

Critical Metals in our Metasomatic Backyard: The West Desert Skarn Deposit

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Critical minerals are increasingly important to the global economy and society due to their importance in green energy technologies, cell phones, national defense systems, and other high-tech applications. Indium (In) is one such mineral that is integral in the production of touchscreens and solar panels. The US is currently 100% import reliant for In, indicating an urgent need to develop secure domestic sources of this critical mineral. The only domestic established resource for indium is the West Desert Skarn Deposit (WDSD) of Utah, which has an inferred resource of 33.7 Mt at 20 g/t In, 3.83% Zn, and 0.15% Cu. The WDSD is a magnesian magnetite skarn that contains sphalerite, chalcopyrite, and chalcocite, with minor galena and pyrite, and trace amounts of the In-bearing minerals roquesite and dzhalindite. Results from this study demonstrate sphalerite contains up to 10.4 wt.% In, whereas chalcopyrite contains <0.6 wt.% In. Roquesite and dzhalindite contain ~45 wt.% and 63 wt.% In, respectively. Some samples contain In and Cu-rich diffusion rims in sphalerite immediately adjacent to chalcopyrite, and roquesite was seen in various stages of exsolution in sphalerite. The diffusion and exsolution textures at the WDSD indicate there may have been subsequent hydrothermal events that postdate initial sulfide deposition, enriching the sphalerite in In and Cu, which was then exsolved due to later changes in temperature, fO₂, fS₂ or the further addition of fluids. We determined that In at the WDSD is recoverable, with most of the samples' In budget (>75%) contained within sphalerite and chalcopyrite. This study demonstrates the co- and by-product critical mineral potential of skarn systems and indicates that systems like the WDSD should be evaluated for more than just major commodities.