Gold Remobilization

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Remobilization of Au can be critical to understanding what controls high-grade ore zones in Au deposits. Determining whether Au has been remobilized is difficult, and most studies fail to produce conclusive evidence. If such evidence for remobilization can be shown, then primary processes can be separated from secondary processes, which is key to understanding the evolution of Au deposits. The Jerome deposit in the Archean Swayze greenstone belt is hosted by altered and deformed monzonitic rocks that intruded polymictic conglomerates that are close to "Timiskaming-age" (<2680 ±2 Ma). Gold mineralization is present in two stages of arsenian pyrite. Primary pyrite is inclusion-poor, oscillatory-zoned, and contains invisible Au in As-rich zones. Secondary pyrite overprints primary pyrite, contains native Au and sulfide inclusions (e.g., chalcopyrite, gersdorffite, tetrahedrite, molybdenite, galena), has a porous texture, and has irregular grain boundaries with primary pyrite. Evidence supporting Au remobilization from primary pyrite are: (1) secondary pyrite with relict zoned textures that extend across grain boundaries from primary pyrite; (2) porous texture in secondary pyrite, which is commonly associated with dissolution-reprecipitation; (3) all elements in secondary pyrite and its inclusions are also present in zones of primary pyrite; and (4) inclusions in secondary pyrite are commonly multi-phase. Analysis of primary pyrite using SEM-EDS, EMPA, and LA-ICP-MS has revealed that zoning and Au incorporation into primary pyrite are predominantly controlled by S availability. Sulfur and As have a near-perfect, negative correlation across oscillatory zones, suggesting that, as S became depleted during pyrite growth, As substituted in S sites. The As substitution creates distortions in the cubic structure of pyrite and allows more Au to become incorporated. Secondary pyrite is the result of dissolution-reprecipitation of primary pyrite, and in it, elements have been redistributed and decoupled from their former associations. Documenting such decoupling is critical because it allows the distinction of primary and secondary geochemical signatures. Dissolution-reprecipitation textures and evidence of Au remobilization from sulfides are not exclusive to this deposit. The Kenty and Rundle Au deposits, also in the Swayze greenstone belt, both show evidence for Au remobilization. Future work will focus on the detailed characterization of secondary processes that control the upgrading of ore to form high-grade Au deposits.