Economic Geology
Vol. 97, 2002, pp. 291–309

Host-Rock and Structural Controls on the Nature and Timing of Gold Mineralization at the Holloway Mine, Abitibi Subprovince, Ontario

J. R. Ropchan, B. Luinstra, A. D. Fowler,† K. Benn,

Ottawa Carleton Geoscience Centre and Department of Earth Sciences, University of Ottawa, 140 Louis Pasteur, Ottawa, ON, Canada K1N 6N5

J. Ayer,

Ottawa Carleton Geoscience Centre and Department of Earth Sciences, University of Ottawa, 140 Louis Pasteur, Ottawa, ON, Canada K1N 6N5, and Precambrian Geoscience Section, Ontario Geological Survey, 933 Ramsey Lake Road, Sudbury, ON, Canada P3E 6B5

B. Berger,

Precambrian Geoscience Section, Ontario Geological Survey, 933 Ramsey Lake Road, Sudbury, ON, Canada P3E 6B5

R. Dahn,* R. Labine,

Newmont Canada Ltd., Holloway Mine, P.O. Box 279, Matheson, ON, Canada P0K 1NO

and Y. Amelin

Jack Satterly Geochronology Laboratory, Royal Ontario Museum, 100 Queen's Park, Toronto, ON, Canada M5S 2C6

Abstract

The Holloway mine, a mesothermal gold deposit, is located within the western Abitibi subprovince, Ontario. Mineralized zones that contain microscopic gold within pyrite are hosted by a sequence of metakomatiites, mafic to felsic metavolcanic, and metasedimentary rocks. There were two mineralization events, however the early one was the main event in terms of the amount of gold mineralization. This event was associated with albitization, silicification, chloritization, and sericitization in addition to pyritization. The later mineralization is associated with sericitization and pyritization. Carbonate and sericite alterations are associated with both mineralizing events. Results of U/Pb zircon age dating of rocks within the sequence constrains the main mineralization event to ~2672 Ma. Ore lenses of the Holloway deposit are enveloped by 080°-striking, steeply south dipping zones of intense deformation and fabric development within the Porcupine-Destor deformation zone. The shear zones are characterized by a strong foliation and, locally, an associated extension lineation. The ore lenses are interpreted to represent lithons that were formed by boudinage of the more competent mineralized zones, which are pervasively albitized. Analysis of geochemical data demonstrates that the REE, Th, Nb, Hf, Ti, Fe, and Al were largely immobile with respect to the albite, quartz, chlorite, sericite, and hematite alterations. Locally preserved textures such as abundant varioles and spherulites indicate that the host metavolcanics were relatively evolved rocks. Geochemical data show they have an iron enrichment trend typical of tholeiitic mafic to felsic suites and that they were derived through fractional crystallization of parent basalt. Because of their high Fe/Mg ratios the rocks reacted with hydrothermal solutions carrying gold, presumably as thio complexes, to form pyrite, which scavenged the gold.

Introduction

The Late Archean Abitibi greenstone belt has a history as a major gold-producing region. Vein-type epigenetic gold deposits, commonly hosted in metavolcanic and metasedimentary rocks, have been known to be spatially associated with regional-scale zones of anomalously intense deformation for over a century (e.g., Colvine, 1989; Kerrich and Cassidy, 1994). The linear zones are commonly referred to as deformation or fault zones, and they may be continuous over 400 km. They are made up of numerous faults and shear zones and are characterized by intense shearing, folding, and alteration.

One of the main deformation zones in the Abitibi greenstone belt is the Porcupine-Destor deformation zone, which is mapped from Timmins, Ontario, in the west, to Val d'Or, Québec, in the east (Fig. 1). Recently, mineral exploration programs along the Porcupine-Destor deformation zone have led to the discovery of several new gold mines and the identification of numerous prospects, sparking renewed interest in this area.

This paper is concerned with the Holloway gold mine, which has been in operation since 1996 and is currently owned by Newmont Canada Limited. The Holloway mine is situated within the Porcupine-Destor deformation zone, about 60 km east of the town of Matheson, Ontario. It is a mesothermal gold deposit, which has several discontinuous zones of mineralization, and it is characterized by extensive alteration of the host rocks. We present the first detailed investigation of the geology, geochronology, geochemistry, and

† Corresponding author: e-mail, afowler@uottawa.ca
*Present address: MGI Limited, 466 Hodgson Road, Fredericton, New Brunswick E3C 2G5, Canada.