Raskevicius T, Beaudoin G, Kyser TK, 2016, Whole rock d18O and d2H footprint to the Canadian Malartic gold deposit, Abstract, GAC-MAC, Whitehorse, YK

The Canadian Malartic Au deposit is the result of a hydrothermal system that has altered the host metasedimentary rocks of the Pontiac Group, metavolcanic rocks of the Piché Group, and late mafic dykes and porphyritic intrusions. Au mineralization formed by hydrothermal fluids flowing through these rocks which caused exchange reactions of O and H isotopes. These reactions are reflected in whole rock $\delta^{18}O$ and $\delta^{2}H$ values that can be used to trace the isotopic footprint of the mineralized system. The isotopic footprint in Pontiac greywackes is marked by a decrease in $\delta^{2}H$ below -90‰ in the mineralization from background values of ca. -60‰, whereas $\delta^{18}O$ values remain relatively constant near 10‰. Mafic dykes in the area record an increase in $\delta^{18}O$ from background values of ca. 8‰ to values greater than 9‰ and a decrease in $\delta^{2}H$ from ca.-70‰ to ca. -80‰ in mineralization. The $\delta^{18}O$ and $\delta^{2}H$ values of biotite from auriferous veins indicate that the mineralizing fluid in equilibrium at 450°C would have had a $\delta^{18}O$ of 8.2-11.2‰ and a $\delta^{2}H$ of -6 to 1‰, compositions near those of metamorphic fluids at 450°C in equilibrium with average unmineralized greywacke. Kriging of regional variations in O and H isotopic compositions show the $\delta^{2}H$ contour of -60‰ in greywackes encircles the mineralized domain and is elongated towards the NW and SE. In mafic dykes, the $\delta^{2}H$ contour of -72‰ marks both the mineralized domain as well as a large area towards the S and SE. The $\delta^{18}O$ isopleths from greywackes do not show a significant spatial association with mineralization. However, the $\delta^{18}O$ 8.3‰ isopleth from mafic dykes encircles the centre of the mineralized domain and is extended over an area towards the SE. In hostrocks, decreasing $\delta^{2}H$ towards mineralization may be attributed to either a decrease in temperature towards mineralization or the infiltration of a later, low $\delta^{2}H$ fluid in the fractured domain near mineralization. As this was a rock dominated system, $\delta^{2}H$ was preferentially exchanged while $\delta^{18}O$ of the greywackes remained largely unchanged. Modeling of O-H isotopic exchange would require the mineralized domain to be ca. 250°C and a temperature gradient extending to ca. 500°C 1-2 km south of the deposit. The increase in $\delta^{18}O$ observed in mafic dykes proximal to mineralization may be attributed to the carbonatization and silicification of these rocks by the mineralizing fluid.

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