Geophysical Research Abstracts, Vol. 8, 05784, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05784

A new palaeoproxy for lake temperatures based on crenarchaeotal lipids: application in Lake Challa, East Africa

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Understanding and predicting climate change is a major scientific challenge, particularly with regard to climate-induced environmental changes and their impact on human society. Models to predict future climate change are complex, and based in part on what we know of past climate variability, from recent instrumental and historical records as well as from geological climate archives such as lacustrine and marine sediments, speleothems, and tree rings. However, the study of palaeoclimates is limited in part by our ability to accurately determine past temperature variability, especially on the continents. Unfortunately, many available biotic and abiotic temperature proxies are also affected by precipitation rate, evaporation rate, atmospheric CO_2 concentrations and changes in source composition.

We are currently developing a proxy for lake surface-water temperature based on fossilized crenarchaeotal membrane lipids, a continuation of our successful work in marine settings (Schouten et al., 2002). The calibration based on analyses of surface sediments of large lakes (see Powers et al., 2005) is remarkably similar to that obtained for marine settings, indicating that this palaeotemperature proxy is independent of salinity.

In the EuroCLIMATE project CHALLACEA we will use this new proxy to reconstruct -with excellent time resolution and age control- the post-glacial temperature history (21 ka BP to present) of equatorial East Africa from the continuous and finely laminated sediment record of Lake Challa, a crater lake on the lower East slope of Mt.

Kilimanjaro. This reconstruction is aided by an analysis of a set of core-top sediments from the present-day lake. Preliminary findings indicate that surface and down-core sediments indeed contain fossil crenarchaeotal membrane lipids, and have recorded a substantial warming during the deglaciation period. Additional data will be presented at the meeting.

Powers L. A., Johnson T. C., Werne J. P., Castañeda I. S., Hopmans E., Sinninghe Damsté J. S., and Schouten S. (2005) Large temperature variability in the southern African tropics since the Last Glacial Maximum. *Geophys. Res. Lett.* **32**, L08706-10.1029/2004GL022014.

Schouten S., Hopmans E. C., Schefuß E., and Sinninghe Damsté J. S. (2002) Distributional variations in marine crenarchaeotal membrane lipids: a new tool for reconstructing ancient sea water temperatures? *Earth. Planet. Sc. Lett.* **204**, 265-274.