Mesoproterozoic diabase in Death Valley, California

O.T. Rämö[1*], J.P. Calzia[2], I. Mänttäri[3], T. Andersen[4], Y. Lahaye[3] and M. Lehtonen[3]

[1]*Dept. Geosciences and Geography (DiGG), P.O. Box 64, FI-00014 University of Helsinki, Finland*
[2]*U.S. Geological Survey, Menlo Park, CA 94025, USA*
[3]*Geological Survey of Finland, P.O. Box 96, Espoo FI-02150*
[4]*Dept. of Geosciences, University of Oslo, Norway N-0316*

Mesoproterozoic diabase dikes and sills are widespread throughout the southwestern US. In the Death Valley region of SE California, diabase in sills a few meters to ∼450 m thick, intrudes the Neoproterozoic Crystal Spring Formation. Baddeleyite from diabase in Crystal Spring and Saratoga Springs have ID-TIMS U-Pb ages of 1087±3 Ma and 1069±3 Ma, respectively (Heaman and Grotzinger, 1992). We have analyzed (by LA-ICPMS) the U-Pb isotope composition of tiny baddeleyite grains spotted in thin sections in search of a magmatic age of the Jupiter Hill diabase sill in the Kingston Range, southern Death Valley. Ten *in situ* spots define a weighted-average $^{207}Pb/^{206}Pb$ age of 1101±12 Ma (MSWD 5.6). This age can be considered, within the experimental error involved, a reliable estimate of the emplacement age of the Jupiter Hill diabase sill. The upper unit of the Crystal Spring Formation is thus older than 1.1 Ga, contrary to recent detrital zircon U-Pb data released by Mahon et al. (2014). We have also analyzed three samples from the Jupiter Hill and Crystal Spring diabases for Nd isotopes. These diabases are transitional basaltic and moderately enriched in LREE with $^{147}Sm/^{144}Nd$ of ∼0.15. The initial ε_{Nd} (at 1100 Ma) values for the Jupiter Hill sill are +2.9 (chilled margin) and +4.6 (sill interior) and that for the Crystal Spring sill -1.0. The two samples from Jupiter Hill are hydrothermally pervasively altered with only zircon, baddeleyite, and apatite as preserved magmatic minerals. It is likely, however, that the igneous values of the conserved elements (e.g., REE) have been retained. The measurable difference (∼1 ε-unit) of the initial ε_{Nd} of the chilled margin and sill interior may have petrogenetic significance. The chilled margin is higher in SiO_2 and Mg/Fe, and lower in total REE than the sill interior and may represent an earlier batch of basaltic magma derived from a mildly depleted lithospheric mantle source. The sill interior could have been crystallized from a less-contaminated basaltic magma from the same deep source, yet shielded from contamination by armored conduit margins. The Crystal Spring diabase presumably registers a local, more enriched, source in the subcontinental mantle of Mojavia.