

The Au-Pd Mineralization at the Conceição Iron Mine, Itabira District, Southern São Francisco Craton, Brazil: An Example of a Jacutinga-Type Deposit

GEMA RIBEIRO OLIVO,^{†,*}

Department of Earth and Planetary Sciences, McGill University, 3450 University Street, Montreal, Quebec, Canada H3A 2A7

MICHEL GAUTHIER,

Département des Sciences de la Terre, Université du Québec à Montréal, Case Postale 8888, succ. Centre-ville,
Montreal, Quebec, Canada H3C 3P8

ANTHONY E. WILLIAMS-JONES,

Department of Earth and Planetary Sciences, McGill University, 3450 University Street, Montreal, Quebec, Canada H3A 2A7

AND MARTIN LEVESQUE

Département des Sciences de la Terre, Université du Québec à Montréal, Case Postale 8888, succ. Centre-ville,
Montreal, Quebec, Canada H3C 3P8

Abstract

The Conceição mine, which is located in the Itabira district, southern São Francisco craton, is a rare example of gold and palladium mineralization hosted by jacutinga, an altered Lake Superior-type iron-formation. The mine sequence consists of three metamorphosed lithostratigraphic units, which are from the oldest to the youngest: (1) an Archean volcano-sedimentary sequence, (2) a Paleoproterozoic iron-formation, and (3) a Paleoproterozoic quartzite. These units are cut by mafic intrusive rocks and, with the exception of intrusive contacts, all contacts between the various units are structural and interpreted as thrust faults. The rocks were subjected to three phases of folding: (1) D_1 , characterized by tight asymmetric and isoclinal folds, which develop locally into sheath folds (the D_1 fabrics are the S_1 foliation and elongation lineation); (2) D_2 , represented by tight, large-scale folds and associated parasitic folds; and (3) D_3 , characterized by open folds with an associated crenulation cleavage. The D_1 and D_2 deformation are interpreted to be products of simple shear with a transport direction consistently east over west. These rocks were metamorphosed to typical mineralogy of amphibolite facies conditions during the D_1 phase of folding.

The Conceição orebody consists of a single quartz vein surrounded by jacutinga. The vein is parallel to the S_1 foliation, which is locally oriented west-southwest and dips 55° to 75° NW, and was folded by D_2 deformation. It extends 100 m downdip in the direction of the L_c elongation lineation and 400 m along strike. The jacutinga consists of centimeter-scale layers of muscovite, specular hematite (hematite I), and octahedral hematite grains (hematite II) with remnants of magnetite, and a finely laminated envelope around the quartz vein, which is composed mainly of Fe hydroxides, hematite (hematite III), kaolinite, muscovite, and tourmaline. The quartz vein is dismembered and quartz grains are partially corroded and filled by Fe hydroxides and kaolinite. The ore minerals, interpreted to have formed during the main hydrothermal event, are palladian gold (up to 3.2 wt % Pd) and an unknown Pd-Sb-As mineral (tentatively identified as mertierite II), which are typically included in hematite II octahedra. A few grains of palladian gold (up to 0.9 wt % Pd) were found mantling hematite II grains. Native gold is commonly associated with Fe hydroxide in the finely laminated alteration envelope around the quartz vein and is interpreted to have precipitated during weathering.

The similarities between the Au-Pd orebodies at the Conceição and Cauê deposits (referred to as "jacutinga-type" deposits) suggest that they were formed by the same processes and their characteristics favor an epigenetic model for gold and palladium concentration in the iron-formation. Since the Cretaceous, these Archean and Proterozoic rocks have been weathered, and the hydrothermal silicates and oxides have been replaced by kaolinite and Fe(Mn) hydroxides; gold and palladium have been remobilized and reprecipitated as pure metals or Pd oxides.