American Mineralogist, Volume 88, pages 189–194, 2003

Norrishite, $K(Mn_2^{3+}Li)Si_4O_{10}(O)_2$, an oxymica associated with sugilite from the Wessels Mine, South Africa: Crystal chemistry and ^{40}Ar-^{39}Ar dating

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ABSTRACT

Norrishite, $K(Mn_2^{3+}Li)Si_4O_{10}(O)_2$, an OH-free mica, is found in a silicate-rich sample from the Wessels mine, Kalahari manganese field, South Africa. The mineral forms centimeter-sized black aggregates in dark-purple sugilite, and is associated with kornite and Mn-rich pectolite.

Single-crystal X-ray data, collected on norrishite of end-member composition, yielded a monoclinic *C*2/*m* lattice with $a = 5.291(2)$, $b = 8.904(2)$, $c = 10.049(4)$ Å, $\beta = 98.15(5)°$, $V = 920.6$ Å^3, and $Z = 2$, characteristic of the 1*M* polytype.

^{40}Ar-^{39}Ar analyses on a gem-quality sugilite yielded an age of 1048.1 ± 5.9 Ma interpreted as a mineral crystallization age that dates the main hydrothermal event that led to enrichment of the Mn ore. The norrishite age data are more complex and suggest a crystallization age ≈1010 Ma and a subsequent alteration at ca. 850 Ma. The age results obtained suggest that the hydrothermal activity is related to the collision and tectonism affecting the edges of the Kalahari craton, and show that sugilite, and probably also unaltered norrishite, are suitable for dating metamorphism.