

# Structural Setting and Geochronology of Auriferous Quartz Veins at the High Rock Island Gold Deposit, Northwestern Superior Province, Manitoba, Canada

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## Abstract

The High Rock Island gold deposit occurs across the intrusive contact between a granitoid pluton and a mafic metavolcanic rock at the southern margin of the Island Lake greenstone belt. The main structure at the deposit is a ~5-m-wide, north-trending, and steeply dipping dextral ductile-brittle fault zone (the “main fault”) that cuts at a right angle across the pluton-greenstone contact and the contact-parallel foliation. Total horizontal displacement along the fault is ~9 m, of which ~3 m is accomplished by ductile shearing and ~6 m by brittle faulting.

The gold deposit consists of steeply dipping auriferous quartz veins that are hosted in, and were emplaced during, the dextral shearing along the main fault. They include: (1) the “main vein” (a fault-fill vein) that occurs in the center of, and is parallel to, the main fault, (2) en echelon veins (extensional veins) that occur on both sides of the main vein and cut across the foliation, and (3) foliation-parallel veins that occur locally. Detailed analysis of the geometry of the en echelon veins, partly based on a new Mohr circle construction method, shows that the deformation in the main fault was transtensional. The faulting and quartz vein emplacement were controlled by the contacts of a north-trending mafic dike. They took place under greenschist facies conditions, postdating amphibolite facies metamorphism in the host rock.

The mineralized quartz veins contain both monazite and titanite, which yield U-Pb ages of  $2687 \pm 2$  Ma and  $2658 \pm 5$  Ma, respectively. Although the exact interpretation of the two ages remains somewhat uncertain, it is likely that gold could have been introduced during a secondary event at ~2658 Ma in a vein originally formed at ~2687 Ma or earlier. This is supported by the isotopic affinity of Pb in titanite with that in galena that is spatially closely associated with gold. The interpretation that gold was introduced after the emplacement of the quartz veins is also consistent with the observation that the main vein only contains significant gold (and sulfide) where it is cut by a vein-parallel fault. In any case, the mineralization at the deposit took place at the latest stages of orogenic development in the northwestern Superior province.