Insights into Initial Stages of Rifting from Seismotectonics and SKS Splitting in the North Tanzanian Divergence

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Abstract

Magmatism and faulting are preponderant processes involved in continental rifting. Their interaction, relative importance, and dependence to the rheological properties of the lithosphere and to the timing of rifting, remain poorly known. To address this question, we have used the results from a seismological experiment, called SEISMO-TANZ (35 stations, broadband and enlarged-band), launched in the North Tanzanian Divergence (NTD) for 6 months in 2007. The region encompasses one of the youngest parts of the East African rift (EAR) and is characterized by the development of the rift into the Tanzanian craton. The NTD is often considered as non-volcanic compared to other places in EAR and the lithosphere is highly resistant. More than 2000 local earthquakes were recorded, highlighting active faults and one magmatic intrusion. Inherited structures play a key role as guides for dykes and slips. 26 Focal mechanisms (double-couple hypothesis) were obtained from P-wave polarities and indicate a transtensive deformation in the southern part of the region (Manyara rift). The stress inversion performed indicates a stable, well-determined sigma3 axis striking ESE-WNW. From 25 teleseismic events recorded during the experiment, we have measured seismic anisotropy (SKS splitting) and present here our last results. Fast polarization directions are quite homogeneously NE-SW and delays times increase from the craton (W) to the Mozambique belt (E). Fossilized anisotropy and dykes or melt-filled lenses alignments would both explain the majority of these observations. We finally compare these results with other seismic anisotropy measurements made in EAR and with geodetic and seismotectonic analyses in order to better assess the origin of the strain pattern in this part of the rift, and to discuss the respective role of magmatism, faulting and fabrics in the extending lithosphere.