The long HSPDP-Chew Bahir record from southern Ethiopia:

Enhancing our environmental record of anatomically modern human origins

V.Foerster1, A. Asrat2, A. Cohen3, R. Gromig4, C. Günter1, A. Junginger5, H.F. Lamb6, F. Schäbitz7, M.H. Trauth1, the HSPDP science team

1University of Potsdam, Institute of Earth and Environmental Science; Karl-Liebknecht-Str. 24-25; Germany

2Addis Ababa University, School of Earth Sciences; P. O. Box 1176, Addis Ababa; Ethiopia

3University of Arizona, Department of Geosciences, Tucson, AZ 85721; USA

4University of Cologne, Institute of Geology and Mineralogy; Zülpicher Str. 49a; 50674 Cologne, Germany

5Eberhard Karls Universität Tuebingen, Department of Earth Sciences,

Senckenberg Center for Human Evolution and Palaeoenvironment (HEP-Tuebingen); Hölderlinstrasse 12; 72074 Tuebingen; Germany

5Aberystwyth University, Department of Geography and Earth Sciences; Aberystwyth SY23 3DB; U.K.

6University of Cologne, Seminar for Geography and Education; Gronewaldstrasse 2; 50931 Cologne; Germany

What role did climate dynamics play in human evolution and the dispersal of Homo sapiens within and beyond the African continent? In order to provide an environmental context to this central question, the ICDP-funded Hominin Sites and Paleolakes Drilling Project (HSPDP) has successfully completed coring five fluvio-lacustrine archives of climate change during the last ~3.5 Ma in East Africa. The five high-priority areas in Ethiopia and Kenya are located in close proximity to key paleoanthropological sites covering various steps in evolution. The Chew Bahir basin in southern Ethiopia is one of those sites, located ~90 km east of the Lower Omo River valley -site of the oldest known fossils of anatomically modern humans. Chew Bahir was cored in late 2014, yielding two (278.58 m and 266.38 m, >85% recovery) adjacent cores (HSPDP-CHB14-2A and 2B) from the western margin of the Chew Bahir rift basin. The long Chew Bahir record is expected to provide valuable insights into the pronounced moisture fluctuations during the last > 500 ka BP, a time interval that comprises the transition into the Middle Stone Age as well as the origin and dispersal of Homo sapiens.

We present here our initial results of the long HSPDP Chew Bahir cores, including the correlation of the two parallel sediment cores, the stratigraphy that was developed during the initial core description and several high-resolution multi sensor core logging (MSCL) data sets. The magnetic susceptibility data reveals cycles of ca. 15 m, 30 m, 50 m and 125 m, that can be tentatively linked with orbital cycles controlling wet-dry alternations in the Chew Bahir basin. A first chronology will be based on radiocarbon, OSL, Ar/Ar dating and paleomagnetics as soon as the ages have been determined. The sampling of the nearly continuous (>90%) composite core has been completed at a 32 cm routine sample spacing. The earliest results of the ~4,000 discrete sediment samples for further multi-proxy investigation show that the Chew Bahir deposits seem to have reacted sensitively towards changes in moisture influx, provenance, transport mechanisms and diagenetic processes. Combining our first results from the long cores with the results from a pilot study of short cores taken in 2009/10 along a NW-SE transect across the basin (Foerster et al., 2012, 2015, Trauth et al., 2015), we have developed a hypothesis linking climate forcing and paleoenvironmental signal formation processes in the basin, providing an important prerequisite for understanding the environmental record contained in the long sediment cores. X-ray diffraction on the first sample sets from the long Chew Bahir record show a similar process that has been recognized for the uppermost ~20 m during the pilot-study of the project: the diagenetic illitization of smectites during episodes of higher alkalinity and salinity in the closed-basin lake caused by a drier climate followed by a threshold-type formation of analcime during phases of pronounced aridity.

The good recovery and anticipated excellent time resolution of the cores will give us a continuous record of environmental fluctuations on decadal to orbital timescales, that will allow us to test current hypotheses of the influence of climate on human evolution and dispersal.

References:

Foerster, V., Vogelsang, R., Junginger, A., Asrat, A., Lamb, H.F., Schaebitz, F., Trauth, M.H., 2015. Environmental Change and Human Occupation of Southern Ethiopia and Northern Kenya during the last 20,000 years. Quaternary Science Reviews 129, 333–340.

Trauth, M.H., Bergner, A.G.N., Foerster, V., Junginger, A., Maslin, M.A., Schaebitz, F., 2015. Episodes of Environmental Stability and Instability in Late Cenozoic Lake Records of Eastern Africa. Journal of Human Evolution 87, 21–31.

Foerster, V., Junginger, A., Langkamp, O., Gebru, T., Asrat, A., Umer, M., Lamb, H., Wennrich, V., Rethemeyer, J., Nowaczyk, N., Trauth, M.H., Schäbitz, F., 2012. Climatic change recorded in the sediments of the Chew Bahir basin, southern Ethiopia, during the last 45,000 years, Quaternary International 274, 25–37.

HSPDP: http://hspdp.asu.edu/