
Characterization of Hydrothermal Tobelitic Veins from Black Shale, Oquirrh Mountains, Utah

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Abstract: Hydrothermal tobelitic phyllosilicates modeled as ISII (R3) ordering with a minimum of 2– 3% and a maximum of 6– 8% interstratified smectite occur in veins and as replacement of fossils in hydrothermally altered black shale. These heavy metal-rich phyllosilicate veins formed during a Mesozoic-aged, regional-scale hydrothermal event that affected an area which encompasses the Mercur Au district (Wilson and Parry, 1990a, 1990b). Associated minerals include kaolinite, quartz, chlorite, Fe-oxides, I/S (R1, 45% smectite), and pyrite. N and O contents of NH_4 phyllosilicates determined by microprobe analysis range from 0.19 to 1.78 and 48.6 to 52.9 elemental wt. %, respectively. Infrared absorption analysis indicates N occurs as NH_4^+ . Very high O analyses are probably caused by contamination with kaolinite. A representative structural formula for the tobelitic material is $[(\text{NH}_4)_{0.36}\text{K}_{0.36}\text{Na}_{0.03}]-(\text{Al}_{1.91}\text{Mg}_{0.13}\text{Fe}_{0.03})(\text{Si}_{3.21}\text{Al}_{0.79})\text{O}_{10}(\text{OH}_{1.88}\text{F}_{0.12})$.

Correlation plots of data from microprobe analyses indicate an atypically high correlation between interlayer charge and octahedral layer charge and no correlation between (K+Na) and N. More typical correlations between N and (K+Na) and between interlayer charge and tetrahedral layer charge are obtained if 2– 8% of a beidellitic smectite are factored out of the analyses. This amount of smectite is consistent with modeling of X-ray diffraction data using the computer program NEWMOD (Reynolds, 1985).

Possible sources of NH_4 are from introduction by hydrothermal fluids or from thermal degradation of organic matter prevalent within the host rocks during low-grade metamorphism. The occurrence of NH_4 phyllosilicate veins in unoxidized shale and the limited occurrence of NH_4 phyllosilicates within the host shales suggests a hydrothermal source for the NH_4 .

Key Words: Ammonium illite • Hydrothermal • Microprobe • Nitrogen analysis • Tobelite

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