Round Hill Shear Zone-Hosted Gold Deposit, Macraes Flat, Otago, New Zealand: Evidence of a Magmatic Ore Fluid

CORNEL E. J. DE RONDE,†

Institute of Geological and Nuclear Sciences, P.O. Box 31-312, Lower Hutt, New Zealand

KEVIN FAURE,*

Department of Geochemistry, Geological Survey of Japan, 1-1-3 Higashi, Tsukuba, Ibaraki 305-8567, Japan

COLIN J. BRAY,

F. Gordon Smith Fluid Inclusion Laboratory, Department of Geology, University of Toronto, Toronto, M5S 3B1, Canada

AND DAVID J. WHITFORD

CSIRO, Division of Petroleum Resources, PO Box 136, North Ryde, NSW 1670, Australia

Abstract

The 0.8-Moz Round Hill shear zone-hosted gold deposit is one of several located on, or near, the Hyde-Macraes shear zone, Macraes Flat, New Zealand. Field relationships show stockwork veins are the oldest part of the hydrothermal system, followed by flat and ramp veins. Hanging-wall shear veins formed early but have been modified by late deformation.

Fluid inclusion microthermometric results for dominant type I inclusions show that flat and ramp veins have the same average wt percent NaCl equiv values (2.2 ± 0.6%) and were precipitated from the same fluid. Salinity data for these veins overlap with those from hanging-wall veins (average 1.3 ± 0.3%) and stockwork veins (1.6 ± 0.6% for vein margins; 0.9 ± 0.3% for vein centers), although both of the latter trend toward lower overall wt percent NaCl equiv values, suggesting mixing between relatively dilute and more saline end members. All of the above veins have similar temperatures of homogenization (T_h), ranging between 110° and 188°C. Fluid inclusion trapping temperatures are considered to be ~300°C, equating to a ~10-km depth of formation. Carbon dioxide dissolved in the hydrothermal fluid is responsible for up to one third of fluid inclusion apparent salinities. Stockwork and hanging-wall veins thus have true salinities of <1 wt percent NaCl equiv (<0.17 molal) and flat and ramp veins have true salinities of <2 wt percent (<0.34 molal).

Fluid inclusion volatiles from Round Hill and other Macraes deposits are dominated by H_2O (99.02–99.69 mol %), with lesser CO_2 (0.14–0.76 mol %), N_2 (0.03–0.32 mol %), and CH_4 (0.06–0.17 mol %). Noticeable concentrations of hydrocarbons occur in many of the samples. Fluid inclusion cation and anion data show few components of relatively low concentration are dissolved in the hydrothermal fluid, consistent with CO_2-corrected microthermometric measurements.

A range in fluid inclusion δD_{H2O} values obtained for the Round Hill deposit is coincident with the different vein types and also indicates mixing between two fluids. One fluid is considered to be O isotope shifted meteoric water, as trapped by the early stockwork veins, and has the lowest δD_{H2O} values of –80 per mil. The other fluid is represented by flat and/or ramp and hanging-wall veins that have δD_{H2O} values up to –40 per mil. The Macraes δD_{H2O} data show a trend toward the magmatic water end member for geothermal systems associated with convergent plate boundaries and are consistent with a 25 to 50 percent magmatic component in the Macraes hydrothermal system.