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2015 GSA Annual Meeting in Baltimore, Maryland, USA (1-4 November 2015)

Paper No. 95-12

Presentation Time: 10:45 AM

SYNCHROTRON XRD INVESTIGATION OF TEMPERATURE– $a_{\text{H}_2\text{O}}$ –TIME RESOLVED DEHYDRATION OF METATORBERNITE

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Work on U-contaminated soils has highlighted the importance of autunite group minerals in groundwater zones of several DOE sites and weathered ore deposits. Autunite group minerals are characterized by sheets of actinyl square bipyramids linked by phosphate tetrahedra with interlayer sites occupied by H_2O -coordinated cations. An important characteristic of autunite-group minerals is a series of complex transitions in hydration state. *In situ*, synchrotron x-ray investigations of metatorbernite ($\text{Cu}[\text{UO}_2]_2[\text{PO}_4]_2 \cdot 8\text{H}_2\text{O}$, basal spacing ~ 8.7 Å) using continuous heating produces lower hydrate phases with ~ 8.3 , 6.9 and 5.4 Å basal spacings (Stubbs et al, 2010).

More detailed investigation was carried out on the GSECARS Sector 13BMC beamline using relative-humidity sensors, micro-heaters and manual gas mixing. Under dry conditions, transition to the 8.3Å phase occurs at 64°C, with the first appearance of the 6.9Å phase at 76°C. As expected, increased $a_{\text{H}_2\text{O}}$ is associated with higher dehydration temperatures and experiments were carried out in 1°C steps across a range of relative humidity.

Reactions for both metatorbernite-to-8.3Å phase and 8.3Å phase-to-6.9Å phase can be reversibly driven by temperature or $a_{\text{H}_2\text{O}}$ changes. Reaction temperatures are surprisingly sensitive to $a_{\text{H}_2\text{O}}$ with a Temperature-versus- $a_{\text{H}_2\text{O}}$ slope of $\sim 0.8^\circ\text{C}$ per 1% relative humidity. At low relative humidity, the reactions are rapid, with completion within 5-10 minutes. Under dry conditions, however, the phases fail to rehydrate over many hours.

Session No. 95

[T133. Mineralogy Writ Small: A Tribute to the Distinguished Career of David R. Veblen](#)

Monday, 2 November 2015: 8:00 AM-12:00 PM

Room 317 (Baltimore Convention Center)

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