MINERALOGY AND PETROLOGY OF THE MIOCENE-PLIOCENE AGUACATE VOLCANIC ROCKS OF COSTA RICA

Weiland, T.J.[1] and Suayah, I.B.[2]
[1]Department of Geology, Georgia Southwestern College, Americus, GA 31709
[2]Department of Geology, CB #3315, University of North Carolina, Chapel Hill, NC 27599-3315

ABSTRACT

Aguacate Formation is a Miocene to Pliocene volcanic sequence exposed along the Cordillera de Tilarán and Fila de Aguacate of Costa Rica. Emplacement of the sequence coincides with the emergence of southern Central America and the closure of the "mid-American channel".

The Aguacate Formation consists of a thick (up to 800 meters) sequence of lava flows, tuffs, agglomerates, volcaniclastic sediments and concomitant shallow intrusions. The lava flows are typically porphyritic and range in composition from basalts to andesites (49 to 62 wt. % SiO_2). Microprobe and modal data show that: (1) plagioclase (AN_{93} to AN_{46}), clinopyroxene ($EN_{50}FS_{15}WO_{35}$ to $EN_{42}FS_{13}WO_{45}$) and Fe-Ti oxide phenocrysts are ubiquitous in all samples; (2) olivine (FO_{75} to FO_{65}) is present in basalts and basaltic andesites; and (3) orthopyroxene ($FS_{28}EN_{72}$ to $FS_{33}EN_{67}$) occurs in basaltic andesites and andesites. Plagioclase xenocrysts as well as mafic to intermediate volcanic/plutonic xenoliths are common in samples of all compositions.

Chemically, the Aguacate Lavas are calc-alkaline, predominantly medium-K (mean K_2O-1.44 wt. %) basaltic andesites and andesites. Compositional variability shows that as SiO_2 increases: (1) K_2O, Na_2O and Ba increase; (2) MgO, CaO, FeO* and V decrease; (3) Al_2O_3, TiO_2, P_2O_5, Sr, Ni, Zr, Rb and Sr exhibit no definite trends. REE patterns lack Eu anomalies and display LREE enrichment (La_N/Yb_N = 2.6 to 23.7) with relatively unchanged HREE compositions (Yb_N = 7.05 to 8.64).

A multi-process magmatic evolution involving separation of mafic phases and mixing of variably differentiated and probably co-magmatic pulses best explains the observed geochemical trends, common disequilibrium textures and abundant glomeroclasts/xenoliths.