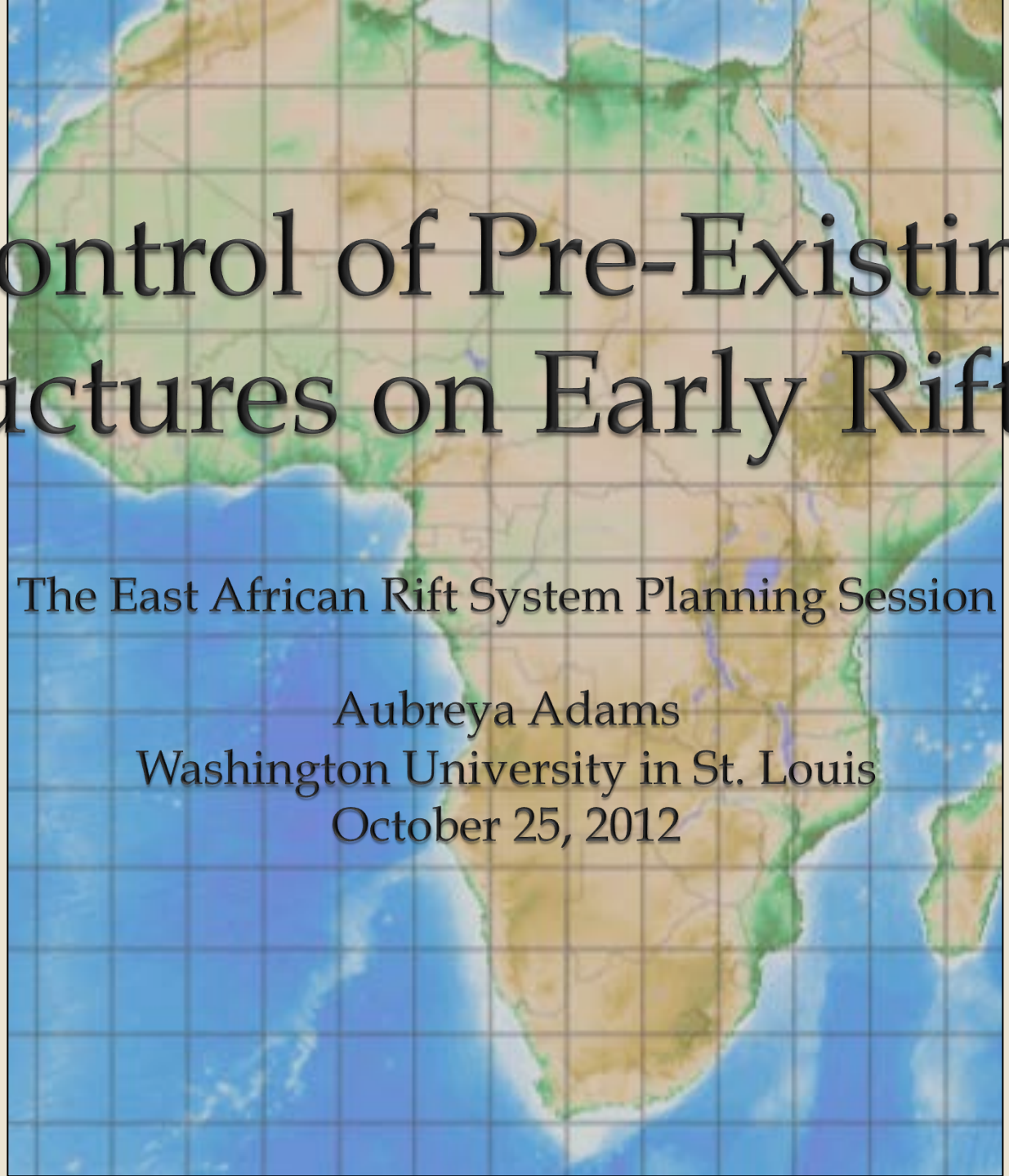
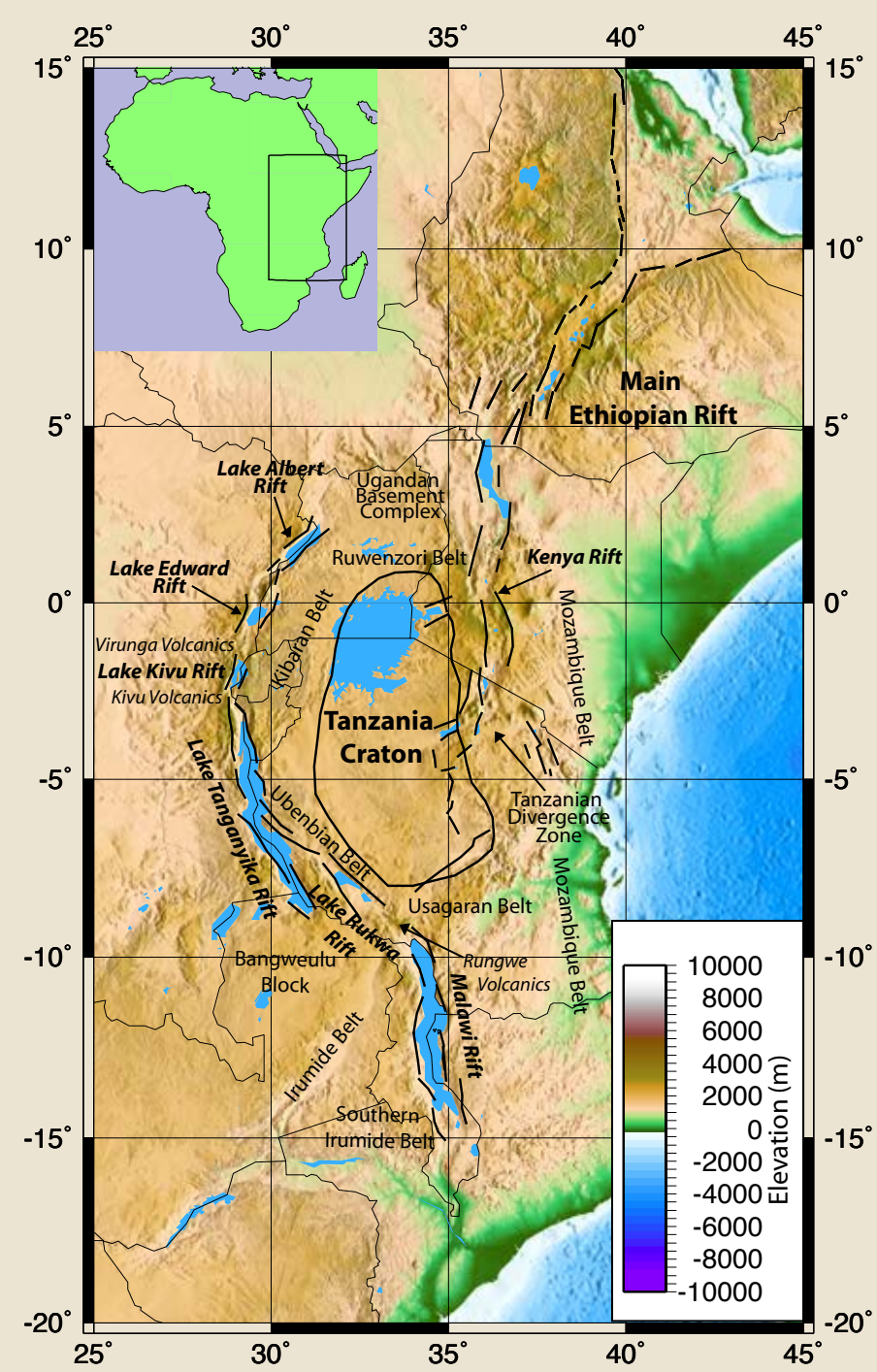


Control of Pre-Existing Structures on Early Rifting

The East African Rift System Planning Session

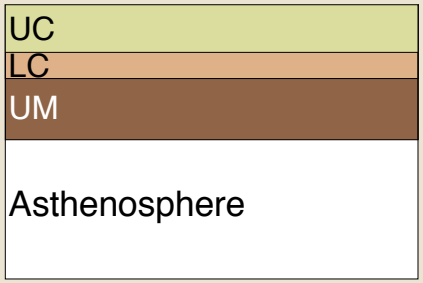
Aubreya Adams
Washington University in St. Louis
October 25, 2012

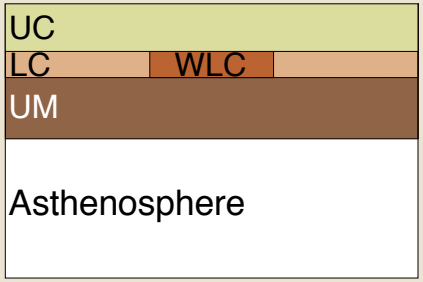


East African Rift System

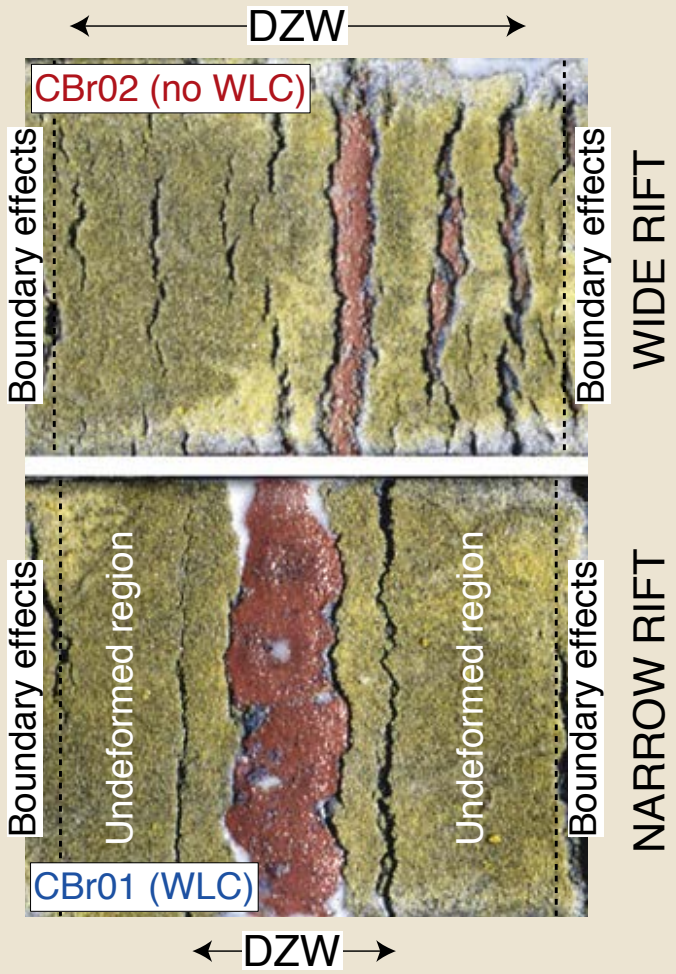
* Complex and diverse lithospheric structure and history
* Varying degrees of volcanic and seismic activity
* Broad range of extension and rifting styles

Models of Pre-Existing Structures Controlling Rifts

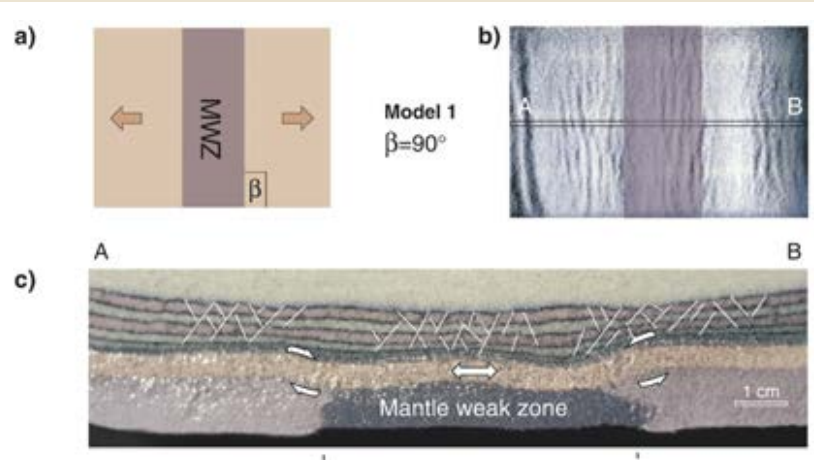


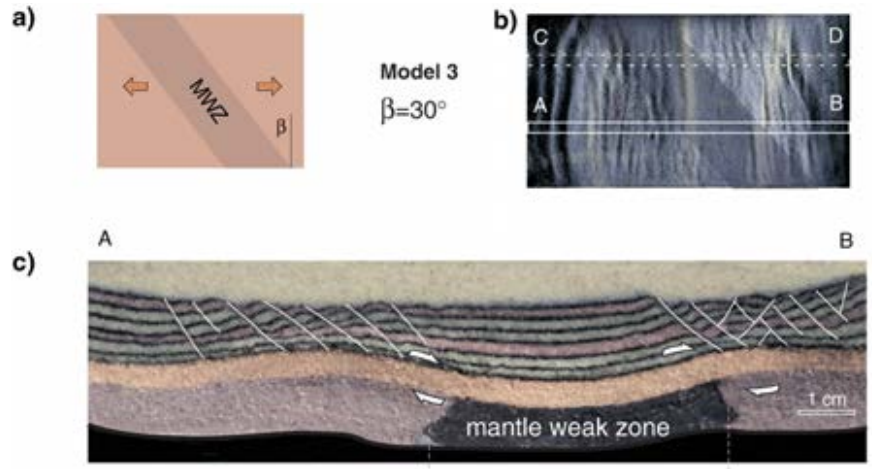


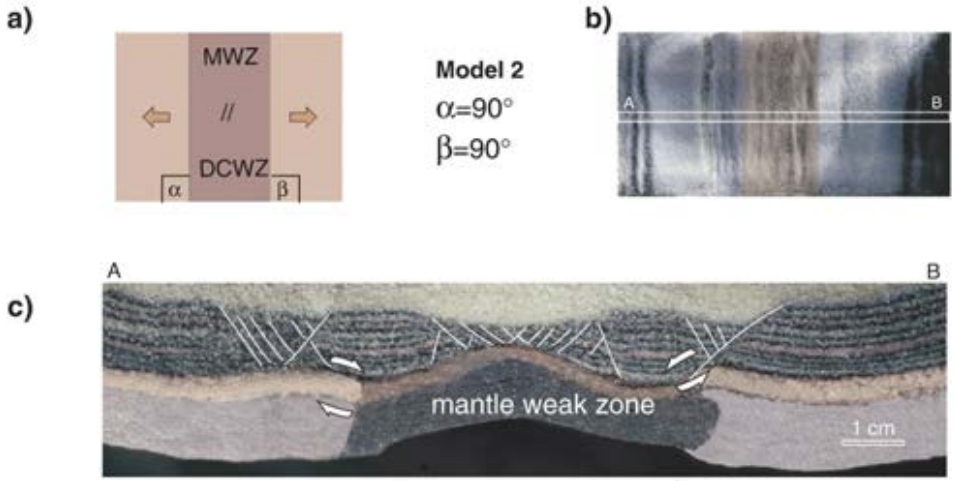
Corti et al. 2003

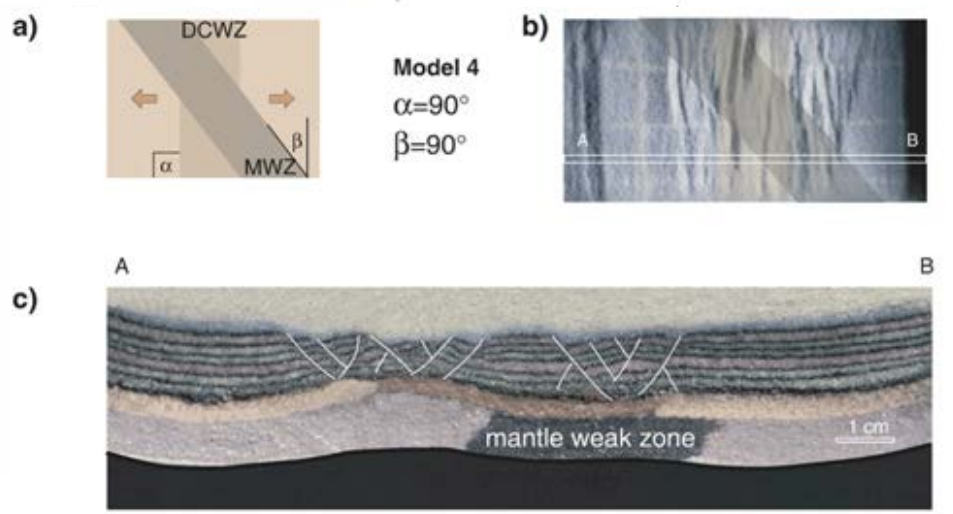


Models of Pre-Existing Structures Controlling Rifts



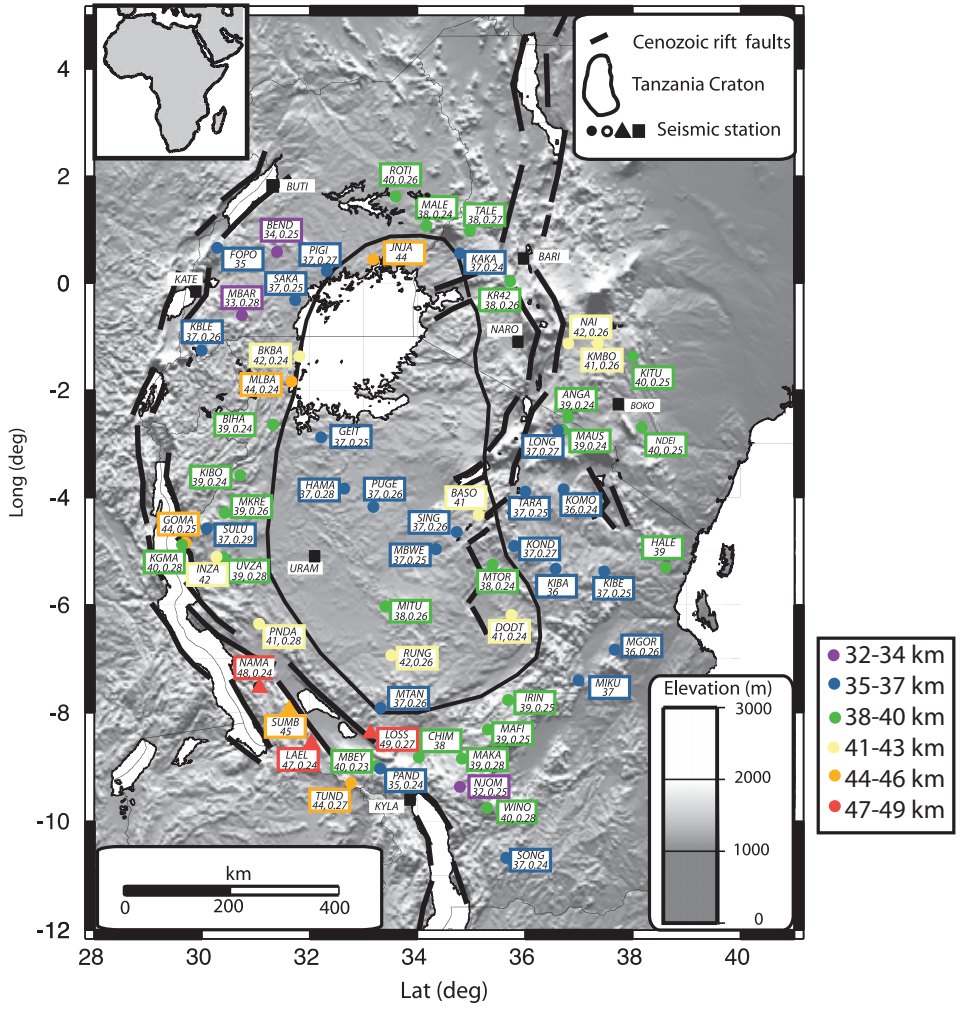




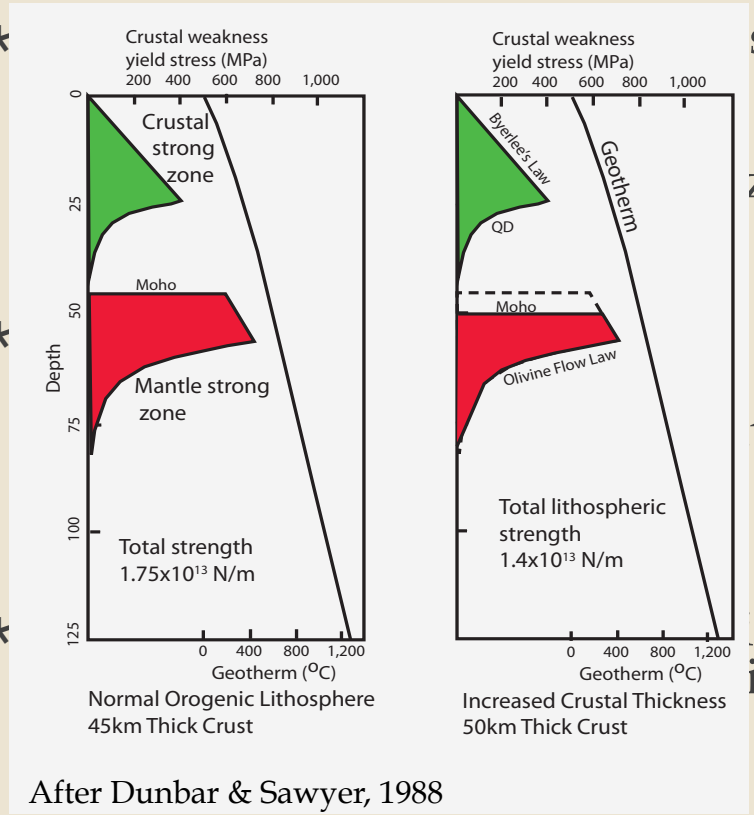


Sokoutis et al., 2007

Crustal Thickness Across the East African Plateau

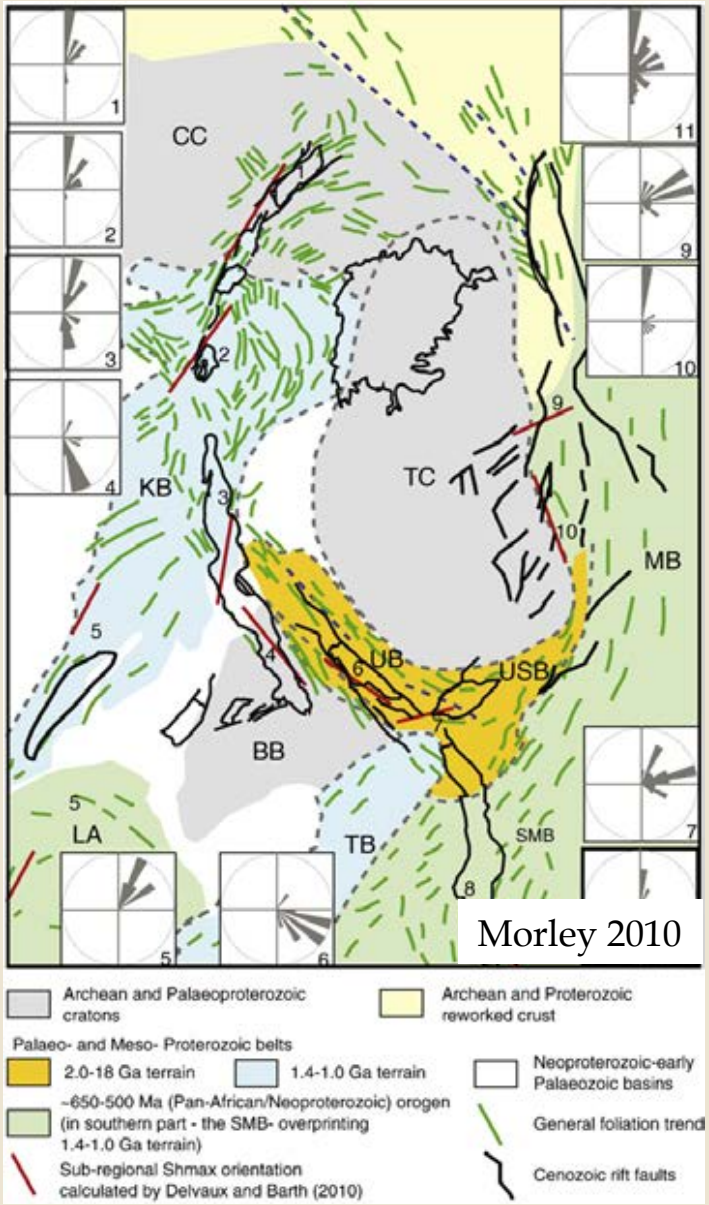


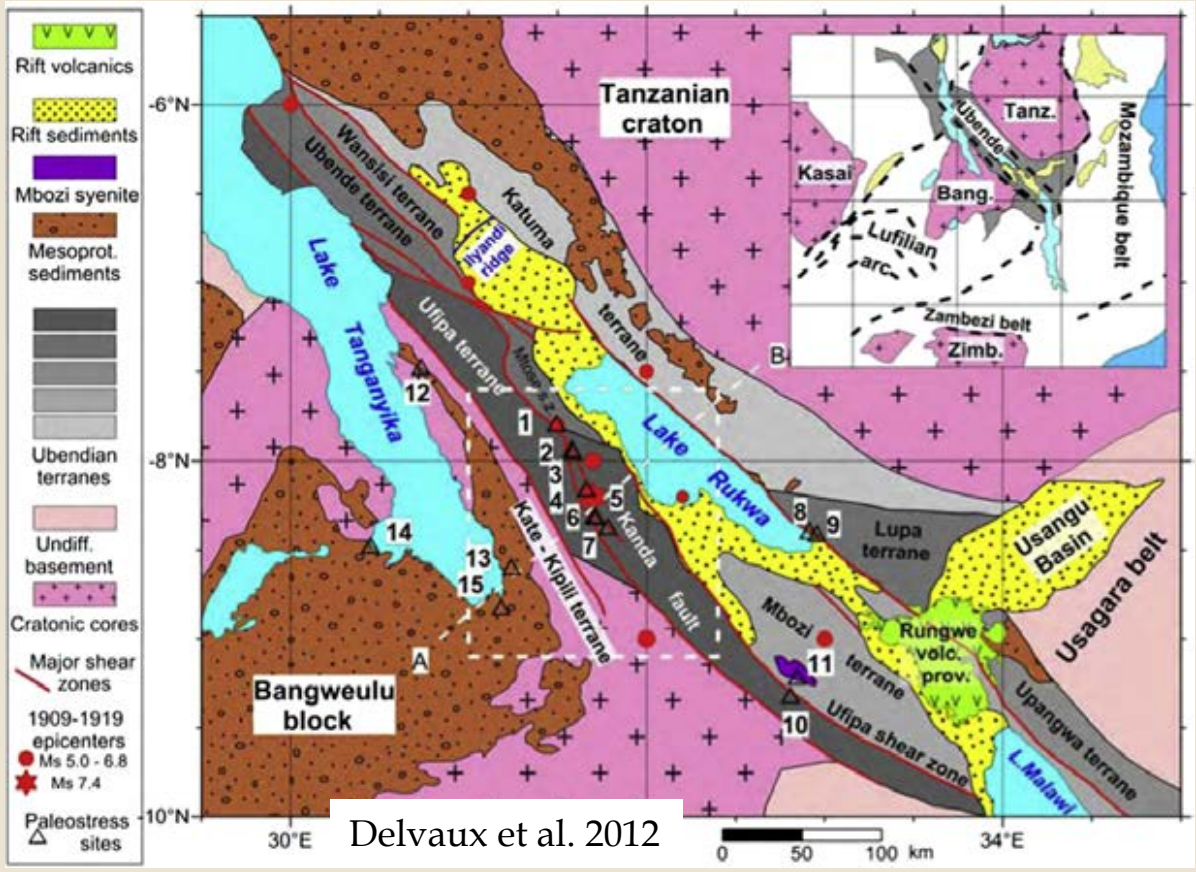
After Tugume et al., 2012



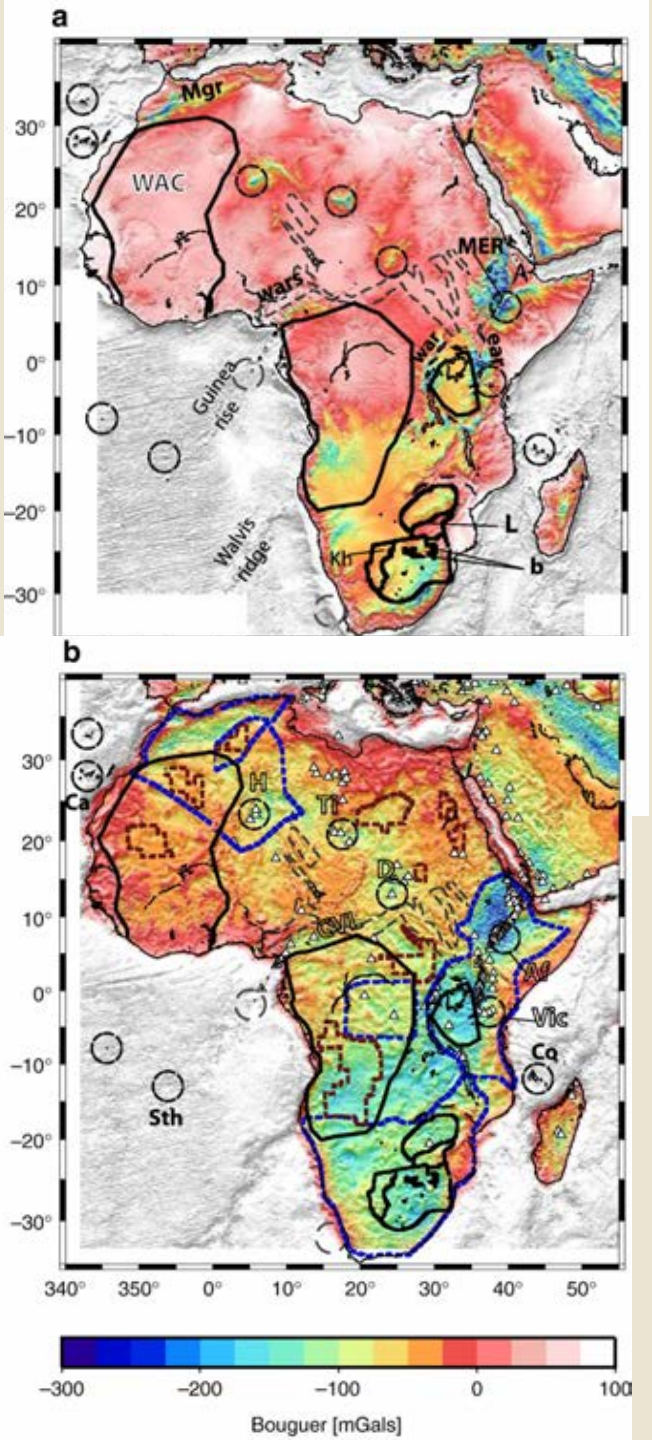
After Dunbar & Sawyer, 1988

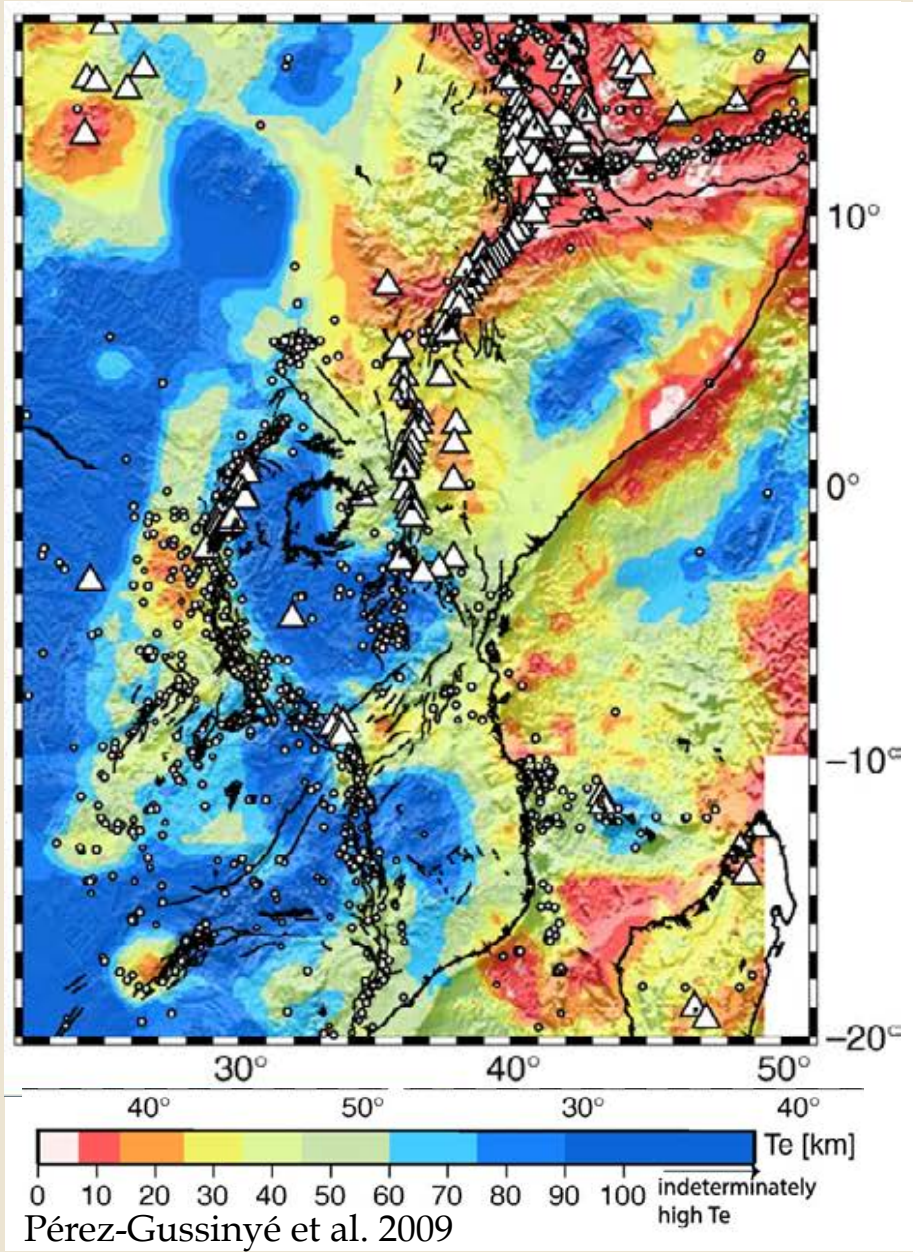
Reactivation of Shear Zones in the Ubendian Belt





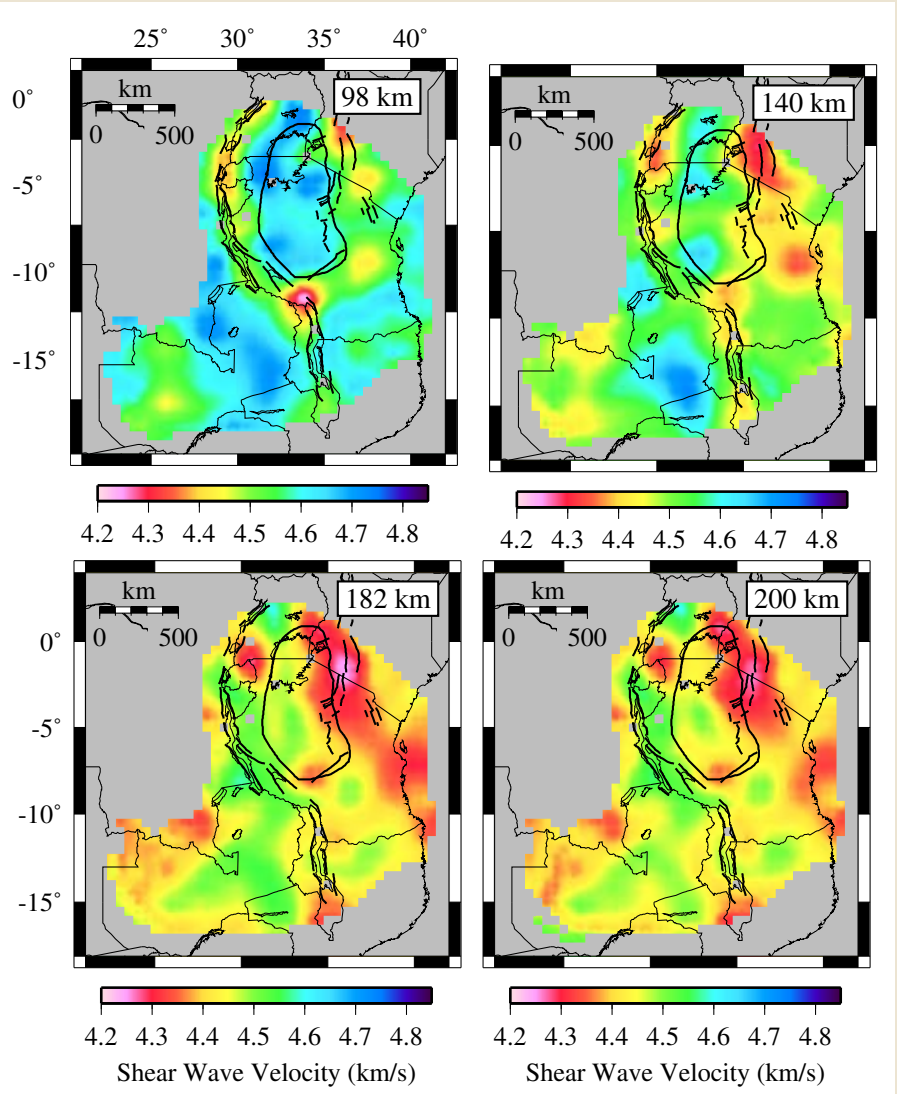
Lithospheric Strength

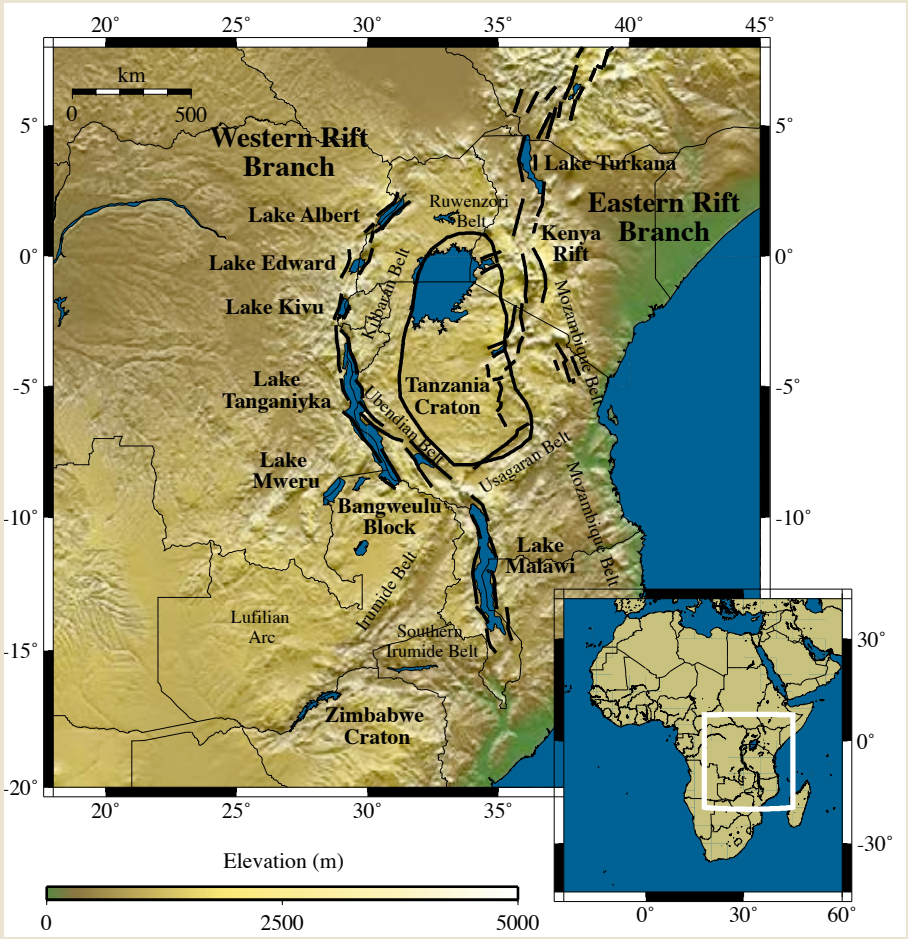




Pérez-Gussinyé et al. 2009

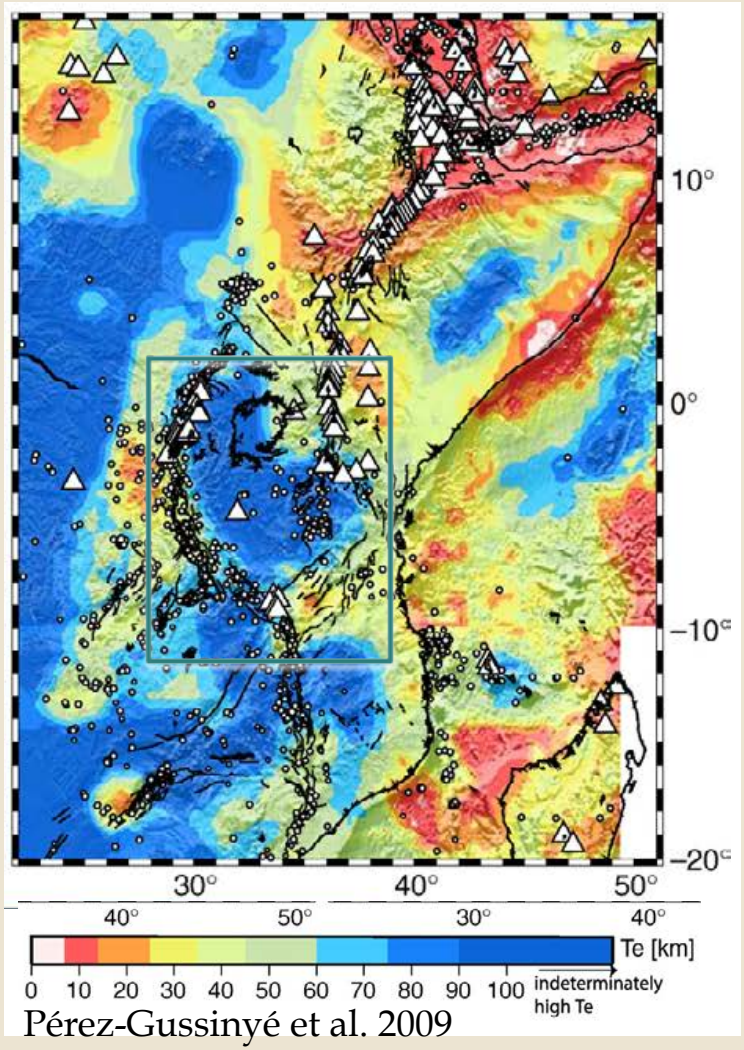
Lithospheric Controls on the Western Rift Branch



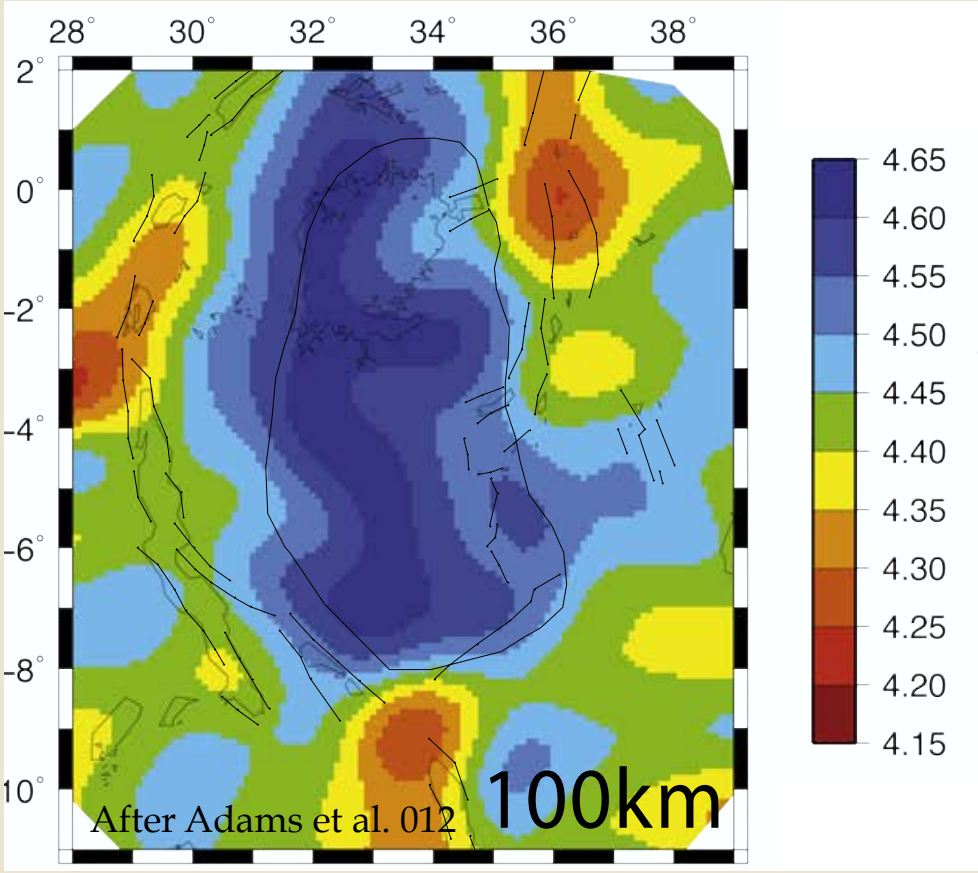


O'Donnell et al., in prep

Lithospheric Properties of the Tanzanian Divergence Zone

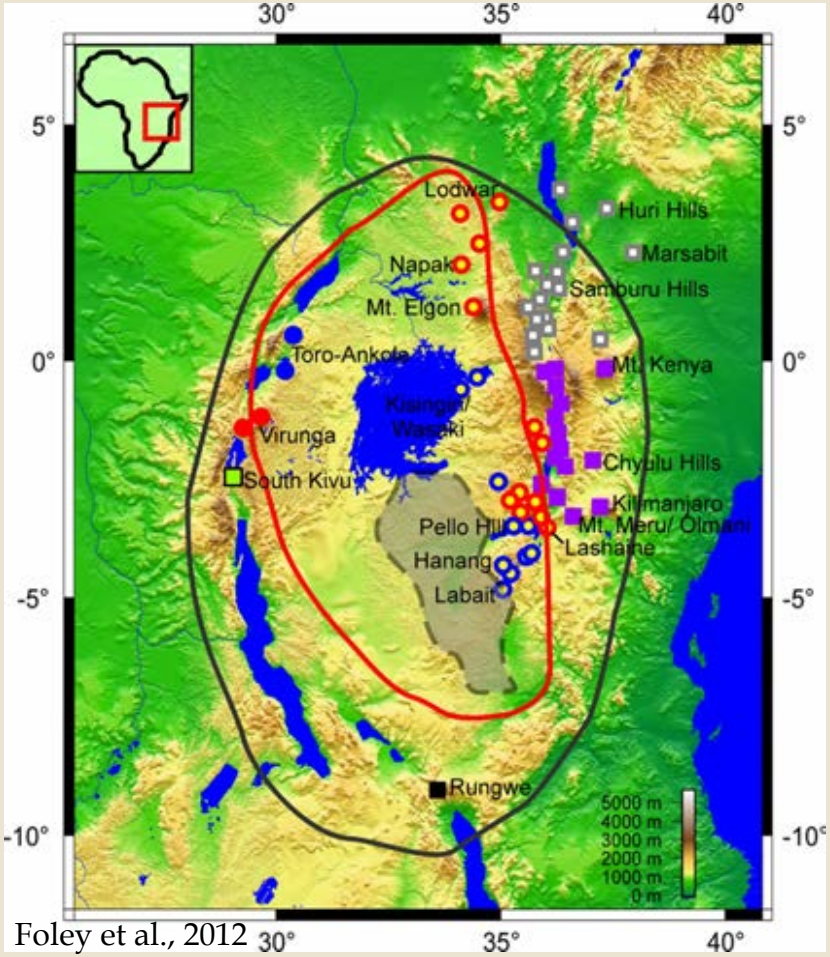


Pérez-Gussinyé et al. 2009

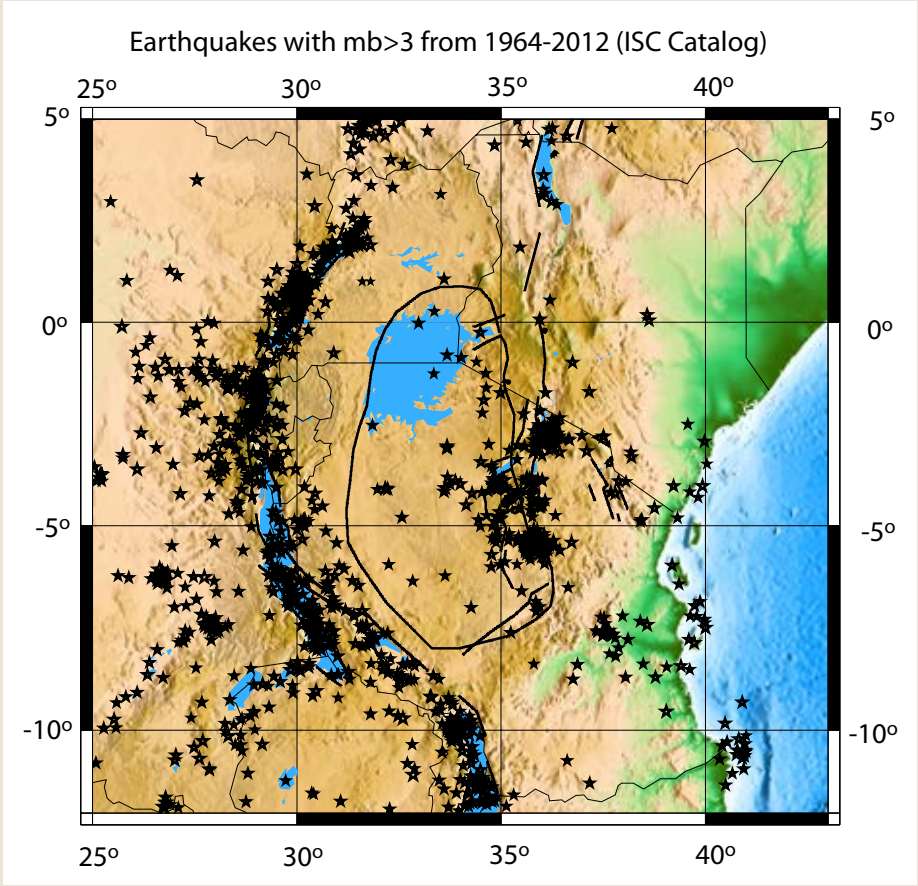


After Adams et al. 012

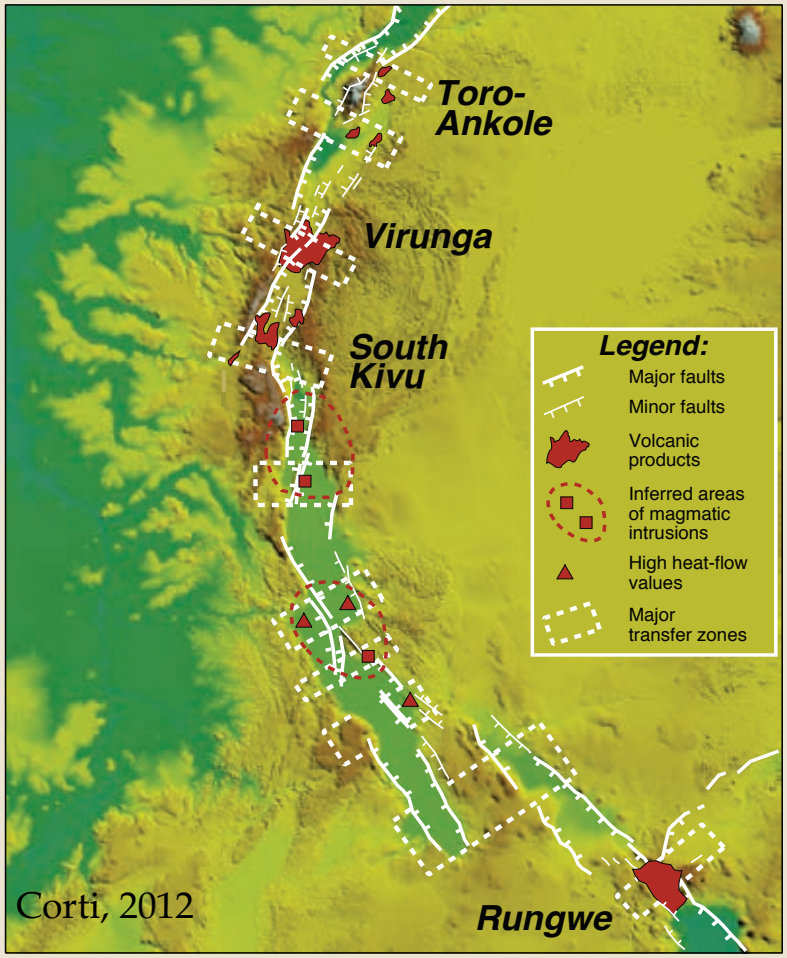
The Role of Magmatism in Rift Initiation



Foley et al., 2012



The Role of Magmatism in Rift Initiation



* The limited magmatism associated with the Western Rift Branch is isolated to transfer regions between rift segments.
* In oceanic spreading centers, magmatic activity is more prevalent towards the center of rift segments.
* This may indicate an important difference in the role of magmatism in early and late-stage rifting.

Summary

* Spatial correlation between pre-existing structures and rift formation.
* Models predict a wide variety of rifting styles influenced by pre-existing zones of weakness.
* Numerous lithospheric structures proposed to as controls on rifting
* Outstanding questions
  * Which lithospheric structures have the greatest first-order influence on rift formation? Which features exert only second-order effects?
  * Why do rifts not always form where lithospheric strength appears to be minimal?
  * What is the relative importance of magmatic activity versus pre-existing structures?
  * How do pre-existing structures impact rifting styles? Short vs. long border faults? Narrow versus diffuse rift patterns?