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Scientific Drilling and Coring in Lake Malawi, Africa

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Abstract

The Lake Malawi Drilling Project (LMDP) overcame many logistical and technical challenges to successfully drill and recover high quality, near continuous sediment cores from beneath one of the largest, deepest and most remote lakes in the world. Lake Malawi sediments contain a high resolution record of past climate in sub-Saharan Africa and the sediment cores obtained from the LMDP are being studied to reconstruct the climate history. The in-land location and the deep water (>600 m) conditions in Lake Malawi required mobilization of a dynamically positioned drilling vessel and a mobile coring system from Europe and North America. Major refit of a fuel barge resulted in a vessel that could hold station long enough to complete the drilling objectives through near-daily severe thunderstorms. After initial incompatibilities between the coring system and the drilling system, 616 m of high quality sediment cores were recovered from a total of 7 boreholes at two sites. The average core recovery at the two sites, excluding the first shakedown borehole, was 100%. Once split, the visual observation of the core sections showed excellent core quality with very little drilling disturbance. The excellent core quality enables scientific analyses of stratigraphy that represents changes in past climate.

Introduction

Lake and marine sediment deposits have long been an important source for studying the Earth's past climate. The sediments of Lake Malawi, located in the East African Rift valley, are ideally suited for high resolution climate studies. The regional sensitivity to climate variations, high lake sedimentation rates, and undisturbed lake bottom combine to create a high resolution annual to decadal climate record. The sediment age is directly related to the depth of the sediment beneath the lake floor. To obtain the past climate record over a long period of time, sediment must be recovered from deep beneath the lake floor. The goal of the Lake Malawi Drilling Program (LMDP) was to recover high quality, continuous sediment cores from below the lake floor in water depths ranging from 350m to 600m. Originally, four sites, shown in Figure 1, were proposed for drilling based on interpretations of high-resolution seismic reflection data (Scholz, 1999).

Lake Malawi is one of the largest, deepest and most remote lakes of the world. Due to the in-land location of the lake, drillship mobilization for deep water drilling is impossible. Lake conditions are very susceptible to seasonal conditions. It was important to complete the drilling program within a pre-determined weather window to minimize operational complications due to rough weather. Malawi is also considered one of the poorest nations of Africa (CIA, 2006) with limited infrastructure and resources. The drilling program required that a dynamically positioned drilling vessel be mobilized with the capabilities of station keeping, drilling and coring in deepwater. Technologies from the oil and gas industry and the geotechnical drilling and scientific communities were combined and adapted to successfully drill and recover core from two sites in Lake Malawi.

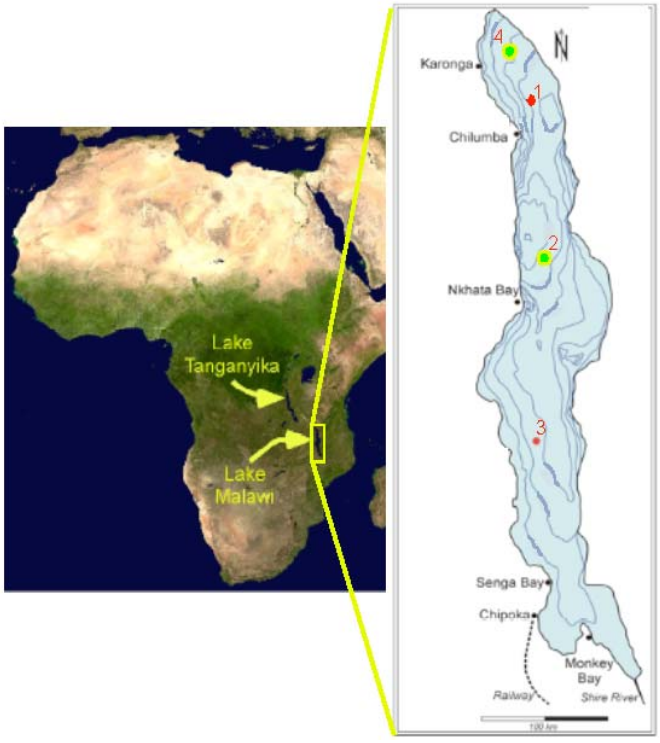

Figure 1. Location of proposed drilling sites on Lake Malawi.