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Booth No. 207 ORBITAL CONTROL OF EUXINIA IN LAKE MAGADI OVER THE PAST 1 MILLION YEARS: MOLYBDENUM, ARSENIC, AND VANADIUM RECORDS

Tuesday, 6 November 2018
09:00 AM - 06:30 PM
Indiana Convention Center - Halls J-K

A ~200m core was recovered from Lake Magadi, Kenya, as part of the Hominin Sites and Paleolakes Drilling Project. The mostly lacustrine sediments rest on trachytic bedrock dated to 1.08 Ma. Age control of the core is based on $^{40}Ar/^{39}Ar$ (tephra), ^{14}C (organics), and U-series (cherts) dates, and the Bruhnes-Matuyama paleomagnetic boundary. The modern basin is a regional drainage sump, hosting an ephemeral saline and alkaline salt pan fed by hot springs and seasonal rains. Whole-sediment chemistry was determined every ~32cm throughout the core. Our results show some of the highest levels of several elements ever observed in lake sediments: Mo (1500 mg/kg), As (300 mg/kg), and V (500 mg/kg). These elements are soluble when reduced, and preferentially sorb or co-precipitate with sulfides. We suggest these high concentrations were produced by a combination of stratification (meromixis), which enabled mobilization and scavenging by sulfides, and an extremely negative water balance in the basin, which allowed strong evaporative concentration.

Prior to ~700ka, mineralogy suggests the basin was fresh to moderately saline, and was not sensitive to orbitally induced changes in regional hydrology. At ~700ka, a significant shift in Zr/TiO_2 ratios indicates a major change in the trace element profile of incoming detritus, perhaps related to tectonics. After this shift, La/Lu ratios covary with Mo, As, and V, suggesting the basin was sensitive to hydrologic changes; major fluctuations are found in geochemical indicators related to salinity, anoxia, and euxinia. All six eccentricity maxima (glacial terminations) between 700 and 100ka correlate with peaks in Mo concentration; MIS 11, which is not associated with high eccentricity, is not observed.

These results suggest that peak aridity occurred in the eastern rift during glacial maxima over the past 700 ka, a finding that is at odds with some other records of the region. Over the past 100 ka, the basin has trended to even more extremes of carbonate evaporite accumulation and complete desiccation, reflecting either climatic trends or geomorphic adjustment that has reduced the amount of inflow. These dramatic geochemical changes likely were associated with terrestrial ecosystem changes that may have influenced human behavior and evolution over the past million years.

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