

Tungsten Skarn Potential of the Yukon-Tanana Uplands, Eastern Alaska, USA—A Mineral Resource Assessment

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Tungsten (W) has a variety of industrial and technological uses. It has been identified by the U.S. Government as a critical mineral for the United States owing to its strategic importance and U.S. reliance on W imports. Consequently, there is an ongoing initiative by the USGS to understand domestic resource potential. W skarn deposits are a major source of world W supply and the Yukon-Tanana Uplands (YTU), in eastern Alaska, are prospective for this deposit type. The regional geology is characterized by juxtaposed Paleozoic lithotectonic packages that were rifted from and reaccreted to North America in the Mesozoic. Multiple episodes of arc-related magmatism followed accretion. W-skarn genesis is mainly associated with 100-90 Ma plutonic suites in the YTU; major W-skarns in Canada (e.g., Mactung, Cantung) are part of the same metallogenic event, supporting a favorable geologic setting for W skarns in the YTU. We conducted an assessment for undiscovered W-skarn resources for parts of the lesser-explored (Alaskan) portion of the YTU.

Geographic Information System (GIS) proximity analysis was used to delineate the intersection of granitoid plutonic rocks and carbonate-bearing rocks to define three tracts of land permissive for W-skarn. The permissive tracts were qualitatively mapped for mineral potential using the Alaska Geochemical Database (AGDB) and Alaska Resource Data File (ARDF). This analysis indicated that much of the western YTU near Fairbanks has high potential for undiscovered W-skarn deposits, whereas the eastern and southern YTU (Fortymile district and Eastern Alaska Range) has only isolated areas of medium and high potential. The western YTU has sufficiently high potential and data quality to warrant a quantitative assessment of undiscovered W resources. Probabilistic estimates suggest a potential range of 1 to 3 undiscovered W skarn deposits in the western YTU tract. Estimates were combined with a recently published global W skarn grade-tonnage model in a Monte Carlo simulation to estimate undiscovered contained resources, and the USGS Resource Assessment Economic Filter (RAEF) was then applied to constrain the amount of simulated WO₃ that may be economically recoverable in various mining scenarios. This simulation indicates approximately 60 - 30 kt WO₃ may be recoverable from a potential undiscovered W-skarn deposit in the western YTU tract, with a Net Present Value (NPV) of ca. \$330 to \$40 million USD, depending mainly on proximity to infrastructure.

Contained WO₃ estimates for the western YTU tract in our analysis are significantly lower than the known resources in W skarns in the Canadian portion of the YTU, but still potentially economically significant. Some of the differences in prospectivity may result from lower permeability and lack of continuity of favorable carbonate rock horizons in the relatively high-grade metamorphic country rocks of the YTU in Alaska. Qualitative and quantitative mineral resource assessments such as this one in the western YTU are helpful tools for making initial regional estimates of undiscovered resources, delineating target areas for new data acquisition, focusing future investigations, and steering research on the underlying controls of district-scale metallogenic budgets.