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Magmatic Na-rich phlogopite in a suite of gabbroic crustal xenoliths from Volcán San Pedro, Chilean Andes: Evidence for a solvus relation between phlogopite and aspidolite

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ABSTRACT

Magmatic Na-rich phlogopite (1–5 wt% Na_2O) is present as a late-crystallizing mineral in two groups of texturally and mineralogically distinct gabbroic xenoliths at Volcán San Pedro (36°S, Chile), an Andean arc volcano. Phlogopites are characterized by high 100·Mg/(Mg + Fe) (up to 83) and high Cr_2O_3 contents (up to 0.4 wt%), and they are always found surrounding variably resorbed olivine, pyroxenes, Cr-spinel, and in some cases, plagioclase. We interpret these micas as the result of open-system processes involving infiltration of water-rich evolved melts [with high Na/(Na + K)] and reaction with refractory minerals. The highest 100·Na/(Na + K) (~70) and Na_2O concentrations (~5 wt%) in phlogopite appear to require reaction with liquids of unrealistically high Na/(Na + K) if no other factor is considered. This, together with the observation that phlogopites consist of alternating Na-rich and Na-poor cleavage-parallel bands, can be best interpreted by the presence of a solvus between the aspidolite (Na) and phlogopite (K) end-members. The high proportions (up to 15 vol%) of Na-rich phlogopite in two different groups of gabbroic xenoliths suggest that it might be a more common and abundant mineral than has been previously recognized, and that it may be used as an indicator of open-system processes.