

LAKE SEDIMENTS REVEAL PAST CLIMATE

Long, undisturbed sedimentary sequences from African lakes are necessary to understand the Earth's climate history. From the same sediments we may also get a clue to human migration out of Africa.

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The tropics are the heat engine that drives the world's climate system. Furthermore, they are the primary source of atmospheric water vapour, and a major source of biogenic methane, both important greenhouse gases. Thus a proper understanding of Earth's climatic history cannot be achieved without long, high-resolution climate reconstructions from the tropics.

INTERNATIONAL COLLABORATION – DEEP DRILLING

The best and most continuous proxy climatic records from low latitudes are provided by deep lakes where anoxic bottom waters provide ideal conditions for the accumulation of long, undisturbed sedimentary sequences. With these considerations in mind, in the early 1990s an international group

of scientists established the International Decade for the East African Lakes (IDEAL) programme which had as one of its principal goals the identification of African lakes capable of yielding long palaeoclimatic records.

Accessing such records requires deep drilling, no simple matter in Africa where two of the most promising lakes, Malawi and Tanganyika, are very deep, subject to rough conditions, and essential facilities such as ports and workshops are of low quality. Fortunately, IDEAL's programme overlapped the establishment of the International Continental Scientific Drilling Program (ICDP) and with the emergence of the latter, deep drilling became a viable prospect. To date, two African lakes have been drilled, Lake Bosumtwi, Ghana, and Lake Malawi, both projects funded by ICDP and NSF. Lake Bosumtwi occupies a 1.07 Ma meteorite impact crater in West Africa, while Lake Malawi, Africa's next largest rift lake, contains a sedimentary record that probably stretches back to the Miocene.

LAKE BOSUMTWI

Lake Bosumtwi is generally regarded as the best site for a very high-resolution (annual in some sections) record of tropical West African climatic history, and is furthermore strategically located for correlation with important climatic records from the Atlantic Ocean.

The Viphya, a freight barge temporarily converted into a drilling platform. Lake Malawi, February 2005.



In 2004 five sites were drilled, several cores sampled the complete sedimentary fill (max. thickness ca. 300 m) with further holes drilled into the underlying impact breccia. The sediments include deposits from the first few minutes to hours after the impact event, the transition from impact rocks to lacustrine sediments being marked by a layer of microtektites and lapilli. Overlying deposits are generally finely laminated muds, ideal for high-resolution palaeoenvironmental studies.

LAKE MALAWI

Drilling in Lake Malawi followed in 2005 and required the conversion of a barge into a drilling platform. Two sites were drilled, one in 600 m of water to obtain as long a record as possible, the other in shallower water (350 m) with the specific aim of sampling the last 100000 years of lake history. A 385 m core representing ca. the last 1.5 Ma was obtained from the deep-water site, and three parallel 38 m cores covering ca. 75 ka from the shallower site.

DRY – AND WET

A number of interesting results have already emerged. Prior to the drilling programme, many workers familiar with tropical Africa's climatic history anticipated that the period contemporaneous with the Last Glacial Maximum ca. 22-18 ka ago would stand out as an exceptionally dry interval. While it was undoubtedly dry in Africa at that time, more intense droughts are apparent in the drilling record, notably at 70-80 ka ago, when Lake Bosumtwi seems to have been completely desiccated and Lake Malawi extremely low.

The presence of shallow-water sands and paleosols further down in the Malawi long core indicate earlier periods of intense aridity with lake levels as much as 590 m. below present! At these times the Lake Malawi catchment was reduced to a semi-desert.

Pollen, charcoal and microfossil evidence also suggests that the climate of southern tropical Africa underwent a mode change at ca. 60-70 ka. Prior to this time, the climate seems mainly to have been driven by insolation variations in the precession waveband. Climatic variations were extreme with intense droughts and periods of extreme wetness. After ca. 60 ka, conditions changed to a generally more humid climate with a lesser tendency to high-amplitude oscillations. It is speculated that this change may, among other things, have aided the expansion of modern humans out of Africa by providing humid corridors into Europe and Asia.



(A) Accretionary lapilli formed by rainout from the Bosumtwi meteorite impact dustcloud. This layer marks the transition from impact debris to lacustrine deposits.

(B) Typical finely laminated, organic-rich mud from a Lake Bosumtwi core. The white laminae are authigenic carbonate minerals.



E.ON RUHRGAS HAR AMBISIØSE MÅL