



Research Paper

## GOLD PRELIMINARY EXPLORATION AROUND KARAU-KARAU SCHIST BELT, NW-NIGERIA

Ahmad Isah Haruna<sup>1</sup>, Umar Sambo Umar<sup>1\*</sup>, Abdulraouf Rilwan<sup>1</sup>, Audu Daya Mohammed<sup>2</sup>,  
Nuru Abdullahi Nabage<sup>1</sup> and Mustapha Aliyu<sup>1</sup>

\*Corresponding Author: Umar Sambo Umar ✉ umarsamboumar@yahoo.com

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The preliminary study was aimed at identifying gold enriched targets worth investing resources for detail exploration project before mining. Geological mapping of the study area which forms part of the karau-karau schist belt reveals that lithologically the area composed of Pre-Cambrian gneisses, fine to medium grain granite, porphyritic biotite granite, porphyritic hornblende granite, diorite as well as the metasediments which are mostly muscovite-biotite schist, phyllites and quartzites. Guided by the geophysical technique using gold detector (BR 800-P metal detector), a total of five pits and five trenches were excavated and logged geologically, soil horizons intercepted were brownish clays, brown mica schist and reddish clay with yellow stains, in places the top soil was lateritic with angular quartz pebbles, some alluvial and eluvial gold have been suspected but at this stage cannot be confirmed. XRF geochemical analysis conducted on rock samples indicated 3 targets for primary gold along quartz veins, Au was found positively correlating with Si which conforms with views regarding the quartz veins as host to primary gold across Nigeria's gold mineralized schist belt. Same analysis on soils obtained from each of the pits and trenches successfully identifies four probable gold anomalous zones including one pit and four trenches, this pattern is suggestive that placer gold is more laterally distributed than it does with depth.

Keywords: Gold, Mineralization, Preliminary exploration, Karau-Karau, Schist belt

### INTRODUCTION

Gold mineralisation in Nigeria is associated with schist belts which prominently occur in western half of the country (Turner, 1983; and Garba, 2000 and 2002). The schist belts are low to medium grade Proterozoic metasediments and metavolcanics (Danbatta, 2007). According to Garba (2002) and Talaat and Mohammed (2010),

the gold is known to occur as alluvial and eluvial placers and in primary veins mostly associated with quartz.

This work is aimed at delineating probable gold anomalous zones within the study area where detailed exploration for the gold can be concentrated. The scope of the work includes reconnaissance geological survey on scale 1:

<sup>1</sup> Department of Applied Geology, Abubakar Tafawa Balewa University, Bauchi.

<sup>2</sup> National Steel Raw Materials Exploration Agency.

6,000, topographic survey (ground truthing), geophysical scanning technique, detail geological mapping on grid bases, excavation of five pits to depth of 5 m each and trenches with dimensions of 1.5 m x 10 m and 1 m deep. Samples obtained were analysed using XRF geochemical method.

## STUDY AREA

The research area geologically forms part of the Karau-karau schist belt (Woakes *et al.*, 1987), and geographically lies within Tsibiri-Shika village, Giwa Local Government Area, Kaduna State. It is located about 6 km off Zaria Funtua road. The road is readily accessible by car and on motor-bike. Numerous links of untarred roads connect the various footpaths to the villages.

The geomorphology of the area is controlled by the lithology and structures of the crystalline basement rocks. The more resistant rocks form low lying outcrop and/or ridges parallel to the regional N-S trend. The depressions and most of the land are occupied by relatively flat and undulating extensive flood plains. The soil cover is mostly weathered schist, quartz excretes and laterites. The site is composed of flood plains and valleys probably created by gully erosion, the streams are perennial.

## MATERIALS AND METHODS

Detailed geological mapping was carried out using topographic map on scale 1:4,500. A conventional traversing along an established grid line using bruton compass and Global Positioning System (GPS) was done. The whole area was traversed using the established grid pattern so that no rock outcrop was missed during the traversing. All rock units and outcrops were mapped, exposures were photographed, locations and orientations were recorded and

measured using the GPS and bruton compass respectively. Rock and sediment samples obtained from the study area were analysed using XRF geochemical method (Table 2).

Guided by the recommendations made after the geophysical investigations using gold detector (BR 800-P metal detector), a total of five pits and five trenches were excavated (plates 7 and 8). The projected depths of the pits were five (5 m) meters each but with varying dimensions of 1 m x 2 m and 1.5 m x 2 m. While dimension of the trenches is 1.5 m x 10 m and 1 m deep. The trenches were excavated perpendicular to the strike of the targeted vein so as to be able to establish the width of the vein. Representative soil samples obtained from these pits and trenches were analysed in a geochemical laboratory using XRF method (Table 1).

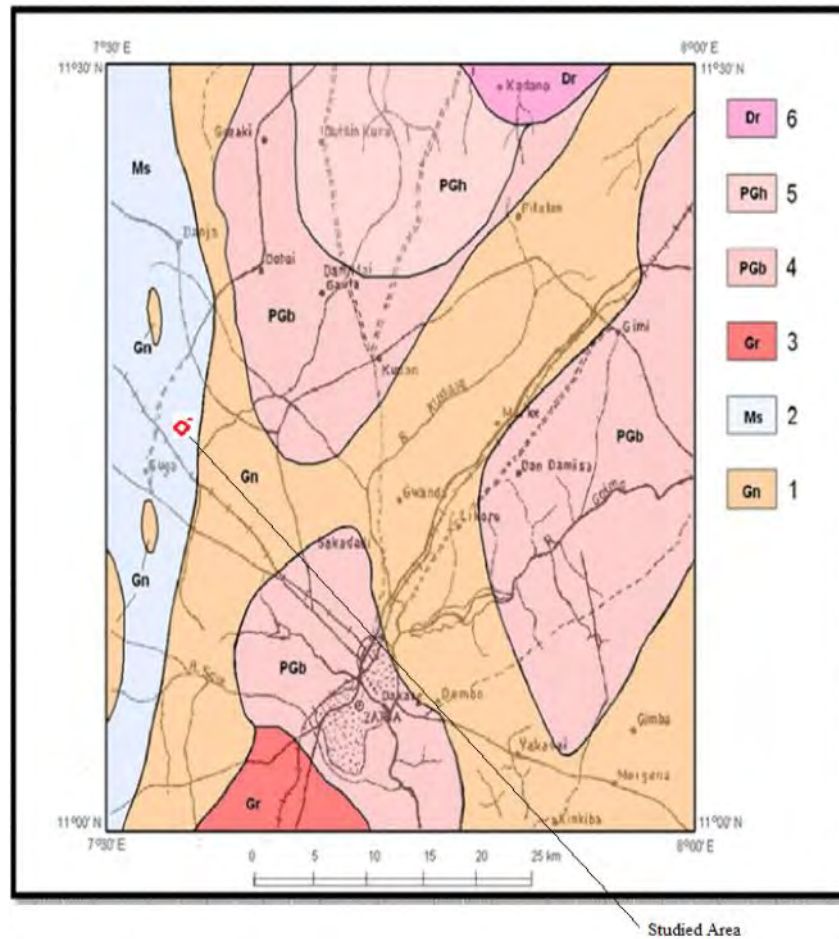
## RESULTS AND DISCUSSION

### Field Geology

The study area belongs to the Pre-Cambrian basement complex of the northern Nigeria (McCurry and Wright, 1977; and Wright, 1985). The field data was used to produce detailed geological map (Figure 1). Lithologically, the study area majorly composed of Pre-Cambrian gneisses, Pan African granites, as well as the metasediments which are mostly muscovite-biotite schist, phyllites and quartzites (plates 1 and 5). This is typical of the Karau- Karau schist belt (McCurry, 1976; and Grant, 1978). Pebbly laterite (plate 3) and angular boulders of quartzites form small ridges as quartz floats (plate 5),

The dark brown mica schist has a highly dipping foliation planes, the mica schist is invaded by concordant and discordant quartz veins (plates 1 and 2) that appear to have been deformed with the host. The quartz veins are believed to host

Figure 1: Geological Map of the Study Area



**Note:** 1 - Gneiss, 2 - Metasediments, 3 - Fine to Medium Grain Granite, 4 - Porphyritic Biotite Granite, 5 - Porphyritic Hornblende Granite, 6 - Diorite.

Plate 1: Foliated Mica Schist



Plate 2: Typical Quartz Vein



Plate 3: Quartz Breccias Within Laterite



Plate 6: Alluvial Placer at the River Bank



Plate 4: Banded Iron Ore with Quartz



Plate 7: Pit 5 (1 m x 2 m) Strike: 340° NW



Plate 5: Quartzite Floats

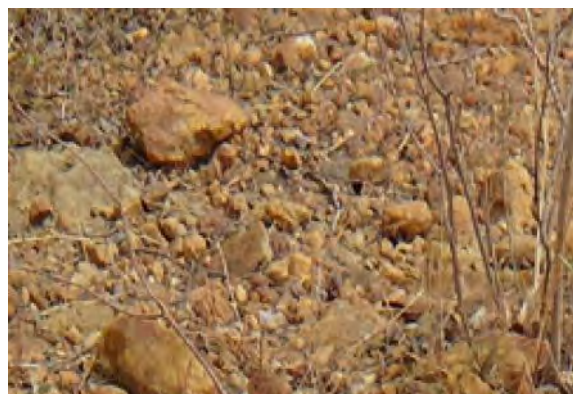


Plate 8: Typical View of Trench 2



primary gold mineralization within the schist belts of Nigeria (Garba, 2000 and 2003; Talaat and Mohammed, 2010; and Amuda, 2013). The veins

are possibly Pan-African crustal fissures, since they trend in NW– SE which conformed to Pan-African minor structural trend (Garba, 2002; and

Akande, 2006). However, quartz veins hosting primary gold within Nigeria's schist belt is not trend controlled (Garba, 2002). There is evidence of pockets of banded iron ore in the area (plate 4). In fact, iron rich laterite is the dominant features which usually contain quartz breccias,

it's not surprising since world class iron ores including magnetite and hematite with raw iron (Fe) content >65% (Ahmad *et al.*, 2017) have been reported from adjacent area. The western half of the area is covered by the superficial soil mostly used as farm lands.

Figure 2: Geological Logs of the Trenches (Trench 01 to 05) and the Pits (Pit 01 to 05)

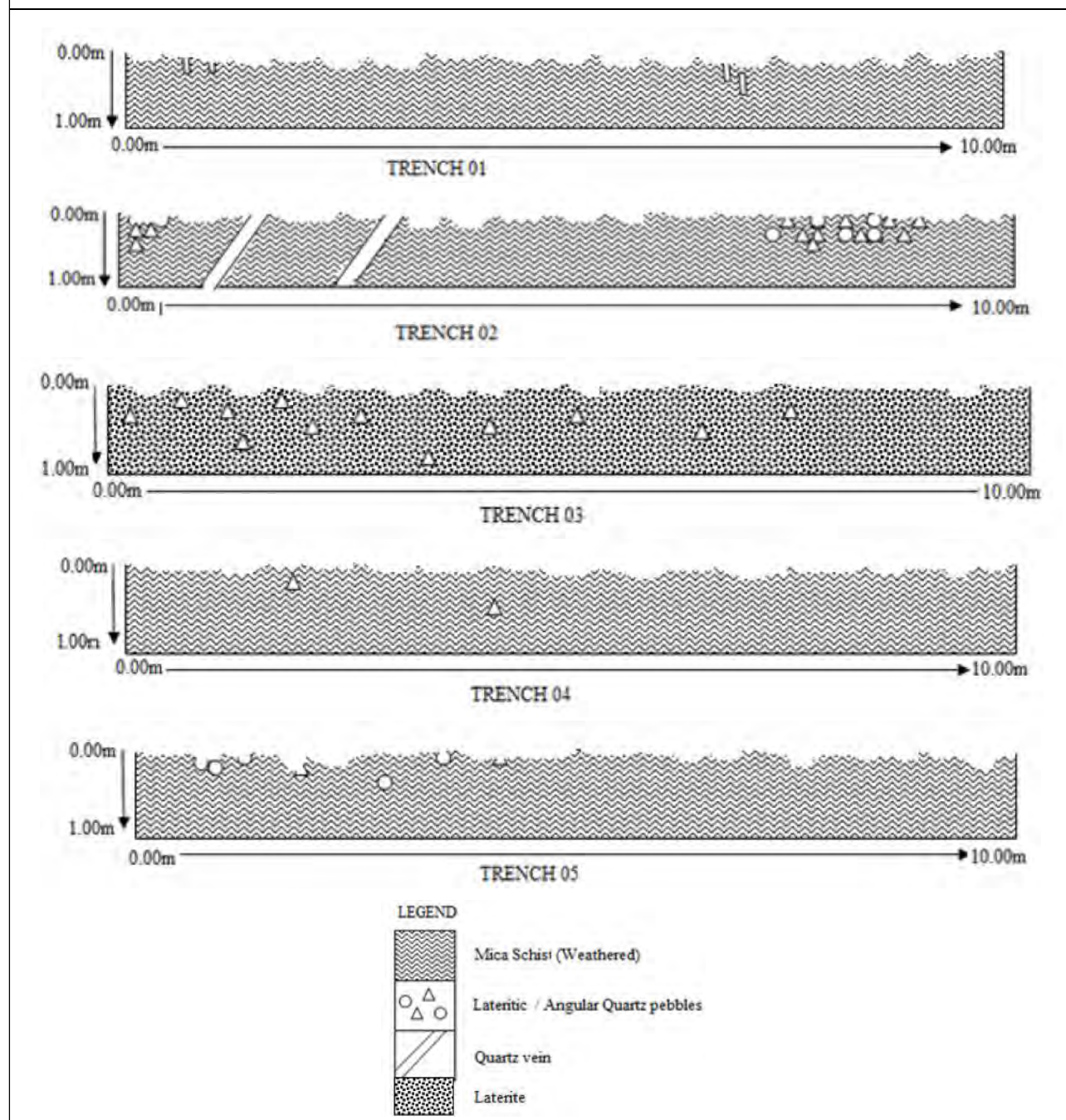
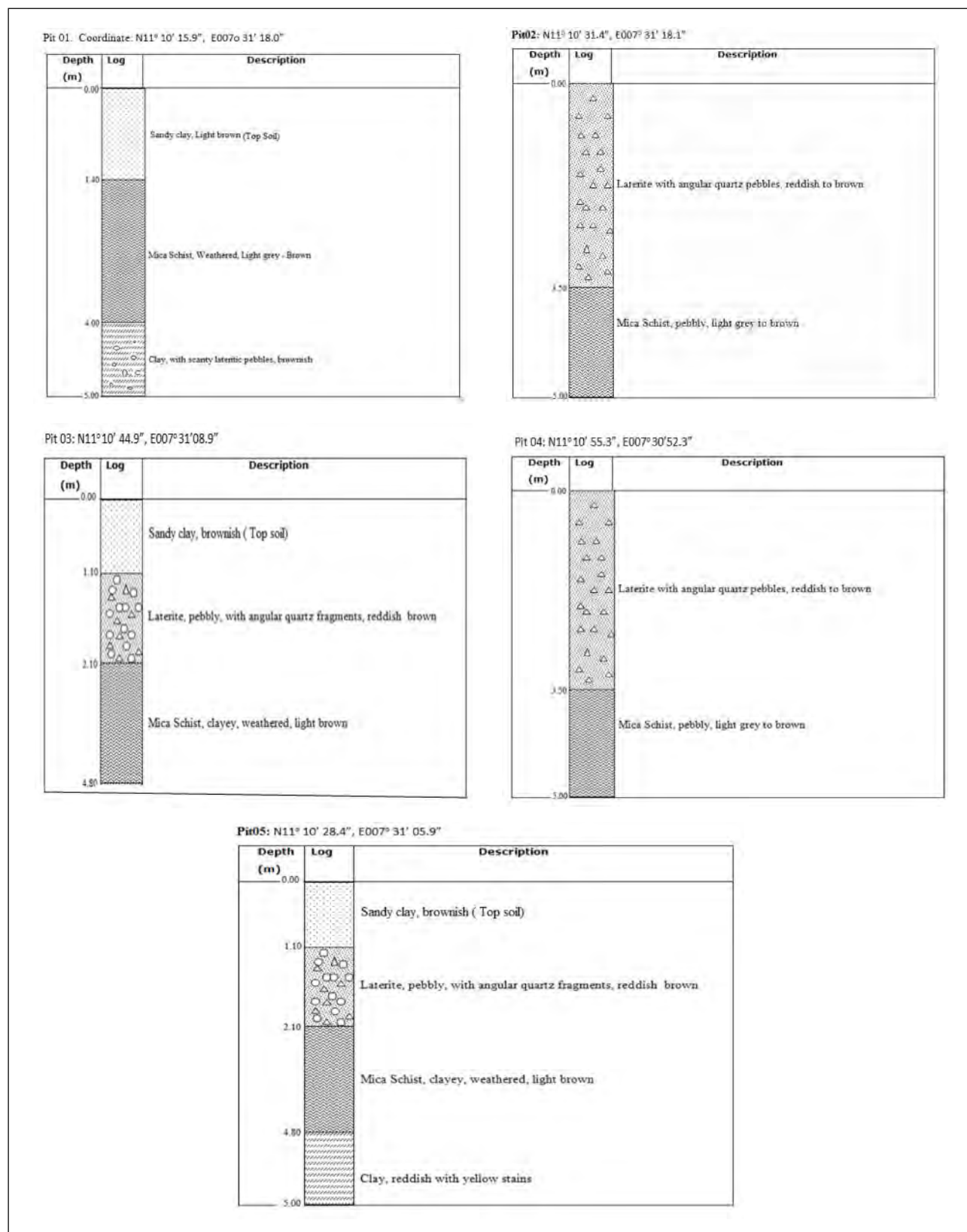


Figure 2 (Cont.)



## Pits and Trench

The geological logs (Figure 2) for both the pits (plate 7) and the trenches (plate 8) indicated that lithologies intercepted were brownish clays to sandy, reddish to brown mica schist and light brown or reddish clay with yellow stains, in places the top soil was lateritic with angular quartz pebbles. Gold grains was found to be hosted as eluvial placers across these horizons, a similar study within the Julie belt of NW-Ghana had previously indicated world class gold deposit within soil samples (Umar *et al.*, 2016).

## Geochemical Analysis and Interpretations

The analytical results of samples from the study area are given in Tables 1 and 2. The distributions of economic gold grades are not uniform but vary extensively within the study area. This is however not unexpected considering the 'nugget' or coarse grain gold effects in such mineralization systems which more often than not underestimates the true gold value.

The geochemical analysis of the soil samples from the pits and trenches (Table 1) indicated about four probable gold anomalous zones where detailed exploration can be conducted and more resources invested, these include pit 05 (P05) with corresponding Au concentration of 0.45 percent and trenches 01, 02 and 05 (TR01, 02, and TR05) with respective values of 0.22, 0.21 and 0.19 percentage concentration. This pattern of gold enrichment suggests that eluvial gold within the study area is more laterally distributed than it does with depth.

Table 2 presents the geochemical analysis for rock samples obtained from the quartz veins, about three exploration targets for primary gold mineralisation has been identified. Table 2 has also indicated positive correlation between Au

Table 1: XRF Geochemical Analysis of Soil Samples Obtained from Pits (P) and Trenches (TR) (in conc. %)

Sample ID	Al	Si	S	K	Sc	Ca	Ti	V	Cr	Mn	Fe	Cu	Zn	Ag	Ba	Fu	Hg	Au	Pb
P01	188	51.7	0	3.93	0	0.048	1.53	0.074	0.048	0.13	22.25	0.026	0	1.18	0	0.26	0.96	0	0
P02	216	49.2	0	5.7	0.012	0.829	1.27	0.067	0.055	0.065	19.9	0.047	0.028	1.68	0.04	0.22	0	0	0
P03	0	80	0.03	0.98	0.001	0.14	0.68	0.035	0.093	0.076	13.32	0.04	0	1.8	0	0	1.1	0	4.3
P04	22.5	47.2	0	4.68	0.008	0	1.17	0.068	0.049	0.09	22.34	0.036	0	1.51	0.05	0.23	0	0	0
P05	128	39.8	0.05	2.45	0	29.12	1.25	0.044	0.027	0.16	9.29	0.023	0	1.33	0.4	0.07	0.6	0.45	1.3
TR01	22.9	47.8	0	8.92	0	0	1.13	0.051	0.033	0.063	16.75	0.03	0.02	1.64	0.27	0.018	0	0.22	0
TR02	158	61.8	0.1	6.2	0	0	1.06	0.037	0.051	0.066	12.59	0.029	0	1.67	0.27	0.15	0	0.21	0
TR03	158	38.5	0.068	1.69	0	0.24	0.97	0.085	0.075	0.031	40.53	0.046	0	1.53	0.15	0.27	0	0	0
TR04	196	39.9	0.075	2.82	0.009	0	0.93	0.065	0.057	0.16	34.39	0.04	0.079	0	0	0.4	0	0	0
TR05	221	46.6	0	8.96	0	0	1.34	0.043	0.041	0.38	18.23	0.045	0.043	1.13	0.41	0.29	0	0.19	0

Table 2: XRF Geochemical Analysis of Rock Samples Obtained from the Study area (in conc. %)

Sample ID	Al	Si	K	Ca	Ti	V	Cr	Mn	Fe	Cu	Zn	Ag	Eu	Hg	Re	Au	Pb
GW0JW0V1001	0	91.76	0.424	0.092	0.038	0	0.155	0.061	3.548	0.026	0	1.79	0	0.96	0	0.86	0
GW0JW0V2001	9.81	63.2	0.301	0.829	1.03	0.063	0.095	0.23	22.15	0.074	0	1.47	0.35	0	0.33	0	0
GW0JW0V3001	0	87.37	0.804	0.14	0.188	0.008	0.107	0.059	4.271	0.032	0	1.66	0	1.1	0	0	4.3
GW0JW0V4001	0	90.4	0.419	0.11	0.512	0.014	0.142	0.075	4.482	0.021	0	1.93	0	0	0	0.91	0
GW0JW0V5001	7.6	21.4	1.42	0	0.528	0.046	0.076	0.06	50.65	0.085	0	0.946	0	0	0.33	0	17
GW0JW0V6001	0	60.5	0.87	0.1	0.356	0.035	0.1	0.082	21.77	0.057	0	1.48	0	0	0	0	4.8
GW0JW0V7001	0	87.92	0.041	0.145	0.268	0	0.111	0.063	3.075	0.029	0	1.65	0	0.98	0	0.84	4.8
GW0JW0V8001	0	78.5	0.291	0.097	0.185	0	0.1	0.041	14.11	0.063	0	1.77	0	0	0	0	4.7

and Si, this is important since many authors have reported the quartz veins in various areas within the schist belts of Nigeria as the host for primary gold mineralization (Turner, 1983; Akande, 1988; Garba, 2000, 2002 and 2003; Akande, 2006; Talaat and Mohammed, 2010; and Amuda, 2013).

## CONCLUSION

The primary sources of gold mineralization are believed to be the quartz veins stringers and lenses hosted by the rock units in the highly foliated mica schist, while alluvial placers may be targeted at the river bank and flood plains within the study area.

The preliminary geological exploration carried out had identified various rock types including host rocks, structural patterns and probable gold concentration points. Pitting and trenching, though not enough to determine the depth of weathering to bed rock have revealed to some extent the lithological units in the study area. Geological mapping, geophysical investigation via gold detector which guided the excavation of the pits and trenches, as well as the XRF geochemical analysis, have been proven as effective methods in preliminary gold exploration since gold anomalous targets have been scientifically delineated.

## RECOMMENDATION

It is recommended that further exploration should among others include core drilling, to determine the depth of the primary host rock for the gold. Moreover, systematic panning (in tonnage) is recommended on the alluvial and eluvial placers along the river channel and across soil horizons to determine whether an appreciable quantity of gold can be recovered.

It may be possible to present a resource estimate for the area prospected. This could be proven and upgraded after a bulk sampling and metallurgical testing follow-up before mining.

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