Scanning x-ray fluorescence results from a ~1 Ma paleoenvironmental record adjacent to the Olorgesailie archeological sites (Kenya)

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The influence of high-latitude glacial cycles and precessional or half precessional forcing on Plio-Pleistocene African climate remains an area of continuing controversy (deMenocal, 2011; Herbert et al., 2010; Potts, 2013; Trauth et al., 2010). Regional climate records—sea surface temperatures or dust fluxes from Gulf of Aden sediments—have been linked to major shifts in human evolution. Outcrops in the Kenyan and Ethiopian rift valleys document repeated occurrences of freshwater lake-systems and wooded landscapes from the past 4 million years at locations that are presently seasonally-dry savanna. However, limited insight into continental climate dynamics at finer temporal and spatial scales restricts our ability to infer how environmental change may have affected adaptive change and lineage turnover in hominins or broader-scale mammalian evolution during the Plio/Pleistocene.

A 2012 drilling campaign recovered a total of 216 m long sedimentary sequences at two drill sites on the Koora Plain, a depositional basin adjacent to Olorgesailie, a major Early-Late Pleistocene archeological locality (Potts et al, 2004; Pennisi, 2013). Together with the Hominin Sites and Paleolakes Drilling Project (HSPDP), these research initiatives aim to characterize East African paleoclimate with sufficient precision to enable correlation with hominin evolution and to identify evolutionary causal factors at specific time slices since ~4 Ma.

$^{40}Ar/^{39}Ar$ dating of tephra present in the cores and a detailed lithostratigraphy—including smear-slide microscopic analyses, and X-radiographic and optical images—provide the framework for high-resolution paleoenvironmental and paleoclimatic reconstructions. Here we present high-resolution XRF scanning data from these sedimentary sequences. Patterns in these data reflect depositional changes with time (e.g., diatom productivity, weathering processes) driven by environmental variability and can potentially be linked to climate parameters such as

precipitation. In particular, we have focused on the details of a well-preserved laminated section of the core record, which we anticipate may harbor information about seasonal lake dynamics relevant to evaluating East African orbital and millennial-scale climate variability patterns.

References:

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