EVOLUTION OF THE ANDEAN CENTRAL VOLCANIC ZONE: FROM CONTAMINATION OF ARC ANDESITES TO LARGE-SCALE CRUSTAL MELTING

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Neogene volcanic rocks in the Central Volcanic Zone of the Andes show punctuated changes in composition and eruptive style in the late Miocene which reflect changes in the thermal regime of the arc crust. Chemical and isotopic data from andesitic centers at 25°S, whose ages are 20, 16, 11, 8, 5, 2 and 1 Ma, show that crustal contamination of arc andesite increased sharply at the end of the Miocene (8 - 5 Ma), and remained at a high level (ca. 30%) to the Quaternary. The contamination process is inferred to be assimilation of crustal melts and the timing of increased contamination of andesite coincides with major ignimbrite emplacement in the Altiplano-Puna Volcanic Complex at 21-24°S. These large-volume felsic ignimbrites are dominantly of crustal origin (eNd = -7 to -9; Sri = 0.7084-0.7132); thus magmatism involved recycling of the basement and little net crustal growth. Preliminary thermal modelling shows that heat provided by ponding of andesitic magmas in the crust would suffice to produce crustal melting on the scale observed. Petrologic models for the source depth of the Pliocene ignimbrite magmas (20 - 30 km) agree roughly with the location of geophysical anomalies present today under the arc at 22-24°S. Low P-wave velocities, attenuation of S-waves, gravity minima and high electrical conductivity in the mid crust (below 20 km) are consistent with a zone of partial melting. This suggests that the thermal conditions for mid-crustal melting established in the late Miocene arc are still present.