Evidence for intermediate composition in bimodal basalt-rhyolite large igneous province

Dereje Ayalew[1], Pierre Barbey[2], Gezahegn Yirgu[1] and Bernard Marty[2]

[1]Department of Geology and Geophysics, Addis Ababa University, P O Box 1176 Addis Ababa, Ethiopia

[2] CRPG-CNRS, B.P. 20, 54501 Vandoeuvre-les-Nancy, France

ABSTRACT

The rhyolitic ignimbrites from Were Ilu area are unlike most of the ignimbrites from Ethiopian CFB province, being contained phenocrysts and microphenocrysts of plagioclase (An_{23-39}), augite ($En_{30-34}Wo_{36-38}Fs_{29-35}$), pigeonite ($En_{34-37}Wo_{9-10}Fs_{54-56}$) and titanomagnetite, typically occurring as glomerophyric clusters. Inclusion relationships suggest that the sequence of crystallization of minerals should be pigeonite < augite < Ti-magnetite < plagioclase. These phenocrysts show embayed and rounded margins indicating resorption. The glass inclusions within plagioclase phenocrysts are compositionally akin to the matrix glass. Mineral compositions are inconsistent with the host rhyolites. Textural and mineralogical characteristics suggest that the phenocrysts were not in equilibrium with (i.e. crystallized before) the host rhyolite and that they must have crystallized from an iron-rich intermediate magma. This provides strong evidence for the coexistence of intermediate magma with rhyolite. The absence of intermediate products is believed to be related to the crystal load which lessen their probability of eruption.