

Proterozoic mantle lithosphere beneath the East African Rift (Southern Ethiopia): In situ Re-Os evidence

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The Os isotope compositions of sulfides in spinel lherzolites hosted by Quaternary alkali basalts from NE of the Turkana Depression, S. Ethiopia, reveal the presence of Proterozoic subcontinental lithospheric mantle (SCLM) beneath the continental rift setting in East Africa. Most of the sulfides have subchondritic $^{187}\text{Os}/^{188}\text{Os}$ (<0.129). A large range in $^{187}\text{Re}/^{188}\text{Os}$ (0.003-0.809) suggests recent addition of Re, perhaps reflecting the Paleogene mantle plume activity, which not only caused the East Africa Rift but also significantly perturbed the SCLM in the region. Sulfides with low $^{187}\text{Re}/^{188}\text{Os}$ (<0.075 ; Griffin et al., 2002) yield similar T_{MA} and T_{RD} model ages of 1.1 ± 0.2 Ga, interpreted as the depletion age of the SCLM beneath the region. Re-Os mixing lines defined by sulfides in single samples give an initial $^{187}\text{Os}/^{188}\text{Os}$ (0.1184) consistent with formation of some volumes of the SCLM at ~ 1.3 Ga. T_{RD} model ages of sulfides can provide minimum estimates for the SCLM age and record later metasomatic events. All model ages of the sulfides suggest a main SCLM depletion age at 1.1 Ga with a later metasomatic event at 0.4-0.5 Ga. A few older ages (1.5-1.8 Ga) suggest the presence of older parts of the SCLM, but no Archean model ages were found. The SCLM depletion age of 1.1 Ga is consistent with the known Meso-Neoproterozoic crustal evolution event of the East African Orogen (Stern, 2002), and the 0.4-0.5 Ga may be related to closing stages of the Paleozoic Pan-Africa orogeny. The sulfide Re-Os data show that Proterozoic SCLM has survived the extensive continental rifting due to the mantle plume.

REFERENCES

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Stern, R., 2002, JAES, v. 34, 109-117.