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Petrography, Ore Mineral Paragenesis, and Gold Deportment of the Twin Hills Gold Deposit, Central Namibia

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The Twin Hills Gold Deposit is an orogenic gold deposit hosted within the metamorphic turbidites of the Kuiseb Formation in the Southern Central Zone of the Damara Belt. This study aimed to understand the petrography of the host rocks, the formation of the ore minerals and assess the deportment of the Twin Hills Gold Deposit. The host rocks are characterized by graded bedding ranging from pelitic mica-rich interbeds to psammitic quartz-rich interbeds, forming an interbedded metagreywacke package. The Interbedded metagreywacke is made up of quartz, biotite, muscovite, plagioclase, orthoclase and cordierite. The ore mineral assemblage is characterized by gold, pyrrhotite, arsenopyrite, and pyrite. Gold mineralization at the Twin Hills Gold Deposit is associated with two main hydrothermal alteration styles, namely, potassic alteration and silicification. This research suggests at least three stages of mineralization within the Twin Hills Gold Deposit. The first stage is the diagenetic stage, which involved the enrichment of diagenetic arsenian pyrite (Py_0) in the turbiditic sediments with gold and other trace elements via the exhalation of reduced, deep-seated Au-As enriched H_2S -rich basinal brines onto the sea floor. The second stage involved the release of gold initially locked up within the arsenian pyrite (Py_0) crystal lattice into metamorphic fluids and the subsequent precipitation of free gold (Au_1) from gold-bearing fluids. The third stage is the quartz veining stage, which was responsible for the remobilization of fine gold grains (Au_1) from the groundmass of the metagreywacke and concentrating them into the biotite selvages. This led to further upgrading of the gold grades to higher economic levels. The gold deportment analyses revealed three modes of occurrences of gold within the Twin Hills deposit. This includes gold disseminated within the groundmass, gold grains disseminated within biotite selvages associated with quartz veinlets and gold grains included within arsenopyrite crystals.