Characteristic features of the In Abeggui gold deposit (Hoggar Shield, South Algeria)

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The In-Abeggui gold deposit is located in the Eastern part of the Laouni terrane (Hoggar, South Algeria). Our studies lead us to distinguish two shape kinds of gold mineralization i/big quartz-tourmaline veins hosted in gabbro-diorite massif; ii/ stockwerk and veins hosted in microgranite-aplite dikes.
These felsic rocks are the latest and crosscut all the structures. All is incorporated in the frame of a Neoproterozoic volcano-sedimentary basin. The mineralization is characterized by intensive hydrothermal alteration where microgranite-aplite transformed in quartz-muscovite association (greisen).
Mineral association encountered in this deposit is : quartz-tourmaline-muscovite-rutile-topaz-wolframite-molybdenite-pyrite-arsenopyrite-pyrrhotite-chalcopyrite-bismuthinite-native bismuth-galena-sphalerite-native gold-calcite-dolomite and iron oxides. Yet, In Abeggui is a gold deposit by it characterized by the presence of topaz ± molybdenite ± wolframite linked to greisens stage; as well as by plenty of rutile.

Keywords: Hoggar; Native gold; Quartz-tourmaline; Stockwerk; Gabbro-diorite; Aplite; Greisen.

1. Introduction

In-Abeggui deposit is located 210 km, as the crow flies, south east of the city of Tamanrasset (Fig. 1). These deposits and showings are hosted in mylonites and ultra-mylonites (Aïssa et al., 2006). By difference of other Hoggar gold deposts, It is not related to such large lithospheric faults or "mega-shear zones", and not hosted in mylonites, but in a large gabbro-diorite massif. It shows two morphological types of auriferous veins and a different mineral paragenesis (Boutrika, 2006, 2019).

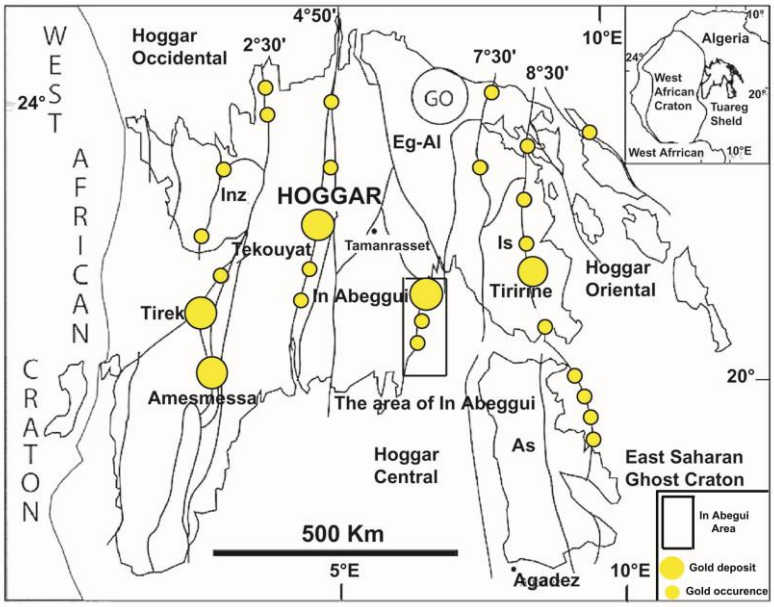

Figure 1. Location of In-Abeggui area (Laouni Terrane ; Central Hoggar)

The objective of this study is to contribute to a better knowledge of the gold mineralization of Hoggar through the example of the In-Abeggui gold deposit, which at first sight appears different from the other gold deposits of Hoggar, currently known.

2. Geological setting

The In-Abeggui gold deposit (Fig. 2) is marked by major fault passing by its center and crosscutting all formations. In this deposit gabbro-diorite bodies is intrusive into the Neoproterozoic volcano-sedimentary series. The mineralized veins are mainly hosted in one mafic body.

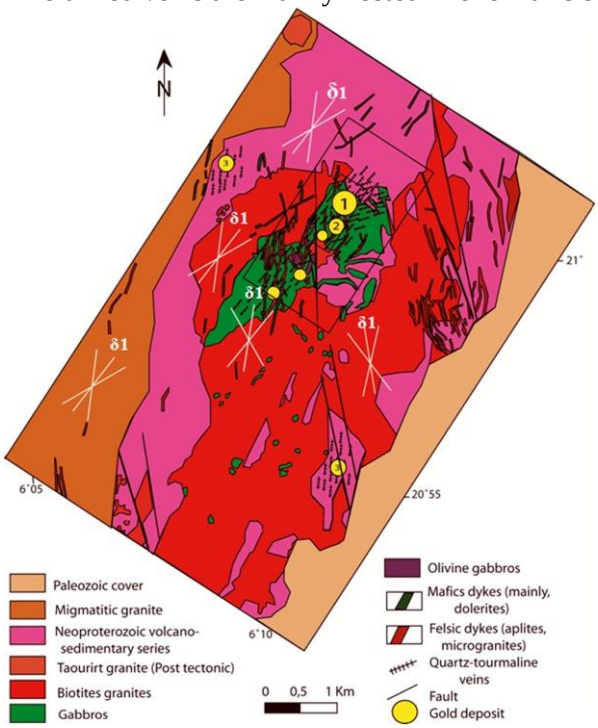

Figure 2. Geological map of In-Abegui area (Boutrika, 2006, 2019)

4. Gitology

The In-Abeggui deposit is located in the context of a large Neo-Proterozoic volcano-sedimentary basin, in which an enormous mass of gabbro-diorites is located.

Our studies have allowed us to distinguish two distinct morphological types of gold mineralization i/ large tourmaline quartz veins hosted in a gabbro-diorite massif; ii/ stockwork and tourmaline quartz veins hosted in microgranite-aplite dikes (Fig. 3). These latter rocks are late and intersect the large gold-bearing quartz veins hosted in gabbro-diorites (Boutrika 2006, 2019).

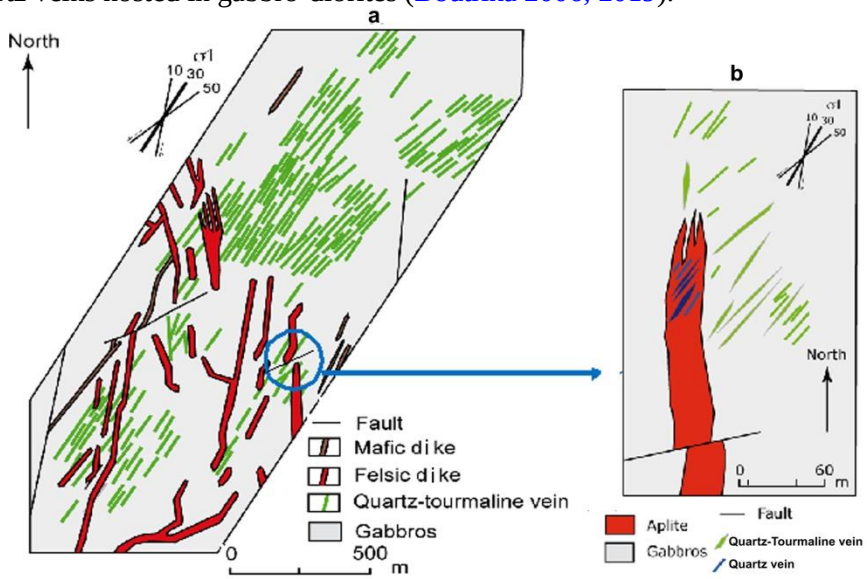

Figure 3. Schematic map of North part of In-Abegui deposit. a: well developed and predominate swarms of quartz-tourmaline veins in the gabbro-diorite massif; b: Zooming out on encircled area showing clearly the gold bearing quartz vein showing that the felsic dike.

5. Mineralization

The main minerals are:

5.1 Pyrite (FeS_2): It represents a predominant sulphide in the quartz - tourmaline veins. It occurs as cubic crystals, irregular shape, and veins.
5.2 Arsenopyrite (FeAsS): The microscopic study show that the arsenopyrite occurring as euhedral inclusions in zoned pyrite minerals.
5.3 Bismuthinite and native bismuth: The electron microprobe study reveals Bismuthinite (Bi_2S_3) and native Bismuth (Bi) as inclusions inside pyrite (Figure. 4).

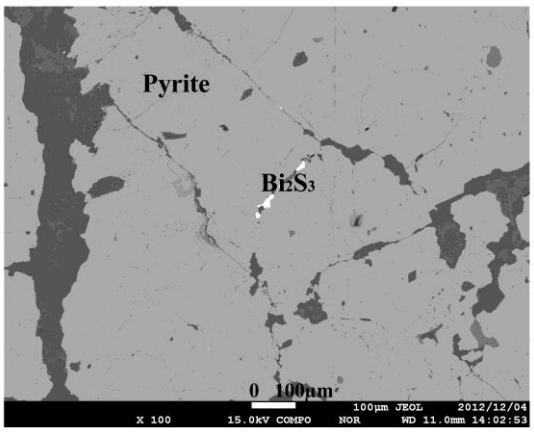

Figure 4. Backscattered electron image Showing Bismuthinite and native bismuth as inclusions in pyrite.

5.4 Gold: Grains and flakes of native gold are visible by naked eye at the surface of the hand samples. The microscopic study shows that the absolute majority of the gold grains have very small size (0.1 mm; seldom 0.5-1mm). Native gold fills the microscopic cracks in quartz, tourmaline and especially in the pyrite (Fig. 5).

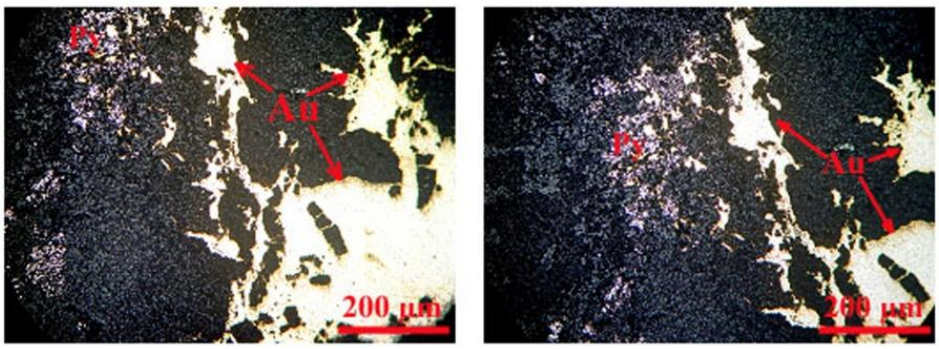

Figure 5. Native Gold (beach and micro-veins) cutting pyrite minerals inside quartz vein hosted in the gabbros (Central sector). Ech. S25/2 LPA.

5.5 Titanium, Iron oxides and iron hydroxide : Metalliferous minerals are accompanied by the Titanium and Iron oxides (rutile, ilmenite and hematite) and iron hydroxide (goethite and limonite).
Mineral association encountered in this deposit is: quartz-tourmaline-muscovite-rutile-topaz-wolframite-molybdenite-pyrite-arsenopyrite-pyrrhotite-chalcopyrite-bismuthinite-native bismuth-galena-sphalerite-native gold-calcite-dolomite and iron oxides. Yet, In Abeggui is characterized by the presence of topaz ± molybdénite ± wolframite linked to greisens stage (Table 1).

6. Conclusion
In the In-Abeggui deposit, gold mineralization was deposited during the late phase of the pan-African orogeny, under the same conditions as the gold deposits of the NE belt of Sérido (Brazil) and the panafrican belt of Arabian plate). In general, gold mineralization in the Laouni terrane (Hoggar Central) is different from other types in the rest of the Hoggar; it is not related to major lithospheric submeridian events. They are localized on the margins of terranes and are associated with deep second-order tectonic accidents and show mineral parageneses that are more varied and complex.
In fact, in addition to the bismuth minerals (native bismuth and bismuthinite), there is a typical mineral association of greisen (wolframite and molybdenite) as well as a particular abundance of rutile.

Table 1. Mineral paragenesis of In-Abeggui deposit (Boutrika 2006; 2019)

Stages / Mineralogy	Greisen stage	Gold stage	Supergene stage
Quartz	▬	▬	
Tourmaline	▬	▬	
Muscovite	▬		
Topaz	▬		
Wolframite	▬		
Molybdenite	▬		
Pyrite	▬		
Arsenopyrite		▬	
Pyrrhotite	▬		
Chalcopyrite		▬	
Bismuthinite		▬	
Native Bismuth		▬	
Galena		▬	
Sphalerite		▬	
Native gold		▬	
Iron oxides and Hydroxides			▬

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