

Petrogenetic Study of Cenozoic Volcanism in Yabello and Amaro Regions, Southern Ethiopia (A PhD Research in Pheasant Memorial Laboratory)

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Abstract

Basaltic magmatism in southern Ethiopia is erupted in four major phases: pre-rift transitional tholeiites (45-35Ma), syn-extensional alkali basalts (19-11Ma), post-rift dominantly alkaline basalt (4-3 Ma and < 2 Ma). Controversial Plume-lithosphere interaction models are proposed to the genesis of these basalts.

In the first study (Amaro) area basalts from late Eocene to Quaternary are exposed. Hence, this area is an ideal place to study genesis of Pre- syn-, and post-rift basalts. The second (Yabello) area is found with in the eastern part of the broad rift zone, Turkana depression. Volcanic rocks in the Yabello region occurred as lava flows, spatter cones, scoria cones and maars, and are dominantly basaltic in composition, with pyroclastic deposits and minor phonolites, trachytes, and rhyolites. The basalts of this area are erupted in three phases: 1) Miocene (10.5 - 12.7 Ma) alkali basalt, 2) Pliocene (3.6 - 4.7Ma) tholeiitic basalt, and 3) Quaternary (0.2 - 1.9 Ma) basalt.

The main objective of this work is to conduct comprehensive petrological, geochemical, and geochronological investigation on pre-, syn-, and post-rift volcanic successions in southern Ethiopia (Yabello and Amaro areas). The purpose of the work is to address four outstanding questions of magmatism in continental rifting: Do the mantle plume beneath east Africa trackable and varies? Do temporal (sequential) and spatial chemical variations exist in the flood volcanics and if exist what governs most i.e. pre-melting heterogeneities, variable degree of partial melting in the mantle or post-melting processes? Do the age and thickness of continental lithospheric mantle affect the magmatism in southern Ethiopia? What do comparative study of the southern (this study) and northern Ethiopia (previous) suggests for the evolution of plume dynamics and continental break-up?

Preliminary petrographic description of the Eocene (Amaro), Oligocene (Gamo) and the Pliocene (Eleweya) volcanics shows trachy andesitic composition with abundant plagioclase, olivine and scarce pyroxene phenocrysts. The syn-rift Miocene (Teltele) basalts are characterized by olivine and pyroxene phenocrysts with numerous oriented plagioclase situated in the groundmass. However, the Quaternary basalts of the area show spatial variation. Those Quaternary olivine basalts of Mega and Nech Sar areas are characterized by the abundant strongly iddingsitized olivine phenocrysts whereas the Quaternary basalts of Arbaminch and Bobem show similar phenocryst assemblages with the Eocene-Oligocene and Pliocene basalts. The future work will be to determine the geochronological and geochemical variations in these lavas.