

## Phenocryst O isotope constraints on the timescale of basaltic magmatism

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The O isotope ratios of phenocrysts from Cenozoic continental basalts of alkaline and theoleiitic compositions in eastern China were analysed by the laser fluorination technique. The results show  $\delta^{18}\text{O}$  values of 4.42 to 5.70‰ for clinopyroxene and 4.00 to 5.91‰ for olivine. Most clinopyroxene  $\delta^{18}\text{O}$  values are lower than the normal mantle values of  $5.6 \pm 0.2\%$ , with the lowest  $\delta^{18}\text{O}$  values of 4.42 to 4.86‰ in the alkali basalt. In contrast, most olivine  $\delta^{18}\text{O}$  values approach the normal mantle values of  $5.2 \pm 0.2\%$ , with a few alkali basalts having distinctly lower or higher  $\delta^{18}\text{O}$  values. There is also O isotope disequilibrium between coexisting clinopyroxene and olivine. The basalts appear to acquire supracrustal components from magma source, which was generated by subducting the  $^{18}\text{O}$ -depleted oceanic crust into the asthenospheric mantle. Because O isotope exchange by diffusion is very fast between the minerals and melt at mantle temperatures and thus capable of homogenizing the low  $\delta^{18}\text{O}$  signature with the normal mantle, preservation of the low  $\delta^{18}\text{O}$  values for the phenocrysts suggests very short duration of magma residence at mantle depths.

Quantitative estimates have been made on timescale of O isotope reequilibration during basaltic magmatism. Assuming 6 to 7 km thickness for the subducted oceanic crust and rates of 1000 to 2000 m/Ma for O transport within mafic crust, it is calculated that timescales of 1 to 2 Ma can result in complete O isotope reequilibration between the  $^{18}\text{O}$ -depleted subducted oceanic crust and the normal  $\delta^{18}\text{O}$  asthenospheric mantle. Such short timescales require that the low  $\delta^{18}\text{O}$  melts derived from the dehydrated oceanic crust would not transport through the convective asthenospheric mantle, but immediately metasomatize the overlying subcontinental lithospheric mantle.

The O isotope disequilibrium between clinopyroxene and olivine provides a further constraint. By taking the grain radii of clinopyroxene and olivine as effective diffusion radii, timescales of achieving O isotope reequilibration by diffusion exchange at  $\sim 1200^\circ\text{C}$  are calculated. The results show that under both anhydrous and hydrous conditions, the timescales required for diffusion reequilibration across both minerals are 1 ka and 0.01 ka, respectively. This suggests the maximum timescale for melting, transport and eruption could be less than 1 ka. In this regard, the low  $\delta^{18}\text{O}$  values would be inherited and then preserved in the most clinopyroxene and few olivine phenocrysts.

## Petrography, geochemistry and origin of cement dolomite in the Lower Paleozoic dolomite of the Central uplift, Tarim basin

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The early Paleozoic strata located in the Central uplift of Tarim basin are composed of huge dolomite, which have undergone complex tectonic evolution. Cement dolomite is prevalent in the formation, where two genetically distinct cement dolomites are recognized: rhombus and saddle cement dolomites. They occur in different diagenetic considerations and have different characters. The rhombus dolomite widespread in the formation is characterized by a clear internal structure and unit extinction under crossed polars. The later cement dolomite shows curved crystal faces and wavy extinction under crossed-polarized light, and exhibits complex internal structure, which is composed of rim, clutellum and core. The frequency of the cement dolomites is more intense along faults. The Ca/Mg values of rhombus cement dolomite is similar to that of matrix dolomite, and the Fe concentrations in this style is very low, most of which below the detection limit. The saddle cement dolomite has low Ca/Mg values and high Fe concentrations correspondingly. Electron microprobe analyses at the rim, clutellum and core of the saddle cement dolomite show that Ca/Mg values and Fe concentrations are not homogeneous, and the lowest Ca/Mg values at core points, and the highest Fe concentrations at clutellum points, which can reach 4%wt.

Stratigraphic, petrographic and geochemical data suggest that rhombus cement dolomite deposited steadily and that source of  $\text{Mg}^{2+}$  was altered seawater in early diagenetic process. However, material source of saddle cement dolomite was hydrothermal dissolution of former dolomite. The formation of saddle dolomite cement, three part of which formed in different fracture phases, is associated with faulting. The deposition of dolomite cement is porosity decrease, but saddle cement dolomite can be regarded as a result of hydrothermal dissolution, while can improve dolomite reservoir capability.