Future insights into East African continental climate variability and human evolution over 3.5 Ma: the Hominin Sites and Paleolakes Drilling Project (HSPDP)

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Understanding causative relationships between human evolution and Earth system history has motivated scientists since the time of Darwin. Since then, scientists have speculated on how and when humans and our close relatives evolved and what conditions drove this evolutionary story.

Outcrop-based continental hydroclimate reconstructions from Eastern Rift Valley (East Africa) and sea surface temperatures or dust variability using marine sediment cores from the Gulf of Aden over the last 4 Ma were associated with major evolutionary steps in human evolution [deMenocal, 2011, Herbert et al., 2010, Trauth et al., 2009]. These reconstructions provide only limited (and spatially-averaged) insights into continental climate dynamics. The effects of millennial-scale or even shorter events for early hominin evolution have scarcely been explored, although such events are clearly linked to demographic and population-level changes during the Holocene in Africa [Kröpelin et al., 2008]. The lack in continuity, temporal and spatial resolution of available paleoreconstructions restricts our understanding about the factors that interacted to control African climate and ecosystem dynamics during the Plio/Pleistocene and thereby limits our ability to infer how they may have affected major turnovers in hominin or other mammalian evolution. A high-resolution paleoclimate reconstruction using indicator (or proxy) records encompassing evolutionary events such as the last appearance datum (LAD) of *Australopithecus afarensis*, the first appearance data (FAD) of *Homo* and *Paranthropus*, and changes in stone tool technologies from a suite of paleolakes adjacent to the different hominid-bearing basins would allow anthropologists to test the contrasting hypotheses of human evolution.

The Hominin Sites and Paleolakes Drilling Project (HSPDP, http://hspdp.asu.edu) [Cohen et al., 2009] is utilizing advanced field, laboratory, and numerical approaches for collection and analysis of lake sediment drill core records from key anthropological localities in Kenya and Ethiopia. The goal of HSPDP is fundamental transformation of the debate over the role of global, regional and local environmental dynamics in shaping hominin evolutionary history. Aiming to characterize any Earth system drivers with sufficient precision that enables a correlation with hominine evolution and their identification as evolutionary causal factors HSPDP has recovered drill cores from four paleolake basins next to key anthropological sites in the Kenyan and Ethiopian rift valleys (northern Afar, Turkana basin, Tugen Hills, Lake Magadi). A drilling campaign at the Koora Graben next to Olorgesailie, Kenya was undertaken in early 2013 by colleagues at the Smithsonian Institution. Combined, these records cover key intervals of hominin prehistory over the last ~3.5 Ma.

East Africa is not only a key region to study factors driving hominid evolution, the area is also a hot spot to understand the driving mechanisms, which determined African tropical paleoclimate and their extremes. These topics will be addressed by reconstructing paleoenvironmental and climatic conditions using continuous sediment core scanning (e.g., XRF, color) of the HSPDP drill cores among a suite of other indicator and proxy records. Here the recent state of the HSPDP project, preliminary drilling results and envisaged research will be presented.

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