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Coastal geomorphological processes shaped iSimangaliso World Heritage Site

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The iSimangaliso Wetland Park was listed as South Africa's first World Heritage Site in recognition of its superb natural beauty and unique global values, reflected in the isiZulu name, which means miracle and wonder. The coastal environment comprises three major lake systems, eight interlinking ecosystems, Africa's largest estuarine system, the southernmost Indian Ocean coral reefs and some of the highest vegetated coastal dunes in the world.

The unique ecology and associated high levels of plant and animal endemism owe their origin to coastal geomorphological processes influenced by global climatic cycles and sea-level fluctuations since the rifted African continental margin emerged some 140 million years ago in the late Cretaceous. Following the Lebombo volcanic event, continental sedimentation into the incipient rift was followed by marine sedimentation on a shallow continental slope until the Paleocene. The marine regression following the mid Miocene sea-level highstand deposited littoral sediments against the Lebombo mountain foothills, now up to 70km inland. Weathered remnants of these coarse beach and dune deposits underlie the late Pleistocene to Holocene parabolic dunes that form the coastal plain. The forested coastal barrier dunes, rising to over 180m, are a composite feature formed by Holocene dunes that accreted against a late Pleistocene aeolianite barrier dune. The present morphology of the Bazaruto island archipelago in Mozambique presents a snapshot of the geological context of the present coastal barrier between the eastern shores of Lake St Lucia and the Cape Vidal coast, as it was during the Last Interglacial.

The influence of cyclical sea-level fluctuation of at least 200m during the Cenozoic has alternately exposed the continental shelf and submerged coastal dunes. During short periods of lowered sea level, rivers incised narrow canyons into the continental shelf that now offer refuge to Coelacanth fish, regarded as a "living fossil". Submerged linear dune ridges form the substrate for spectacular coral reefs that are part of the miracle of the iSimangaliso environment.

The raised Neogene beach deposits, now deeply weathered and rubified, occur in a low rainfall environment along the Phongolo River valley. Towards the east, the karst-weathered remnants underlie mid to late Pleistocene dunes forming the core of the Sihangwane-Tshongwe dune megaridge. The coastal freshwater lakes of the Kosi system and Lake Sibaya, South Africa's largest natural lake, are perched on a clayey Pleistocene dune-interdune landscape that was inundated during the mid-Holocene sea-level highstand, before being isolated from the sea by coastal barrier dunes. These wetlands are maintained by limited surface runoff and significant baseflow from groundwater in the surrounding parabolic dunefields. The very existence of aquatic biota in Lake St Lucia is linked to seepage from surrounding Holocene dunes that maintains freshwater refugia during droughts when the lake bed is exposed by reduced river inflow and evaporation.

The future sustainability of the St Lucia estuarine environment in the face of rising sea-level and reduced river discharge relies on management principles derived from an understanding of coastal sedimentology and long-term temporal changes in geomorphological processes.

References:

- [1] Porat N and Botha GA (2008) *Quaternary Science Reviews* 27: 1024–1046.
- [2] Wright CI et al (2000) *Marine Geology* 167: 207–229.

