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Holocene environmental change along the southern Cape coast of South Africa – Insights from the Eilandvlei sediment record spanning the last 8.9 kyr

Michael Wündsch[1,*], Torsten Haberzettl[1], Hayley C. Cawthra[2,3], Kelly L. Kirsten[4], Lynne J. Quick[4], Matthias Zabel[5], Peter Frenzel[6], Annette Hahn[5], Jussi Baade[1], Gerhard Daut[1], Thomas Kasper[1], Michael E. Meadows[4], Roland Mäusbacher[1]

[1]Physical Geography, Institute of Geography, Friedrich Schiller University Jena, Löbdergraben 32, 07743 Jena, Germany
[2]Marine Geoscience Unit, Council for Geoscience, PO Box 572, 7535 Bellville, South Africa
[3]Centre for Coastal Palaeoscience, Nelson Mandela Metropolitan University, PO Box 77000, 6031 Port Elizabeth, South Africa
[4]Department of Environmental and Geographical Science, University of Cape Town, South Lane, Upper Campus, 7701 Rondebosch, South Africa
[5]MARUM – Center for Marine Environmental Sciences, University of Bremen, Leobener Str., 28359 Bremen, Germany
[6]Institute of Geosciences, Friedrich Schiller University Jena, Burgweg 11, 07749 Jena, Germany

*corresponding author: E-mail: michael.wuendsch@uni-jena.de

Abstract

This study investigates Holocene sediments from Eilandvlei, a coastal lake located within the Wilderness embayment at the southern Cape coast of South Africa. The evolution of the present estuarine/coastal lake system is reconstructed based on seismic data as well as a multi-proxy approach on a 30.5 m sediment core spanning the last ~8.9 kyr. Geochemical (Ca, TOC/S, Br/TOC) and micropalaeontological data (diatoms, foraminifera) reflect changes in the degree of marine influence at the core site. The embayment likely developed via distinct phases of connectivity to the Indian Ocean caused by sea level changes and dune progradation. Marine conditions prevailed at the core site from ~8900 to 4700 cal BP. The rapid sea level rise during the early Holocene probably caused the inundation of a palaeovalley that most likely had formed at lower sea levels during the Pleistocene. Towards the mid-Holocene the sea level exceeded its present height around ~7500 cal BP creating a marine embayment. At ~4700 cal BP, the embayment became distinctly more disconnected from the ocean turning into a lagoon system that persisted until ~1200 cal BP. Subsequently, the marine influence further decreased and the present estuarine/coastal lake system was established.

Grain size and geochemical data (Fe, Si/Al, chemical index of alteration (CIA)) further reflect changes in the deposition of terrigenous sediments at the core site. While the sedimentation of fine-grained (< 16 µm), iron-rich and highly weathered material is linked to periods of increased river discharge, higher amounts of deposited quartz (31-250 µm, high Si/Al) point to relatively dry and/or windy conditions during which increased aeolian transport of dune sands occurred. The proxies indicate reduced river discharge and hence possibly drier climatic conditions than today from ~8900 to 7900 cal BP and ~6400 to 3000 cal BP. In contrast, the periods between ~7900-6400 cal BP and ~3000 cal BP-present were likely characterized by high river discharge and thus, generally more rainfall. The reconstructed palaeoclimatic variations are discussed within the context of e.g., shifts in the position of the Antarctic sea ice extent and the mid-latitude westerly wind belt as well as changes in the El Niño-Southern Oscillation (ENSO).