

Lake Edward, East Africa: Carbonates, the Silica Cycle, and Late Holocene Century-scale Drought. James M. Russell and Thomas C. Johnson.

Lake Edward, Uganda/Congo is ideally configured to record past variations in tropical African rainfall, situated on the eastern edge of the Congo basin near the heart of the African monsoon. Here we present multiproxy analyses (biogenic silica content, stable isotopic, and geochemical analyses of inorganic calcite) from well-dated late Holocene cores from Lake Edward. The stable isotopic composition and the % Mg in inorganic calcite are highly covariant, and provide evidence for eight major droughts over the past 5,400 years. The biogenic silica content (% BSi) of the sediments varies between 2 and 70%, and may record more subtle climate variations than carbonate-based proxies due to long residence times for dissolved Mg. High-resolution, cm-scale profiles of the % BSi analyzed from 900 to 3,500 cal yr BP contains considerably more decade-scale variability than the carbonate profiles, and is strongly correlated to the % Mg in calcite. Peaks in BSi occur during wet periods defined by low % Mg in calcite. This is likely due to reduced silica input to Lake Edward during periods of drought, limiting diatom production, coupled with diatom dissolution during lake lowstands. The latter process is suggested by the presence of large nodules of amorphous opal, likely precipitated from dissolved diatom silica. Lastly, lithologic analyses of cores from both Lake Edward and adjacent crater basins can be used to test interpretations of geochemical data and allow us to assign relative severity to droughts observed in the geochemical records.

These analyses demonstrate the power of multiproxy analyses and cross-proxy validation in Lake Edward, and provide evidence for numerous late Holocene drought events in equatorial Africa. These include a drought during the Grand Solar Maximum (about 900 cal yr BP) as well as a major drought at 2,000 cal yr BP that is evident across much of East Africa. These events appear linked to both solar variability and ocean-atmosphere interactions in the tropical oceans, highlighting the complexity of climate variability in the region.