Geophysical Research Abstracts, Vol. 7, 02656, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02656

'Adakitic' rocks of the Yungay Formation, Peru: problems with tectonic setting and origin

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The Yungay Formation, Cordillera Blanca (9˚S) is characterised by strong depletions in Y, Yb and HREE's (La/Yb 30-40, Sr/Y 80-100, Na_2O>5wt %), with Mg numbers ranging from 10-50. These data differ significantly from Cretaceous and Eocene lavas in western Peru, which show classic arc signatures of high-Mg, LILE-enriched calc-alkaline compositions. The Yungay characteristics have been used by some to denote a slab melt origin (adakite); however in this region such a mechanism is highly unlikely. The high-K content of the Formation makes an origin from low-K tholeiitic MORB doubtful. Equivalent chemical compositions found in the adjacent Cordillera Blanca Batholith (CBB) show formation through melt of underplated mafic crust. Ar-Ar dating on Yungay mineral separates gives an age range in the Quecha III (6.4-6.2$\pm$0.1 Ma), a period of abnormal crustal thickening (>50km), rapid exhumation and shallowing of the subducting Nazca Plate from c. 30˚ to c. 5˚. If the Yungay Group 'adakites' formed via slab melting, $\sim$300km of flat-slab travel with no de-watering reactions would have to take place. The Yungay ignimbrites and the CBB are found on either side of the Cordillera Blanca Fault (CBF), with both appearing to have exploited this deep crustal lineament and implying a common structural link between their source regions. However, the presence of adakite-like rocks cannot be used solely to categorize tectonic setting; thermal models, analyses of water contents and isotopic compositions in melt inclusions can all be used to further constrain an origin environment. Preliminary results of mineral pair (Qtz-Bt) oxygen isotope equilibria suggest eruption temperatures of >900˚C, consistent with partial melt of lower crust due to periodic influx of mantle-derived basalt. A combination of analytical techniques needs to be used when determining an origin for these rocks, instead of a classification based wholly on geochemical models.