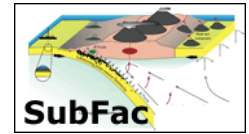


Investigating the processes and timescales of andesite differentiation: a comprehensive petrological and geochemical study of Arenal Volcano, Costa Rica



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In September 2006, a special issue of JVGR entitled: "Arenal Volcano, Costa Rica - Magma Genesis and Volcanological Processes" was published with 16 articles on the current eruption, eruptive history, and hazards presented by Arenal Volcano in Costa Rica. Several of the papers in this issue were funded by MARGINS or MARGINS-related NSF grants. The principal contribution from U. Iowa (Reagan et al., 2006) described disequilibria between ²¹⁰Pb (half-life = 138 d), ²¹⁰Pb (half-life = 22.6 y), and ²²⁶Ra (half-life = 1,600 y) in whole rocks and plagioclase mineral separates erupted between 1968 and 2003. These data combined with other U-series data from Tepley et al. (2006) suggested that the time-frame of differentiation from basalt to basaltic andesite was between several hundred years and several decades. Lava erupted in 1971 had (²¹⁰Pb) in excess of (²²⁶Ra) by as much as a factor of 2 (Figure). These lavas were the first to mark the change in geochemical trend, which was attributed to the beginning of progressive mixing of recharge magma into an original shallow magma body by Ryder et al. (2006). This coincidence suggested that the ²¹⁰Pb excess was only in the uppermost part of the intruding magma, and was attributed to Rn degassing from large volumes of underlying magma or Rn extraction from conduit-area rocks due to cracking and heating. Equations used to model the duration of the Rn flux, as well as the volume and depth of magma needed to produce the radon were produced for the paper. Plagioclase mineral separates had ²¹⁰Pb - ²¹⁰Pb - ²²⁶Ra disequilibrium patterns suggesting a growth period stretching over a period of more than 50 years up to the time of eruption.

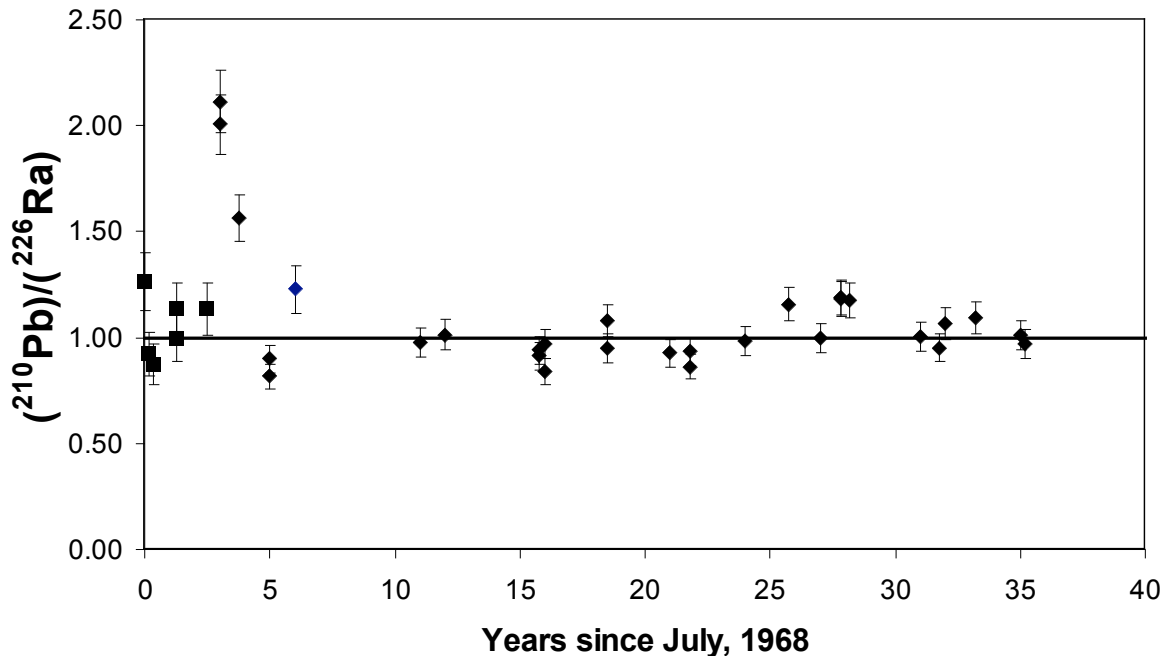


Figure: Plot of (²¹⁰Pb)/(²²⁶Ra) values corrected for time between eruption and the date of measurement Squares represent lavas erupted from the original shallow magma body. Diamonds represent the compositions of lavas resulting from mixing of this original magma with a recharge magma as well as crystal fractionation (Ryder et al. 2006).

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Ryder, C. H., Gill, J. B., Tepley III, F., Ramos, F., Reagan, M., 2006. Closed to open system differentiation at Arenal Volcano (1968-2003). *Journal of Volcanology and Geothermal Research*. 157, 75-93.

Tepley III, F. J., Lundstrom, C. C., Gill, J. B., Williams, R. W., 2006. U-Th-Ra disequilibria and the time scale of fluid transfer and andesite differentiation at Arenal Volcano, Costa Rica (1968-2003). *Journal of Volcanology and Geothermal Research*. 157, 147-165.

