Are oceanic plagiogranites from Cyprus Archean TTG analogues?

C. S. MARIEN[1]*, C. MÜNKER[1], J. E. HOFFMANN[13] AND D. GARBE-SCHÖNBERG[4]

[1]Institut für Geologie und Mineralogie, Universität zu Köln, Germany (*correspondence: marienc@uni-koeln.de)
[3]Institut f. Geologische Wissenschaften, FU Berlin, Germany
[4]Institut für Geowissenschaften, CAU Kiel, Germany

TTGs are melts of mafic crust that represent ca. 2/3 of the preserved Archean continental crust. In the Phanerozoic, the formation of felsic melts from oceanic crust is less voluminous, but it has been speculated, as to wether such melts may serve as analogue for Archean crust formation processes (e.g., [1]). In particular the thickness of oceanic crust and its hydrothermal processing may have significantly changed through geologic time. Different endmember models are invoked for the petrogenesis of modern oceanic plagiogranites that make up the majority of felsic melts in such environments, including high-pressure dehydration melting and fractional crystallization in deeper levels of oceanic crust (e.g., [2]).

In order to evaluate the significance of modern plagiogranites as putative equivalents to Archean crustal lithologies, we performed combined conventional trace elements, high precision HFSE, and Sr-Hf-Nd isotope measurements on plagiogranites from the Troodos Ophiolite Complex in Cyprus. In line with earlier trace element data [3], most samples exhibit depleted LREE and Rb-Ba contents. Initial Nd-Hf isotope compositions at 90 Ma overlap with those of surrounding mafic rocks and range from +5.6 to +8.3 and +14.4 to 16.4, respectively, whereas initial $^{87}Sr/^{86}Sr$ ratios are slightly more radiogenic (0.704 to 0.707). Most plagiogranites exhibit relatively narrow Nb/Ta at around 15-16. A dinstinctive group of samples, however, exhibit more variable Nb/Ta (12.3-19.8) and Zr/Hf (24-32.3) values, coupled with positive Zr-Hf anomalies.

Collectively we can distinguish three different petrogenetic groups: compositions of the first two groups can be explained via fractional crystallization from ambient arc-tholeiites and boninites, respectively. Compositions of a third group can be explained by dehydration melting of altered oceanic crust in the presence of ilmenite and amphibole. Altogether, HFSE ratios in Cyprus plagiogranites are much less fractionated than in their Archean equivalents, reflecting a much shallower environment for formation.

[1] Willbold *et al*. (2009), *EPSL*, **279**, 44-52 [2] Koepke *et al*. (2007), *CMP* **153**, 67-84 [3] Freund *et al*. (2014), *CMP*, **167**:978