Structural and lithological controls on BIF-associated gold: Insights from the Tiriganiaq deposit, Meliadine district, Nunavut

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Banded iron formation (BIF)-associated gold deposits, a subtype of orogenic lode gold deposits, are structurally controlled at all scales, ranging from the distribution of deposits along major structures to the internal textures and structures of the ore. The layer anisotropy of the host BIF induces significant structural complexities pre- and post-gold deposition. Understanding these complexities is critical to optimize exploration models and mine development. One of Canada's largest emerging gold districts, the Meliadine gold project, owned by Agnico Eagle Mines Ltd., is located within the Rankin Inlet greenstone belt in Nunavut; it comprises numerous gold deposits and prospects spatially associated with the Pyke fault and its splays. Many of these gold deposits are spatially associated and/or directly hosted in BIF units, including the Tiriganiag deposit. A large portion of the ore at Tiriganiaq is hosted within the geometrically and structurally complex BIF-associated 1150 and 1250 ore zones or "lodes". The objective of this study is to better understand the main lithological and structural controls on gold distribution and the relative timing of events at ore zone to deposit scale, by documenting the geometry of the 1150 and 1250 zones, and geochemically characterizing each unit. Detailed mapping at Tiriganiaq indicates that the main controls on gold distribution within the 1150 ore zone are Lower Fault-parallel, narrow north-dipping reverse shear zones that overprint the slightly steeper, north-dipping main S_2 foliation that is axial planar to tight F_2 folds. Shallowly south-dipping extension veins associated with the shear zones and related fault-fill veins are preferentially developed in tightly F_2-folded, dm- to m- thick BIF layers around the moderately north-dipping reverse shear zones. The current working hypothesis includes a protracted D_2 deformation event that started with the development of tight, upright F_2 folds and axial-planar S2 fabrics, followed by the development of overprinting reverse shear zones, and/or a C-S-type system, with the reverse shear zones controlling the development of shear-hosted extension ore veins. The extension veins carry much higher gold grades when intersecting folded BIF units. Continuation of underground mapping and study of delineation holes that intersect these zones especially in close vicinity to the mapped exposures in plan, section, and longitudinal view will allow for the documentation of the complex geometry of the BIF units, including potential pre-D_2 features, and important structural and lithological controls on gold distribution in the 1150 and 1250 ore zones.