Paper Number: 5460

Evidence for former land surfaces on the emergent South Coast shelf, South Africa

Cawthra, H.C. [1,2], Cowling, R.M. [2], Marean, C.W. [2,3]

[1] Geophysics Competency, Council for Geoscience, Bellville, South Africa, hcawthra@geoscience.org.za
[2]Centre for Coastal Palaeosciences, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa
[3] Institute of Human Origins, School of Human Evolution and Social Change, Arizona State University

---

The south coast has one of the richest Middle Stone Age archaeological records in the world, with sea cliff caves and open-air sites on the exposed landscape holding rich archives of early humans. With the onset of the rhythmic Quaternary glacial-interglacial climate cycles, shorelines have shifted between a maximum lowstand depth of 130 m below and a maximum highstand elevation of 13 m above present-day sea level approximately every 100 kyr since 900 ka in tectonically stable areas. During most of this time (~90 %) sea level has been significantly lower than it is at present, exposing a now submerged terrestrial ecosystem of what is now the continental shelf and drastically altering the landscape. Expansion of the coastal plain, ameliorated climate due to the Agulhas Current, and rich and diverse terrestrial and marine resources are some of the reasons that the South Coast of South Africa has been proposed as a refuge for early modern humans during glacial periods of the Pleistocene. Here, we attempt to better understand offshore coastal environments now submerged by high sea levels off the coast near Mossel Bay, offshore of the Pinnacle Point archaeological site. We present scenarios for times of strong glacial conditions (MIS 6, 2) and a relatively weaker glacial (MIS 4).

The data presented here show a low-relief “plains” landscape with only one significant offshore outcrop of cliffed coast with caves for potential human occupation, situated 8 km along strike from the present-day Pinnacle Point embayment. The geological substrate in the region would promote the occurrence of both sandy and rocky shorelines during times of lowered sea level and help explain a complex shellfish stratigraphy preserved in archaeological cave site PP13B. This submerged landscape was characterised by nearby river systems and a mobile deposit of unconsolidated sediment (shelf sands) available for dune construction on the inner shelf where the rocky headlands protect these deposits in the sheltered embayment of Mossel Bay. Accommodation space for coastal deposits in the area is controlled by antecedent drainage pathways and the gradient of the adjacent inner continental shelf. The geological substrate crops out near the surface on this current-swept shelf as a result of the poorly developed outer shelf sediment wedge and soils derived from weathered limestone, siltstone and shale bedrock likely formed during sea-level lowstands. A dominance of Uitenhage Group claystone on the inshore and outer shelf limestones which crop out on the seafloor is anticipated, with floodplain and wetland sediments outcropping adjacent to the fluvial incisions. Based on the seismic evidence, these lithologies are anticipated to have locally outcropped at the surface when erosional surfaces were sub-aerially exposed during the retreat of sea level from MIS 7 – 6, and 5e – 2, respectively. At these times, scattered development of Strandveld Fynbos is envisaged to have formed mosaics in an area dominated by Renosterveld on the inner shelf and Limestone Fynbos on the outer shelf.

Sea level reached a maximum depth of 130 m BMSL during MIS 6 and the seismic and geological record presented in this study attest to a vastly different environment to what is presently exposed. Wetlands and floodplains were present and broad, shallowly incised rivers carved what would have been a broad,

flat, coastal plain. As sea level rapidly transgressed towards the Last Interglacial, coastal barrier systems shifted in a landward direction and were rapidly cemented by a relative abundance of carbonate in the system. The geological record of shelf evolution for the time from MIS 4-2 (71 – 57 ka/29 – 14 ka) suggests that laterally extensive floodplains were infilled, and overspilled, with sediment into the channels carved during MIS 6. Extensive dunefields, extending up to 10 km inland from their associated palaeoshorelines, covered much of the emergent shelf. The seismic stratigraphic record, as well as the diagenetic features, attest to a water table close to the surface. The sedimentary bedforms may have obstructed or slowed drainage as suggested by leached palaeosols and carbonate mixing observed in petrographic thin sections.