Petrology and Geochemistry of c. 1.8 Ga Granites Linked to Skarn W-F-Mo ± Cu Mineralization, Bergslagen District, Sweden

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The Bergslagen mining district in south-central Sweden contains numerous skarn-related tungsten prospects located mainly along its western margin. Mineralization typically comprises disseminated scheelite, fluorite, and molybdenite ± chalcopyrite in skarn-altered marble horizons that form part of a c. 1.9 Ga syn-orogenic volcanic-sedimentary basin. Based on previous work, a link between late-orogenic (c. 1.8 Ga) granites and W-F-Mo ± Cu mineralization has been proposed. Here, we present a new petrological and geochemical assessment of c. 1.8 Ga granites in western Bergslagen to constrain key petrogenetic factors that promoted skarn tungsten mineralization.

Granitic intrusions closest to skarn W prospects comprise weakly foliated to massive equigranular syenogranite to alkali feldspar granite that locally contains xenoliths, mafic enclaves, and/or minor aplitic-pegmatitic parts. Biotite is the main mafic mineral along with accessory molybdenite, magnetite, fluorite, pyrite, chalcopyrite, zircon, and xenotime. Skarn-distal granites are weakly foliated to massive equigranular to megacrystic biotite ± muscovite ± hornblende granites, also associated with aplite-pegmatite.

All the granites generally have high-silica, peraluminous, and ferroan characteristics, are relatively enriched in SiO_2, total alkalis (K + Na), U, Th, Ta, and Y, and depleted in Ca, Mg, Ti, Nb, Zr and total REEs. A regional geochemical trend of increasing incompatible lithophile element abundances from skarn-distal to skarn-proximal granites is evident, suggesting fractional crystallization was an important control on enrichment of late-stage magmas linked to W ± Mo ± F mineralization. Overall, the granites have overlapping fractionated I- and A2-type affinities and likely formed via anatexis of mainly c. 1.9 Ga metaigneous source rocks affected by older subduction and metasomatic events. Coeval arc-related magmatism at c. 1.8 Ga and a switch to a net extensional tectonic regime may have initiated crustal anatexis and melt migration leading to granite formation in the mid- to upper crust, with a concomitant exsolution of W-mineralizing hydrothermal fluids.