Mineralogy of Au Mineralization at the Quebradona Creek, Jericó (Antioquia, Colombia)

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INTRODUCTION

The Quebradona creek sector is located about 6 Km to the SE of Jericó townsite, in the Antioquia Department, NW Colombia (Fig. 1). In this area, an important Cu-Au porphyry-type mineralization target (Quebradona) has been drilled by different mining companies between 2008-2012 (i.e. B2Gold Corp., Anglo Gold Ashanti Colombia) on the basis of geological recognition, geochemical anomalies, well-identified hydrothermal alteration types, and the occurrence of several late Miocene hypabyssal intrusives and hydrothermal breccias. Early geochemical analyses in drill-cores of the Aurora area (B2Gold Corp in 2008) returned values up to 2 g/t along tens of meters, and the existence of a porphyry-type Au-Cu gold mineralization has been proved.

The aim of this contribution is to provide information on the mineral associations and textures for the mineralization, on the basis of surface samples collected prior to diamond-drill rounds.

GEOLOGICAL SETTING

The Quebradona Creek area is located in the Middle Cauca river region, between the Central and Western cordilleras of the Colombian Andes. Local geology comprises large outcrops of volcano-sedimentary rocks of the late Miocene Combia Formation, which are intruded by hypabyssal intrusives and breccias of similar age (Fig. 1). In the Quebradona creek area an extensive outcrop of breccia, with more than 80 m wide and 400 m long, with an important vertical development, more than 100 meters, is well-recognized.

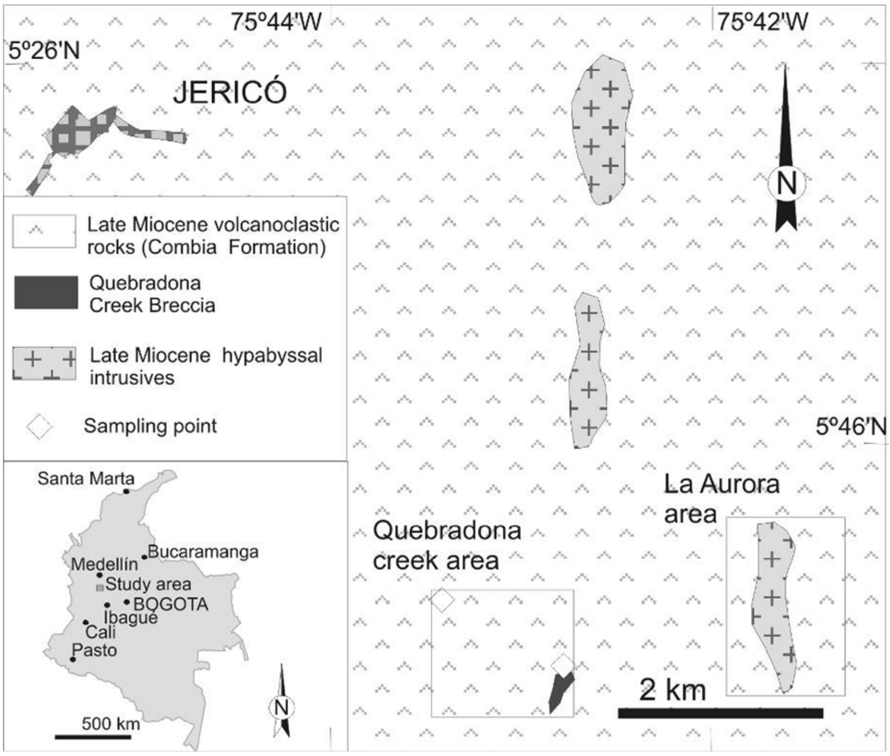

fig 1. Geological map of the study area, adapted from Leal-Mejía (2011).

MINERALOGY AND TEXTURES

The host rocks of the breccia are affected by extensive argillic and sericitic hydrothermal alteration, besides important silicification. Monazite-(Ce) and xenotime-(Y) are richly scattered as fine-grained anhedral crystals in the vicinity of the veins in the altered rocks.

The Quebradona creek igneous breccia consists of irregular angular fragments of the volcano-clastic rocks of the Combia Formation scattered in a fine-grained igneous matrix. The size of the fragments is variable, ranging between few milimeters and several decimeters. Both matrix and rock fragments have been affected by strong hydrothermal alteration, producing pervasive sericitic and argillic alterations of the rock fragments and of the igneous matrix, along with silicification. Mineral associations consist mainly of quartz, kaolinite and sericite. As a result of this silicification, the rock becomes more resistant to weathering and erosion than the surrounding volcano-clastic rocks; therefore, the silicified rock shows important topographic expression. Scarce altered pyrite is found in the breccia outcrops.

The Quebradona creek igneous breccia contains large amounts of members of the tourmaline group. Tourmaline occurs as thin prismatic crystals, up to 1 cm in lenght, arranged radially, as in the luxulianites (Fig. 2). It is black in hand sample and has a dark greenish pleochroism in thin section. Crystals have zoning, either concentric or longitudinal. The outhermost part of the

palabras clave: Filón, Oro, Telururos, Turmalina, Pórfido, Brecha | *key words:* Vein, Gold, Tellurides, Tourmaline, Porphyry, Breccia

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tourmaline fans is slightly depleted in Fe, and presents a clearer color than the centers. However, the composition of the whole tourmaline plots in the alkaline group (Henry et al., 2011), close to the schorl end-member (Fig. 3).

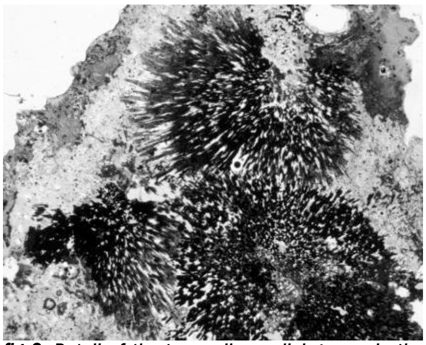

fig 2. Detail of the tourmaline radial groups in the Quebradona creek igneous brecci. Transmitted plane polarized light.

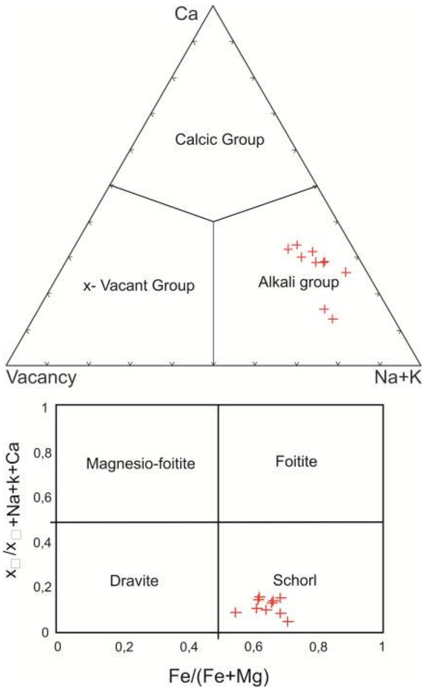

fig 3. Representation of the tourmaline compositions from the Quebradona breccia in the classification diagrams of Henry et al. (2011).

A dense network of small veinlets is spread along these breccia bodies. Such veinlets are composed of fine-grained sulfides. In most of the cases these sulfides have been completely replaced by secondary minerals in the outcropping area.

Because of the advanced supergene alteration of the sulfides in the breccia, ore minerals have been studied in the surrounding quartz-sulfide veins (e.g. La Coqueta sector, NW of the Quebradona breccia). Quartz is the main gangue

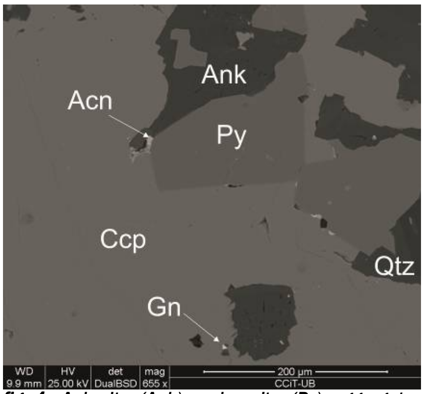

fig 4. Ankerite (Ank) and pyrite (Py) aggregates replaced by chalcopyrite (Ccp) and veined by galena (Gn) and acanthite (Acn). SEM image, mode BSE

mineral in these veinlets, accompanied with minor amounts of ankerite (Fig. 4).

Pyrite is the most common ore mineral and occurs as euhedral crystals scattered in quartz or in massive aggregates. Pyrite crystals are less than 2 mm in diameter, and are associated with a generation of Cd-rich sphalerite, which occurs as anhedral grains included in pyrite crystals. Chalcopyrite anhedral grains, less than 5 mm in diameter, are produced during a second generation of sulfides (Fig. 4).

A complex ore sequence fills cracks in the above-mentioned sulfides. All of these minerals are anhedral and fine-grained, less than 2 microns in size. These ores comprise silver-rich gold ("electrum"; Fig. 5), sulfides as galena and acanthite (Ag_2S; Fig. 4), tellurides as hessite (Ag_2Te; Fig. 5) and cervelleite (Ag_4TeS; Fig. 6), and a bismuth telluride, possibly hedleyite (Bi_7Te_3).

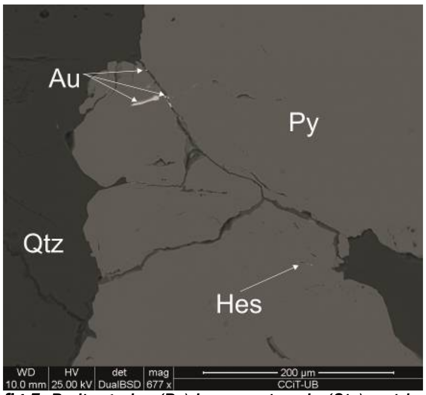

fig 5. Pyrite grains (Py) in a quartz vein (Qtz), cut by thin veinlets of gold (Au) and hessite (Hes). SEM image, mode BSE.

In addition, during these late stages fine-grained silver sulfosalts are produced, as bismuthian tetrahedrite (Fig. 6), matildite ($AgBiS_2$; Fig. 6), stromeyerite ($AgCuS$) and freibergite ($(Ag_{4+2x}Cu_{2-2x})[(Cu,Ag)_4(Fe,Zn)_2]Sb_4S_{12}S_{1-x}$).

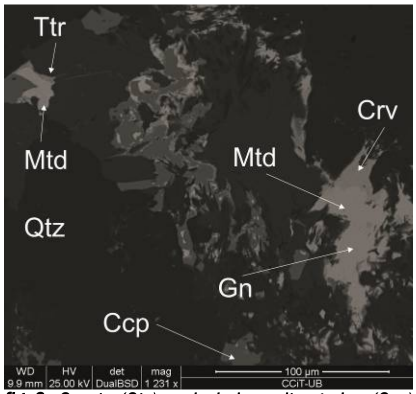

fig 6. Quartz (Qtz) and chalcopyrite grains (Ccp) replaced by bismuthian tetrahedrite (Ttr), matildite (Mtd), cervelleite (Crv) and galena (Gn). SEM image, mode BSE.

DISCUSSION AND CONCLUSIONS

The style of the hydrothermal alterations found in the intrusive breccia suggested the proximity of hypabyssal porphyritic intrusives, as does the alignment with other outcropping porphyrytic dikes and proved by later diamond-drill rounds.

Tourmalinization is also common in Colombia in other important Au mineralizations closely associated with Intrusion-Related Gold Deposits, (e.g. San Martín de Loba; Leal-Mejía, 2011). Hence, the composition of this mineral seems to be a potential tool in the exploration of gold deposits associated with intrusives in Colombia.

The ore mineral associations are enriched in tellurium and precious metals. These mineral assemblages also suggest that the environment for the formation of the Au mineralization is closely related to an intrusive.

ACKNOWLEDGEMENTS

This research was supported by the project SGR 444 of the Generalitat de Catalunya.

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