

2.2 Geology and Geomorphology

In terms of the geology of KZN, the coast can be readily divided into two zones, separated by the Thukela River.

The southern section is made up of bedrock, with a thin cover of soft sediments. This part of the coast consists of a series of rocky headlands with intervening sandy beaches, often across the mouths of estuaries. The rocky hinterland of the southern coast rises steeply to the Drakensberg escarpment, allowing dozens of rivers to flow to the sea. North of the Thukela River, the coast is composed of soft sediments that were deposited during the past million years; hard rock is virtually absent. Consequently, the northern part of the KZN coast has beaches that extend for kilometres, occasionally broken by tidal inlets and headlands of cemented beach and dune sand.

KZN beaches

The continental shelf along the KZN coast is very narrow by world standards, varying from a few kilometres wide off Kosi Bay to a maximum of 47 km off the Thukela River. The KZN coast is also one of the most linear in the world, a factor that reflects its geological origin. KZN has a semi-diurnal (mixed), micro (0-2 m) to lower meso (2-4 m) tidal range and is swell-dominated. The coast is subject to large swells derived from cold fronts, especially cut-off low pressure systems (as discussed in *Section 2.1*) such as those of 1966 and 2007.¹

KZN beaches are generally narrow and shallow, often with bedrock occurring at less than 3 m below the surface of the sand. The pattern of increasingly sandy beaches from south to north is linked to the northward decrease in wave energy along the KZN coast.²

The northern sections of KZN's coast portray near-continuous sandy shores, which are discussed in *Section 3.2*,

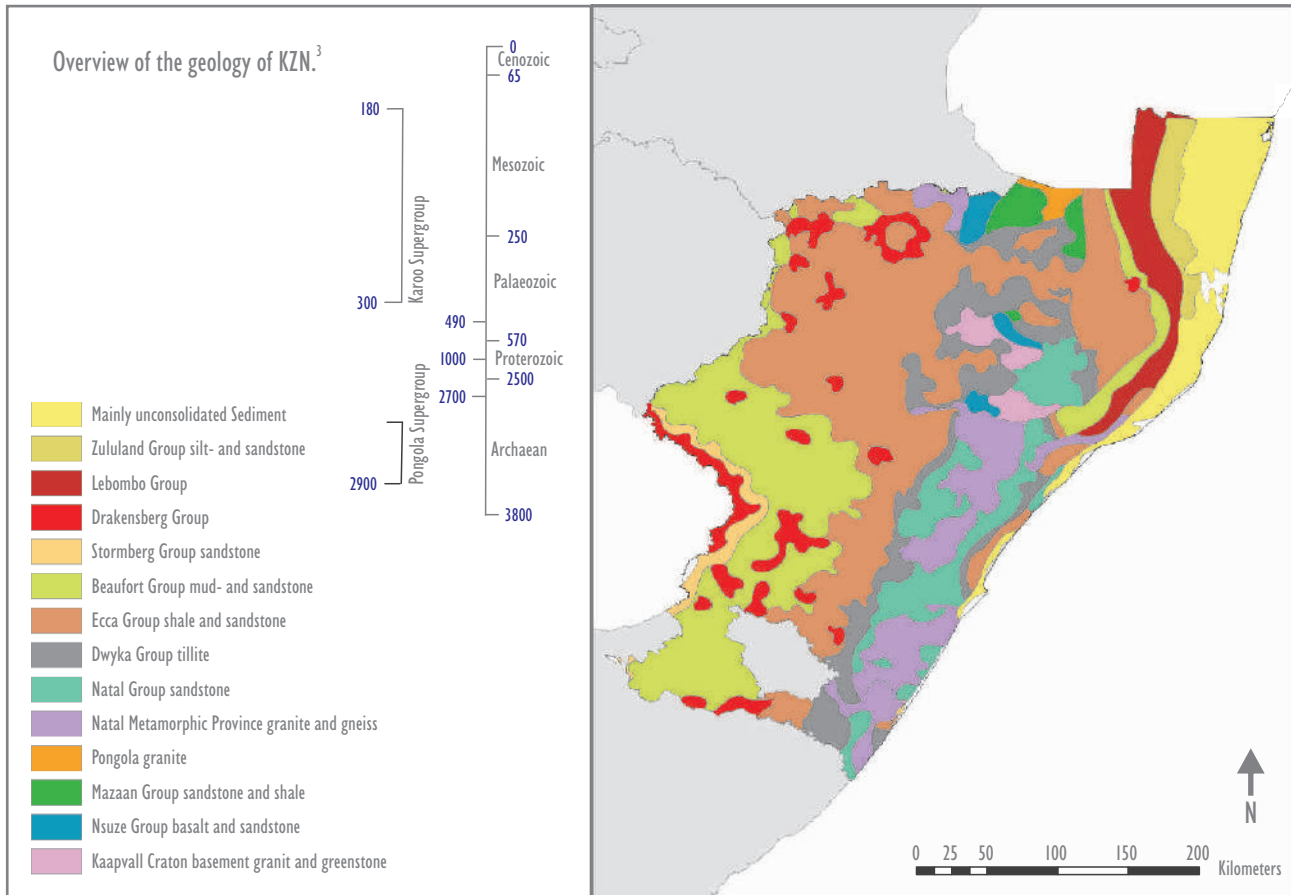
backed by high, forested dunes and locally developed fore-dunes. Occasional outcrops of beach-rock and aeolianite form headlands that cause the creation of zeta bays on their northern (down-drift) side. The coast is intercepted by a number of tidal inlets; with the inlet at Richards Bay having been modified to accommodate the port.

Around the Port Durnford area, the coast is eroding into Quaternary dunes and the sediment is dispersed along shore. This erosion is creating high erosional bluffs, which are quite unusual in KZN. North of the Thukela River, the coast is actively

Rabbit Rock, KZN north coast.



Photo: Jennifer Olbers



accumulating sediment, resulting in a series of low beach ridges.

South of the Thukela, the coast is characterised by headland bound embayments that become narrower to the south as the coast becomes more rocky. The rocky sections have a strip of sand accumulated at the base of gentle bedrock slopes. The biggest sand accumulations occur in the embayments at the mouths of small rivers.

Further south, the coast comprises a major Quaternary dune complex, the Durban Bluff Complex. Wave refraction around the Bluff has formed a large zeta bay beach that extends from Durban Harbour to Umhlanga Rocks, which is now maintained by artificial beach nourishment. In the south the coast is rocky with sandy beach accumulations in the numerous small river mouths and other small embayments.

Bedrock (Solid Rocks)

The oldest rocks on the KZN coast are the exposed granites of the Natal Metamorphic Province on the south coast, from about 1200 million years BP.⁴ They create distinctive rounded pinkish outcrops, particularly noticeable around Port Edward. Overlying these rocks are the distinctive sandstones of the Natal Group Sandstone, which are well exposed along the Mtamvuna Estuary and in the waterfall at the Vungu Estuary.

Next oldest are the Dwyka Group, a collection of sedimentary rocks that were laid down while South Africa was experiencing glacial conditions, some 300 million years ago. Outcrops of this rock are typically a distinctive grey-green mudstone with pebbles protruding; exemplified by the exposed rocks found at Zinkwazi. The cliffs around Ballito are the best place to see the overlying rocks of the Ecca Group; these ancient sedimentary rocks comprise alternating sandstones and shales that were laid down over 250 million years ago in an ancient sea. Many of the sandstones in this group were

deposited at ancient river deltas. These are presently exposed as a result of major tectonic processes in the Earth's crust during the Jurassic and Cretaceous periods, when the Natal continental margin was formed. They have been subject to millions of years of erosion and denudation since then.

Quaternary (Soft Sediments)

The solid rocks are overlain by the much younger sediments of the Quaternary (or Pleistocene) period. This period began about 2.58 million years ago and ended about 10 000 years ago.⁵ During this time, the Earth passed through several ice ages and intervening warm periods (interglacials). Global sea level rose and fell by over 100 m between the ice ages and interglacials. During the Quaternary period, rivers eroded sediment from the high rocks of KZN and deposited it at the coast and on the adjacent continental shelf.⁶

The coastal plain north of the Thukela is made up almost entirely of Quaternary sediments (mainly sand) deposited as beaches and coastal dunes (some of the highest in the world) during these periods of rising and falling sea level. South of the Thukela River, these sediments are less obvious because of the steep rocky basement, which left little space for sediment accumulation. Nevertheless, localised accumulations do occur, such as on the Durban Bluff, the remnants of Pleistocene dunes at Umgababa, and Port Edward's red desert. These Quaternary sediments are typically still loose sand and pebbles, but in a few places they have been transformed into rocks. The occasional headlands on the Zululand coast (e.g. Black Rock, Jesser Point) are made of cemented dunes or aeolianite and occasional outcrops of cemented former beaches and dunes can be seen at Isipingo and Reunion.⁷

Holocene

In general, sea level has been rising during the latter part of the Pleistocene and early Holocene periods (i.e. the past 17 000 years); however, the rate of rise has varied and has even been punctuated by some sea level drops. Overall, sea level in KZN has risen by 130 m^{8;9} since the close of the last ice age. The sea reached its present level about 7 000 years ago.⁹ Since then, it has been more-or-less stable, having fluctuated within two to three metres of its present position.⁹

There is good evidence of these slightly higher sea levels around Kosi Bay and St. Lucia, where former shorelines are

exposed just above the present sea level. Submerged beach and dune deposits on the seabed are evidence of Quaternary sea levels that were lower than present, for example at Aliwal Shoal¹⁰ and Sodwana Bay.¹¹

One of the results of sea level rise during the Holocene period was the truncation of KZN river drainage basins. Many of the tributaries were removed from their trunk streams (streams into which tributaries flow) and gave rise to a plethora of very short streams, particularly south of the Thukela River. This accounts for the large number of estuaries on this stretch of coast.

The geology controls the geomorphology of the KZN coast, which in turn reflects changes in the functioning of the coast, and provides valuable insight for future management of the coast. ■

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