Raskevicius T, Beaudoin G, Kyser TK, 2015, Whole rock d18O and d2H footprint to the Canadian Malartic gold deposit, Thesis Presentation, U Laval, QC

The Canadian Malartic gold deposit is the result of a hydrothermal system that altered the host metasedimentary rocks of the Pontiac Group, metavolcanic rocks of the Piché Group, porphyritic dykes and sills, and mafic dykes. Gold mineralization formed by hydrothermal fluids flowing through these rocks and resulted in exchange reactions of oxygen and hydrogen isotopes. These reactions are reflected in whole-rock $\delta^{18}O$ and $\delta^{2}H$ values of the rocks that can be used to map the isotopic footprint of the mineralized system. The isotopic footprint in Pontiac greywackes is marked by an increase in $\delta^{2}H$ values away from mineralization from -91‰ to background values of ca. -59‰, whereas $\delta^{18}O$ values remain relatively constant near 10‰. Mafic dykes in the area also record a footprint marked by an increase in $\delta^{2}H$ values from -84‰ near mineralization to background values ca. -73‰ and a decrease in $\delta^{18}O$ values away from mineralization from 9.8‰ to background values of ca. 8.3‰. The isotopic composition of the metamorphic fluid in equilibrium with the average least altered greywacke at upper greenschist to amphibolite conditions of ca. 475°C is approximately $\delta^{18}O$ = 7.6‰ and $\delta^{2}H$ = -12‰. This is very near the compositions of the mineralizing fluid at the Canadian Malartic deposit reported by previous studies. Kriging of regional variations in oxygen and hydrogen isotopic compositions in host rocks to the Canadian Malartic deposit enables the mapping of the isotopic footprint. In greywackes, the -59‰ $\delta^{2}H$ isopleth encircles the mineralized domain and is elongated towards the northwest and southeast, while the 9.9‰ $\delta^{18}O$ isopleth appears to encircle the mineralized domain, but, remains very close to the background values. In mafic dykes, the -73‰ $\delta^{2}H$ isopleth encircles the mineralized domain as well as a large area to the south and southeast while the 8.3‰ $\delta^{18}O$ isopleth encircles the centre of the mineralized domain and extends over an area towards the southeast. Host rock oxygen and hydrogen isotope compositions thus permit the identification of a cryptic alteration footprint up to 2.5 km outside of the Canadian Malartic.

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