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Paleoecology of mangroves along the Kenyan coast

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As a PAGES-Inter-Africa Mobility Research Fellow, Dr. Christine Omuombo undertook training, a laboratory exchange and research networking at the University of Cape Town's Stable Light Isotope Laboratory.

Most of the paleoclimatic reconstructions from East Africa have been obtained from lacustrine and swamp records. These records reveal the effects of long-term climate change and local tectonics linked to the development of the East African Rift System, and the sensitivity to changes in the African monsoonal rainfall belt that migrates with the Intertropical Convergence Zone (ITCZ; Nicholson 1996). These records of past changes have shown the variability in the amount of precipitation over nearly constant temperatures (Bonnefille et al. 1991).

Along the coastal zone, few records exist of the paleoclimatic response of ecosystems. The mangrove forest is one of the most important ecosystems along the Kenyan coast, covering 60% in the Lamu Archipelago within the tidal and intertidal zones (Fig. 1). The sediments in these zones are usually either in-situ, or transported from inland catchments by the Tana river, and distributed along the coast by longshore sediment transport.

The intertidal zone and organic carbon in the Lamu Archipelago

The intertidal zone is sensitive to global carbon cycle processes driven by sea-level changes. The Lamu Archipelago, a group of low-lying islands with wide intertidal platforms, comprises the old deltaic plains of the Tana River that developed after the last glacial sea-level lowering and subsequent post glacial Holocene flooding of continental shelf and coastal valleys, isolating the island from the delta system (Accordi and Carbone 2016). The aim of the PAGES-Inter-Africa Mobility Fellowship was to carry out the analysis of $\delta^{13}C$ and $\delta^{15}N$ values, total organic carbon (TOC), and total organic nitrogen (TON) content and atomic C/N ratios at the Stable Light Isotope Laboratory at the Department of Archaeology, University of Cape Town, to provide a comprehensive paleoenvironment dataset from sediment samples from the Lamu Archipelago. In addition, the fellowship was also a networking opportunity with research teams at the University of Cape Town (Department of Geological Sciences, The African Climate and Development Initiative, and the Plant Conservation Unit), and with the Iziko Museum.

The relevance of sediment geochemistry on mangrove paleoecology

The relative sea-level rise variation of the coastal zone in East Africa during the Late Holocene is not well understood. Several attempts have been made to reconstruct Holocene sea-level changes from the relationships between key mangrove taxa along the Tanzanian coast (Punwong et al. 2018), which have shown its utility in estimating low and high magnitude rise during the entire period. Sediments in the intertidal zones, where mangrove forests are found, are carbon sinks currently being studied to help mitigate the effects of climate change, even though the sediment dynamics are not well understood.

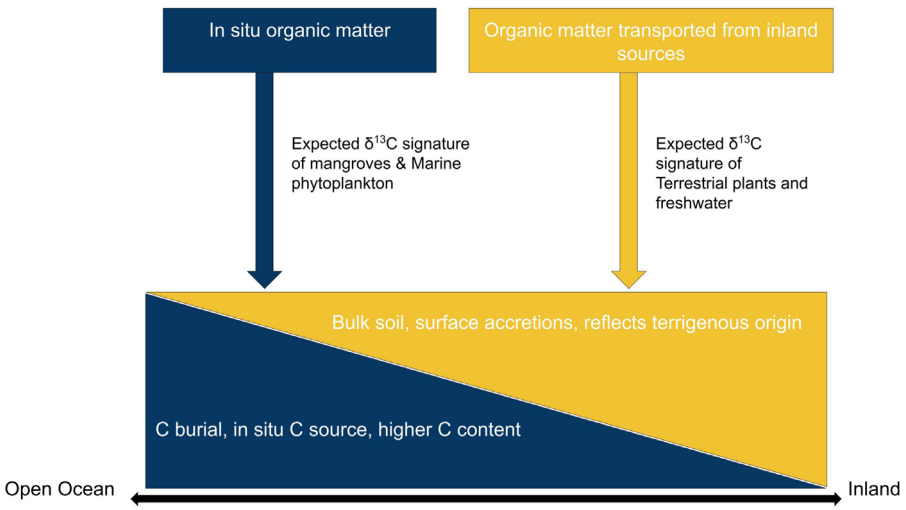

Figure 1: Conceptual diagram of organic matter from the intertidal zone. The yellow color corresponds to terrestrial/inland origin of organic carbon, while the blue color represents in-situ produced organic carbon.

The geochemical analyses at the Stable Light Isotope Laboratory

A total of 50 samples from a sediment core and surface sediments were obtained in the Lamu Archipelago, with the aim of determining coherency of the paleoecological and fluvial dynamics of the coastal zone, and the broad climatic changes. At the beginning of the stay, a laboratory protocol was developed specifically for the sediment samples which are not common at the facility, enabling the preparation of the samples for analysis. This step was followed by training on instrument calibration, sample analysis, and quality control. The energy crisis in South Africa, with frequent rolling blackouts, affected the efficiency and accomplishments of the laboratory analyses. The support from colleagues in the laboratory was very commendable in learning new ways of working and efficiency.

Currently, it is estimated that the analysis of the samples will take another five to eight weeks after the end of the fellowship. These results will be part of a manuscript on the past vegetation changes linked to climatic and sea-level fluctuations, erosion, and changes in anthropogenic land use during the Late Holocene along the Kenyan Coast. Plans are underway to develop joint proposals for future exchanges and partnerships, and to present findings at the East Africa and South Africa Quaternary Associations meeting, and other conferences.

AFFILIATIONS

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REFERENCES

Accordi GE, Carbone F (2016) J Afr Earth Sci 123: 234-257

Bonnefille R et al. (1991) Rev Palaeobot Palynol 67: 315-330

Nicholson SE (1996) In: Johnson TC and Odada EO (Eds) The Limnology, Climatology and Paleoclimatology of the East African Lakes. CRC Press, 25-56

Punwong P et al. (2018) Est Coast Shelf Sci 212: 105-117