juveniles of *P. longicosta* (and less obviously *P. oculus*) particularly in the external ribbing. The internal doming, however, is unlike these species which are very flat when juveniles. It is also unusual, if these are *Patellas*, that only juveniles of a particular growth size should occur, with no sign of adult specimens, although adults of another species of *Patella* do occur. Of the known species of *Siphonaria*, the present material most closely resembles *S. deflexa* and particularly the variety *cyanomaculata*. This latter species also has strong radial ribs, but usually these are more numerous (15-20 as opposed to 9-12). *S. deflexa* has a present-day distribution from Natal to the Cape Peninsula and has been recorded from the Pleistocene of the Algo Bay area.

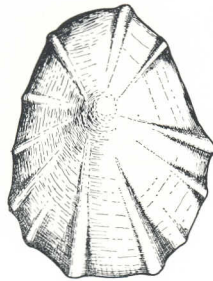


FIG. 7. *Siphonaria* sp.

Class PELECYPODA

Family **Donacidae**

Donax cf. *serra* (Chemnitz)

Fig. 8

Description

Shell typically donaciform; posterior face set at angle to rest of shell, but not separated by strong ridge, with numerous fine concentric serrulations. Few very faint radial grooves just anterior to posterior face, further radial lines visible below surface layer, margin slightly undulate. Apex smoothly rounded. Maximim apex-to-posterior margin distance only slightly shorter than distance of apex-to-anterior margin.

Material

Five specimens, of similar size, largest with longest diameter 13,2 mm, altitude 5,0 mm. S.A.M. L14187/P.

Remarks

The possibility exists that the present material belongs to the Patellidae, but several factors give an impression of *Siphonaria* rather than *Patella*. These factors include the small size, the raised dome-like central portion with its faint groove possibly indicating the position of the siphon. Of the Patellidae the present material resembles juveniles of *P. longicosta* (and less obviously *P. oculus*) particularly in the external ribbing. The internal doming, however, is unlike these species which are very flat when juveniles. It is also unusual, if these are *Patellas*, that only juveniles of a particular growth size should occur, with no sign of adult specimens, although adults of another species of *Patella* do occur. Of the known species of *Siphonaria*, the present material most closely resembles *S. deflexa* and particularly the variety *cyanomaculata*. This latter species also has strong radial ribs, but usually these are more numerous (15–20 as opposed to 9–12). *S. deflexa* has a present-day distribution from Natal to the Cape Peninsula and has been recorded from the Pleistocene of the Algo Bay area.

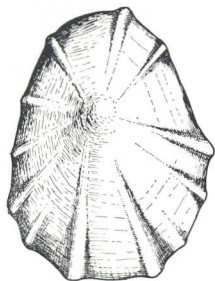


FIG. 7. *Siphonaria* sp.

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Fig. 8

Description

Shell typically donaciform; posterior face set at angle to rest of shell, but not separated by strong ridge, with numerous fine concentric serrulations. Few very faint radial grooves just anterior to posterior face, further radial lines visible below surface layer, margin slightly undulate. Apex smoothly rounded. Maximim apex-to-posterior margin distance only slightly shorter than distance of apex-to-anterior margin.

Material

One complete right valve 27,5 mm × 16,9 mm. S.A.M. L14187/Q.

Remarks

In shells of *Donax serra* of similar total length to the present specimen, the apex-to-posterior distance is obviously shorter than the apex-to-anterior distance. The present specimen is close to being equilateral. The serrulations of the posterior face in similar sized specimens of *D. serra* are stronger and fewer in number than in the present specimen. In spite of these differences, *D. serra* is the species most closely approached. *D. rogersi* (Haughton 1931: 36) from the Pleistocene of the west coast, although almost equilateral, has the posterior area demarked from the rest of the shell by a strong angular ridge. *D. haughtoni*, also from the Pleistocene of the west coast (Carrington & Kensley 1969: 213) is strongly inequilateral.

The distribution of living *D. serra* is from Walvis Bay to Durban (Barnard 1964) and the species has been recorded from the Pleistocene deposits of Lüderitzbucht, Orange River, Velddrift, and Sedgefield.

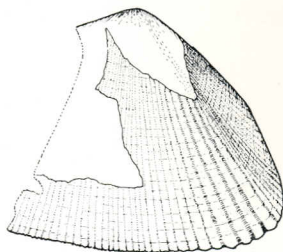


FIG. 8. *Donax* cf. *serra*

Donax sp.

Fig. 9

Description

Posterior area demarked from rest of shell by rounded ridge, strong radial grooves and ridges in this region. Numerous faint growth lines visible. Margin slightly serrulate.

Material

One incomplete left valve (posterior portion only). S.A.M. L14187/R.

Remarks

In the strength of the ridges in the posterior region, the angle of the latter to the rest of the shell, and the pattern made by the radial lines and growth lines on the posterior face, the present specimen most closely resembles *Donax aemulus*, a semitropical/tropical species, occurring from Natal to Moçambique

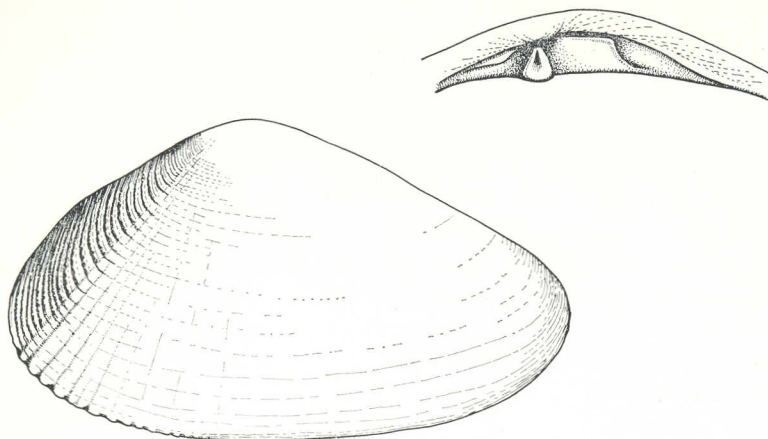


FIG. 9. *Donax* sp. Right valve, external view; right valve, hinge.

and Malagasy. This species has also been recorded from the Pleistocene of Durban.

UNCONSOLIDATED SEDIMENTS (L14259)

Phylum **BRACHIOPODA**

Kraussina rubra (Pallas)

Kraussina rubra (Pallas), Jackson, 1952: 22.

Material

Numerous external and internal casts, particularly of dorsal valve. S.A.M. L14259/A.

Remarks

Few casts of the external surface of the shell are present, and these are incomplete. The number of radial striae agrees well with this species. The internal casts of the dorsal valve are abundant and quite characteristic, with the branchidium situated between two large eye-like depressions of the umbonal callosity. *K. rubra* occurs alive from Lambert's Bay to the Transkei.

Phylum **MOLLUSCA**

Class **GASTROPODA**

Family **Patellidae**

? *Cellana* sp.

Material

Several complete internal casts and fragments of external casts. S.A.M. L14259/B.

Remarks

The external casts show very fine striations as in *Cellana capensis*, but the material is too incomplete for further comment.

Family **Haliotidae***Haliotis* sp.*Material*

Fragments of shell casts, including apex of one shell. S.A.M. L14259/C.
Entire internal cast S.A.M. L14259/D.

Remarks

See p. 176.

Family **Turbinidae***Turbo sarmaticus* Linnaeus

Turbo sarmaticus: Barnard, 1963: 214.

Material

Numerous examples of casts of the operculae. Diameter of operculae up to 24 mm, indicating a shell with a diameter of about 65 mm. Also numerous fragments of internal casts of shells with diameter of individual whorls of up to 28 mm, indicating a shell of about 70 mm diameter. S.A.M. L14259/D.

Remarks

The external, i.e. papillose, surface of the operculum of this species can be deduced as the sandy matrix has filled all the spaces between the papillae. The species has been recorded from the Pleistocene of the Saldanha Bay area, and occurs living from False Bay to the Transkei, and very occasionally from Table Bay and the west coast of the Cape Peninsula.

Class PELECYPODA

Family **Donacidae***Donax* sp.*Material*

Two internal casts of left valves, 34 mm and 22 mm in length. S.A.M. L14259/E.

Remarks

The general shape, structure of the hinge (determined from silicone casts) and position of the adductor muscle scars, all agree well with living material of this genus. Without external casts, the specific position is difficult to determine.

Phylum **ECHINODERMATA**

Class ECHINOIDEA

Parechinus angulosus (Leske)*Material*

One almost complete internal cast, 23 mm in diameter, S.A.M. L14259/F.

Remarks

No differences can be detected between the characteristic internal sculpturing of the ambulacral plates and pores of the present material and that of living material. *P. angulosus* is the most common echinoid living around the Cape, and is usually found on rocky shores.

DISCUSSION

The age of the Langebaanweg marine invertebrate fossils

The relationships of the deposits containing the marine fossils to the rest of the 'E' quarry succession has been one of the more problematical aspects of the local stratigraphy, and it is not intended to enter into a discussion of this in the present paper.

The marine deposit is overlain by an horizon of phosphatic rock, and a layer of non-phosphatic sand and silt, bearing mammalian fossils. The mammalian fauna of this deposit dates from the late Pliocene, and has an inferred age of about 4 million years (Hendey 1970b). Should further work necessitate a change in the age of this mammalian fauna, the inferred age of the marine deposits will also need to be altered.

The loose non-phosphatic sand and silt in which the marine vertebrates occur cannot readily be distinguished from the overlying deposits. These two sets of deposits are regarded as possibly having been accumulated during a single geological episode, with their respective faunas indicating a change in the environment from a marine shoreline to an estuary. The most commonly occurring terrestrial vertebrate (a tortoise) in the non-phosphatic sand and silt is also found in association with the marine vertebrates of the marine deposits, while shark's teeth similar to those which occur in such abundance in the marine deposits are also found. There is no reason to believe that the marine invertebrate assemblage from the site BDT 2/1971 is not contemporaneous with the associated marine vertebrates at the same level. This assemblage is thus regarded as broadly contemporaneous with the mammalian fauna from the overlying deposits.

It is less certain that the marine invertebrates from the cemented phosphatic matrix (L14187) are contemporaneous with the marine vertebrates which occur in the unconsolidated sediments at the same level. The shark's

teeth recovered from the cemented matrix, however, are similar in type and preservation to those of the unconsolidated sediments. (In how far these teeth may be used to indicate contemporaneity is uncertain, as these forms cover a time span from the Cretaceous to recent times.) The two invertebrate assemblages do have certain genera and possibly also species in common. The indications are that these two assemblages are similar in age, and that they both date from the Upper Pliocene. The differences in preservation and in the nature of the matrices may simply reflect deposition under differing conditions rather than geologically significant temporal separation. The two assemblages have nevertheless been treated separately as their contemporaneity has not been proved.

The marine deposits of 'E' quarry are underlain by a clay of underdetermined thickness, the age and origin of which is unknown, and thus sheds no additional light on the age of the marine fauna.

Reports on the Tertiary of southern Africa are few in number and of a descriptive nature. Haughton (1926, 1932), in discussing the fossil mollusc faunas of the west coast, came to the conclusion that these were of late Tertiary age and correlated them with the Alexandria Beds of Redhouse, in the Zwartkops area of the east coast. These latter beds were described by Newton (1913) as being of Mio-Pliocene age. It is now considered that the west coast deposits discussed by Haughton are of Pleistocene age (Carrington & Kensley 1969: 190-191). None of the forms mentioned by Newton have been found in the present material.* Cox (1939) reported on the Tertiary and Post-Pliocene deposits of Inhambane, Moçambique. The material mentioned is very typically of Indian Ocean affinity, and has nothing in common with the present material.

BRIEF ECOLOGICAL COMMENTS

From the species list (Table 1) it may be seen that both assemblages contain rock- as well as sand-dwelling forms. Amongst the phosphatic matrix assemblage, only the two species of *Donax* and the single species of *Bullia* are sand-dwellers. All the other species are either permanently attached to a rocky substrate (the acorn barnacles, which are too fragmentary for identification), or grazers found on rocky shores or on algae attached to rocks (the patellids *Oxysteles*, *Haliotis*, *Littorina*, *Tricolia*, *Siphonaria*, *Diodora*), or are carnivores found in rock pools or under stones (*Tritonalia*, '*Clavatula*', '*Turris*', '*Crassispira*', *Thais*). Of these, the species tentatively placed in *Littorina* is the most abundant (although little quantitative importance can be attached to a single 'cluster' of fossil shells). It seems quite likely that the Pliocene shore in the area under discussion had both rocky and sandy components. The second most abundant species is that tentatively placed in the Pyramidellidae. Comparatively little is known of the ecology of these forms, many of which are probably commensals or parasites of other invertebrates.

* Engelbrecht *et al.* (1962) record *Donax serra* from the Tertiary Alexandria Beds.

TABLE I

List of species from both assemblages

CEMENTED PHOSPHATIC MATRIX (L14187)		UNCONSOLIDATED SEDIMENTS (L14259)	
MOLLUSCA: GASTROPODA		BRACHIOPODA	
<i>Bullia</i> sp.	S	<i>Kraussina rubra</i>	R
<i>Cellana capensis</i>	R	MOLLUSCA: GASTROPODA	
' <i>Clavatula</i> ' sp.	R	? <i>Cellana</i> sp.	R
' <i>Crassispira</i> ' sp.	R	<i>Haliotis</i> sp.	R
<i>Diodora parviforata</i>	R	<i>Turbo sarmaticus</i>	R
<i>Haliotis saldanhæ</i>	R	MOLLUSCA: PELECYPODA	
? <i>Littorina</i> sp.	R	<i>Donax</i> sp.	
<i>Ocenebra scrobiculata</i>	R	ECHINODERMATA: ECHINOIDEA	
<i>Oxystele tigrina</i>	R	<i>Parechinus angulosus</i>	R
<i>Patella granularis</i>	R		
? <i>Pyramidella</i> sp.	R		
<i>Siphonaria</i> sp.	R		
<i>Thais dubia</i>	R		
<i>Tricolia neritina</i>	R		
<i>Turbonilla kraussi</i>	R		
' <i>Turris</i> ' sp.	R		
MOLLUSCA: PELECYPODA			
<i>Donax</i> cf <i>serra</i>	S		
<i>Donax</i> sp.	S		
ARTHROPODA:			
CRUSTACEA: CIRRIPIEDIA			
Acorn barnacle fragments	R		

R = rock-dwelling

S = sand-dwelling

Amongst the unconsolidated sediment assemblage, only the *Donax* is a sand-dweller. The other species are sessile on rocks (*Kraussina*) or are herbivorous forms found on rocks (*Haliotis*, *Cellana*, *Turbo*). Judging from the number of casts of *Turbo* operculæ, this species must have been fairly abundant.

Three genera, viz. *Haliotis*, *Cellana* and *Donax*, appear in both assemblages. Whether these included the same species is difficult to decide, due to the poor state of the sandy matrix material.

It is interesting to note that *Cellana capensis* at present only occurs northwards from East London, and that *Turbo sarmaticus* (with the rare exceptions mentioned above) occurs eastwards from False Bay. This may indicate a somewhat higher sea temperature on the west coast during the Pliocene than obtains at present.

Although several of the fossil forms have been identified with extant species, it is possible that some of the specimens are representatives of extinct species. Further material and more detailed work will clarify the situation.

SUMMARY

22 fossil mollusc forms including a new species of *Haliotis*, one species of brachiopod and one species of echinoderm are recorded from two assemblages from Langebaanweg, Cape Province. The age of the fossils is deduced by correlation of the overlying mammalian fauna with that of East Africa, as dating from the Upper Pliocene.

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BULLOUGH, W. S. 1960. *Practical invertebrate anatomy*. 2nd ed. London: Macmillan.

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Scalaria coronata Lamarck, 1816: pl. 451, figs 5 *a*, *b*; Liste: 11. Turton, 1932: 80.