Interaction between coastal processes and lagoonal fauna, between Walvis Bay and Lüderitzbucht, South West Africa

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CONTENTS

ABSTRACT

Aspects of the faunal composition and ecology of a recently dried-up lagoon in the Conception Bay area are discussed. The reasons for the demise of the lagoon are speculated on, and related to similar changes in coastal structures at several other localities on the South West African coast.

1 INTRODUCTION

The relatively uninterrupted coastline of South West Africa offers few areas for marine organisms seeking a sheltered habitat. Where the few sheltered areas do occur, e.g. Lüderitzbucht and Sandvis, a fairly rich estuarine or lagoonal fauna becomes established. This fauna is characterised, as with the intertidal rocky shore fauna, by large populations of a relatively small number of species. Much of the South West African coastline is formed by the shifting sands of the Namib Desert, and the unstable nature of this coastline is well illustrated at Sandvis. British Admiralty charts over a period of about 90 years show a progressive silting up, from what was once a deep water anchorage for sailing vessels to the present shallow lagoon, with the position of the sea mouth visibly changing over a three-year period of observation (1973 – 1976). Yet another and more dramatic sign of this changing nature of the coastline was seen recently at the Conception Bay area (24.00S., 14.30E.) south of Sandvis. A considerable salt pan area was observed between the sea and the dunes. On examination, this pan revealed vast numbers of dead mollusc shells, representing what was at an earlier stage a sheltered lagoonal area similar to Sandvis. Many of the molluscs, and especially the bivalves had died in their life positions, and this led to speculation on the faunal constitution of this 'dead' lagoon, and on the causes for its demise.

2 DESCRIPTION OF THE AREA

The area in which the shells were observed stretches south-east from the slight embayment of Conception Bay. At the northern end is a small true lagoonal area, apparently receiving sea water only at spring tides. This lagoon is not more than 20 – 30 cm deep and apart from some polychaete worms, seems to be uninhabited by macro-organisms. To the north-east the area is bounded by deflation plains, while to the south and south-east the pan is covered by a broad peninsula of continuous dunes, the northern edge of which is broken up into small barchan dunes and tongues of sand. The western edge of the area is the beach with a fairly steep slope which effectively prevents the high-tide water from spilling onto the plain of the salt pan.

3 FAUNAL OBSERVATIONS

Mollusc shells were found over a vast area of the pan. Different parts of the pan appeared to vary in species composition and thorough collecting of these areas was carried out. The identification of the molluscs allowed a certain degree of speculation on the ecological conditions ruling when the animals were alive. Five roughly defined areas could be distinguished, which merge almost imperceptibly with one another.

3.1 The eastern edge of the pan. This is a relatively narrow area bounded by a one-metre high bank, which probably represents the remains of a storm beach, containing as it does agate, jasper, and yellow chalcedony bearing – quartz, gravel and sand. At the base of this bank, shells of *Marginella capensis*, *Nassarius plicatellus* and *Siphonaria capensis* were abundant, while shells of *Crepidula procellana*, *Turritella capensis* and *Petricola bicolor* were fairly common. *N. plicatellus*, *T. capensis* and *M. capensis* inhabit sandy or muddy substrates, while *C. porcellana* and *S. capensis* have a limpet-like habit on rocks. *P. bicolor* is a bivalve which bores into soft rocks or is sometimes found in tightly packed clumps of mytilid bivalves attached to rocks. This mixture of rock and sand dwellers may indicate deposition by limited wave action at the old shore line of a shallow open bay before the formation of the lagoon. Similarly, the southern end of the pan, where not covered by dune sand, would also seem to be an old shore line, with vast numbers of shells representing a mixture of habitats. These include *Calyptraea trochiformis*, *Argobuccinum argus*, *Thais cingulata*, *Fissurella mutabilis*, and *Ostrea* sp. (all rock dwellers), *Bullia digitalis*, *Donax serra*, *Lima rotundata* and *Mactra glabrata* (usually sandy intertidal-subtidal exposed beach dwellers). Along with these were the shells of characteristically lagoonal species including *Dosinia lupinus*, *Tapes corrugata*, *Bullia laevissima*, and *Turritella capensis*.

3.2 By far the largest area of the pan is dominated by the bivalve *Lutraria lutraria*. This mollusc is a sand or mud dweller which at Sandvis is found at a depth of about 20 cm below the substrate surface, in areas which are only exposed at the low tides of springs. At the Conception salt pan, large areas are covered with pairs of valves of *Lutraria*, the valves of each pair usually touching, and positioned vertically with the anterior ends held in place in the sand by a hard crust of salt. (Plate 1). Assuming the species to live in about 20 cm of sand, and the shells now being half exposed, about 25 – 30 cm of substrate has been removed over large areas of the pan, probably by wind action. (A graphic account of the action of strong wind in the Conception Bay area is given by Harger (1914) who comments on the denudation of the South African subcontinent in general terms.) The abrasive action of wind-driven sand can be seen on several of the *Lutraria* shells which have been worn

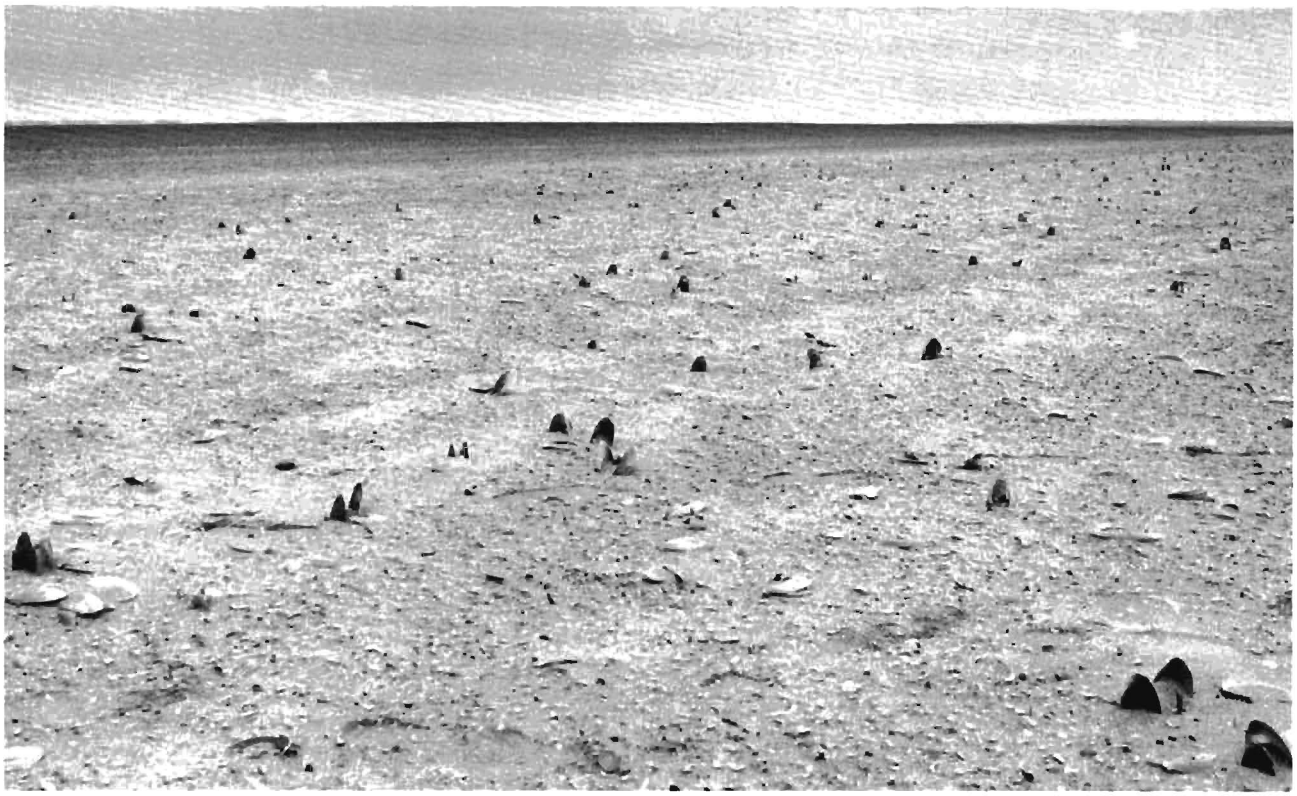


PLATE 1: Pairs of *Lutraria lutraria* valves in life position, Conception Bay.

PLATE 2: Low mounds surrounding tubes of the polychaete *Diopatra neopolitana*, Conception Bay.

away. Lying amongst the vertical pairs of *Lutraria* shells (which are seldom denser than 1 or 2 / m^2) are large numbers of other mollusc shells. These include the sand or mud dwelling bivalves *Dosinia lupinus*, *Gastrana matadoa*, *Leporimetis hanleyi* and *Tapes corrugata*, (Plate 2) all of which are abundant, and sometimes found with both valves together. These four bivalve species burrow into the substrate to a shallower depth than *Lutraria* and are thus now lying loose on the pan surface. Shells of the gasteropods *Marginella capensis*, *Turritella capensis*, *Nassarius plicatellus*, and *Bullia laevissima* are also common in the *Lutraria*-dominated area. All four are mud-dwellers and are usually found on the surface or in the upper three centimetres of the substrate, usually in subtidal areas.

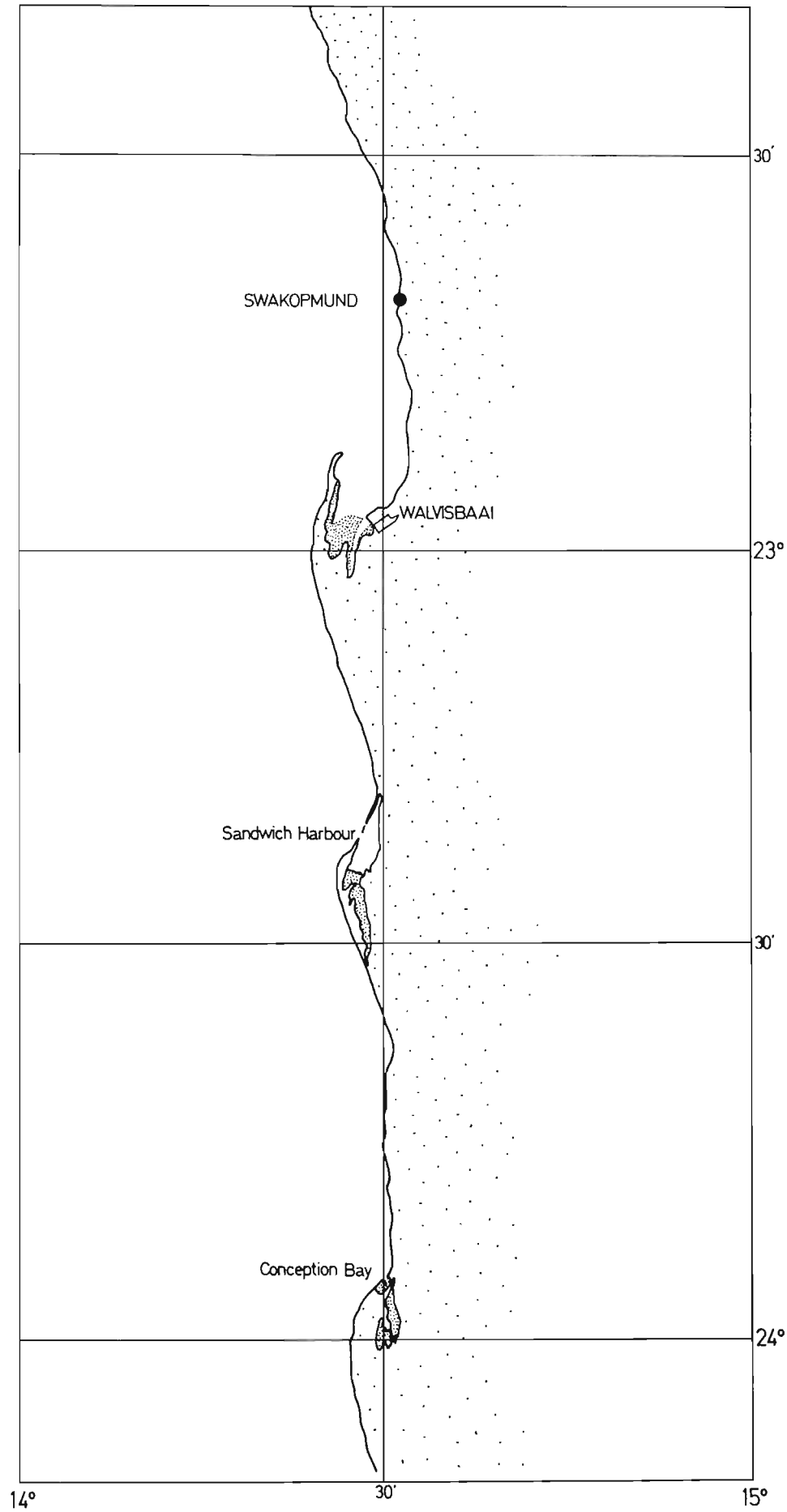
3.3 More limited areas than the *Lutraria* flats are dominated by the shells of *Dosinia lupinus* often exposed in pairs in the life position. In these areas *Lutraria* is absent. This may be accounted for by reference to substrate tolerance or preference. It was noticed at Sandvis that *Dosinia* was found in sediments ranging from coarse sand to very fine mud, while *Lutraria* tended to be confined to coarse sediments. In the *Dosinia*-dominated areas, *Tapes corrugata*, *Leporimetis hanleyi* and *Bullia laevissima* shells occur but are never common.

3.4 In a few isolated areas, the filled-in remains of drainage channels could be seen, marked by pairs of *Perna perna* valves which are locally abundant. (Plate 3). These are usually the very large shells characteristic of a sheltered habitat. Populations, living in an exactly similar situation, have been observed at Sandvis. Amongst the *Perna* shells (which in life are anchored in the sand by the densely matted byssus threads) the shells of *Natica vittata* were common. Many of these still had the calcareous operculum in position in the shell mouth. *Tapes corrugata* and *Leporimetis hanleyi* were abundant in this area, the former often showing the countersunk hole on the side of a valve indicating predation by *Natica*.

3.5 A small area of low hummocks of salt encrusted sand was found. On investigation it was found that these low mounds were formed around the tubes of the large polychaete worm *Diopatra neopolitana*. (Plate 4). The parchment-like material of the actual tube was still present, surrounded and probably preserved by a sheath of hardened mud. The mouths of these tubes are usually level with the substrate surface (as observed at Sandvis) and as the mounds in the area under discussion are about 10 – 15 cm high, this amount of substrate has been removed by wind action.

PLATE 3: Filled-in drainage channels with *Perna perna* shells dead *in situ*, Conception Bay.

PLATE 4: Valves of *Tapes corrugata* lying on the surface, Conception Bay.



MAP 1: Map showing coastal localities.

4 DISCUSSION

A glance at the map (Map 1) shows a repetition of broadly similar geographic conditions at Conception Bay, Sandvis, and Walvis Bay. The similarities include a bulge in the coastline, forming to the north a shallow embayment, the southern end of which ends in a salt pan. At Walvis Bay the embayment is considerably larger than at the other two localities. In all three cases the most westerly-extending part of the coastline is a sandbar, formed under the influence of the strong northward-flowing longshore currents. Varying conditions in the general north-flowing current, localised eddying effects, winds, and tides, will all have an influence on the form of this sand bar. The sand bar at Pelican Point, Walvis Bay, has been extending northward over the past few years, while the whole character of Sandvis has changed appreciably in the last 90 years. Hottentots Bay (26.07S., 14.57E.) just north of Lüderitz, presents a similar situation. Kaiser (1926: 414) explains the silting up of the lagoon south of Hottentots Bay as a combination of the shifting of the shore line, and the addition of wind-borne sand. Here the embayment is formed by a rocky island which has been connected to the mainland. The southern lagoon formed here is also becoming a salt pan, and bivalves dead *in situ* (including *Lutraria* sp. and *Solen* sp.) are visible. (J. Rogers, Geological Survey, pers. comm.)

The coastline between Lüderitz and Walvis Bay should perhaps be viewed as a dynamic system of interaction between the sea and its currents and tides, and the land with its wind-borne sand. The same set of conditions has obviously been duplicated at various times and at different localities on this coast. Thus, lagoonal areas have been formed through the action of currents depositing sandbars under the localised influence of rocky outcrops or islands. These lagoons, which are colonised by various organisms seeking sheltered water, may be of temporary duration, and having reached a certain stage of development, begin to disappear, either because of silting, or because of a change in the set of the local currents. The four sites mentioned above, along this stretch of the coast, may thus be seen as different stages of the same process. Walvis Bay is still a well-established lagoon. (That its potential for supporting a considerable animal and plant ecosystem is not realised, must be seen as an effect of man's activities, especially those of shipping pollution and the formation of commercial salt-pans.) Sandvis already has a documented history of change and is becoming shallower. The pan at Hottentots Bay, although holding some water, is too saline to support marine organisms, and dead molluscs are already apparent. The Conception Bay pan is probably older, and has for some time been dry (with the exception of the tiny lagoon at the northern end) and has lost a considerable amount of the original sediments, thus exposing the remains of large populations of molluscs. Wieneke and Rust (1973) postulate a direct correlation between climatic and geomorphic conditions on the coastal areas of the Namib, and refer to alternate phases of arid stability and humid activity in relation to coastal morphology.

Under these dynamic conditions the influence of single events must not be under-estimated. A single north-west storm, perhaps coinciding with a spring tide, could as easily remove an entire established sand bank as it could deposit a new sandbar. This seemingly small and localised event could, by closing the mouth of a lagoon, effectively kill the entire marine population of such a lagoon. This is perhaps what happened at Conception Bay, followed by a slower and more steady build-up of the general beach line to make the closure permanent. This slow build-up of the coast is illustrated, not only by the position of old storm beaches on the eastern margin of the pan, but also by the position of the shipwreck of the Evard Bolin. This metal-hulled vessel was driven ashore in 1910, and its remains are now several hundred metres from the present shoreline.

5 ACKNOWLEDGEMENTS

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6 REFERENCES

HARGER, H. S.
1914: Some features associated with the denudation of the South African Continent. *Trans. Geol. Soc. S. Afr.*, 16: xxii–xli.

KAISER, E.
1926: *Die Diamantenwüste Südwest-Afrikas.* Vol. 2. Berlin: Dietrich Reimer.

WIENEKE, F. and RUST, U.
1973: Variations du niveau marin et phases morphoclimatiques dans le desert du Namib Central, Afrique du Sud-Ouest. *Finisterra-Revta port. Geogr.*, 48–65.