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THE HOT DRY STORY OF THE TERNARY FELDSPARS

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The modern story of ternary feldspars begins with Tuttle and Bowen's 1954 text for GSA Memoir 74, in which they deduced from natural occurrences the hydrous field boundary plagioclase + sanidine. The boundary was cotectic until it reached a termination where the reaction changed from even to odd. Yoder et al. (CIW Yb 1957) confirmed that result experimentally. Stewart and Roseboom (JPet 1962) showed all the ways in which the equilibrium among two feldspars plus liquid might end. A generation of wet feldspar studies is summed up with high art by Parsons (2015 Am. Min.). All of these studies assumed water saturation largely because no dry experiments reached equilibrium. Moreover, the container problem of sealed platinum tubing prohibited the simple study of Fe-bearing bulk compositions because of the thirst of Pt for Fe. A generation later the graphite crucibles of the piston-cylinder apparatus yielded surprisingly fast dry equilibria in finely-ground natural bulk compositions at pressure. The feldspars began life as H-shaped "Imperial fighter" skeletons and grew to unzoned rectangles with corner spikes within 24 hours, dry. The difference between the dry and the wet feldspar experiments is dramatic, and the effect of iron shocking. The experimental Fa-An-Ab cotectic runs the span from fayalite-saturated pure An to pure Ab over a temperature range of only 17 degrees C at 5 kbar! The feldspar path of the Kiglapait intrusion runs from An 67 in troctolites to An 52 in olivine gabbro at low silica activity (Morse JPet 2014) to a bracketed ternary minimum near (Or32 Ab68) An12 at 1033 deg C, 5 kbar. Here the solvus impinges on the solidus. The common composition of the solvus crest and liquidus minimum reflects the polymerized liquid and crystal structures. Among natural basalts, 304 probe analyses from a single thin section of the tholeiitic Picture Gorge basalt described the entire range of plagioclase composition from An86 to An~2 (Ab60Or40) (Lindsley & Smith CIW 1971) and was used for a tutorial exercise in dry fractional crystallization by Morse (1980 book). Because the water-saturated feldspar hypothesis dominates the literature to this day, the hot, dry end-member of the tholeiitic feldspar story has been too long ignored. Basalts, the most common mafic rocks, are hot and mostly dry.

Session No. 196

T165. Zen and Now: Honoring the Legacy of E-an Zen's Contributions to Geology
Tuesday, 3 November 2015: 8:00 AM-12:00 PM

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