SES10-2010-000031

Abstract for an Invited Paper
for the SES10 Meeting of
the American Physical Society

Tracking the movement of magma through the crust in the East African rift

CYNTHIA EBINGER, University of Rochester

Although fault and magmatic processes have achieved plate spreading at mid-ocean ridges throughout Earth's history, intense volcano-tectonic rifting episodes have rarely been observed. A 65 km-long segment of the subaerial Red Sea rift in Ethiopia experienced a major volcano-tectonic rifting episode in September 2005. Incipient seafloor spreading centers in the Afar rift are surrounded by continental crust and mantle lithosphere stretched and intruded during the past 30 Ma as Africa and Arabia have rifted apart above a mantle plume. We use seismic data and complementary space-based geodetic and remote sensing data to determine the length and timescales of magmatism and faulting, the partitioning of strain between faulting and magmatism, and their implications for the maintenance of along-axis segmentation. Most of the magma for the initial and subsequent 12 intrusions was sourced from the center of the Dabbahu-Manda Hararo rift segment. Strain is accommodated primarily by axial dike intrusions fed from mid-segment magma chamber(s). These findings show that episodic (approximate century interval), rapid opening of discrete rift segments is the primary mechanism of plate boundary deformation. The length scale ($\sim$65 km) and intensity of crustal deformation ($\sim$6 m), as well as the volume of intrusive and extrusive magmatism (>3 cubic km) provokes a re-evaluation of seismic and volcanic hazards in subaerial rift zones.