Abstract

Parulo and Pulumbura volcanoes are located in the North of the Western Cordillera in Ecuador. Parulo is the closest volcano to the subduction trench and represents a small dome-coulée of an andesitic-basaltic composition. Pulumbura would be the oldest volcano (strongly eroded) of this area and forms lava-flows and domes of an andesitic to a dacitic composition. The geochemical, isotopic and petrographic data of both volcanoes suggest that the enrichment and impoverishment in some incompatible elements are the results of crustal processes such as recharge, fractional crystallization, and assimilation (basement or/and crystal-mushes). These results help to understand the formation of the andesites, which is the principal product in continental volcanic arcs and broadly coincides with the average composition of the continental crust. Besides, rocks with distinct geochemical ratios such as high Sr/Y and La/Yb (like Pulumbura) are often associated with porphyry-copper deposits, thus, understanding the processes of the formation of these rocks have an economic interest as well.

Parulo geochemical signatures are related to high-pressure fractionation of amphibole+ clinopyroxene+olivine and recharge processes, without forming a shallow magma chamber. This explains depletions in TiO_2, MgO, Ni, Cr, among other elements and enrichment as in Th and Sr. The petrography of Parulo is coherent with the absence of a shallower reservoir and with a fast magma ascent to the surface from a deep reservoir. Recharge processes are consistent with the petrography as well, for the presence of abundant amphibole, which often has rims with slight changes in their composition (e.g., Mg#).

Pulumbura rocks formed with an initial magma source similar to Parulo (mantle-derived melts), which suffered a first fractional crystallization in the lower crust. Afterward, fractionation and mixing processes were developed in the middle-upper crust, where the magma cooled more efficiently producing a more extensive volcanic activity of surface with a broader compositional range. Amphibole data shows P-sensitive replacements (Al_{IV} versus Al_{VI}), indicating that Pulumbura rocks formed at variable pressures, some of them could be linked with more superficial magma-reservoirs. The speed of the magma ascent is variable in Pulumbura, the amphibole of the first (Old Pulumbura) and the last (Avisagala-Chaparumi group) phase, in general, do not present gabbroic rims, suggesting that probably the magma ascended fast, which did not allow destabilization of the amphibole. Only the second phase (Sunirumi group), present some gabbroic rims; thus, Sunirumi could have periods of fast and slower magma speed ascent.