COHEN , Andrew S.
Department of Geosciences University of Arizona, Tucson, AZ 85721 USA *acohen@geo.arizona.edu*

Differences in the temporal and spatial scales of paleoenvironmental data and implications for paleoanthropology

Paleoenvironmental and paleoclimatic data of relevance to human evolutionary questions can be derived from three fundamentally different types of geological archives; outcrops at or near paleoanthropological or archaeological sites, and drill core records from either deep sea or continental basinal (typically lacustrine) sites. Archive types vary greatly in terms of both the temporal and spatial scales over which they integrate records of environmental change. For example, a time series at the local outcrop scale of $\delta^{13}C$ in a paleosol series is probably sampling variability in local vegetation over a spatial scale of 100s of m^2, with a temporal resolution on the order of 10^{2-3} yr. In contrast, a typical deep sea dust record might be sampling a broad swath of a continent, at a spatial scale of $\sim 10^6$ km, with temporal resolutions on the order of 10^{3-4} yr. Furthermore, each type of archive can house multiple types of indicator records from geophysical properties, sediments, fossils or geochemistry of environmental variability. Even data sets collected at the same site and with the same stratigraphic intensity may record different spatiotemporal scales of information and are thus not directly comparable. This is because these record components accumulate through fundamentally different mechanisms, for example the accumulation of wind blown pollen from an airshed versus the accumulation of organic matter from the suspension settling of plankton.

The challenge for earth scientists and paleoanthropologists in collaborating to make maximum use of these varied (and not always comparable) types of archives is twofold. First we must explicitly identify the temporal and spatial scales of environmental information required for testing specific hypotheses of human evolution. Second, we must parse both the types of archives and indicator records available to best match the needs of the paleoanthropolgical community to the available or emerging toolkits of the earth scientists.

Drill cores from lakes offer exciting new opportunities to evaluate paleoclimatic history relevant to interpreting hominin evolution precisely because they allow us to examine combinations of temporal and spatial scales of stratigraphic archives which have heretofore been unsampled. The combination of high temporal resolution, intermediate scale spatial resolution, high stratigraphic completeness and long record duration can complement our existing understanding of the paleoenvironmental context of hominin evolution based on outcrops and marine drill core records.