Scheelite Vein Mineralization at the Watershed Tungsten Deposit, Northeast Queensland, Australia

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The Watershed tungsten deposit is located in far north Queensland, about 100 km northwest of Cairns. It has a combined JORC resource of 49.32 Mt @ 0.14% WO_3 totaling 70,400 t of contained WO_3. Watershed lies within the Mossman orogen, in the northernmost part of the Tasman fold belt of eastern Australia. The Mossman orogen comprises a folded sequence of Ordovician-Devonian metasediments, intruded by Carboniferous-Permian granites of the Kennedy Province. The Watershed deposit is hosted in a sequence of folded slates and, locally calcareous, psammites of the Hodgkinson Formation that form a NNW-striking and NNW-plunging anticline. In addition, multiple felsic dikes occur, cutting the metasediments that might be part of the Permian S-type Whypalla Supersuite granites that crop out to the west and east from Watershed.

Mineralization is mainly restricted to altered psammite units with blue-fluorescing (Mo-poor) scheelite being the sole ore mineral at Watershed. Scheelite mineralization mainly occurs in centimetric vein halos, within veins and is scarcely disseminated at locations away from veins. Widespread Fe-poor red-green calc-silicate alteration (garnet-clinozoisite) is spatially related to mineralization. At least three major veining events (stages I, II, and III) have been recognized in drill core. The earliest mineralization event is hosted in quartzite and in fine-grained psammite as (I) sinuous and/or deformed quartz + feldspar + biotite ± scheelite ± pyrrhotite veinlets and veins. The main alteration mineral associated with this event is biotite, and scheelite mineralization is not of economic significance in this stage.

Postdating stage I, the most extensive scheelite mineralization occurs in centimetric halos of quartz-feldspar-scheelite-pyrrhotite and minor arsenopyrite veins from stage II. This vein set, with <50 cm wide sinuous to planar E-W striking veins, mostly cuts green and red calc-silicate–altered psammite breccia, minor quartzite, and granitic dikes. Additionally, minor scheelite occurs disseminated in calc-silicate–altered psammite, and coarse-grained in granitic dikes. Generally, at least six mineral substages are recognized in stage II: (IIa) early quartz + feldspar-scheelite assemblage as margins of veins (<3 cm wide); (IIb) gray quartz, locally with up to 3 cm scheelite, occupying the center of the veins. Stage IIc are white quartz veinlets, which cut across previous veins, locally cut by calcite stringers of stage IId. Stage IIe corresponds to muscovite-sericite veins with minor siderite center line and stage IIf corresponds to fracture-filling pyrrhotite and /or arsenopyrite veins, locally with up to 5 cm arsenopyrite mega crystals, postdating all the above events.

The latest scheelite mineralization occurred in stage III, as quartz-feldspar-scheelite-minor pyrrhotite veins/veinlets with “ladder” texture. They are <3 cm wide, planar or rarely sinuous. Such veins are typically high grade. Different veining events associated with scheelite may reflect different mineralization pulses in the Watershed deposit. The formation temperature, pressure, and depth will be constrained by fluid inclusion and stable isotope studies. Fluid source will be inferred and the potential for more and/or higher-grade mineralization at depth will be assessed.