



## The origin of pyroxene megacrysts in alkali basalts from Patagonia, Argentina

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Clinopyroxene and orthopyroxene megacrysts have been brought to the surface together with mantle xenoliths by Neogene and Quaternary alkali basalts from the back-arc environment in Patagonia. The collected megacrysts are from Pali Aike Volcanic Field (El Ruido, maar) and the Gobernador Gregores cinder cone in southern Patagonia, and from the Laguna Fria outcrop in northern Patagonia.

The most frequent pyroxene megacrysts are augites (twelve samples), one diopside and two enstatites. Enstatites were found in El Ruido and Laguna Fria. The augites are magnesian rich with MG# that vary from 73.1 to 75.3 in Gobernador Gregores, fairly constant at 76.6 in El Ruido and from 74.0 to 78.6 in Laguna Fria. The MG# of diopside is 91.1 and the two enstatites, one from Gobernador Gregores and the other from Laguna Fria, have MG#s 78.3 and 82.5 respectively. The Na<sub>2</sub>O and TiO<sub>2</sub> contents in augites vary from 0.99 to 2.06 wt% and from 0.69 to 1.86 wt% respectively. Systematically, the Gobernador Gregores augites have the highest TiO<sub>2</sub> and Na<sub>2</sub>O contents. The primitive mantle normalized REE abundances have concave upwards patterns. While the Gobernador Gregores augites have (La/Y)<sub>N</sub> ratios that vary from 2.4 to 3.8, the El Ruido and Laguna Fria augites have ratios that vary from 0.91 to 1.74. The enstatites from both localities have similar MREE but they differ markedly in their LREE (in GG La<sub>N</sub>=0.04xPM and in El Ruido La<sub>N</sub>=0.14) and in their HREE (in Gobernador Gregores Yb<sub>N</sub>=0.25 and in El Ruido Yb<sub>N</sub>=0.6). The AL IV/AL VI in all augites is high and vary from 0.75 to 1.07 suggesting that they have been formed at - more than 30 km depth.

The calculated minimum equilibrium temperatures vary between 1260 to 1320°C. Pressure estimates for augites, with exception of the El Ruido augites with a pressure of 1.65 GP, vary between 1.27 and 1.47 GPa. Especially the pressure estimates from Gobernador Gregores megacrysts vary within a small interval from 1.29 to 1.36 GPa indicating an isobaric crystallization. The pressure of the orthopyroxene megacrysts compared to the augite megacrysts is higher and range from 1.56 to 1.72 GPa. The pressure estimate for the single diopside megacryst is 1.11 GPa which is the lowest pressure from all studied megacrysts.

The calculated hypothetical melts in equilibrium with clinopyroxenes megacrysts are of basanitic composition. The liquid lines of descent of various trace elements for these melts demonstrate the clinopyroxene control on a fractional crystallization process where the precipitation of other phases was insignificant.