AGU FALL MEETING
San Francisco | 14 – 18 December 2015

T41F-04: Transition from a localized to wide deformation along Eastern branch of Central East African Rift: Insights from 3D numerical models

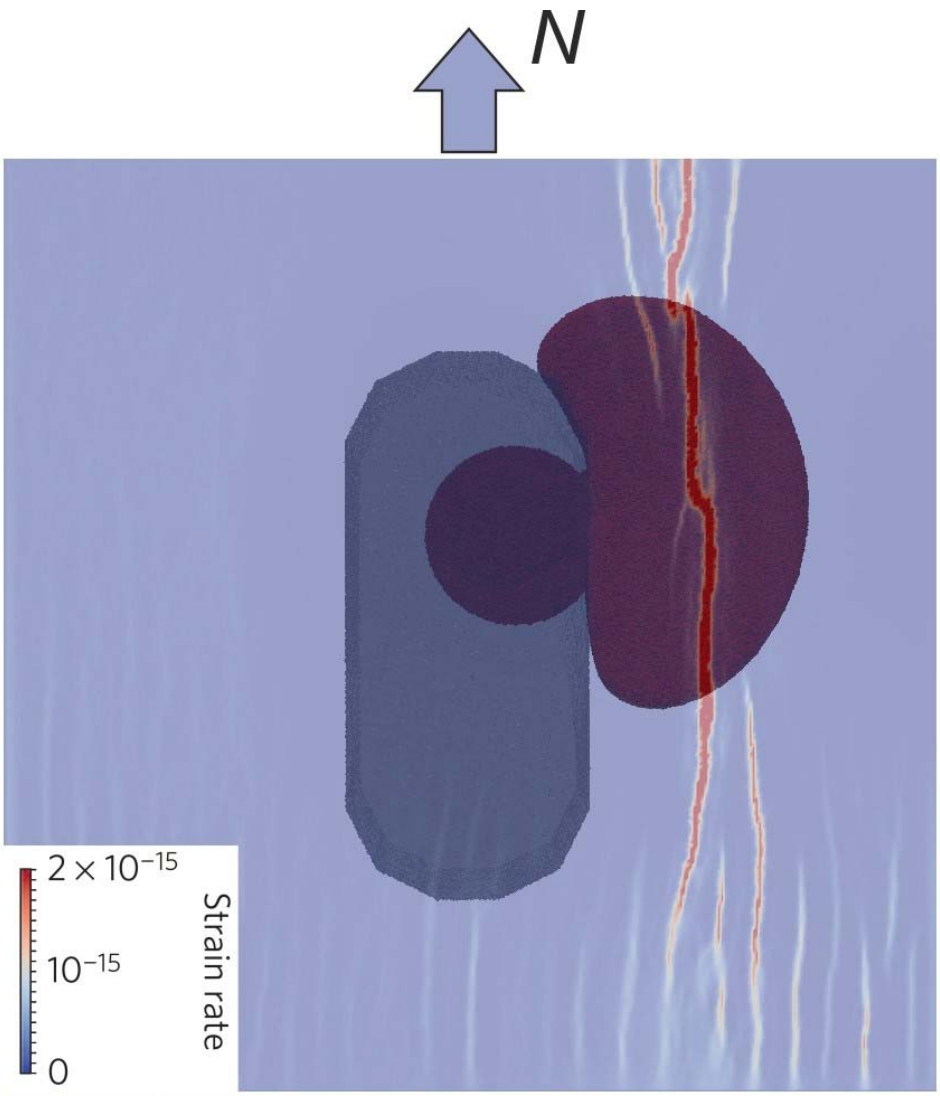
Thursday, 17 December 2015
08:45 - 09:00
Moscone South - 304

The Central East African Rift (CEAR) bifurcates in two branches (eastern, magma-rich and western, magma-poor) surrounding strong Tanzanian craton. Intensive magmatism and continental flood basalts are largely present in many of the eastern rift segments, but other segments, first of all the western branch, exhibit very small volcanic activity. The Eastern rift is characterized by southward progression of the onset of volcanism, the extensional features and topographic expression of the rift vary significantly north-southward: in northern Kenya the deformation is very wide (some 150-250 km in E-W direction), to the south the rift narrows to 60-70 km, yet further to the south the deformation widens again in the so-called Tanzania divergence zone. Widening of the Eastern branch within its southern part is associated with the impingement of the southward-propagating rift on the strong Masai block situated to east of the Tanzanian craton.

To understand the mechanisms behind this complex deformation distribution, we implemented a 3Dl ultra-high resolution visco-plastic thermo-mechanical numerical model accounting for thermo-rheological structure of the lithosphere and hence captures essential features of the CEAR.

The preferred model has a plume seeded slightly to the northeast of the craton center, consistent with seismic tomography, and produces surface strain distribution that is in good agreement with observed variation of deformation zone width along eastern side of Tanzanian craton: localized above bulk of mantle material deflected by cratonic keel narrow high strain zone (Kenia Rift) is replaced by wide distributed deformations within areas situated to north (northern Kenya, Turkana Rift) and to south (Tanzania divergence, Masai block) of it.

These results demonstrate significant differences in the impact of the rheological profile on rifting style in case of dominant active rifting compared to dominant passive rifting. Narrow rifting, conventionally attributed to cold strong lithosphere in passive rifting mode, may develop in weak hot ultra-stretched lithosphere during active rifting, after plume impingement on a tectonically pre-stressed lithosphere. In that case, initially ultra-wide small-amplitude rift patterns focus, in few Myr, into large-scale faults that form a narrow rift.



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