

Experimental constraints on the stability of baddeleyite and zircon in carbonate- and silicate-carbonate melts

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ABSTRACT

Carbonatites are rare igneous carbonate-rich rocks. Most carbonatites contain a large number of accessory oxide, sulfide, and silicate minerals. Baddeleyite (ZrO₂) and zircon (ZrSiO₄) are common accessory minerals in carbonatites and because these minerals host high concentrations of U and Th, they are often used to determine the ages of formation of the carbonatite. In an experimental study, we constrain the stability fields of baddeleyite and zircon in Ca-rich carbonate melts with different silica concentrations. Our results show that SiO₂-free and low silica carbonate melts crystallize baddeleyite, whereas zircon only crystallizes in melts with higher concentration of SiO₂. We also find that the zirconsilicate baghdadite (Ca₃ZrSi₂O₉) crystallizes in intermediate compositions. Our experiments indicate that zircon may not be a primary mineral in a low-silica carbonatite melt and care must be taken when interpreting zircon ages from low-silica carbonatite rocks.

Keywords: Carbonatite, baddeleyite, baghdadite, zircon, silicate-carbonate melt, experimental petrology