ORIGIN OF COEXISTING PLAGIOCLASES (ANDESINE-ANORTHITE) IN THE BOEHLS BUTTE ANORTHOSITE, NORTHERN IDAHO

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The origin of the unusual bi-modal mineralogy (andesine An_{34-48} and anorthite An_{92-98}) of the Boehls Butte anorthosite (BBA) has been debated for many years. Hypotheses proposed for its origin include (1) metasomatic alteration of sedimentary or igneous rocks; (2) subsolidus exsolution, shear differentiation and/or metamorphic coarsening of intermediate plagioclase, or; (3) magmatic crystallization, incorporation of metasedimentary restite and hydrothermal alteration; each of these hypotheses is problematic. We have previously reported oxygen isotope evidence of a complex history of retrograde interaction of the BBA with meteoric-hydrothermal fluids. *In situ*, SIMS O-isotope analyses indicate inter- and intra-plagioclase grain $*^{18}O$ variability of 3-6‰, with localized plag values as low as -16‰V-SMOW, and preservation of very steep, fine-scale gradients in $*^{18}O$ (up to 20‰ over 600:m; Mora et al. 1999). Correspondence between the modal percentage of anorthite in the BBA and low values of whole rock $*^{18}O$ suggest a hydrothermal mechanism for producing the unusual plag assemblage, and CL petrography supports interpretation of anorthite laminae as foci of fluid flow. Experimental studies by Orville (1972) and others have noted the rapid anorthitization of more-sodic plag at high T and in the presence of a Ca-bearing brine, where altered plag may retain its shape, twin boundaries, etc. A similar reaction is invoked to explain many of the unusual textural and isotopic characteristics of the BBA. Removal of quartz in the hydrothermal fluid creates ~26% void volume and significant reaction-enhanced permeability in the BBA. Reaction-enhanced permeability provides an additional mechanism, besides brittle failure, to accommodate the rapid influx and variable and widespread transport of meteoric-hydrothermal fluids through the BBA during late stage decompression, extension and rapid unroofing of the anorthosite complex. The fractional conversion of andesine to anorthite and ^{18}O shifts in the plag can be used to constrain fluid-rock ratios in the BBA and, with other reasonable assumptions, to estimate the magnitude of fluid fluxes responsible for the isotopic resetting. The calculated values are much larger than values typical of regional metamorphic systems, but are reasonable for those estimated for hydrothermal circulation associated with intrusive systems.

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