What Can the Geochemical Variations in Ancient Stromatolites Tell Us About Climate Variability in Eastern Africa?

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East African climate is influenced by various coupled ocean-atmospheric circulation systems such as the seasonal monsoons. In the Turkana Basin of Kenya, stromatolite remnants of blue-green algae (cyanobacteria), are predicted to have recorded the ancient monsoonal variations in Eastern Africa's paleoclimate. In an effort to better understand short-term climate change and the inter-annual rainfall variability of this hydrologically vulnerable region, we investigated elemental variability in stromatolite samples to assess their utility as a paleoclimate archive. We investigated Pleistocene aged stromatolite samples from Koobi Fora Formation in the northeast Turkana Basin. We compare these to stromatolites from the Triassic-Jurassic Newark supergroup of eastern North America. Slabbed samples of stromatolites were chemically characterized with scanning X-Ray Fluorescence Spectroscopy (XRF) as well as Laser Induced Breakdown Spectroscopy (LIBS) to obtain geochemical variations of the stromatolites measuring every mm near the rime of the substrate to the outer edges of the stromatolite. Water samples from the Turkana Basin were analyzed in a previous study to create a baseline dataset for modern rhythms of the monsoon. We examined ancient stromatolite Rb/Sr ratios and compared these results to the modern dataset to determine any similarities in variations. We hypothesize that corresponding variations in Rb/Sr ratios between the ancient and modern water samples may corelate with known climate events such as the Indian Ocean Dipole (IOD) and that by investigating these variations, we may be able to address whether ocean-atmospheric systems will increase in frequency and severity in the future as the planet continues to warm. Spectral Analysis software will be used to interpret whether the chemical variations reflect seasonal or longer-term cycles. Stromatolite results indicate an inverse relationship between Ca and Ti, with more calcium present in the microbial mat that surrounds the substrate which contains more Ti than the microbial mat. This chemical relationship may help differentiate layers in the stromatolites, suggesting XRF may be a very useful tool in assessing small scale hydrologic variability in stromatolite samples. Spectral Analysis results show cycling variations of Rb/Sr ratios indicting the possibility these represent seasonal cycles throughout time which would correlate with the monsoonal rhythm.