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Geochemical Exploration of Gold Bearing Quartz Veins at Nassillé Permit, Liptako NW Niger

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ABSTRACT

The Nassilé permit located in the Niger Liptako area which is geologically composed of greenstone belts of Paleoproterozoic age or the Birimian of the Sirba. The Nassilé permit is only 35 km southwest of the Samira gold mine (SML). In this study, we used field data and chemical analyzes of gold to determine anomalous zones of gold and associated minerals. Structurally controlled, gold-bearing quartz veins were measured and studied in the area from an extensive geological mapping investigation. The associated quartz veins are generally concordant with the main N-S trend quartz veins (N170°, N175°). The lithological and structural studies carried out in these areas have demonstrated the relationship between structures and mineralization and/or lithology. The main characteristics of the gold mineralization in the area appear to indicate hydrothermal mineralization in connection with shear zones. This study allows us to predict that gold bearing quartz veins can be mined at a profit and a detailed geochemical results show some areas with good economic potential for the gold bearing quartz veins associated with Galena and Cu mineralization.

Keywords: Niger Liptako, Nassilé Permit, gold mineralization, quartz veins, geochemical exploration

1. INTRODUCTION

The use of gold as a decoration and as cash makes it a valuable metallic with the attendant rush for its exploration and exploitation worldwide. God (Au) mineral resources that represent one most economic sector in Niger. Today because of its economic potential, Gold (Au) is considered as the most sensuous metal, no precious metal is as legendary and beautiful as gold. Its rarity, beauty, and enigma have furnished it with reputation as a treasured commodity in the course of the records of humanity.

Nevertheless, not much is known about the potentials of Niger's Gold belts, the Liptako area is one that has not received much attention. The lack of information related to the Gold-bearing quartz veins mineralization is therefore a general lack of geological data and inconsistencies for the host lithologies. The relationship between the different geological structures which may together control gold and gold-related mineralization/alteration zones is also lacking. There is also the issue concerning many parts of the greenstone belts where little geological information is available. One of such areas is the Nassilé permit located in the Niger Liptako area which is geologically composed of greenstone belts of Paleoproterozoic age or the Birimian of the Sirba. The main objective of this study is to delineate the zone of high, medium and low gold potential for further exploration and exploitation. The Nassilé permit is only 35 km southwest of the Samira gold mine (**figure 1**).

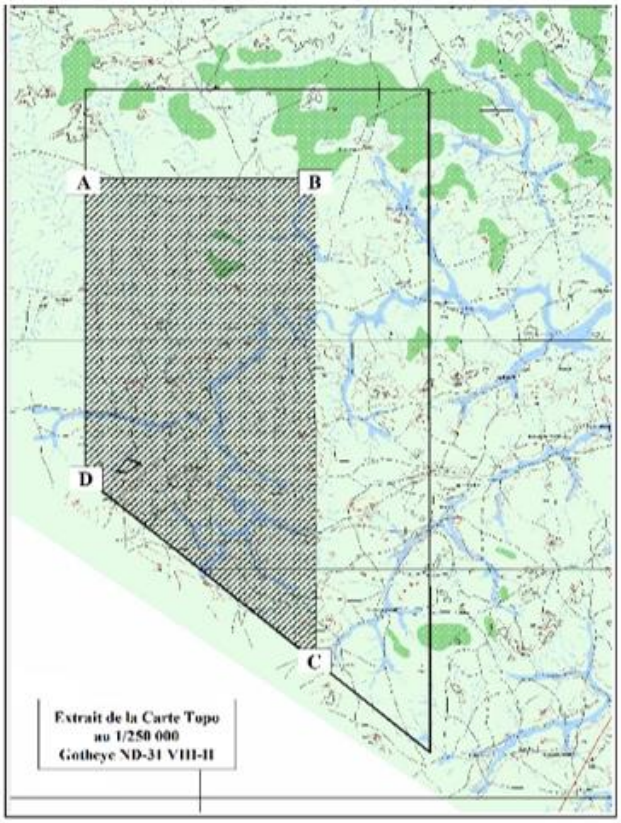


Figure 1: Location of Nassilé Permit

2. MATERIALS AND METHODS

2.1 Geology of the study area

The geology of Niger Liptako corresponds to the northeastern border of the Baoulé-Mossi domain belonging to the Léo-Man Dorsal [1]. The basement formations of this Birimian et domain were granitized, metamorphosed and stabilized between 1.8 Ga and 1.6 Ga [2, 3]. The Niger Liptako basement is composed of two geological parts, such as greenstone belts of Gorouol, Diagorou-Darbani and Sirba, intersected by the granitoid plutons of Téra-Ayorou, Dargol-Gothèye and Torodi [4].

The Liptako greenstone belts is formed of meta-volcanosediments, metasediments, metabasites and meta ultrabasites [5, 6, 7, 8]. While the granitoid plutons is composed of calc-alkaline rocks including a series of Tonalites, Trondhjemites, Granodiorites (TTG) and acidic to intermediate rocks of various nature including diorites, syenites, granites and dacites [9, 10, 11]. According to several authors [8, 12, 13, 14, 15, 16], the Birimian rocks are cross cutted by dykes of pegmatites, quartzo-feldspars-rich veins and dolerite dykes; and covered by sedimentary formations of various ages (**Figure 2**).

Some authors [17, 18] mentioned that in the Léo-Man ridge, most of the gold showings discovered are located in the greenstone belts of the Baoulé-Mossi domain part of the Niger Liptako, while the archaean domain of Kenema-Man which presents few clues. The Nassile Prospect is located in the Sirba greenstone belt, the geological formations which is geologically formed with metabasites (basalts, dolerites and gabbros), metasediments (schists, siltstones, pelites, quartzites, greywackes, conglomerates) and plutonic magmatic rocks (granites, granodiorites, diorites, rhyodacites, rhyolites and granophyres) [5, 6, 19] (**Figure 2**).

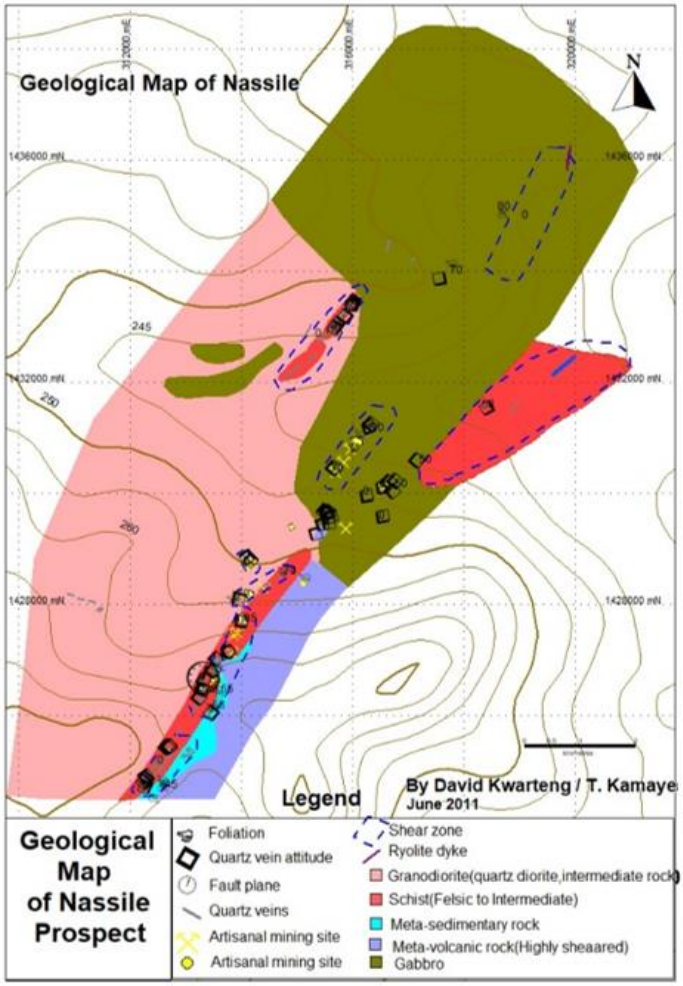


Figure 2: Geological map of Nassile Prospect.

2.2 Field and laboratory work

As part of this study, field and laboratory data were collected. The field work consists of geological mapping of the Nassillé prospect with a view to carrying out a geochemical campaign. Only samples from some 43 out of 168 holes were analyzed at the SGS laboratory in OUAGA by spectrometric technique to measure gold content. After physical treatment of the samples, spectrometric analysis (**Figure 3**) is carried out, which consists of atomic bombardment using a gold film lamp that removes the gold contained in the sample. Thus, the dissolved sample is sucked into an acetylene flame through which a light beam with wavelengths corresponding to that of gold passes. The gold sample absorbs light proportionally to the concentration of gold contained in the solution and the absorption is compared to standard solutions (calibration curve) and makes it possible to determine the concentration of gold in the sample.

Figure 3 : Analyse au spectromètre.

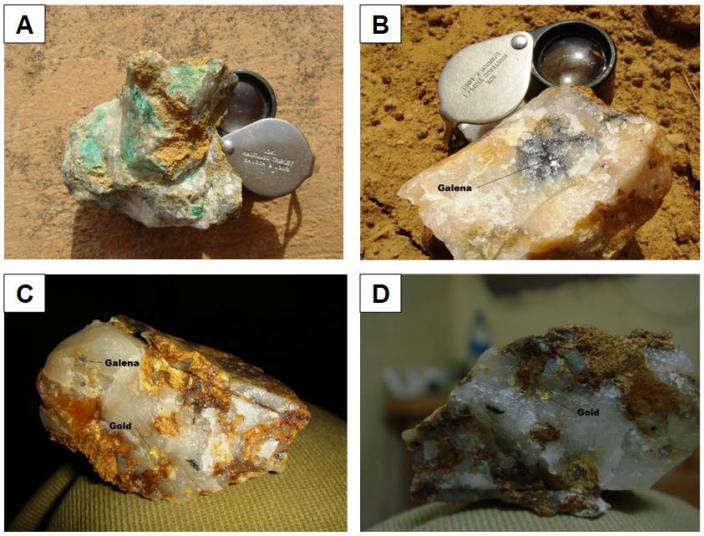
3. RESULTS AND DISCUSSION

3.1 Gold Mineralization

In the study area the quartz veins is found associated with Cu, Au and Galena (**Figure 4**) mineralization in the Nassile Prospect. The Gold bearing quartz veins is generally related to the greenstone schist belts. During the field work several locations of gold mineralization were detected in and around the prospected prospect of Nassile. The gold occurrences associated with quartz veins were detected from field geological mapping (**Figure 5**) and conform to the general trend direction of N-S. This gold mineralization occurs along shear zones and parallel to the shear zones. The N-S trending quartz veins (N170°, N175°) are the most representative of the area and have a steep dip compared to those described by [20, 21] in the Kalama deposit (Northern Mali) which have slight dips.

The N-E trending veins (N50° to N40°) would be carriers of the second phase of mineralization and would be linked to the shearing corresponding to the NNE-SSW accidents that affected the area. Thus, these quartz veins (N-S and N-E direction) would be carriers of a first and a second phase of gold mineralization [20, 21].

The intense deformation observed made these volcanics permeable to the infiltration of hydrothermal fluids and meteoritic waters, thus making possible the formation of mineralized deposits at the study area. This silicification is accompanied by gold concentration deposits, in fact the transport of gold to the concentration sites is ensured by hydrothermal fluids [20, 21, 22].



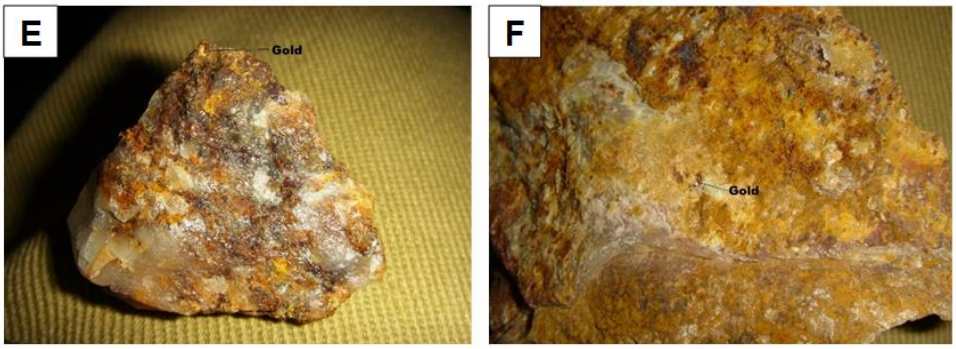


Figure 4: A: Quartz vein bearing Cu mineralization, B:Quartz vein bearing galena, C: quartz vein bearing gold mineralisation associated with galena, D, E and F: quartz vein bearing gold mineralisation.

Figure 5: Structural measurement in gold artisanal pit

3.2 Geochemical anomalies

The systematic geochemical survey work, a large structural and geological mapping program was undertaken and completed at the same time as the aforementioned survey. This mapping consisted of taking structural measurements of quartz veins and lithological units at the gold panning holes and on very rare outcrops in almost all the target areas, namely Tampena and Bamperi and Forbemi. The drilling program was undertaken to test the various structures highlighted by the various works previously completed (**Figure 6**). Thus, 8000m of RC drilling was initially programmed, the volume of the drilling program was progressively extended, on the 8000m initially programmed, an extension of 4251m was added to test other areas of interest, so that 12251m was drilled from start to finish. 168 RC holes were drilled instead of 100 initially programmed with an average depth of 80m/hole.

All RC holes were drilled with an Azimuth N300° and an Inclination of -60°. The holes are drilled perpendicular to the structures determined by the detailed mapping and vertically to the Auger anomalies highlighted during the 2011 campaign. A total of 6834 RC samples were collected, 142 RC holes among them were drilled along the azimuth N300° to N320°, 26 holes along an azimuth 120° relative to magnetic North. The average depth is 73 m/hole with a minimum and maximum of 24 m and 96 m respectively. The deviations of the holes are checked by using EZ-Shot measuring equipment at every 15 m, 45 m and 75 m from the surface of the hole down.

Figure 6: drilling process in Nassile prospect

The geochemical results show that the Au grades are low for RC type samples, however 1.6g/t over 6m were recorded MNRC0013 RC drill hole and 1.03g/t MNRC0009 RC drill hole (**Figure 7**). The table 1 present the entire obtained results. Some interersted anomalies were observed at the MNRC0017 to MNRC0020 at sampling space of 2m. According to interested obtaining an additional information on the Nassile perimeter is needed, (in particular the extension of the limits of the Shear Zone beyond the Tampena region), so that a systematic geochemical auger drill hole to discover other mineralized zones must be conducted in order to highlight significant geochemical anomalies on both sides of the Shear zone which crosses the entire permit from SW to NE.

Table 1: Results of geochemical analysis

Project	HoleID	DepthFrom	DepthTo	Interval	Au_ppm
Nassile	MNRC0001	2	4	2	0.273
Nassile	MNRC0004	62	64	2	0.301
Nassile	MNRC0004	70	72	2	0.283
Nassile	MNRC0005	30	32	2	0.49
Nassile	MNRC0005	54	56	2	0.48
Nassile	MNRC0005	78	81	3	0.29
Nassile	MNRC0006	20	24	4	0.585
Nassile	MNRC0008	16	18	2	0.22
Nassile	MNRC0008	62	64	2	0.44
Nassile	MNRC0009	8	10	2	0.2
Nassile	MNRC0009	62	66	4	1.03
Nassile	MNRC0009	72	74	2	0.29
Nassile	MNRC0010	52	54	2	0.36
Nassile	MNRC0010	72	74	2	0.2
Nassile	MNRC0011	34	40	6	0.34
Nassile	MNRC0011	42	46	4	0.545
Nassile	MNRC0011	64	66	2	0.34
Nassile	MNRC0012	22	24	2	0.31
Nassile	MNRC0012	30	32	2	0.23
Nassile	MNRC0013	38	40	2	0.36

Nassile	MNRC0013	60	66	6	1.613
Nassile	MNRC0014	0	8	8	0.508
Nassile	MNRC0014	46	48	2	0.58
Nassile	MNRC0015	12	14	2	0.231
Nassile	MNRC0015	16	18	2	0.5
Nassile	MNRC0015	22	28	6	0.287
Nassile	MNRC0015	36	40	4	0.34
Nassile	MNRC0015	50	52	2	0.3
Nassile	MNRC0016	12	14	2	0.31
Nassile	MNRC0016	56	58	2	0.32
Nassile	MNRC0017	34	36	2	0.82
Nassile	MNRC0017	40	42	2	1.11
Nassile	MNRC0017	52	54	2	1.18
Nassile	MNRC0018	30	32	2	0.24

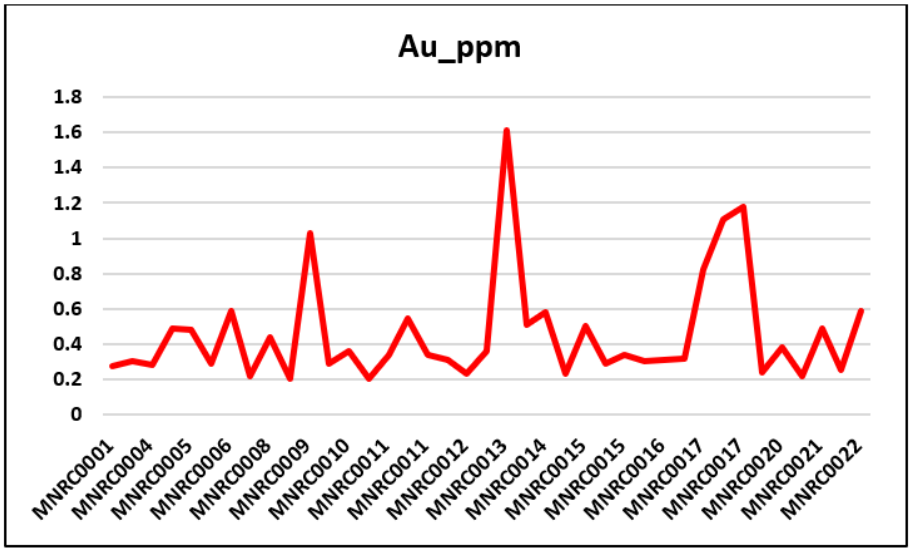


Figure 7: Plot of geochemical analysis results of Au

4. CONCLUSION

The geological mapping of the gold bearing quartz veins mineralization appears to indicate hydrothermal mineralization in connection with shear zones. The process of structural and lithological study in this work indicates two aspects. Firstly, the interpretation of the work carried out in the area showed that the gold mineralization is in quartz veins associated galena. Secondly, not all the quartz vein bearing gold mineralization. It appears that some quartz veins are bearing Copper mineralization.

The geochemical obtained results are ranging from 1.61 g/t to 0.2 g/t with an average of 0.43 g/t. The interesting anomalies are found respectively at MNRC0009; MNRC0017; MNRC0017 and MNRC0013 with gold grades of 1.03 g/t over 4 m; 1.11 g/t over 2 m; 1.18 g/t over 2 m and 1.613 g/t over 6 m respectively. The most significant geochemical anomaly was detected in the NW part of the permit, which is an anomalous zone located at 3.6 km in length.

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