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The geochemical criteria of plume origin for Cenozoic volcano-rocks, Main Ethiopia Rift(MER) : A review

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Based on the compilation of the published sources as well as our unpublished geochemical data[1], utilizing the geochemical software of igneous petrology to deal with litho-geochemical data, the authors of this paper discuss the origin of Main Ethiopia Rift (MER), its tectonic setting and the characteristics of provenance.

The most Cenozoic volcanic rock types of MER are significant both within alkaline basalts(seldom basanite), the phonolite–trachyte plugs and no andesite-dacite and/or alkaline andesite between them in northern Ethiopia [2]. The geochemical characteristics indicate the basalts with high Ti, Fe , Mg and Zr/Nb ratio (9 – 18) and rhyolite with lower Ti, Fe , Mg and Zr/Nb ratio(<9) in Afar Basin[3、 4]. The petrologic diversity of volcanic rocks erupted in MER consists of continental flood basalt (CFB)-syn-rift basalts (similar to MORB) and acidic rocks ,especially lack of intermediate rocks (basaltic andesite to andesite) with a gap of SiO₂ ranging 54%~58%, that exhibit the characteristics belonging to the series from tholeiitic to adjacent calc-alkaline area nearby,and also bimodal volcano-rock series. However, the volcanic rocks of MER were generated by mantle plume. According to La/Nb and Ce/Pb ratios, they may be classified into two types: uncontaminated primary mantle and/or contaminated by continental crust[5、 6、 7]. The important criteria to determinate the primary mantle uncontaminated by crust mainly depend on the ratios of $La/Nb \leq 1$ and $Ce/Pb > 30 \sim 50$ (Figure) .

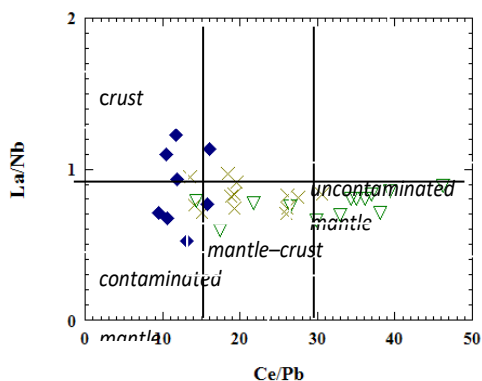


Figure1: Discrimination diagrams of La/Nb-Ce/Pb(after Rooney et al.2007) for MER volcanic rocks derived from uncontaminated mantle and contaminated mantle.

$La/Nb \leq 1$ = mantle origin ; $Ce/Pb < 16$ = contaminated mantle by crust ; $Ce/Pb < 16 \sim 30$ = mantle–crust zone ; > 30 = uncontaminated

mantle (Legend : ×-Oligocene-Miocene basalts (CFBs) of MER (plume in Afar basin) [4] ; ▽- Recent rift basalts of MER [4] ; ◆- Oligocene-Miocene rhyolite in Afar basin[8].

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