

Bawe Island, Zanzibar

Its fossils, the intertidal reef, and notes on *Cylinder textile*

By Felix Lorenz

The island of Zanzibar is situated approximately 40 km east off the coast of Tanzania. It is well known to shell enthusiasts as a source of a large variety of interesting species. Unguja is the name of the main island, which is surrounded by numerous smaller coral islands, each of which has its own local peculiarities.

My first visit to Zanzibar was in 1979, and it was a formative time for me. The war against Uganda had just ended, and the country was suffering from many problems. For example, the idea of an African socialism propagated by JULIUS NYERERE, the beloved father of the nation of Tanzania, which he created in 1964 by uniting Tanganyika and Zanzibar. The idea was to free the country from the aftermath of colonialism by a return to family values and genuine African culture. The concept of "Ujamaa", however, failed and by the beginning of the 1980s the country's economy had collapsed. There were water shortages, constant blackouts, a shortage of everything needed for daily life, and corruption. The US dollar could buy anything, but it was in the hands of a few privileged functionaries and public officials.

The island of Zanzibar was slightly better off than the mainland, but under the ideological and economic influence of the so-called "German Democratic Republic". However, it was less densely populated and less intensely exploited, the sea was rich in fish, and spice farming provided the people with a reasonable income. Tourism was basically non-existent in Tanzania in the early 1980s. While in those days the city of Dar-es-



Scutus unguis is a common inhabitant of the *talpa* zone.

Salaam on the mainland was one of the most dangerous places I have ever experienced, Zanzibar was a moderately safe place in which the Muslim and Christian communities cooperated to make ends meet.

Just offshore from the famous historical Stone Town of Zanzibar City, there are several small islands and submerged reefs which I visited on snorkelling excursions. In the early 1980s one could organize these spontaneously from the sandy beach of Stone Town. That beach has not changed much in the past 40 years. There are still numerous boats lined up and it is busy with people coming and going. But today, there are more tourists than fishermen arriving and leaving.

Stone Town itself has, however, changed from a place mysterious and steeped in history to an imitation of itself. Those who never saw it back then might believe they are catching a glimpse of the old days' enchantment; those who did will be disillusioned. The smell and the dirt have disappeared, and so have the hordes of pitiful street dogs, beggars with diseases long thought extinct, and dark shops three steps down from the narrow, dusty, gravel roads, hidden behind massive carved doors, with treasures covered in cobwebs and a proprietor relaxing in a chair greeting the stranger with a nod. People spoke only Swahili. Today, everywhere seems safe to explore and to eat and drink, visitors are welcomed in every language spoken in the western world, and the beautiful roof garden restaurant (on



Cypraea tigris guarding its spawn in the *lynx* zone.

the top of what used to be a government building) has free WiFi.

Zanzibar City is still an adventure, but from what I can see it has become a much better place, despite the seemingly chaotic traffic creeping past endless rows of horrible prefabricated apartment blocks – a heritage left by the "German Democratic Republic". These are still in place and in use, just like here in the eastern part of Germany.

One of those small offshore islands whose reefs I visited back in the 1980s is Bawe. And this year, I went back there for the first time in a quarter of a century. The island lies approximately 6 km off Stone Town, teardrop-shaped, about one kilometre long and back then, a typical flat island consisting of Pliocene fossil limestone rising two meters above sea level, with dense vegetation on top. Only to the southwestern end of Bawe is there a sandy beach, whereas the remaining coastline barely allows access to the sea due to the sharp, corrugated fossil coral limestone. During the past several years, Bawe has been modified into a luxury resort with private pools and minibars, four restaurants and a trail that leads around the island through a well-kept tropical garden.



Monetaria annulus exposed to the burning sun.

In the areas that have been paved, there is an interesting grainy sand bearing faded yet well-preserved Pleistocene shells. These must originate from the interglacial periods when the ocean levels were 5 to 9 metres higher than today, approximately 125,000 years ago. In satellite images, an area in the north of the island is discernible in which this sand is quarried for landscaping the trails and the areas around the restaurants and the main pool. Most shells are loose and filled with sand, others are cemented to grey conglomerate pebbles. The degree of fossilization ranges from white, with apparent mineral replacement to a moderately fresh, glossy, yet completely faded subfossil stage.

Among the 55 species of gastropods I have collected, the dominant and most conspicuous species is *Ancilla ventricosa*, which varies from 17 to 27 mm in length. The shells are white to yellow and usually retain some nacre. I could have taken hundreds of these pretty shells. Today, this species is rare in Tanzania, inhabiting subtidal sand patches along the eastern coast of Zanzibar and the area north of Bagamoyo on the mainland.

The unmistakable shells of *Murex brevispina* are common, and like those just mentioned, indicators for a silty and sandy bottom in shallow subtidal waters. Several species of Cerithiidae, Costellariidae, Nassariidae, Naticidae and Strombidae are common among the fossil material, all of which are also indicators of this habitat. A species not reported alive from Tanzania as far as I know is the Fascioliid *Fusolatirus formosior*, whose faded fossils were found in fair numbers.

Conasprella longurionis was not rare as a fossil, whereas I only know of a single live-collected Tanzanian specimen, taken in a fish trap from deeper water in the 1990s. There were several fragments and one well-preserved specimen of *Cylinder archiepiscopus*, whose subfossil form is well known as *C. suzannae*. Such specimens are abundant in deposits of Bagamoyo Bay on the mainland. That fauna seems a lot younger than the material from Bawe, judging from the finer condition and fresher colours of the shells. It consists mainly of reef-associated species, such as a large variety of cowries, *Pleuroploca trapezium* and *Chicoreus ramosus*, but it is almost devoid of bivalves, Cerithiidae, and other sand-associated groups.

Among the most common bivalves from the Bawe deposit are *Anadara inaequalis*, several species of Lucinidae, and *Decatopecten* cf. *amiculum*.

Interestingly, *Palmadusta diluculum* was the only cowry I found in the Pleistocene sand, whose fauna also differs completely from the living molluscs inhabiting the reef flat and the sublittoral of Bawe today.

Like the mainland coast of Tanzania, Zanzibar is subject to a considerable tidal fluctuation of up to 6 metres. The littoral habitats are sandbars which are exposed during low tide, moving the waterline up to two kilometres away from the beach, very much to the frustration of those tourists ending up in one of the many resorts along the eastern coast of Zanzibar.

The hard-bottomed eulittoral zones along the Tanzanian mainland and the western coast of Zanzibar are made up of fossil reef flats of Miocene

and Pliocene age, with a variable degree of erosion forming tidal pools of different sizes and depths. Towards the edge, where the fossil substrate drops off, there is a characteristic combination of stone corals from a fringing reef that drops to 20 to 40 meters, tapering out on a rubble and sand bottom. Within the area that becomes exposed during low tide to the upper sublittoral, different habitat zones have been characterized by their cowry fauna (LORENZ, 1998).

The main factors that determine the fauna of these zones are the composition and structure of the hard substrate, the angle at which the seafloor drops from the eulittoral to the sublittoral, and, as a consequence, the temperature the different levels are exposed to during low tide. The further up, the greater the resilience of marine animals: to drying out for several hours, to being exposed to the heat of the sun, and to salinity fluctuations during strong rainfall, to mention just the most obvious.

On the southwestern end of Bawe, a reef flat with hard and soft substrate extends over 1.5 km and is exposed during extreme low tide (Map 1, A). The areas that are also exposed during neap tides are characterized by eroded limestone and tide pools that heat up considerably. In this zone, only a few gastropods manage to survive, among them several species of Neritidae, *Virroconus ebraeus* and *Monetaria annulus*, which gave this extreme habitat the name "annulus zone" (Map 1, B).

In those areas which remain cooler because they are exposed only during medium tides and only for a relatively short period, the molluscan diversity is much higher. There are pools which serve as a retreat during low tide. *Lyncina lynx*, *L. carneola* and *L. vitellus*, *Monetaria moneta*, *Cypraea tigris*, as well as *Luria isabella* and *Naria helvola* are species typically found, more or less exposed,



Erronea caurica elongata is nearly always encountered in pairs.

along the edges of the tide pools of what I called the "lynx zone" (Map 1, C). *M. annulus* is found throughout this habitat. It would also be a perfect habitat for *Bistolida kieneri* and *Melicerona felina*, but I did not see any of these here. During extreme low tides, this habitat is also subject to strong heating, and cowries that have been roaming around during high tide might get trapped in a too-small tide pool in which the temperature rises above a tolerable 35° Celsius. While at Bawe, I could have collected hundreds (!) of very fresh dead *helvola*, as well as other cowry species, in the heated-up tide pools during the full moon tides.

During this period, which occurs once per month, the entire reef flat is exposed long enough to walk to the outer edge at the tip of the reef (Map 1, D). This is where I met families of local fishermen arriving on small dhows or decrepit motorboats to look after their fish traps laid out in a wide circle around the lower littoral. Women and children collect all sorts of marine life, including *Lambis truncata* and small to medium sized *Tridacna* whose animals were cut out of the shell, which was left behind.

The habitat along the outer edge of the eulittoral has a silty substrate loosely covered with ring-shaped slabs of *Porites*, red and brown sponges, and rather coarse coral rubble, with the shallow pools densely populated by sea urchins. In my study of 1998 I called this habitat the "talpa zone", but despite a fair number of long dead specimens, that cowry was absent from the reef of Bawe, perhaps because of the diligent fishermen? On the other hand, *Erronea caurica elongata*, *Staphylaea limacina interstincta*, *Mauritia histrio*, *Ovatipsa chinensis variolaria*, *Talostolida pellucens*, *Purpuradusta fimbriata* and several other cowries could be spotted among the coral rubble or the *Porites* slabs.

A *Cylinder textile* was hiding under every second slab, half buried in sand. As I walked along, carefully lifting and returning small pieces of *Porites*, I discovered a golden specimen, only the third one I have seen in all those years! Although I do not normally take any living shells, I could not resist securing this magnificent shell for posterity. The living animal of a golden specimen is here shown for the first time (Plate 5).

This population was characterized as "*Conus textile* typical" in part 3 of my article series on the tented cones of Tanzania (1993 p. 58: 16a-k). See also RÖCKEL et al. (1995, pl. 66: 18). Back in the early 1990s, I had discussed the *textile* group with my friend DIETER RÖCKEL in the context of what I felt

were at least three distinct "*textile* species" found on Zanzibar:

1) *C. textile*, a quite broad form lacking blue colour elements, with wide tent marks, often similar to *C. neovicarius* from the northwestern Indian Ocean and the Red Sea.

2) *C. archiepiscopus* (back then known as *textile* f. *pyramidalis*), a more slender shell with bluish pigmentation, smaller and denser tent marks which may form longitudinally oriented lines.

3) *C. cholmondeleyi*, whose population from Zanzibar is slender, with very fine tent marks that form wavy longitudinal lines interrupted by whitish lines.

There are supposedly several spots along the south and southeastern coasts of Zanzibar where only *C. cholmondeleyi* is found (MOHAMMED MAKUNGU, pers. comm. 1988). *C. textile* is scattered along the western half, *C. archiepiscopus* dominates in the north (and all along the mainland coast of Tanzania). I have never found all three together.

Dieter and I both agreed at the time that "*suzannae*" belonged to *archiepiscopus* and might represent a mostly subfossil form whose pattern is sometimes similar to *cholmondeleyi*, just coarser. Because over several years I had found a small number of golden specimens alive at Kunduchi Beach on the mainland south of Bagamoyo, the name was maintained as a form in RÖCKEL et al. Thirty years later, I am still puzzled by this group, and the solution offered in the monumental work by MONNIER et al. (2018), which I value a lot, does not fully convince me in this particular case, as they did not list and illustrate *Conus textile* from East Africa at all.

Back to the reef of Bawe. Further to the west of the reef flat described above, the upper sublittoral zone is formed by an extensive reef with a clean sand bottom and large *Porites* blocks whose height is limited by the lowest tidal level (Map 1, E, visible in the satellite image as a black, mottled area). The sandy floor of this area is inhabited by *Lambis lambis*, *Conomurex decorus*, several Cerithiidae, and an astonishing number of *Stephanoconus fuscatus*.

The drop-off is a typical compact reef with the warty aggregations of the cauliflower coral *Pavona clavus* and different species of coral withstanding strong wave action ("*scurra* zone", Map 1, F). Beautiful filigree corals, such as *Acropora*, found in less turbid places of the Indian Ocean, are almost

absent from this part of the reef. In combination with a seriously thinned out population of fish and other photogenic sealife, mostly poor visibility and fairly self-confident prices, this part of Zanzibar is best described as "unattractive for divers".

For me, it was a good experience to visit Zanzibar again after an absence of 28 years. A lot has changed over time, but some things have not. Above all, the great people, whose gentleness and curiosity are undisguised, and whose sense of humour could live up to mine.

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All specimens collected during my stay at Bawe, including those illustrated in this paper, are deposited in the public collection of the Molluscan Science Foundation, Inc., Owings Mills, Maryland, USA.



Mauritia histrio is well protected among sea urchins.

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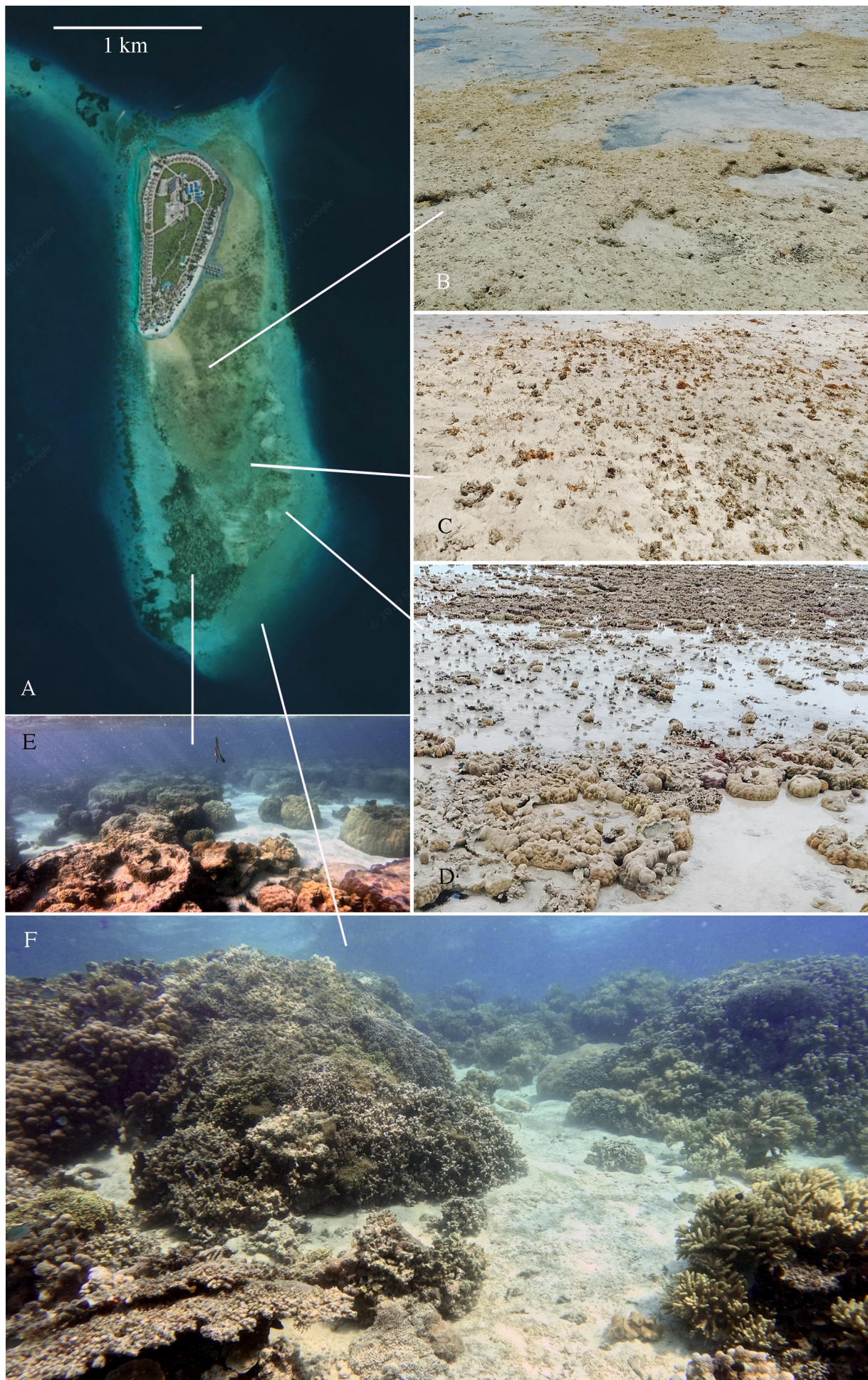




Plate 1. 1: *Ancilla ventricosa* (25 mm); 2: *Ancilla murrayi* (10 mm); 3: *Chilotygma exigua sulcata* (7 mm); 4: *Fusolaturus formosior* (28 mm); 5-7: *Conasprella longurionis* (31-36 mm); 8: *Chicoreus* sp. (23 mm); 9: *Daphnella* sp. (18 mm); 10: *Lophiotoma* sp. (49 mm); 11: *Perrinia* cf. *konos* (15 mm); 12: *Priotrochus obscurus* (18 mm); 13: *Scalptia nassa* (16 mm). All from the Pleistocene of Bawe Is., Zanzibar.



Plate 2. 1: *Dolomena pulchella* (38 mm); 2: *Dolomena columba* (56 mm); 3: *Canarium fusiforme* (32 mm); 4: *Terebellum terebellum* (28 mm); 5: *Canarium olydium* (38 mm); 6: *Gibberulus gibberulus* (40 mm); 7: *Palmadusta diluculum* (17 mm); 8: *Cerithium* cf. *africanum* (16 mm); 9: *Rhinoclavis kochi* (31 mm); 10: *Cerithium columna* (28 mm); 11: *Murex brevispina* (40-45 mm). All from the Pleistocene of Bawe Is., Zanzibar.



Plate 3. 1: *Vexillum* cf. *mucronatum* (23 mm); 2: *Vexillum* cf. *caelatum* (23 mm); 3: *Vexillum* *cadaverosum* (26 mm); 4: *Vexillum* *diaconale* (15 mm); 5: *Vexillum* cf. *virgo* (21 mm); 6: *Vexillum* cf. *horroi* (26 mm); 7: *Domiporta* *circula* (27 mm); 8: *Domiporta* *granatina* (46 mm); 9: *Rapa* *rapiformis* (21 mm) juvenile; 10: *Nassarius* *coronatus* (26 mm); 11: *Nassarius* *arcularia* (26 mm); 12: *Natica* *arachnoidea* (17 mm); 13: *Notocochlis* *antoni* (15 mm); 14: *Mamilla* *fibrosa* (19 mm); 15: *Duplicaria* *jukesi* (41 mm). All from the Pleistocene of Bawe Is., Zanzibar.

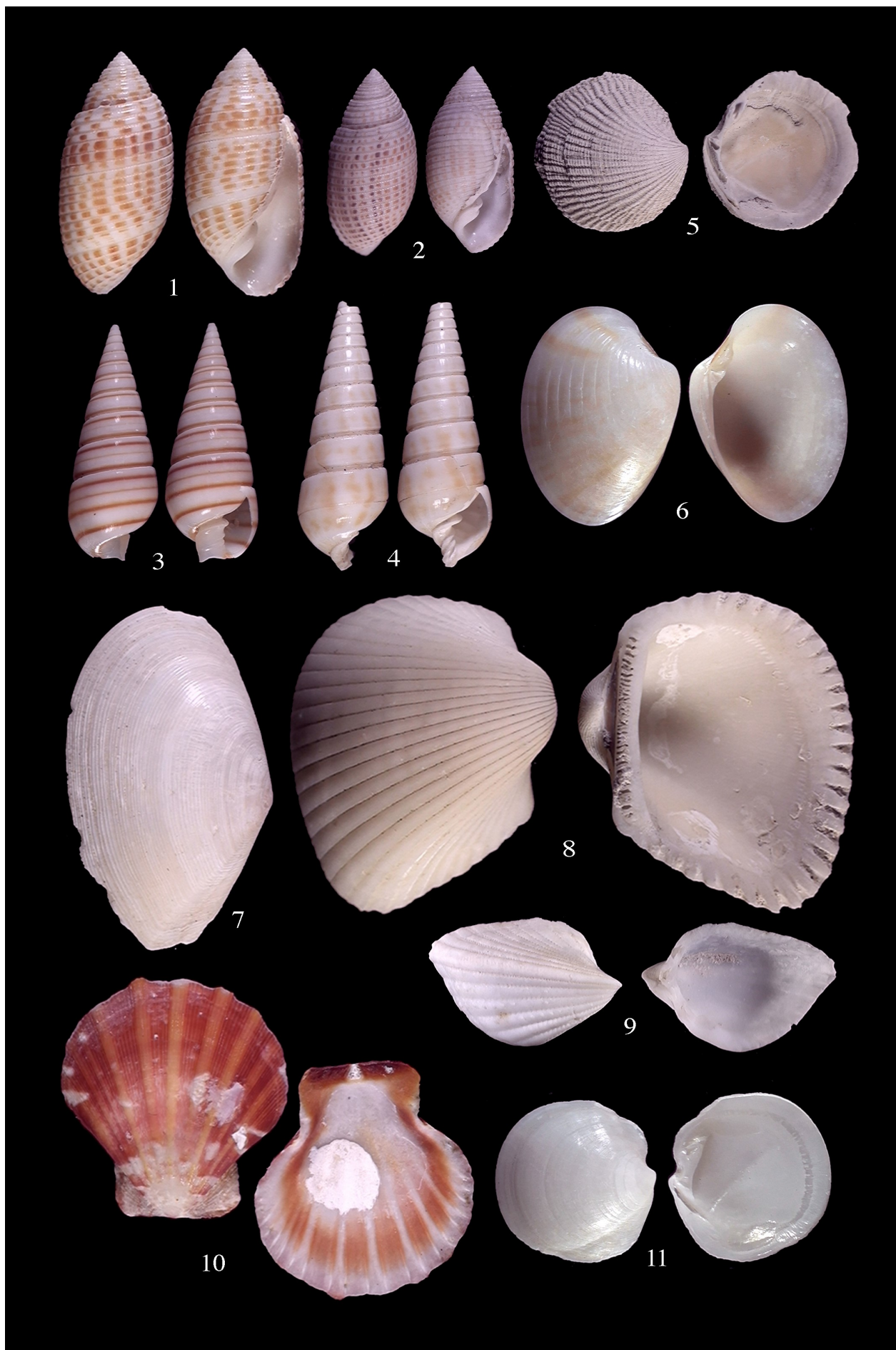


Plate 4. 1: *Pupa solidula* (26 mm); 2: *Pupa coccinata* (20 mm); 3: *Pyramidella dolabrata* (24 mm); 4: *Longchaeus turritus* (28 mm); 5: *Ctena* cf. *bella* (19 mm); 6: *Callista* cf. *multiradiata* (24 mm); 7: *Tellina* sp. (45 mm); 8: *Anadara inaequivalvis* (41 mm); 9: *Lunulicardia retusa* (29 mm); 10: *Decatopecten* cf. *amiculum* (30 mm); 11: *Discolucina virginea* (25 mm). All from the Pleistocene of Bawe Is., Zanzibar.



Plate 5. 1: *Cylinder textile* (61 mm) Tumbatu Is., Zanzibar; 2: *Cylinder archiepiscopus* (60 mm) Nungwi, Zanzibar; 3: *Cylinder archiepiscopus* "suzannae" (56 mm) Bawe Is., Zanzibar, Pleistocene; 4: *Cylinder cholmondeleyi* (59 mm) Jambiani, Zanzibar; 5-7: *Cylinder textile* (54 mm) Bawe Is., Zanzibar, golden form.