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Ore Mineralogy and Hydrothermal Alteration of Tungsten Deposits in the Eastern Pioneer Mountains, Southwest Montana

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The Eastern Pioneer Mountains in Beaverhead County, southwest Montana is largely comprised of the late Cretaceous Pioneer batholith intruding into Mid-Proterozoic to Mesozoic aged sedimentary strata. Hydrothermal alteration and mineralization associated with Laramide magmatism and deformation during the late Cretaceous created a highly mineralized region that includes historic production of Ag, Au, Cu, Fe, Pb, W, and Zn from carbonate replacement deposits, skarns, polymetallic vein deposits, and porphyry Mo systems.

Deposits within the historic Birch Creek (Utopia), Hecla, Brownes Lake, Lost Creek, and Quartz Hill-Vipond Districts are being revisited by geologists from the Montana Bureau of Mines and Geology (MBMG) as part of a new USGS Earth Mapping Resource Initiative (Earth MRI) project. Along with new Earth MRI geophysics for the area, new geological and alteration mapping and sampling is being conducted, with several W deposits and prospects of the Brownes Lake, Lost Creek, and Birch Creek Districts, particularly Brownes Lake and Indian Queen Mines, visited and sampled during the 2025 and 2026 field seasons. Samples were collected from rocks of varying alteration types that included, but are not limited to: magnetite skarn, garnet skarn, and calc-silicate hornfels.

Minerals of interest observed included scheelite, chalcopyrite, several Cu-oxide minerals (azurite, malachite, chrysocolla, and others), and magnetite. Samples were assayed by ICP-MS and analyzed using SEM-EDS to better understand ore mineralogy, grades, hydrothermal alteration, and critical minerals potential.