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Examining Experimentally Formed K-Na Interfaces in Alkali Feldspars using Atom Probe Tomography

TENLEY E WEBB AND CRAIG LUNDSTROM
University of Illinois - Urbana Champaign

Granite makes up a large portion of upper continental crust. Thus, understanding granite generation provides a direct window into continental crust formation. Granites consist of quartz and two feldspars, plagioclase, and K-feldspar indicating generally low temperatures. How K-feldspars, particularly megacrystic ones, form and grow remains an important question in granite research.

We will first present results of cold seal experiments whereby natural quartz, albite and microcline (pikes peak) were mixed with hydrated sodium disilicate (DS) powder, sealed in gold tubing and run at 1 kbar and 425°C for days to week timescales. The DS liquid equilibrates with the granitic assemblage and quenches to glass. The run products are mounted in epoxy for mapping analysis by SEM-EDS. Xray maps show K-spar replacement by albite reflecting the development of Na-K exchange equilibria between crystal and liquid. The exchange within the former microcline occurs along crystallographically controlled directions and is virtually perfect: <0.5 wt% K_2O is found in the now albite portions.

We seek to know how this exchange occurs by interrogating the albite-microcline interface through atom probe tomography. We prepare the sample using FIB by application of conductive/protective coatings followed by lift-out of a wedge used for making atom probe tips. Atom probe tomography uses field ion evaporation of the atom probe tip to produce three dimensional near atomic resolution images. The images show precise reaction chemistry and may help discern reaction mechanisms. New experiments will be run using modified ^{18}O water to examine reactions using isotopic tracing. Observing feldspars on an atomic level will assess the potential of microchannels in feldspars to influence the transport of hydrous peralkaline liquids at low temperature. These data will help to discern the feldspar-liquid reaction processes critical to making granite and thus continental crust.