

Mineralogy of Tungsten Concentrate From the Mt. Carbine Mine, Queensland, Australia: Geometallurgy and Environmental Implications

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Tungsten (W) utilization is due to its unique properties, e.g., high melting point, hardness, and density, which make substitution difficult. Furthermore, supply risks have placed tungsten on the list of critical metals (European Commission). This contribution's objective is to present a framework of identifying potential geometallurgical and environmental implications of processing W-concentrate. The sample material is from the Mt. Carbine vein-type tungsten mine, Australia.

The W-concentrate is scheelite-dominated, however has high mineralogical variety and contains unliberated W-minerals. The majority of scheelite and wolframite is intergrown with quartz, hematite, and chalcopyrite. Moreover, tourmaline, fluorite, muscovite, chlorite, calcite, goethite, rutile/anatase, molybdenite, stannite and native arsenic have been detected (XRD). The concentrate also contains minor to trace cinnabar, native silver, Li-bearing silicates, native bismuth and ferritungstite. Preliminary geochemical data (XRF-EDS) show that the concentrate has a maximum W-content of 64.1 wt.%, 6.43 wt.% Fe, 0.66 wt.% Mn, and 3.89 wt.% Ca. Minor constituents are 3.86 wt.% As, 3.78 wt.% S, 1.07 wt.% Cu, 0.54 wt.% Sn, 0.47 wt.% Zn, 0.11 wt.% Ni, 0.07 wt.% Mo, 85.8 mg/kg Sb and 37.5 mg/kg Cd.

The novelty of this contribution is the detail in the described mineralogy of W-concentrate beyond standard reporting, with mineralogical and geochemical alignment. Our findings point to both beneficiary and problematic outcomes due to the minerals' nature and element enrichment. Firstly, there is potential on Cu-, Sn-, Mo-, and Ag-byproducts. However, the extraction process of W at the smelter could be environmentally alarming, as elements like As, Sb and Cd would be part of the waste. Finally, building deep characterization frameworks for W-concentrates, through this case-study, might offer insight for future mechanical enrichment processes, and prove to be instrumental for industry and favorable for the environment.

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