The Archean Vickers Gabbroic Complex, southern Nunavut, Canada: An example of metamorphogenic gold mineralization localized to a chemically favourable host rock

S.A.J. Tokaryk[1], D.J. Kontak[1], M. Fayek[2], J. North[3]

[1]Department of Earth Sciences, Laurentian University, Sudbury, ON P3E 2C6; [2] Department of Geological Sciences, University of Manitoba, Winnipeg, MB, R3T 2N2; [3]Northquest Limited, Toronto, ON M5C 2C5

The Vickers albitized gabbroic intrusion (VGI, ~2690 Ma), located in the Central Hearne sub-domain of southern Nunavut, hosts a significant new gold discovery (2012; e.g., hole PB-12-09 164.41 m @ 5.39 g/t Au). This mineralization occurs in the northern portion of the Neoarchean Tavani greenstone belt (2.72-2.65 Ga), an area that has been interpreted to contain the Pistol Bay Corridor, an east-west trending brittle/ductile deformation zone. The VGI, a slightly elliptical (900 m x 600 m), heterogeneous body emplaced into volcaniclastic rocks, contains the mineralized envelope, which is located at its NW contact. Lower greenschist grade metamorphism overprints the area, within which the rocks are cut by abundant quartz-carbonate veins. Pyrite ± arsenopyrite are widespread, but their abundance increases with degree of hydrothermal alteration and coincides with anomalous Au values. Several gradational alteration assemblages occur in the mineralized zone: chlorite (CF1+CF2) and silica facies (SF1I + SF2I) are in the VGI, whereas the sericite facies (SF1FW+SF2FW) has been documented in footwall rocks. The Au mineralization is most abundant in the SF1I and SF2I zones where both pyrite and arsenopyrite (>3%) occur as disseminations, stringers, and/or in narrow quartz-carbonate ± chlorite veins. In-situ (SIMS) $\delta^{34}S$ analyses of arsenopyrite (1.6 ± 0.6; n=14) and pyrite (0.2 ± 1.2; n=19) indicate a magmatic source for S, either directly or through remobilization from earlier sulfides, whereas in situ (SIMS) $\delta^{18}O$values for Au-quartz veins (15.6 ± 1.8; n=20) indicate $\delta^{18}O_{H2O}$ of 10.3 to 11.5‰ (at 350°-400°C). Although petrographic and SEM-EDS studies indicate free Au commonly mantles sulfides, LA-ICP-MS elemental maps of sulfides indicate the presence of refractory Au coupled to Ag-As-Sb-Bi-Te-W±Cu-Pb. These data are collectively interpreted to favour a working model whereby metamorphically derived fluids carrying Au, likely as a bisulfide complex, were focused along a rheologically favourable contact zone and subsequently reacted with the Fe-rich VGI destabilizing the Au complex, thus resulting in the localization of Au within this chemically favourable unit.