Paleohydrology from authigenic silicate geochemistry: Examples from East Africa

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Authigenic silicates precipitated from lake water provide proxies for various aspects of paleolake water chemistry. Authigenic silicates tend to accumulate where surface or pore waters are alkaline and aqueous silica activity is high. Availability of Al- or Fe-rich detrital clays leads to Mg-rich smectite formation, whereas pure Mg-silicates are favored in detritus-free systems. Clay mineral reactions in such lakes include: 1) reduction of octahedral Fe; 2) uptake of octahedral Mg; and 3) conversion of smectite to illite, defined by the uptake of K. Detailed X-ray diffraction studies combined with chemistry of ultrafine clay minerals from throughout East Africa suggest that these mechanisms are decoupled representing different environmental conditions.

Clay octahedral compositions can be quantified using molar ratios from structural formulae, such as (Mg/(Al+Fe)) [1]. Stratigraphic variation of this quantity can then be used to provide a proxy for lacustrine paleosalinity.

Work at Olduvai Gorge, Tanzania (1.92-1.75 Ma) based on clay geochemistry shows Al-rich clays associated with peak climatic precession, correlating with December insolation at 20°S [2]. Such detailed records are important for reconstructing continental hydroclimate through Quaternary time. Silicate-based records can provide crucial coverage of lacustrine intervals where biotic records are not preserved.

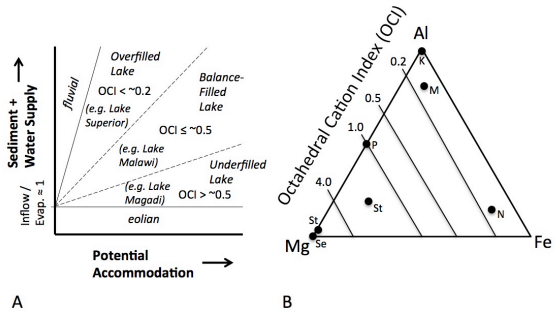

Figure 1 From [1]. A. Lake classification and ranges of authigenic clay octahedral cation indices. B. Compositions of clay minerals. M-montmorillonite; K-kaolinite; N-nontronite; P-palygorskite; Se-sepiolite; St-stevensite; Sa-saponite.

[1] Deocampo (2015) *GSA Spec. Pap.* 515, 49-64 [2] Deocampo *et al.* (in press) *Geology*.