A first approach in understanding the gold mineralization of the Tapajós Mineral Province, Amazonian area, Brazil.

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1 Introduction

The Amazonian Craton (Almeida *et al.*, 1976) is dominated by two Pre-Cambrian structural provinces (Almeida *et al.*, 1981): (i) the *Rio Branco* to the north; and (ii) the *Tapajós* to the south. These two areas are separed by the *Amazonian Province*, which represents the Phanerozoic sedimentary basin that extends from the east to the west apparently following the axis of the Amazonian river (Fig. 1).

The Tapajós Mineral Province is located in the domain (ii), encompasses an area of about 90.000 km^2 and covers much of the southestern part of the craton. Primary gold deposits are widespread in the province and has economic significance (Robert, 1996). The gold occurs in different geological environments and suggests genetic close relationships with granitoids.

2 Regional Geology

The Amazonian Craton (similar to the Guiana Shield; Rogers, 1996) underwent tectonism starting at about 2.0 Ga that has been critical to the gold mineralization (Robert, 1996). Pre-Cambrian rocks underwent most of the region. According to the recently geological mapping (CPRM, 1997) the stratigraphic column for the Tapajós Province is:

I The *Early Proterozoic* units formed by polyphase folded rocks, representing the basement in the area. Mafic and granitic rocks intrude the metamorphic rocks. The main units are:

(i) *Cuíu-Cuíu Metamorphic Complex* consists of granitic gneiss, migmatite, schist, tonalite, diorite and monzonite. The intrusive rocks represent the early-syn tectonic granitoids, age of which is 2.0 Ga (Santos, person com.).

(ii) *Jacareacanga Metamorphic Suite* (Bizinella *et al.*, 1980) comprises the supracrustal rocks formed by schist, metachert and iron quartzite.

(iii) *Parauari Intrusive Suite* consisting of three facies: granodioritic, monzogranitic and syenitic, which rocks represent the syn-late tectonic granitoids, dated at 1.9 Ga (Silva *et al.*, 1974).

(iv) *Ingarana Intrusive Suite* (Pessoa *et al.*, 1977) formed by mafic rocks (olivine gabbro, gabbro, norite and anorthosite) that intrude the Cuíu-Cuíu rocks, age of which is 1.8 Ga (Silva *et al.*, 1974).

II The *Middle Proterozoic* period is marked by the *Uatumã magmatic event*, dated at 1.9-1.7 Ga (c.f. Schobbenhaus *et al.*, 1984), characterised by an extensive calc-alkaline magmatism related to an extension regime, formed by subaerial, intermediate to felsic volcanic rocks and an subvolcanic plutonism (Gibbs and Barron, 1993). These rocks form the Super Group Uatumã (Pessoa *et al.*, 1977) and comprise the following units:

(i) *Iriri Group* (Pessoa *et al.*, 1977) dominated by rhyolite, rhyodacite, dacite, andesite (*Salustiano Formation*) and pyroclastic, tuff and breccia (*Aruri Formation*).

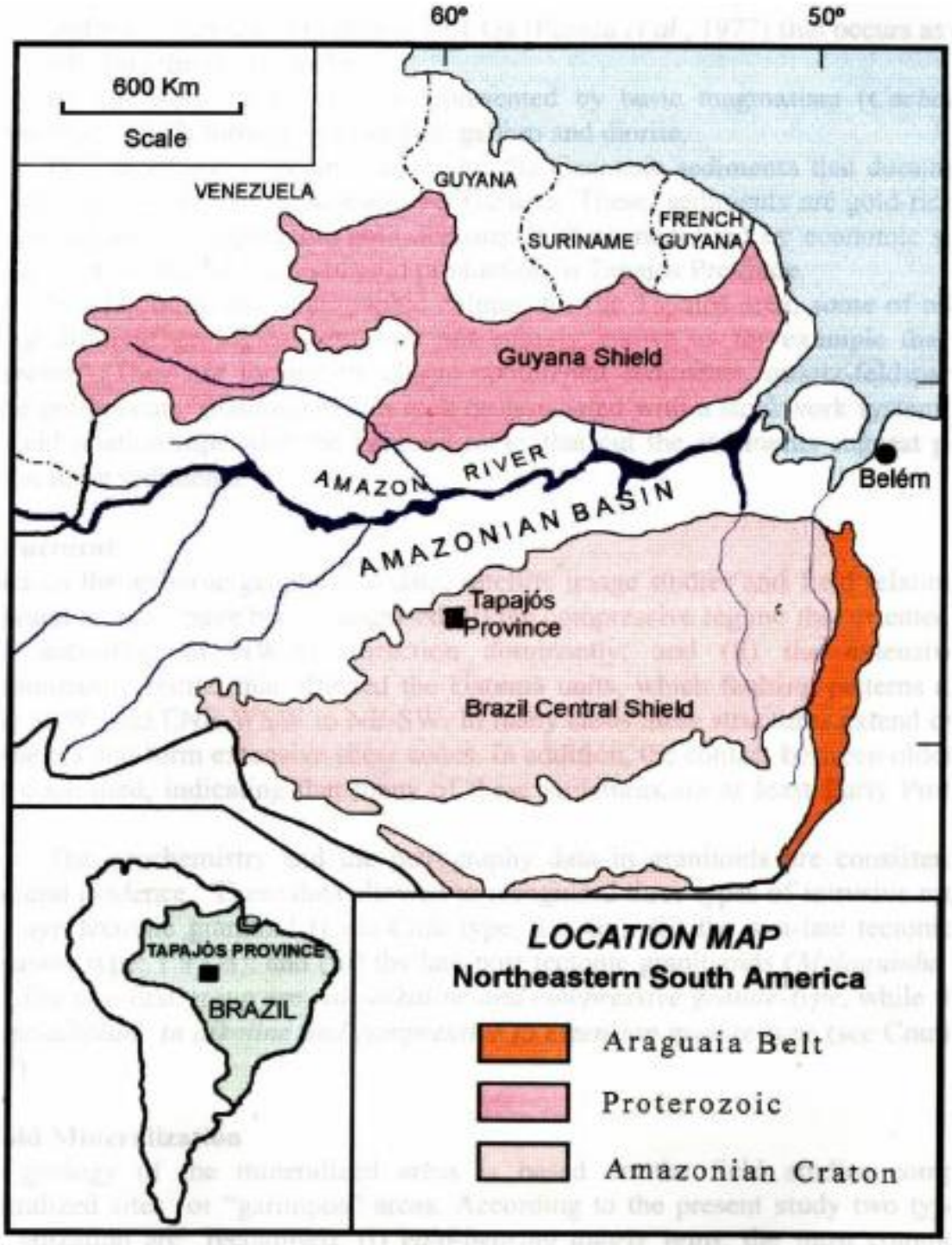


FIGURA 1 Location of the Tapajós Mineral Province

(ii) *Maloquinha Intrusive Suite* (Santos *et al.*, 1975) represents the subvolcanic rocks (alkali-feldspar granite, monzogranite, granite and syenite) or the late-post tectonic granites, dated at 1.75 Ga.

(iii) The *post-Uatumã rocks* consist of: *clastic sedimentary rocks* overlying the Early Proterozoic basement and the Iriri volcanic rocks that form very thick sequences, correlated with the Roraima Supergroup in the Guiana Shield. They consist mainly of quartzite, meta-siltstone, itabirite, and minor amount of limestone and dolomite; and *basic magmatism* dated at 1.61 Ga (Pessoa *et al.*, 1977) that occurs as dykes or sills into the clastic rocks.

III The *Late Proterozoic* is represented by basic magmatism (*Cachoeira Seca*; Pessoa *et al.*, 1977) formed by troctolite, gabbro and diorite.

IV The *Phanerozoic* units comprise the Cenozoic sediments that dominated in the alluvial deposits and are present all over the area. These sediments are gold-rich and form the alluvial and the supergenic gold deposits, both characterised by economic significance and are responsible for the main gold production in Tapajós Province.

In addition to the stratigraphic column for the Tapajós area, some of relationships among different geological units are not entirely known as for exemple the "*Abacaxis sediments*". They are formed by clastic continental sediments, quartz-feldspar enriched, where gold occurs disseminated in rock or associated with a stockwork system. However, the field relationships with the Parauari rocks that cut the sediments suggest pre-Uatumã age for these sediments.

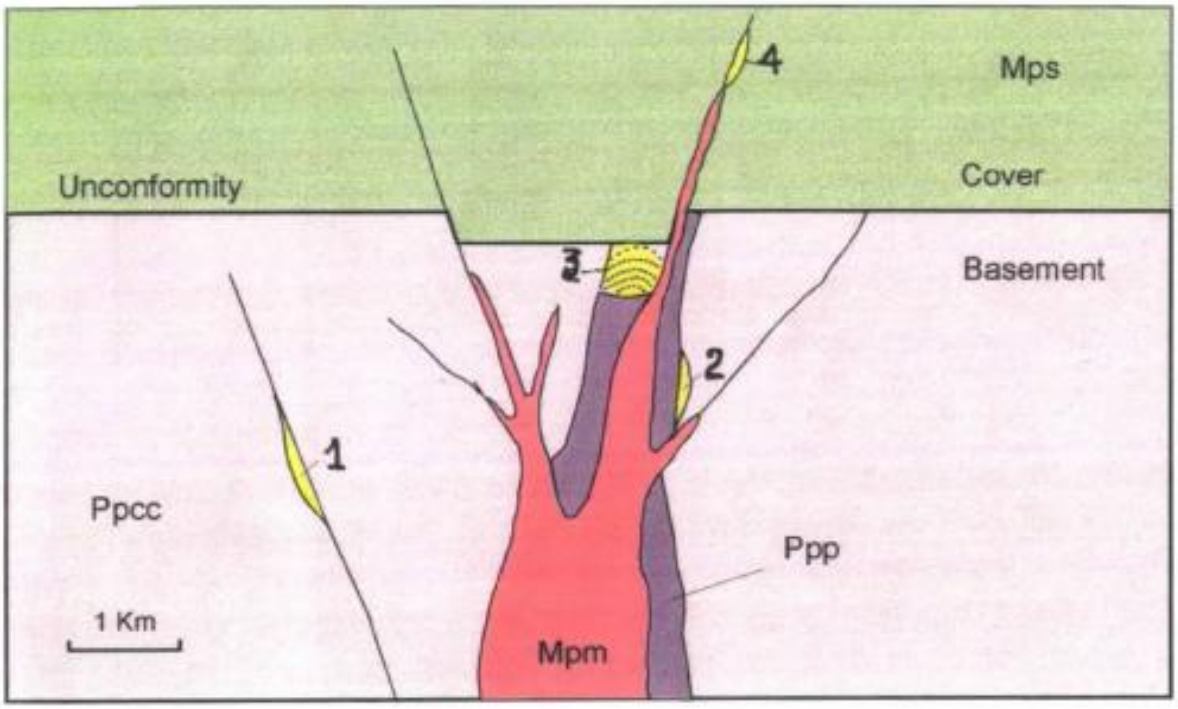
3 Structural

Based on the airborne geophysical data, satellite image studies and field relationships two structural regimes have been recognised: (i) the compressive regime that oriented the oldest units according to NW-SE direction dominantly; and (ii) the extensive regime, predominantly brittle, that affected the Uatumã units, which faulting patterns are: N-S to NNE-SSW; and ENE-WSW to NE-SW. In many cases these structures extend over tens of kilometers and form extensive shear zones. In addition, the contact between oldest units are fault-controlled, indicating that many of these structures are at least Early Proterozoic in age.

The geochemistry and the petrography data in granitoids are consistent with the structural evidence. These data allowed to recognised three types of intrusive rocks: (i) the early-syn tectonic granitoid (*Cuiu-Cuiu* type; 2.0 Ga); (ii) the syn-late tectonic granitoid (*Parauari* type; 1.9 Ga); and (iii) the late-post tectonic granitoids (*Maloquinha* type; 1.75 Ga). The two first group are *calc-alkaline and compressive granite-type*, while the last one is *calc-alkaline to alkaline and compressive to extension granite-type* (see Coutinho *et al.*, 1997).

4 Gold Mineralization

The geology of the mineralized areas is based on the field studies comprising 20 mineralized sites or "garimpos" areas. According to the present study two types of gold mineralization are recognised: (i) *gold-bearing quartz veins*, the most common way of occurrence; and (ii) *disseminated to stockwork mineralization*, identified at just a few sites.



Mpm Maloquinha Intrusive Suite

Mps Iriri Grupo

Ppp Parauari Intrusive Suite

Ppcc Cuiu-cuiu Metamorphic Complex

TYPES OF MINERALIZATION

1, 4 Pluton Related Vein

2 Disseminated / Stockwork Zone

3 Porphyry type

FIGURA 2

Schematic geological model showing the distribution of different types of mineralization in Tapajós Mineral Province (adapted from F. Robert, 1996).

The gold mineralization is widespread and occurs in a variety of host-rock, such as : gneiss basement; granitoids showing different deformation patterns and ages; sediments; volcanic and basic rocks. However, the granitoids represent the most common host rock-type.

5 Conclusions

According to Sillitoe (1991) gold-bearing plutons-related systems contains quartz veins. Usually this type of mineralization occurs peripherally and relatively deep in an intrusion-centered hydrothermal gold system.

The Tapajós gold-bearing quartz veins show some evidences that represent a position intermediated between epithermal/mesothermal gold deposits. The transional epithermal/mesothermal style of quartz vein mineralization and occurrence of disseminated to stockwork-types vein geometries within some of the granitoids in Tapajós Mineral Province indicate that there is the possibility of hard-rock magmatic-type porphyry gold mineralization (Fig. 2).

This type of deposit is charaterised by large tonnage/low grade, as can be found in North American Mesozoic Cordilleran.

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