Two differentiation trends and parent magmas at Calbuco volcano (CSVZ, Chile)

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We have investigated the geochemistry of bulk rock lavas as well as naturally quenched and experimentally homogenized melt inclusions (M.I.) hosted in olivine, plagioclase and pyroxene of the Calbuco stratovolcano situated in the central Southern Volcanic Zone (CSVZ) of the Andes. Lavas (basalts to dacites with a predominance of basaltic andesites) and M.I. range in composition from 45 to 76 wt. % SiO_2 with a restricted compositional gap between 61.5 and 63.5 wt. % SiO_2. From 45 to 61.5 wt. % SiO_2, both bulk rock and M.I. analyses define two differentiation trends that differ by their MgO content. In the AFM diagram, the high- and low-MgO trends respectively plot in the calc-alkaline and tholeiite fields. Moreover, in Harker diagrams with wt. % MgO as the differentiation index, the high-MgO trend is higher in SiO_2, K_2O, Rb, Ba, Y, Ce, Th, U, Zr, Nb and lower in TiO_2, Al_2O_3, FeO, CaO, V, Ni, Cu than the low-MgO trend. Melt inclusions analyzed in highly magnesian olivine (Fo>80) correspond to the least differentiated compositions and are silica-saturated (hypersthene normative) and silica-undersaturated (nepheline normative) in respectively the high- and low-MgO trends. The two parent magmas could have been produced by differentiation either from a common primary magma or from two distinct primary magmas that result from varying extent of partial melting or source heterogeneity. Modelling of the high-MgO differentiation trend indicates that mixing and fractional crystallization are both possible differentiation processes.