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# Silicate diagenesis and environmental change in eastern Africa: Examples from key hominin localities

Daniel Deocampo (1), Daniel Gebregiorgis (1), Nathan Rabideaux (2), Karim Minkara (1), David Davis (1), Gail Ashley (3), John Kingston (4), Alan Deino (5), R. Bernhardt Owen (6), Tim Lowenstein (7), Robin Renaut (8), Verena Foerster (9), Schäbitz Frank (9), Asfawossen Asrat (10), Andrew Cohen (11), Chris Campisano (12), Jeremy Delaney (3), Javier Cuadros (13), and Fred Longstaffe (14)

(1) Department of Geosciences, Georgia State University, Atlanta, Georgia, USA, (2) Department of Chemistry, Rutgers University, Newark, New Jersey, USA, (3) Department of Earth and Planetary Sciences, Rutgers University, New Brunswick, Piscataway, USA, (4) Department of Anthropology, University of Michigan, Ann Arbor, Michigan, USA, (5) Berkeley Geochronology Center, Berkeley, California, USA, (6) Department of Geography, Hong Kong Baptist University, Hong Kong, (7) Department of Geological Sciences and Environmental Studies, Binghamton University, Binghamton, New York, USA, (8) Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan, Canada, (9) Institute of Geography Education, University of Cologne, Cologne, Germany, (10) School of Earth Sciences, Addis Ababa University, Addis Ababa, Ethiopia, (11) Department of Geosciences, University of Arizona, Tucson, Arizona, USA, (12) School of Human Evolution and Social Change, Arizona State University, Tempe, Arizona, USA, (13) Department of Earth Sciences, Natural History Museum, London, UK, (14) Department of Earth Sciences, Western University, London, Ontario, Canada

Many Plio-Pleistocene lake basins in eastern Africa associated with early hominins contained waters that were alkaline, enriched in silica due to weathering of volcaniclastics and hydrothermal activity, and evaporatively concentrated. Such conditions are favorable for the formation of silicate minerals precipitated from solution, or neoformed through alteration of detrital parent material. The most common authigenic silicates thus produced include the zeolite family of minerals and a number of clay minerals, particularly 2:1 clays of the illite and smectite families. Particularly in the absence of well-preserved paleoecological records, these minerals may provide important evidence of paleoenvironmental conditions.

Stratigraphic variations in lacustrine authigenic silicates can give an indication of changes in cation proportions in paleolake waters over time. For example, in Pliocene deposits of the Baringo Basin, Kenya, fluctuations between phillipsite (K-rich) and analcime (Na-rich) facies suggest changing salinity levels because more saline waters have greater Na/K ratios. In one interval in the Chemeron Formation, analcimic muds are interbedded with freshwater diatomites, suggesting a link between high amplitude of environmental variability and peak orbital eccentricity ∼2.6 Ma. In the Lake Magadi basin in southern Kenya, marked increases in zeolite abundance and greater dominance of Na-rich phases indicate hydrological closure and enhanced evaporative concentration suggesting a long-term increase in aridity accelerating ∼380 ka. In short cores of the Chew Bahir basin of southern Ethiopia, greater analcime abundances and incipient low-temperature illitization of smectite (indicating greater K uptake in more saline waters) are associated with Late Pleistocene arid episodes such as the Younger Dryas.

In the Olduvai Basin of northern Tanzania, fluctuations in the Al/Mg ratio of authigenic clay minerals record changes in salinity, as greater Mg is incorporated into clays during saline episodes. These clay mineral changes are accompanied by shifts in the oxygen isotope composition of structural oxygen, indicating equilibrium with variably saline waters. Both elemental and isotopic changes fluctuate over precessional timescales, suggesting orbital control of hydrologic balance ∼1.8 Ma.

Authigenic silicates can be an important source of paleolimnological data, particularly over the range of salinities between the relatively freshwater conditions under which biological proxies readily accumulate, and the extreme salinities associated with evaporites such as halite and trona (Na-carbonate).