

Reconstructing the volcanological and paleoenvironmental setting of an Archean Hollandaire Cu-Au volcanic hosted massive sulphide deposit, Murchison Domain, Yilgarn Craton, Western Australia

Raymond A.F. Cas¹, Patrick C. Hayman¹, Sarah Hull¹, Edward Summerhayes², David Price²

¹School of Geosciences, Monash University, Clayton, 3800, Australia, Australia, ²Silver Lake Resources, South Perth, Western Australia, 6951, Australia, Australia

E-mail: ray.cas@monash.edu

Discovered in late 2011, Hollandaire is a Cu-Au VMS deposit situated near the town of Cue within the Archean Murchison Domain of the Youanmi Terrane, Western Australia, and occurs within the Greensleeves Formation of the Polelle Group (2820-2735 Ma). Host rocks are variably silicified, chloritised and sericitised, have been metamorphosed to upper greenschist facies, and have a pervasive foliation (S1) that is crenulated (S2) in places. As a result, primary textures are obscured. From stratigraphic logging of 31 diamond drill holes, geochemistry (major and trace elements), petrography and geochronology, we reconstruct the paleo volcano-sedimentary setting. Host rocks consist dominantly of either quartz-chlorite-muscovite schists (andesitic to dacitic in composition) or quartz-chlorite-muscovite schists with larger blue quartz crystals (rhyolitic). The former lithofacies, where least deformed and altered, consists of thin interbedded fine and coarse layers up to 100 m thick, as well as intervals of fine-grained carbonaceous black material. This lithofacies is interpreted as a metasedimentary, below wave-base, deep water, distal turbidite succession. The rhyolitic schist lithofacies, with evenly dispersed quartz crystals, ranges up to 300 m thick, and even within less deformed domains is massive and uniform. Fragmentation is absent at the margins of this lithofacies, indicating it is a high-level intrusion. The lone breccia interval (1 m), consisting of cobble-size clasts of coherent rhyolite in a metasedimentary matrix, is interpreted as reworked autoclastic volcanic debris. Undeformed dacite porphyries cross-cut the stratigraphy and clearly post-date deformation, and based on our preliminary geochronological work, are 2780 Ma. Sulphide mineralisation ranges from massive intervals of mainly pyrite and chalcopyrite (up to 14 m thick) to stringers and disseminated styles. Massive intervals are restricted to the metasedimentary lithofacies, while disseminated sulphides are found within both the metasediments and high-level rhyolite intrusion and rarely within the younger dacite porphyries. We interpret much of this as remobilisation but are uncertain to what extent the primary mineralisation reflected seafloor vs sub-seafloor emplacement. We interpret the setting as a rhyolitic cryptodome with VMS mineralisation in a deep-water setting that was pervasively deformed by both S1 and S2 and subsequently intruded by dacitic porphyries. We know of no clear evidence for an arc, however, the tectonic setting remains unclear. Voluminous volcanic events contemporaneous with Hollandaire include the nearby Eelya plutonic complex (2750 Ma), which has similar geochemistry to the high-level rhyolitic intrusion, and the mafic-ultramafic Gnanagooragoo Igneous Complex. This study highlights some of the difficulties in working with Archean deposits and adds to the small database of VMS deposits within the Yilgarn Craton.