Geophysical Research Abstracts
Vol. 17, EGU2015-3698, 2015
EGU General Assembly 2015

Rift initiation with volatiles and magma

Cynthia Ebinger (1), James Muirhead (2), Steve Roecker (3), Christel Tiberi (4), Alfred Muzuka (5), Rrichard Ferdinand (6), Gabrile Mulibo (6), and Gladys Kianji (7)

(1) University of Rochester, EES, Rochester, United States (cebinger@ur.rochester.edu), (2) University of Idaho, (3) RPI, Troy, NY, (4) Universite Montpellier II, (5) NMAIST, Arusha, (6) University of Dar-es-Salaam, (7) University of Nairobi

Rift initiation in cratonic lithosphere remains an outstanding problem in continental tectonics, but strain and magmatism patterns in youthful sectors of the East African rift provide new insights. Few teleseisms occur in the Eastern rift arm of the East African rift system, except the southernmost sector in northern Tanzania where extension occurs in Archaean lithosphere. The change in seismic energy release occurs over a narrow along-axis zone, and between sectors with and without volcanoes in the central rift valley. Are these differences in strain behavior indicative of along-strike variations in a) rheology; b) strain transfer from border faults to magma intrusion zones; c) dike vs fault slip; and/or d) shallow vs deep magma chambers? We present time-space relations of seismicity recorded on a 38-station array spanning the Kenya-Tanzania border, focal mechanisms for the largest events during those time periods, and compare these to longer-term strain patterns. Lower crustal seismicity occurs along the rift length, including sectors on and off craton, and those with and without central rift valley volcanoes, and we see no clear along-strike variation in seismogenic layer thickness. One explanation for widespread lower crustal seismicity is high gas pressures and volatile migration from active metasomatism of upper mantle and magma degassing, consistent with very high volatile flux along fault zones, and widespread metasomatism of xenoliths. Volatile release and migration may be critical to strength reduction of initially cold, strong cratonic lithosphere. Seismicity patterns indicate strain (and fluid?) transfer from the Manyara border fault to Gelai shield volcano (faulting, diking) via Oldoinyo Lengai volcano. Our focal mechanisms and Global CMTs from an intense fault-dike episode (2007) show a local, temporally stable, rotation from ∼E-W extension to NE-SE extension in this linkage zone, consistent with longer term patterns recorded in vent and eruptive chain alignments.