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Petrogenetic Link between Aillikites and Carbonatites in the Tarim Large Igneous Province

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Despite their common field relationships, the petrogenetic links between aillikites and carbonatites remain controversial[1]. This study presents the results of a detailed geochemical and isotopic examination of the Permian Wajilitag aillikites in the northwestern Tarim large igneous province, including olivine major- and trace-element and (*in-situ* secondary ion mass spectrometry) oxygen isotope compositions and bulk-carbonate C-O isotopic analyses. Olivine in the aillikites occurs in two textural types: (i) microcrysts, 0.3-5 mm; and (ii) macrocrysts, 0.5-2.5 cm. The microcrysts exhibit well-defined linear correlations between Fo (79-89), minor and trace elements, indicating that these olivines are phenocrysts crystallized from the host aillikite magmas. Olivine phenocrysts in the more primitive aillikite dykes (Dyke 1) have relatively higher Fo_{82-89} and mantle-like oxygen isotope values, whereas those in the more evolved dykes (Dyke 2 and 3) exhibit lower Fo_{79-86} and oxygen isotope values that trend toward lower than mantle $\delta^{18}O$ values. The decreasing $\delta^{13}C$ values of carbonate from Dyke 1 through to Dyke 2 and 3 suggest that the low $\delta^{18}O$ values of olivine phenocrysts in Dyke 2 and 3 resulted from carbonate melt/fluid exsolution from a common progenitor melt. These lines of evidence combined with the overlapping emplacement ages and Sr-Nd isotope compositions of the aillikites and carbonatites in this area[2] indicate that these exsolved carbonate melts probably contributed to the formation of the Tarim carbonatites thus supporting a close petrogenetic relationship between aillikites and carbonatites.

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