Geophysical Research Abstracts,
Vol. 10, EGU2008-A-10767, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-10767
EGU General Assembly 2008

Changing regimes in sub-volcanic magma systems in the Central Andean Volcanic Zone due to sector collapse

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Magmas in the Central Andes traverse c. 70 km of continental crust and their plumbing systems are prone to be complex, varied in style with time, and distinct in space, depending on (a) magma composition and supply rate from the mantle, (b) depths of storage, (c) density structure of the crust and (d) changing loads by flank collapse of the stratovolcanoes. The latter may be particularly frequent in the Central Andes due to the extremely arid climate of the Atacama Desert and thus very limited erosion during stratovolcano growth. In fact, there are numerous examples of debris avalanche deposits flanking stratovolcanoes between 16 deg and 26 deg S in the Central Andes.

Geochemical, geochronological and mineral chemistry data from distinct stratovolcanoes of the Central Andes are presented here to document contrasting magmatic evolution and plumbing systems. The 163 ka history, composition and volumetric evolution of Volcan Parinacota (basaltic andesite to rhyolite) reveals the existence of distinct evolutionary phases and magma batches that evolve separately and partly overlap in time. Recharge history is distinct in these phases as shown by major and trace elements of erupted magmas as well as Sr, Mg and Fe-zoning in plagioclase phenocrysts. The magma system has been severely disturbed after a 6 km3 sector collapse resulting in changing rates of eruption and mixing.

By contrast, Volcan Taapaca ($>$ 1Ma) is a rather montonous complex of dacite domes with uniform petrography. Dome collapse events were frequent but of small volumes. Only one major sector collapse occurred, which, however, did not lead to any measurable change in magma composition or eruption rate. We attribute this contrasting behavior to the depth of magma emplacement within the crust were the shallower Parinacota magma system is more sensitive to unloading by sector collapse.

Other Andean stratovolcanoes, where sufficient geochemical data exist (Ubinas and El Misti, S. Peru) are contrasted and compared with these examples.