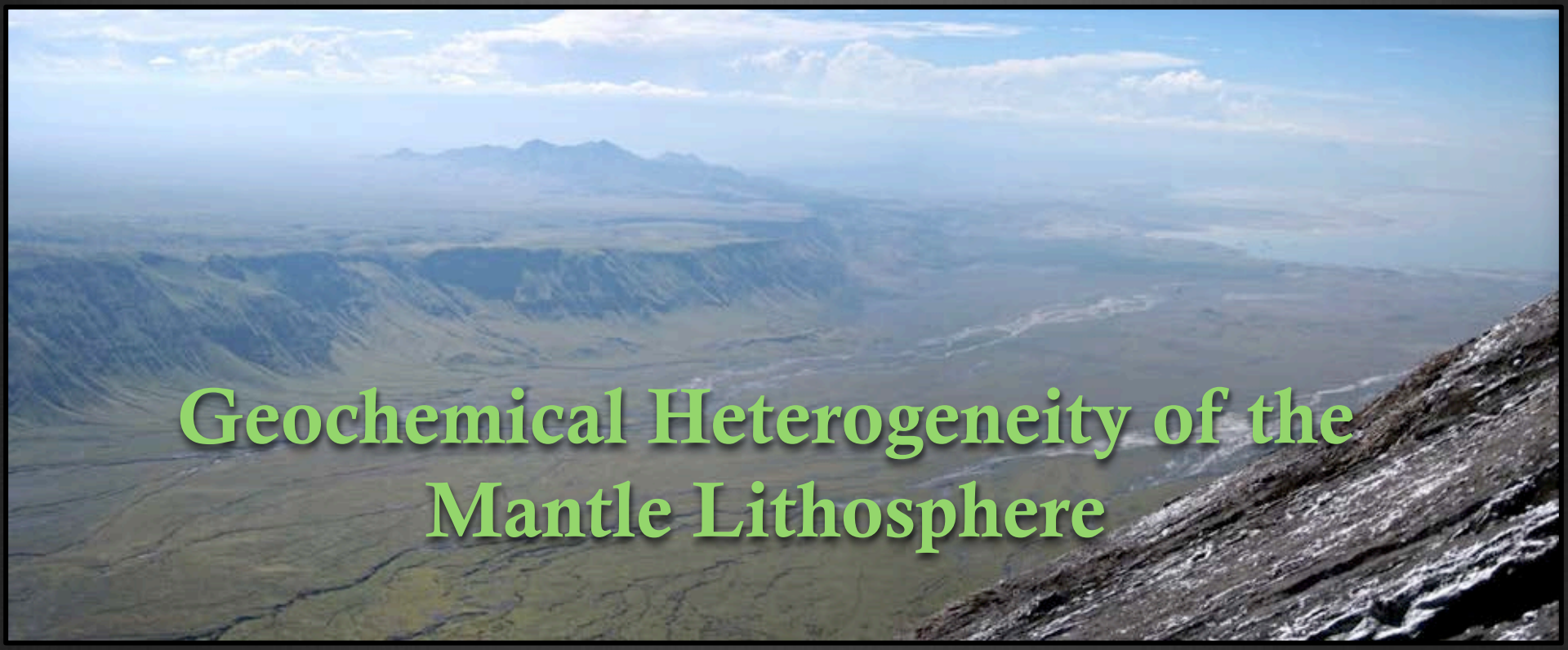
GeoPRISMS: East African Rift System Planning Meeting



Geochemical Heterogeneity of the Mantle Lithosphere

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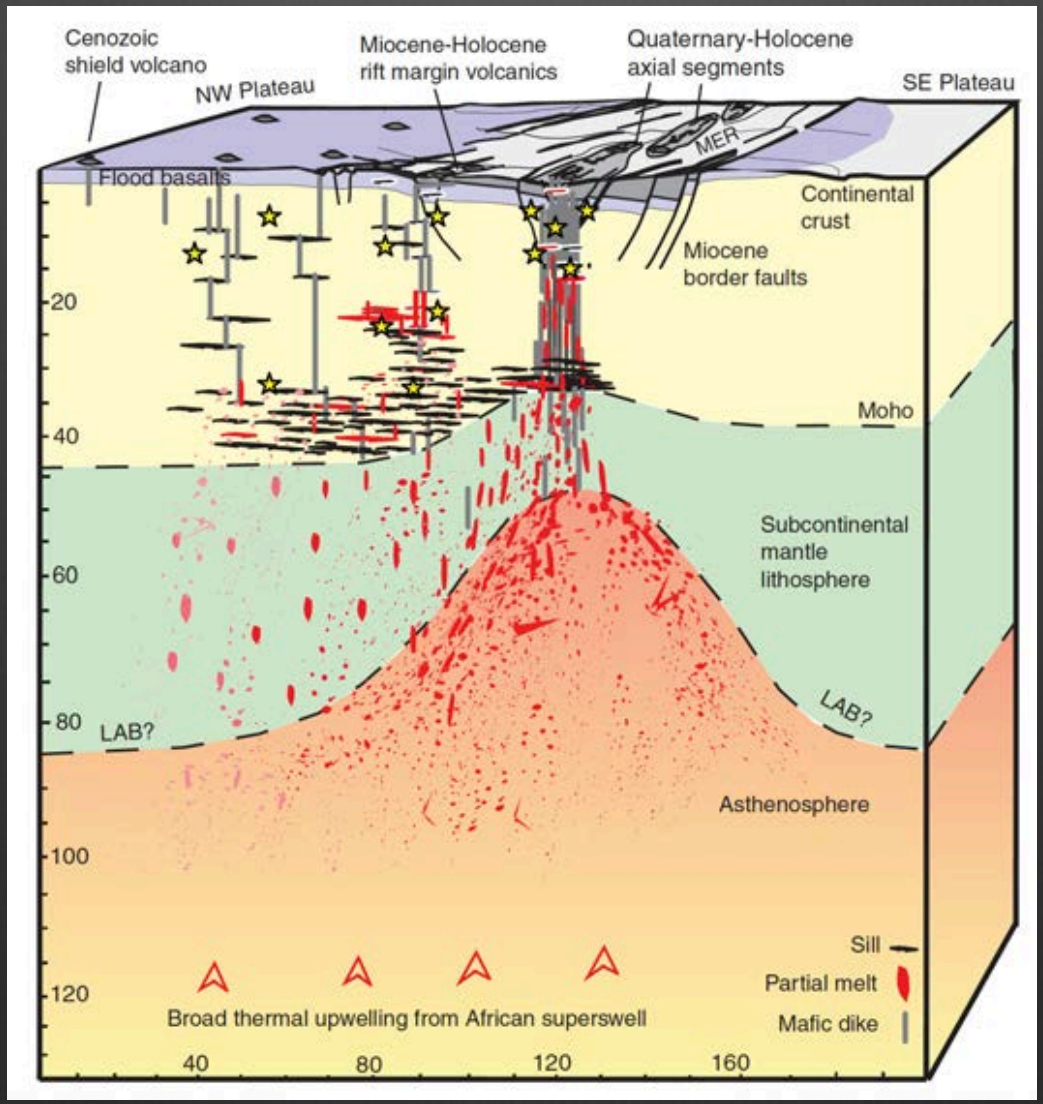
East African Rift - Today



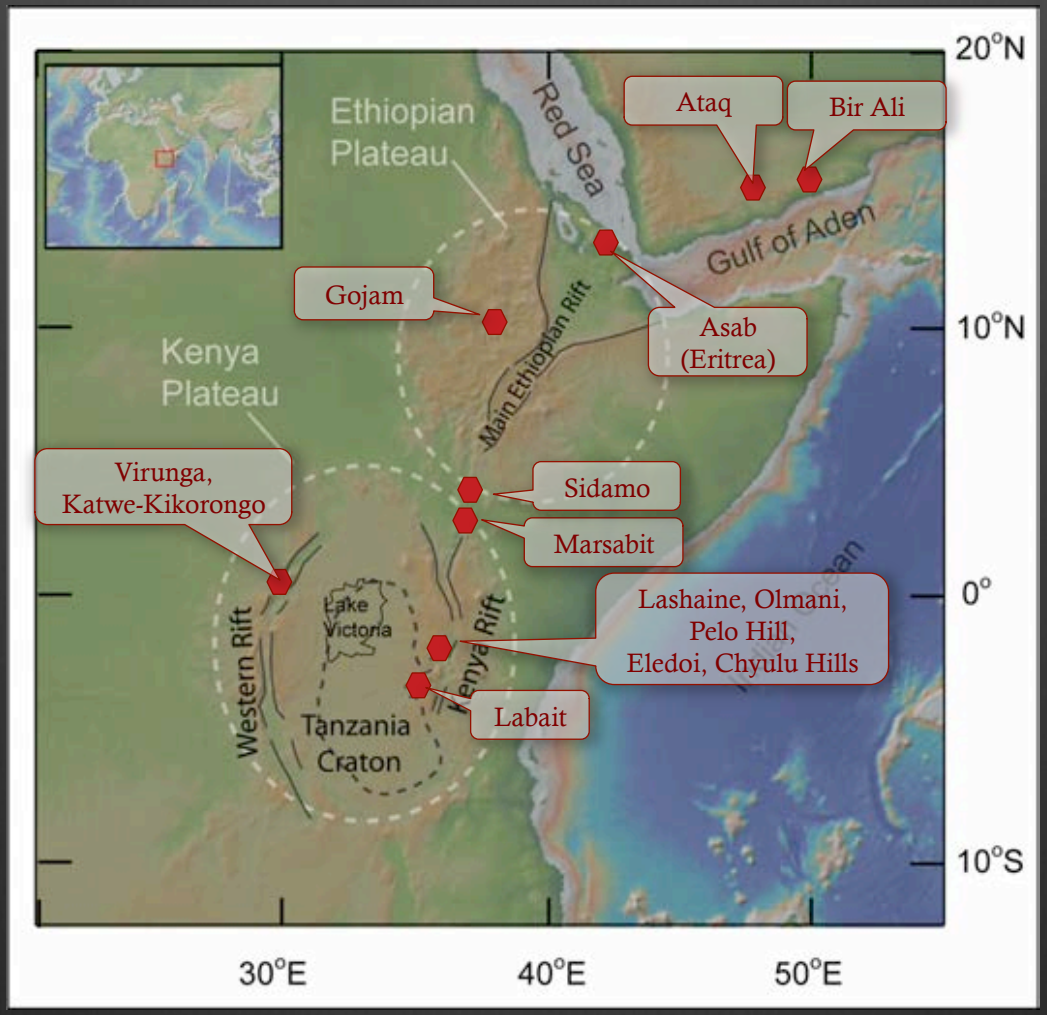
(Bastow et al. 2011)

How does the composition of the lithosphere influence rift initiation and evolution?

- Geochemical and isotopic compositions reflect
  - Age of the lithosphere
  - Mineralogy
  - Pressure and temperature conditions over time
  - Melting and/or metasomatic events

- Geochemical heterogeneities influence the stability of the lithosphere.
  - Thermochemical erosion
  - Mechanical erosion (delamination, lithospheric drip, etc.)

Mantle Xenolith Localities

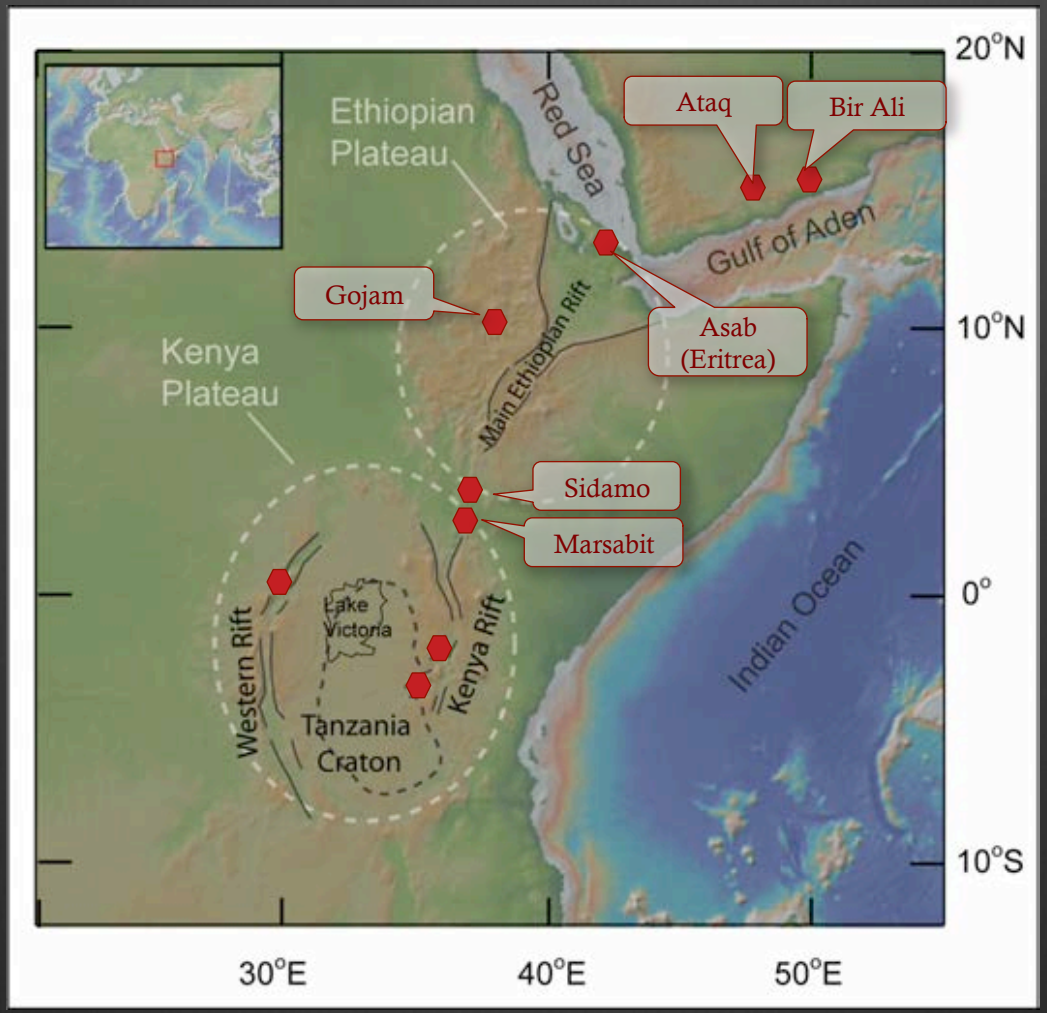


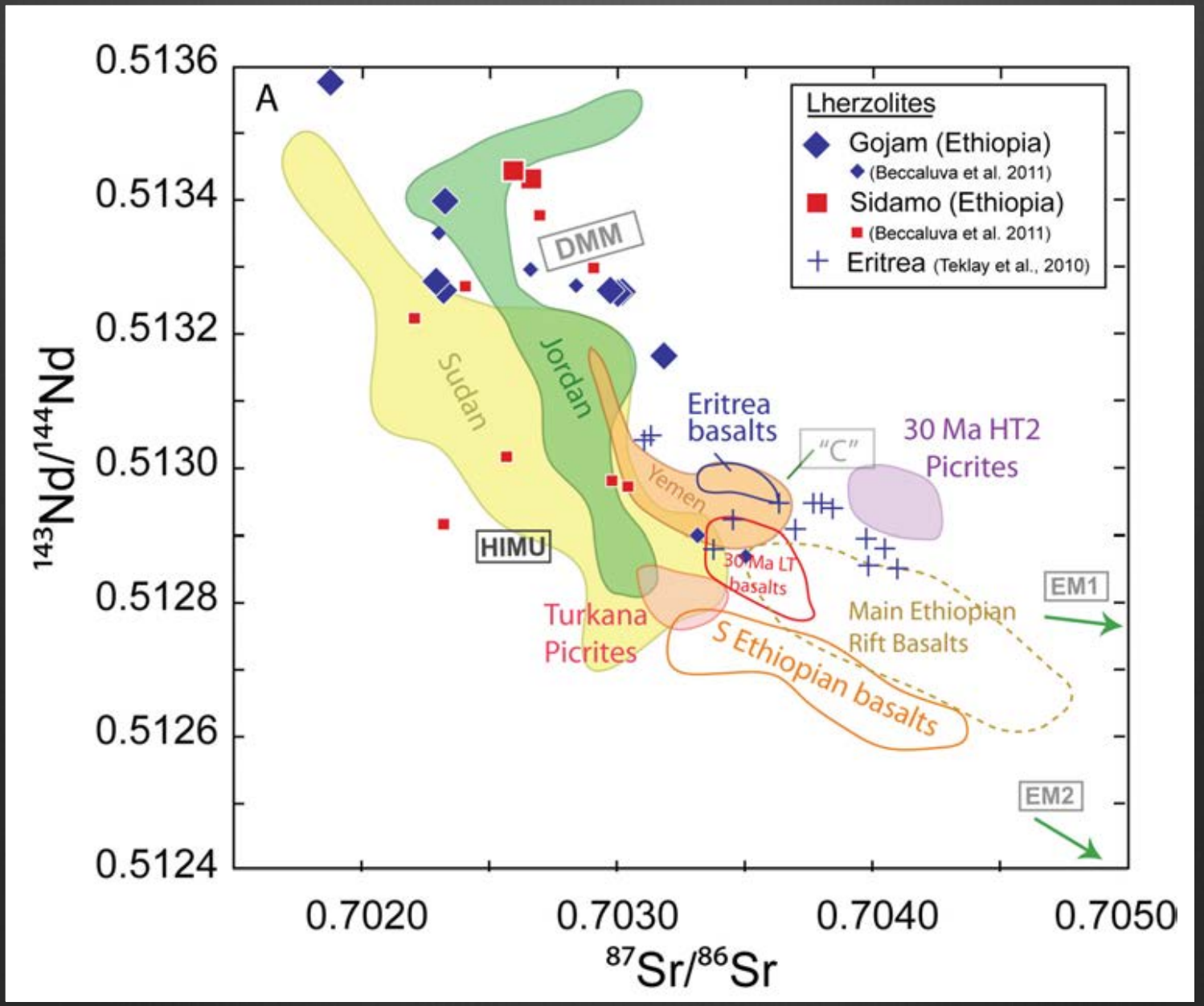
Other notable xenolith localities in Sudan, Saudi Arabia, and Jordan

Mantle Mineralogy: What we know

- Ethiopia & N Kenya
  - Dominantly spinel lherzolite & harzburgite (± amphibole)
  - Rare dunite and websterite
  - Pyroxenite (N Kenya only)
- Western Rift (Uganda)
  - Clinopyroxenites and glimmerites
- Kenya Rift (S Kenya & Tanzania)
  - Spinel lherzolite & harzburgite
  - Garnet lherzolite
  - Abundant dunite (Tanzania)
  - Minor pyroxenite and glimmerite

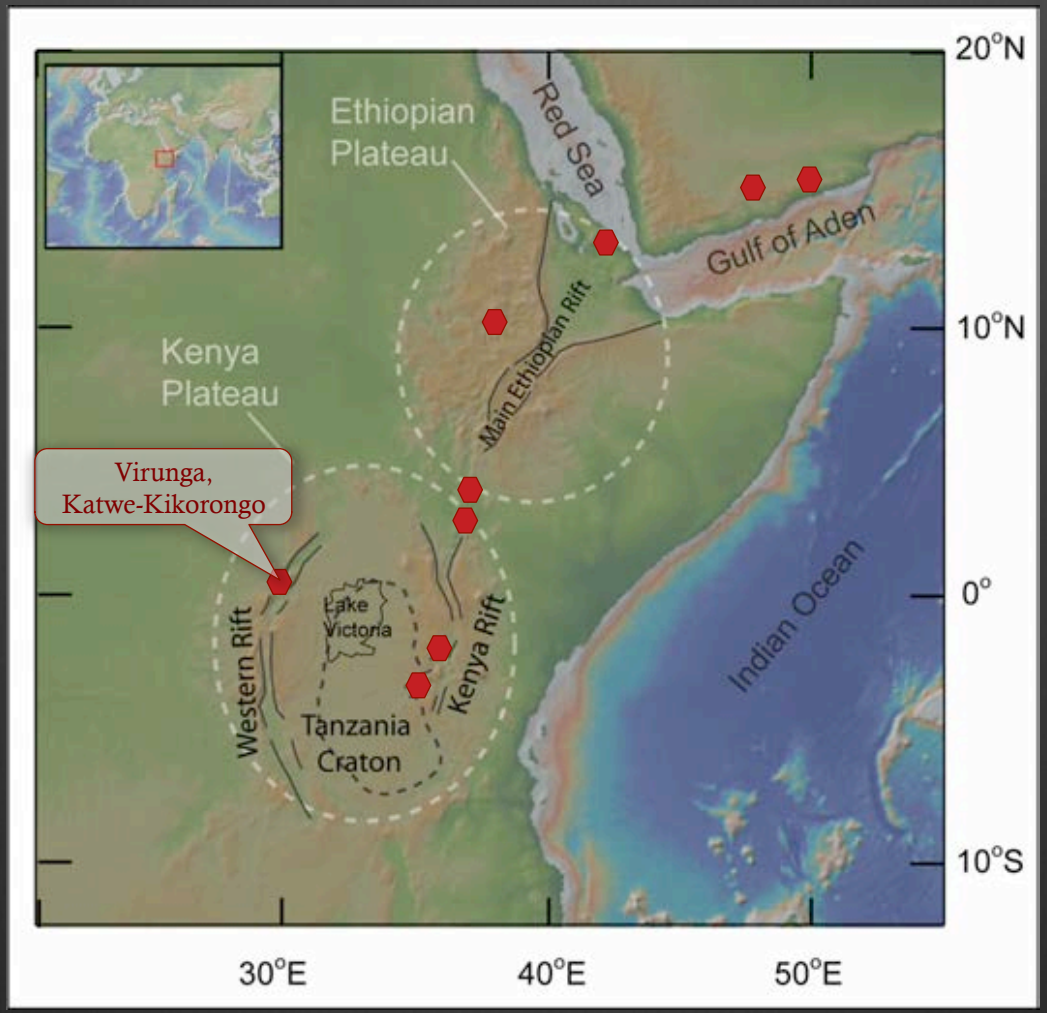
Mantle Xenolith Localities

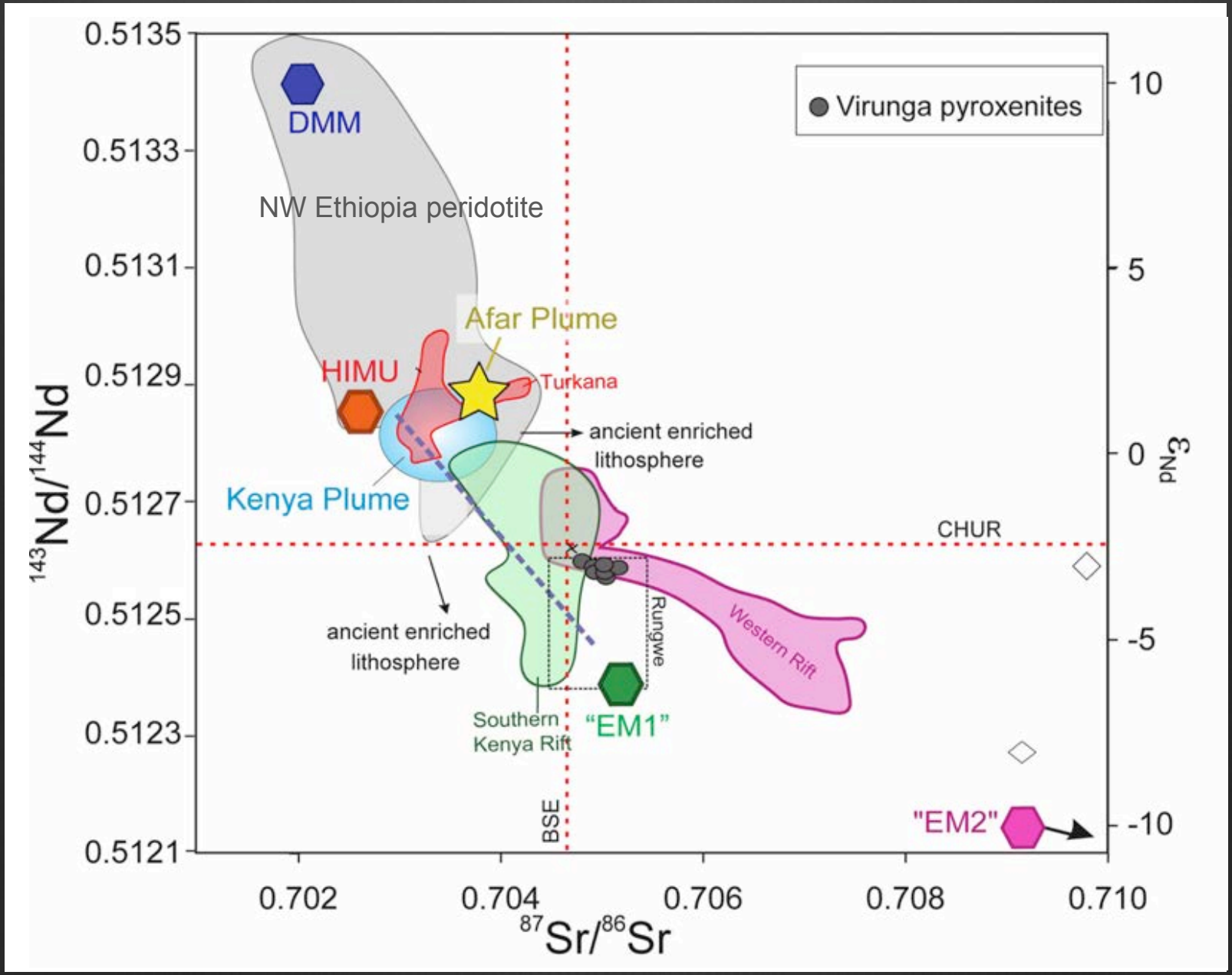




(Baker et al., 1998; Pik et al., 1999; George & Rogers, 2002; Furman et al., 2006; Shaw et al., 2007; Lucassen et al., 2008; Teklay et al., 2010; Beccaluva et al., 2011; Nelson et al., in prep; Rooney et al., 2012)

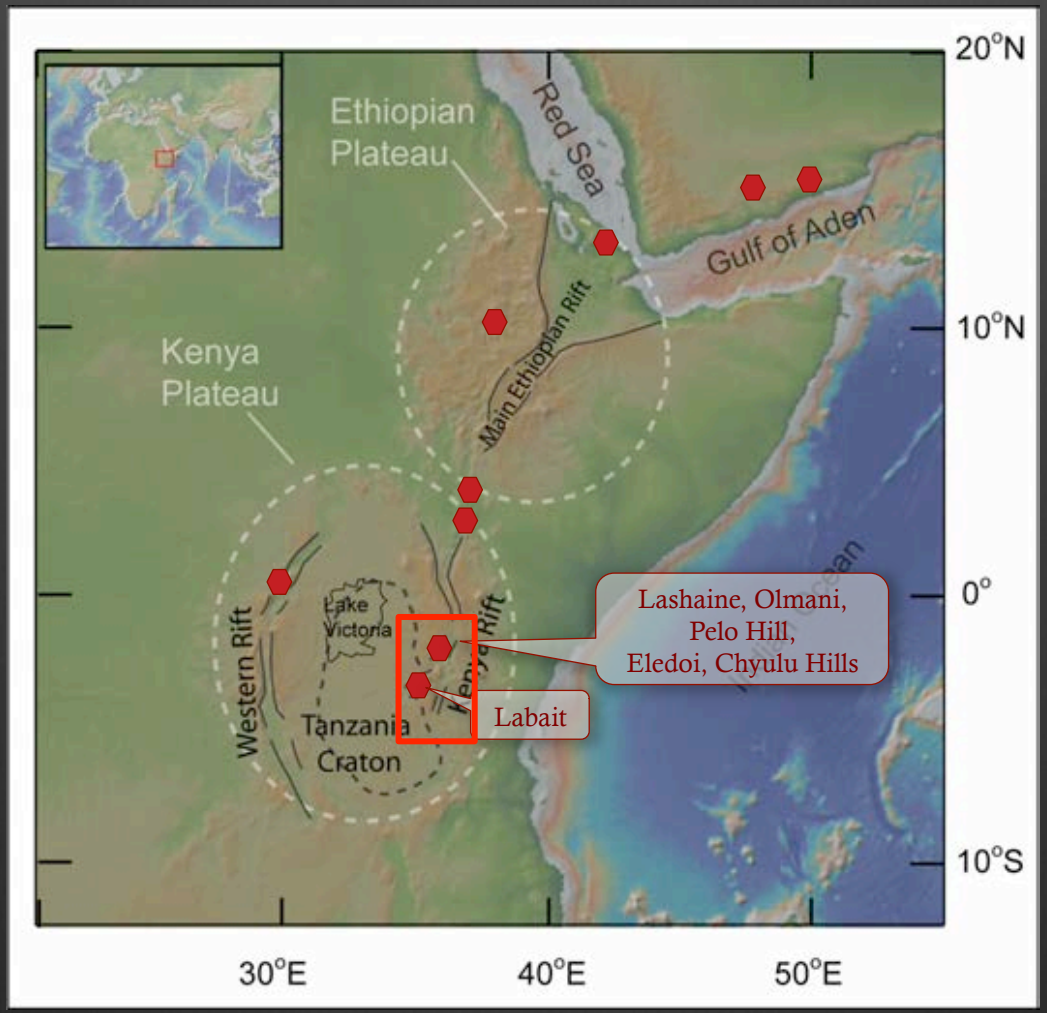
Mantle Xenolith Localities



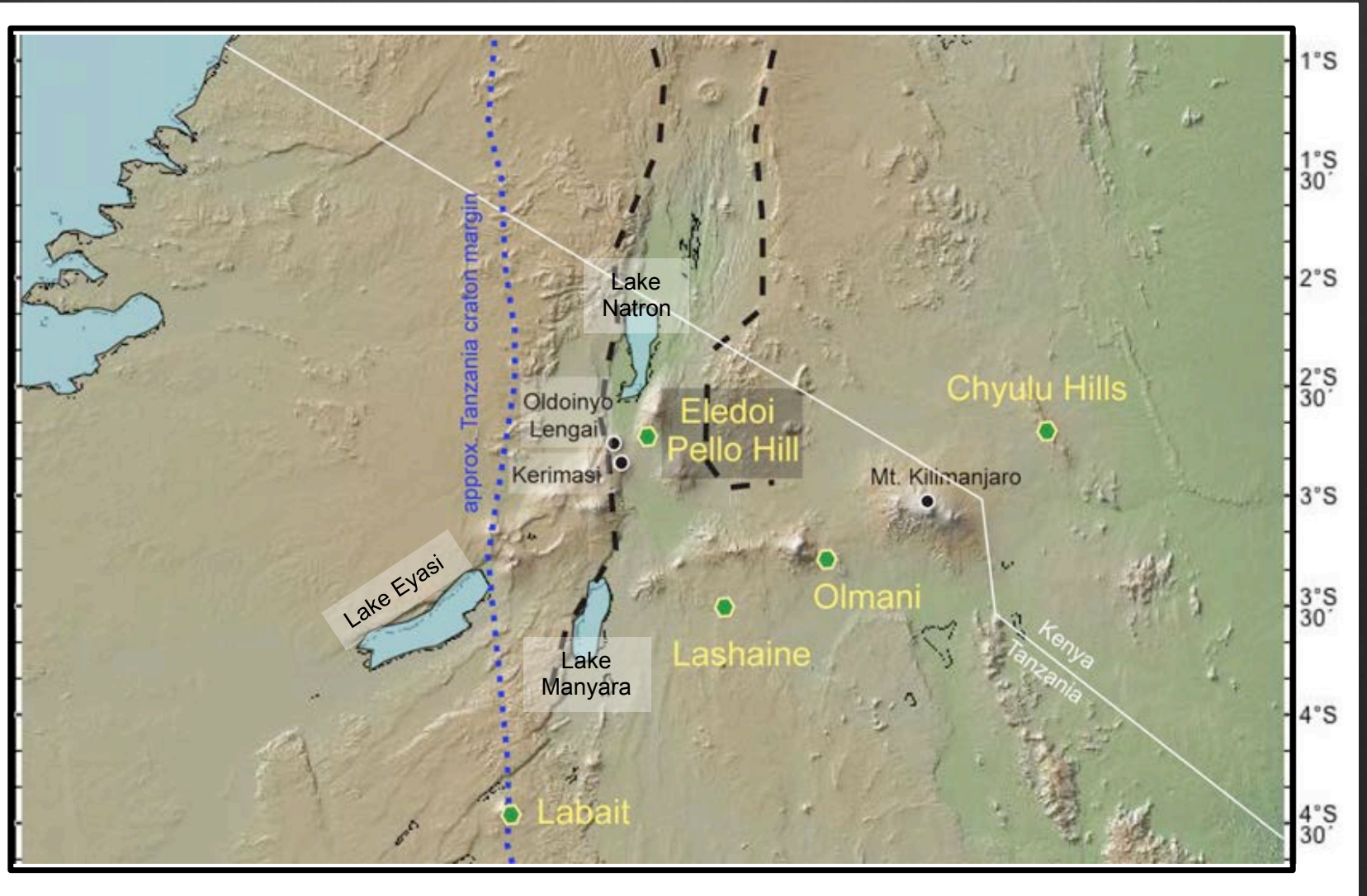


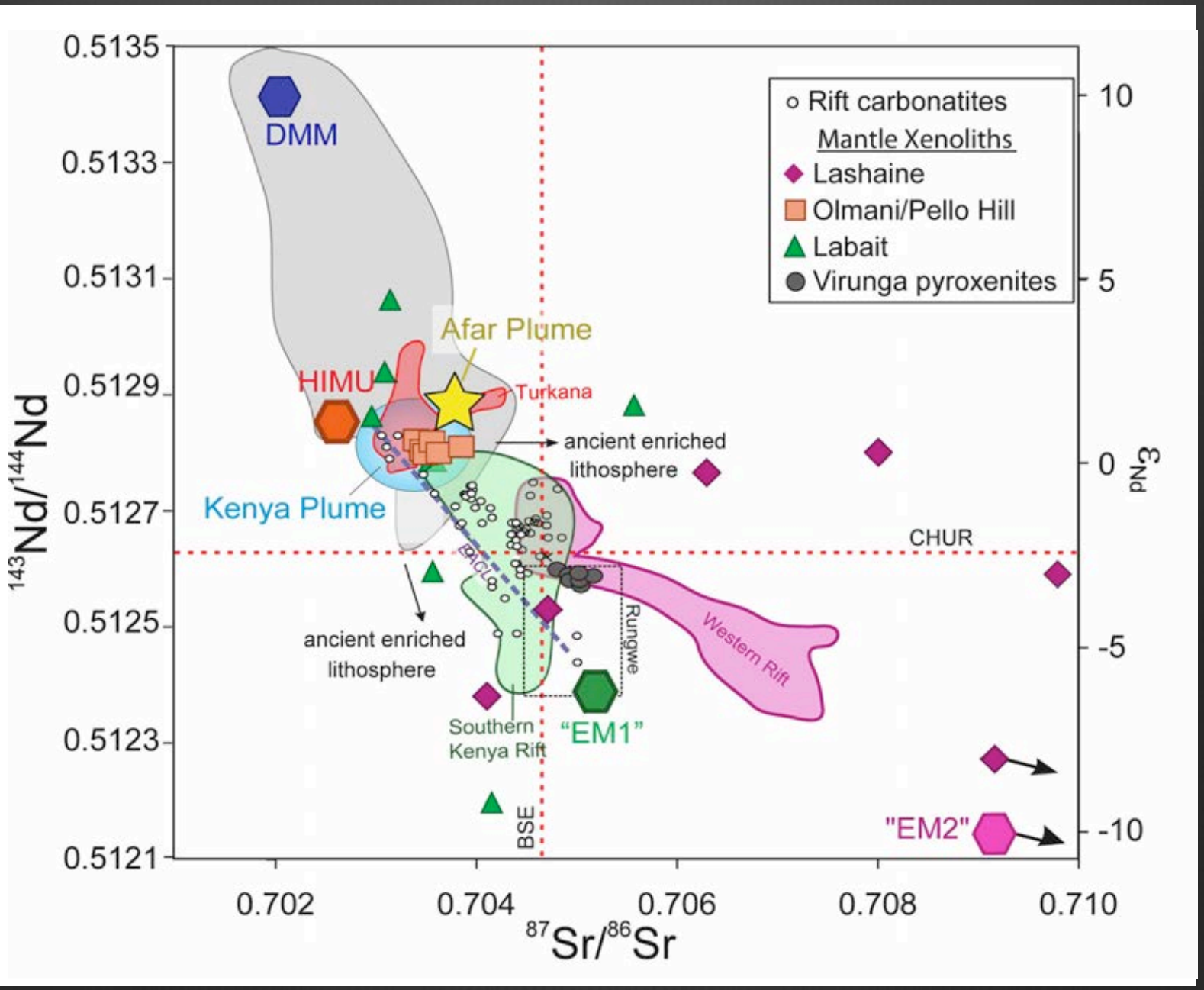
Modified after Aulbach et al. (2011). Additional data from Baker et al. (1998), Beccaluva et al. (2011), Furman et al. (2006),

Mantle Xenolith Localities



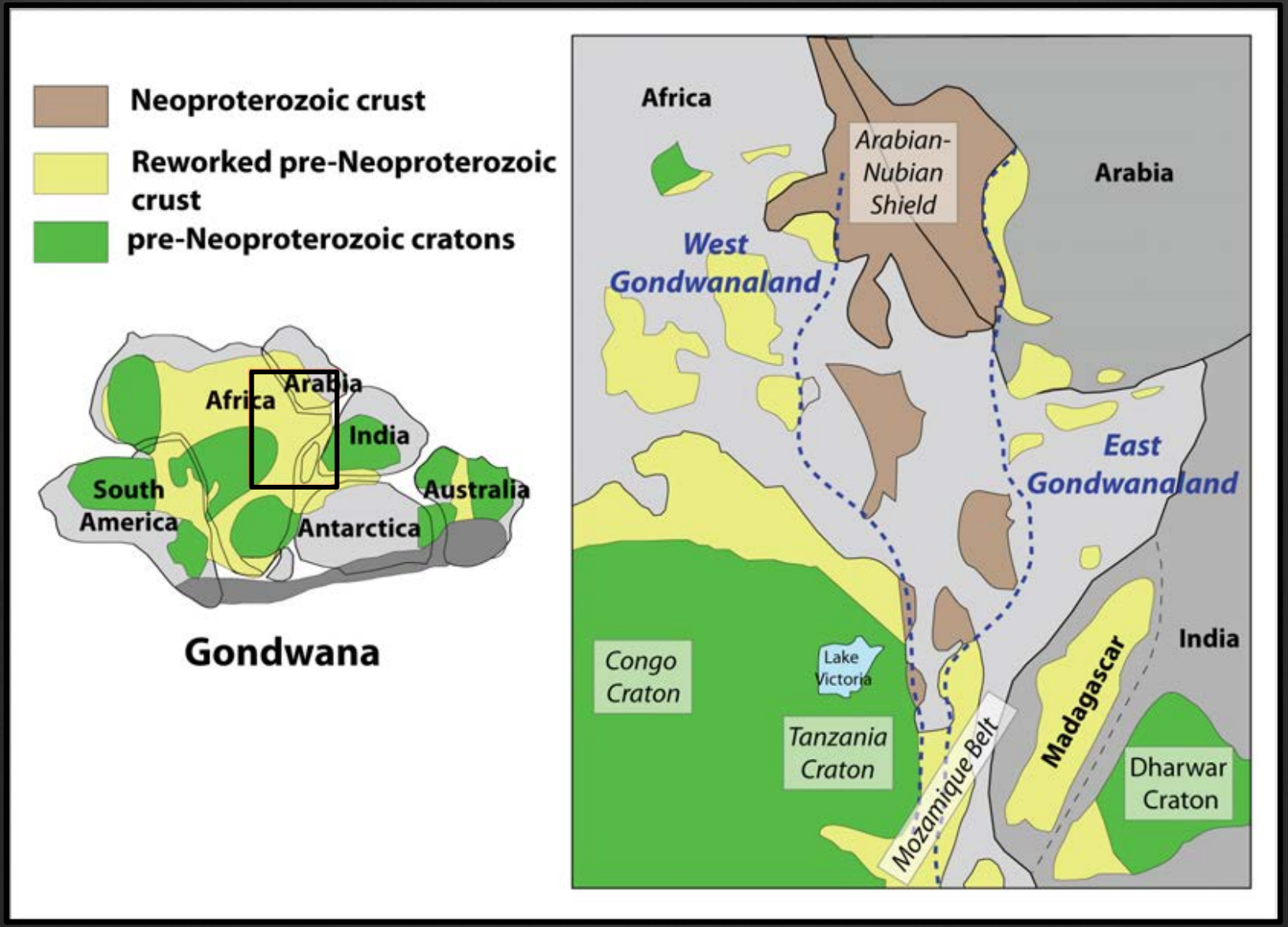
Kenya Rift Xenoliths





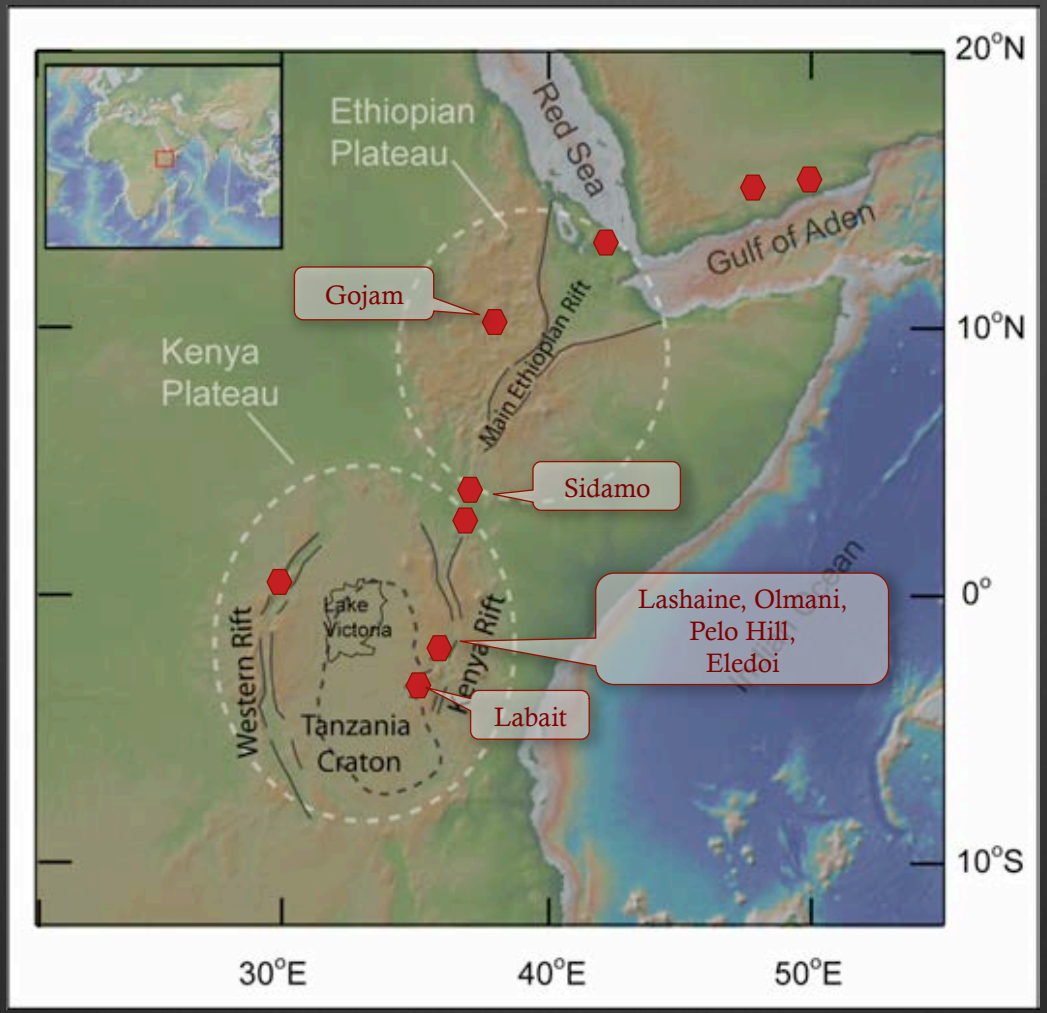
Modified after Aulbach et al. (2011). Additional data from Baker et al. (1998), Beccaluva et al. (2011), Furman et al. (2006), Lucassen et al. (2008), & Teklay et al., (2010).

Pan-Africa: 900-500 Ma

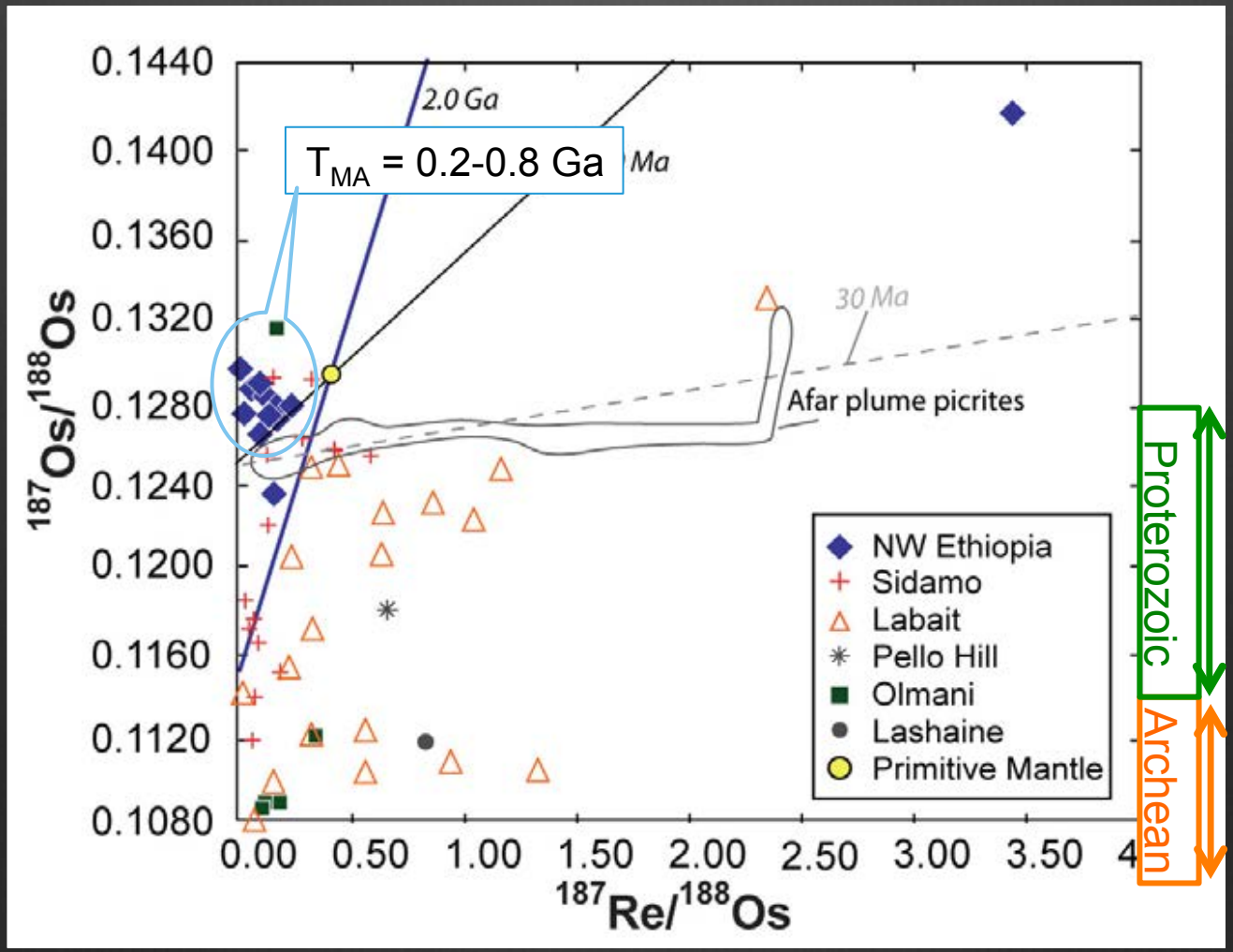


Modified after Stern (2002) and Küster & Harms (2011)

Localities with Os Data

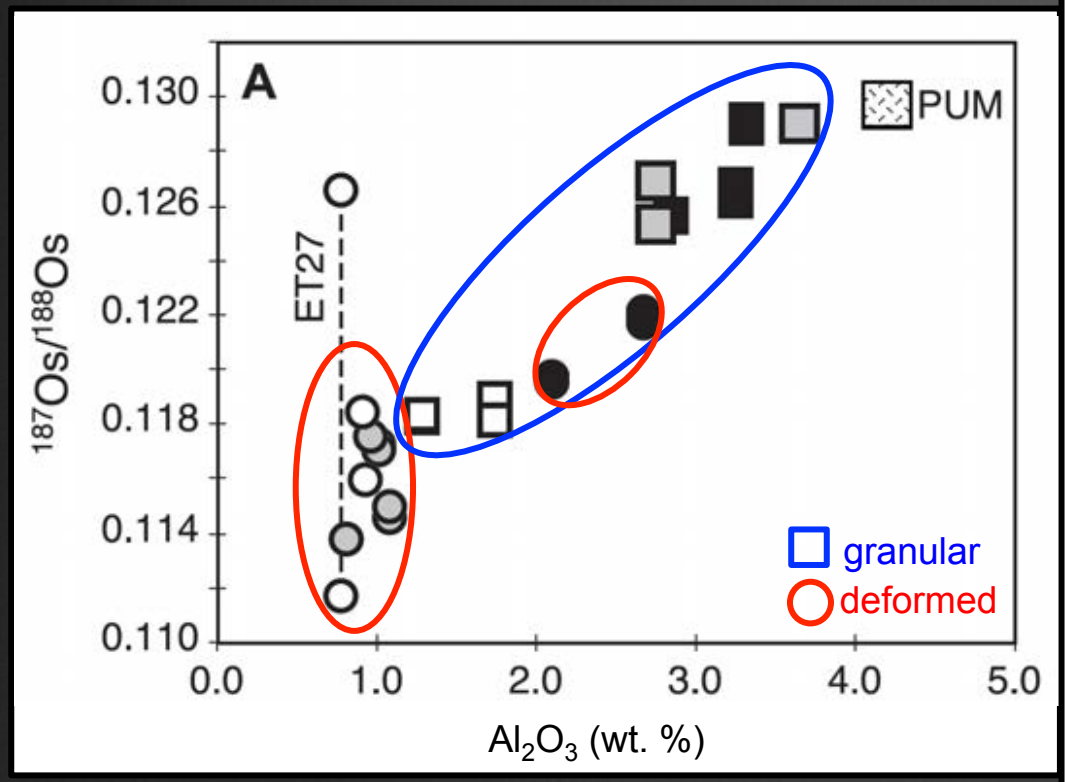


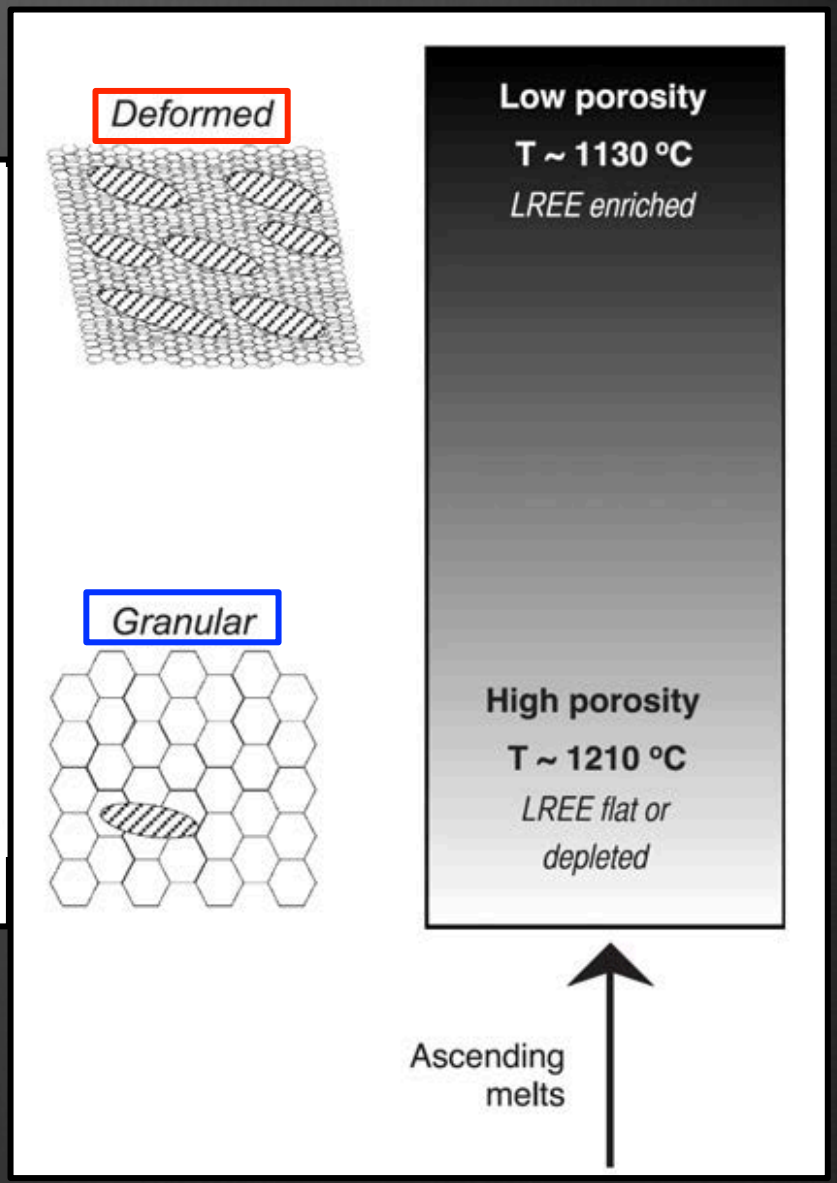
Mantle Ages



(Chesley et al., 1999; Burton et al., 2000; Reisberg et al. 2004; Rogers et al., 2011; Nelson et al., 2012; in prep)

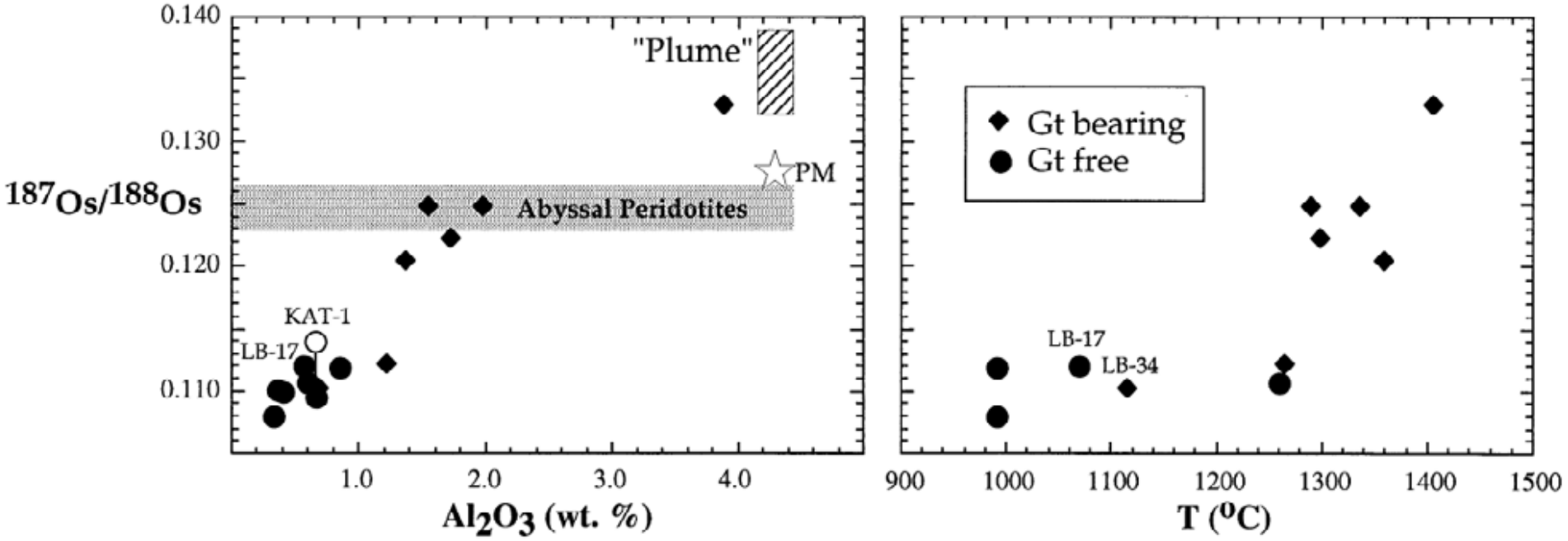
Sidamo (S Ethiopia)





(Reisberg et al., 2004)

Labait (Tanzania)



(Chesley et al., 1999)

Summary

- Lithosphere beneath the EARS is geochemically heterogeneous.
- Heterogeneities reflect
  - Different ages
  - Interaction with plume fluids and melts
  - Ancient (Pan-African) metasomatism
- Questions
  - What role do chemical heterogeneities in the lithosphere play in rift initiation and propagation in various portions of the EARS?
  - How has rifting modified the lithosphere?