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The Archean Maria Lázara gold deposit, Goiás, Brazil: Example of Au-Bi-Te-S metallogeny related to shear zones intruded by synkinematic granitoids

G.M. Pulz & H. Jost
Universidade de Brasília, Instituto de Geociências, Brazil

D. Michel
ENSG-CESEV, Nancy, France

G. Giuliani
Universidade de Brasília, Brazil & ORSTOM, CRPG, France

ABSTRACT: The Maria Lázara gold deposit is hosted into metabasalts submited to intense hydrothermal alteration related to the emplacement of a granitoid dome in a shear zone. This deposit is unusual with respect to other brazilian shear zone-hosted gold mineralization due to Bi-Te-As-S paragenesis and to the maldonite-native gold association.

INTRODUCTION

The Archean Maria Lázara gold deposit is located in the region of Crixás (Goiás, Brazil), within the eastern part of the Guarinos Greenstone Belt. Mineable gold occurs as primary mineralization in quartz-carbonate and albite-carbonate veins and veinlets.

GEOLOGICAL SETTING

The gold deposit occurs within the Carroça shear zone which represents the contact between the Archean Guarinos Greenstone Belt and Moquém granitic gneiss block. It is located in the innermost portion of a 400 m wide and 5 Km long hydrothermal alteration halo developed in fine-grained mylonites and ultramylonites derived from the greenstone belt metabasalts. The alteration halo comprises (i) an outer (400-500 m wide) propylitic zone (carbonate, epidote, titanite, chlorite, muscovite); (ii) an intermediate (50-100 m wide) potassic zone (biotite, K-feldspar, garnet, muscovite, chlorite) and, (iii) an inner sericitic zone (< 15 cm wide) with high amount of muscovite, chlorite, tourmaline and sulphide. Textural relationships between mylonitic and hydrothermal mineral assemblages show that mineral growth has been polyciclic. During each pulse the hydrothermal assemblage grew after the mylonitic minerals thus laterally expanding the alteration halo.

Gold occurs disseminated in veins and veinlets. It is accompanied by an intense and characteristic sulfidization developed in the potassic and sericitic zones. Relationship between the alteration haloes and veining shows that fissure filling took place by crack-seal process (Ramsay 1980).

STRUCTURAL SETTING

The gold deposit occurs within a triple point structure (Brun & Pons 1981) developed in the southern portion of the Guarinos dome (Pulz 1990). This dome consists of a synkinematic small trondhjemitic intrusion emplaced into the strike-slip Carroça shear zone that show a northwest trend, a steep southwest dip and a dextral displacement. The mylonite assemblages result from a high strain ductile deformati-

on of both supracrustals, granitic gneisses and trondhjemitic rocks.

GOLD MINERALIZATION

The ore mineralogy is formed by sulphides which are disseminated either in the sericitic and potassic alteration haloes or in the quartz-carbonate and albite-carbonate veins.

Arsenopyrite is the dominant phase with subordinate pyrite, chalcopyrite, pyrrothite and galena. These opaque minerals are accompanied by surprisingly large proportions of species of the Bi-Te-S complex phases dominated by species of the bismuthinite-tetradymite and joesite B-sulphotsumoite series. Minor phase include molybdenite and monazite which occurs as inclusions in arsenopyrite and in the gangue.

Some of the ore minerals were analysed by SEM and QEM methods. Arsenopyrite exhibits different morphologic varieties but without variations in composition. Zoning is conspicuous in each variety characterizing two generations of arsenopyrite: (i) a S-rich one, occurring the core of the crystals. It is general y crouded by inclusions of silicates (tourmaline, sericite, chlorite), sulphides (pyrrothite, chalcopyrite , carbonates and oxides (ilmenite); (ii) an As-rich arsenopyrite, occurring either as rims of zoned crystals or as single crystals. In both cases it is free of solid inclusions.

GOLD MINERALOGY

Gold occurs (i) as native gold associated with maldonite (Au_2Bi) and Bi-sulphotellurides as joesite-B (Bi_4Te_2S), bismuthinite (Bi_2S_3) and native Bi within quartz-carbonate veins of the potassic and sericitic zones. Maldonite is intergrow with native gold and was recognised by QEM (Table 1); (ii) as free gold with up to 7% Ag in the sericitic alteration halo.

Table 1. QEM analyses of maldonite (University of Nancy I) from the Maria Lázara gold deposit.

ELEMENT		ANALYSES		
wt%	Bi	35,28	34,87	34,50
	S	0,01	0,00	0,00
	Au	65,76	64,92	64,50
Total		101,05	99,79	99,00
at%	Bi	33,56	33,61	33,51
	S	0,06	0,00	0,00
	Au	66,38	66,39	66,49

GEOTHERMOMETRY OF GOLD MINERALIZATION

The maldonite + native gold association and the presence of native Bi suggest for low temperature (373-116 ºC) conditions during gold deposition (Boyer & Picot 1963; Ohmoto & Massalki 1983).

CONCLUSIONS

The widespread kilometric alteration halo around the Maria Lázara gold deposit suggest important fluid/rock interaction during shearing, with the contribution of CO_2-rich fluids derived from dynamic metamorphism. Additionally, the occurence of metassomatized and sheared trondhjemitic dykes in the neighbourhood of the deposit as well as the association of Au with Bi, Te, S, As, B, P and Mo suggest that the felsic intrusions played an important role during mineralization by controling several degrees of fluid/rock interaction, fluid pressure and temperature, triggering a large hydrothermal convective system within the shear zone.

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E.A.Ladeira
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