

Progress towards using oxygen isotopes in baddeleyite to assess Pb loss

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Baddeleyite is a commonly used mineral for U-Pb dating of mafic rocks, especially in Precambrian samples. Baddeleyite appears to be less susceptible to Pb loss than zircon and commonly plots close to concordia. So far, only a few dating studies have been conducted at very high temporal resolution e.g.[1] [2] and in these studies, small degrees of Pb loss appear to be an almost ubiquitous problem.

Pb loss in zircon can be correlated with oxygen isotope disturbance, where fluid interaction with metamict zircon facilitates recrystallization and Pb loss [3] [4]. Here we investigate whether the same phenomena occurs in baddeleyite. However, before this question can be answered, baddeleyite oxygen isotope reference materials need to be created for the ion microprobe. High spatial resolution analysis is needed for small (<100 µm) baddeleyite grains, which subsequently need to be dated by TIMS. We are currently developing a baddeleyite reference material from a synthetic baddeleyite. Laser fluorination analysis of multi-grain aliquots and single grains from the synthetic baddeleyite reveal that the material is relatively homogeneous with a $\delta^{18}\text{O}$ value of $6.39 \pm 0.5\text{‰}$ 2SD. Preliminary ion probe data indicate a similar range suggesting that matrix effects (such as orientation effects) may be negligible. Also, preliminary data from natural crystals suggests that oxygen isotopes in natural baddeleyite can vary over a large range (up to 5‰). Hence even an analytical precision of $\pm \sim 0.5\text{‰}$ should be sufficient for initial studies.

We will use this reference material to assess oxygen isotope disturbance in natural baddeleyite crystals that are known to contain Pb disturbance. We will then date the same grains analyzed for oxygen isotopes by ID-TIMS to assess the relationship between Pb loss and oxygen isotope variations in baddeleyite.

[1] Rioux, M., et al. (2010) *Contrib.Min.Pet.***160**, 777-801. [2] Sell, B., et al. (2014) *Earth.Plan.Sci.Let.***408**, 48-56.[3] Valley, J.W., et al. (1994) *Chem.Geol.***234**, 105-126.[4] Davies, J.H.F.L., et al. (2015) *Amer.Min.* in press