

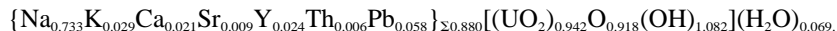
Clarkeite: New chemical and structural data

ROBERT J. FINCH* AND RODNEY C. EWING

Department of Earth and Planetary Sciences, University of New Mexico, Albuquerque, New Mexico 87131, U.S.A.

ABSTRACT

Clarkeite crystallizes during metasomatic replacement of pegmatitic uraninite by late-stage, oxidizing hydrothermal fluids. Samples are zoned compositionally: Clarkeite, which is Na rich, surrounds a K-rich core (commonly with remnant uraninite) and is surrounded by more Ca-rich material; volumetrically, clarkeite is most abundant. Clarkeite is hexagonal (space group $R\bar{3}m$) $a = 3.954(4)$, $c = 17.73(1)$ Å ($Z = 3$). The structure of clarkeite is based on anionic sheets of the form $[(\text{UO}_2)(\text{O},\text{OH})_2]$. The sheets are bonded to each other through interlayer cations and H_2O molecules. The empirical formula for clarkeite from the Fanny Gouge mine near Spruce Pine, North Carolina, is:



Na predominates and the Pb is radiogenic. The general formula for clarkeite is



where $\text{Na} \gg \text{K}$ and $p > (q + r + s)$. The number of O^{2-} ions and OH groups in the structural unit is determined by the net charge of the interlayer cations (except Pb): $y = 1 - (p + 2q + 3r + 4s)$. This suggests that the ideal formula for ideal end-member clarkeite is $\text{Na}[(\text{UO}_2)\text{O}(\text{OH})](\text{H}_2\text{O})_{0.1}$. The structural sheets are destabilized as U decays to Pb (increasing x), and Pb enters vacant interlayer cation sites. Clarkeite eventually recrystallizes to lead uranyl oxide hydrates such as wölsendorffite or curite.