Geophysical Research Abstracts,
Vol. 10, EGU2008-A-04177, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-04177
EGU General Assembly 2008

The relative role of tectonics and climate change: lake cycles and wetland records from the Olduvai basin, East African Rift

G. Ashley

Dept. of Earth and Planetary Sciences, Rutgers University, Piscataway, NJ, USA (gmashley@rci.rutgers.edu)

Olduvai basin has 2 million year long paleontological and archaelogical records including at least three hominin species. Nearly 75% of the recovery sites are in the "junction area" which represents only 1% of the 250 km2 of sedimentary outcrop of fluvio-lacustrine deposits. This concentration of life appears to be due to a fortuitous interplay of rift-related tectonics and astronomically controlled climate fluctuations that created localized lush freshwater environments ($\sim$1.85-1.75 Ma) in this arid setting. Olduvai was an apparent attraction for hominins, as well as a wide range of animals from the nearby Ngorongoro Volcanic Highland and adjacent Serengeti grasslands.

The Gregory branch of the East African Rift (EAR) lies east of Olduvai. Volcanism during early basin history produced thick volcaniclastic deposits; drainage was westward from the highlands into the basin. As the basin evolved, periodic deformation under extensional stresses (NW-SE to W-E) created a regional tilt to the east shifting the basin depo center eastward through time. A lake existed between 1.85-1.75 Ma. An eastward shift occurred at $\sim$ 1.8 Ma and the basin evolved to an eastward draining fluvial environment (post 1.70 Ma). A syn-depositional fault system comprised of steeply-dipping normal faults disrupted the layer cake stratigraphy into fault blocks. This study recognizes several closely spaced N-S faults in the "junction area" that created adjacent horsts and grabens that affected groundwater flow creating seeps and springs.

Superimposed on this background of active tectonics are long term astronomically controlled wet-dry cycles, i.e. Milankovitch precession cycles (19-23 ka). Changes in solar insolation are thought to drive stronger summer monsoon maxima increasing net annual rainfall. The level of Lake Olduvai fluctuated in sympathy with the wet/dry cycles; the groundwater system likely responded similarly. Aquifers swelled as meteoric water trapped on nearby 2000 m high Ngorongoro Highland moved down into the basin. Water surfaced along fault planes and probably at the intersection of groundwater and impermeable beds. A 1 km2 lush wetland developed within the faulted "junction area" sourced by seeps and a number of point sources (springs). Analysis of lithic artifact assemblages accumulated between 1.85-1.75 Ma showed consistent use of these freshwater resources by hominins during both wet and dry periods.