

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

FERNANDA GERVASONI^{1,*}, STEPHAN KLEMME¹, ARNO ROHRBACH¹, TOBIAS GRÜTZNER¹, AND JASPER BERNDT¹

¹Institut für Mineralogie, Westfälische Wilhelms Universität, Corrensstrasse 24, 48149 Münster, Germany

ABSTRACT

Carbonatites are rare igneous carbonate-rich rocks. Most carbonatites contain a large number of accessory oxide, sulfide, and silicate minerals. Baddeleyite (ZrO_2) and zircon (ZrSiO_4) 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 SiO_2 -free and low silica carbonate melts crystallize baddeleyite, whereas zircon only crystallizes in melts with higher concentration of SiO_2 . We also find that the zirconsilicate baghdadite ($\text{Ca}_3\text{ZrSi}_2\text{O}_9$) 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