

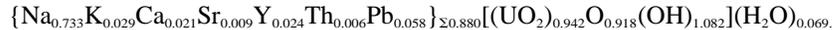
## Clarkeite: New chemical and structural data

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### 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  $\text{H}_2\text{O}$  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  $\text{O}^{2-}$  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.