FIELD GEOLOGY AND ECONOMIC ASSESSMENT OF A MINERALIZED BARYTE VEIN IN TOLA, MAYOBELWA AREA, NORTHEASTERN NIGERIA

MAIMUNA HALILU[1]

[1] Department of Geology, Modibbo Adama University of Technology, P.M.B 2076 Yola, Adamawa State.

* Corresponding author: Email:maimunadocta@gmail.com /Tel: +2348151401114

ABSTRACT

Investigations were undertaken for baryte mineralization in the Tola area of Northeastern Nigeria. The area is underlain by granite gneisses, porphyritic granites and alluvial deposits with granites and its porphyritic variants being the most dominant rock type. The mineralization is known to occur as fracture in filling in granitic and gneissic rocks of the Precambrian basement. Preliminary assessments of rock cuts from the vein showed the baryte to be of quality high enough to warrant further studies.

Keywords: Baytes, Tola, Mineralization, Basement, Vein, Economic assessment, Geology

1.0 INTRODUCTION

Increased industrialization has been on the rise since the industrial age began over 200 years ago. Due to the need and rush for source of raw materials, there has been increased need for prospections to discover more tappable reserves of much needed raw materials.

Baryte exploration in Nigeria has mainly been limited to the Benue trough although preliminary information has shown mineralization within the basement complex of Nigeria particularly the Oban Massif, Hawal Massif and the Eastern Basement Complex of Nigeria. Old Nigerian Geological Survey reports observed that baryte occur in Nigeria as vein infilling materials associated with both cretaceous sedimentary rocks of the Benue trough and the Pre-Cambrian basement rocks. Basement gneisses have been observed to host barite at Lessel Mbato, near Gboko (Oden, 2012). Edu (2006)also observed basement gneisses, porphyritic and fine grained granite hosting barite in parts of Taraba State bounding the trough. Most sediment hosted barite deposits are bereft with issues related to exploitation including water logging and mine wall collapse with prospects of a basement hosted deposit possibly having a lesser degree of this problems. The present study aims to assess the Tola mineralization for its viability as an economic lode for Baryte production.

2.0 GEOLOGIC SETTING

The area of study falls within the Precambrian basement complex of NE Nigeria which in the context of African geology is a part of the Pan-African mobile belt forming the eastern flank of the West African craton (Woakes and Bafor, 1982). Early works on the northern basement complex began with the work of Falconer, 1911 who published the geology of parts of the basement and the neighboring chad basin. Carter et al., 1965 identified by regional mapping that the north eastern basement complex include migmatites, granites and granite gneiss.

Ekwueme (1993) further expanded on this observing that the basement rocks of Northeastern Nigeria comprises of migmatites, gneisses, dolerite, porphyritic granites and volcanic rocks. The Tola area which is located at the tip of the Eastern basement complex (Fig 1) is composed of granitic rocks, gneisses and alluvial deposits (Fig 2)

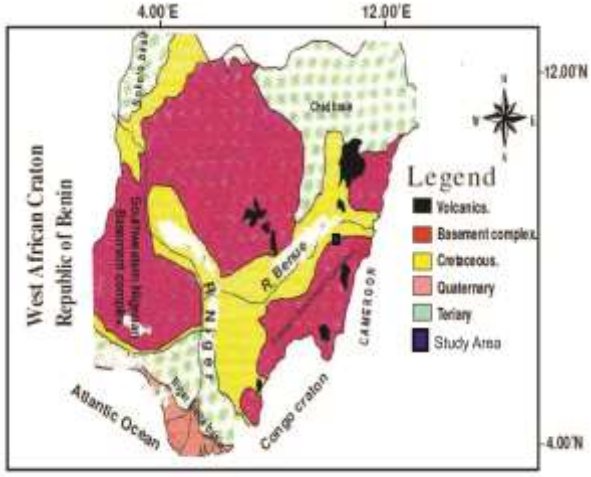

Fig 1. Map of Nigeria showing the eastern basment complex

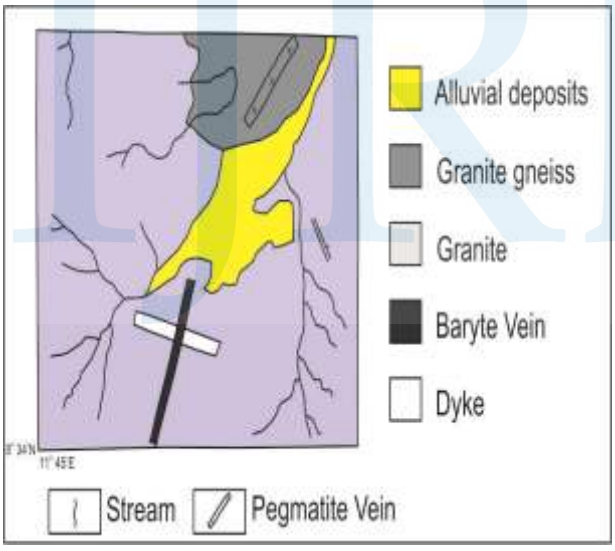

Fig 2. Geologic Map of the Tola Baryte Deposit

3.0 SAMPLING AND ANALYTICAL TECHNIQUES

Systemic sampling of grided areas suspected to contain baryte bearing veins were assayed for exploratory purposes. Stream sections and rock cuts showing mineralization were also sampled. The rock cuts sampled are the focus of this study.

The samples were pulverized and sent to the Activation Laboratories, Canada for major and trace element geochemistry. The samples were analyzed using a X-ray Flouroscene machine and an Induced Coupled Plasma Mass Spectrometry (ICP-MS). Accuracy and precision are

better than 3-5% (RSD) for most elements and about 5% for some transition elements with detailed analytical procedure being described elsewhere (Liu et al., 2008).

4.0 DISCUSSIONS

4.1 Nature of the Mineralization

The barytes in the Tola area are hosted in a vein trending 40^{o}NE and has a strike length of about 180m. Some smaller veinlets branch away from the main vein and its not immediately clear if all of them have baryte mineralization or if the contain just quartz. Study of some of the well developed veinlets show a simple paragenetic arrangement of Quartz-Baryte-Quartz. Physical observation of rock cuts from the vein show the baryte to be white in colour with its crystal cloudy with guange quartz occuring as intergrowths.

Table 1 shows oxide composition from two rock cuts which are representative of the vein mineralization in Tola.

Table 1: Oxide composition of two representative samples from the Baryte Vein

Oxide	Sample A	Sample B
SiO_2	22.50	3.59
Al_2O_3	0.145	0.203
SO_3	10.89	12.10
Fe_2O_3	1.2	0.89
TiO_2	0.67	0.38
MgO	0.01	0.03
CaO	12.17	10.90
Na_2O	0.03	0.05
K_2O	0.02	0.09
BaO	51.23	70.62
MoO_3	0.89	0.74
L.O.I	1.20	0.75

Compared to industry standards (Andrews, 2003), The deposit has good enough quality that it can be used for industrial purposes although the Specific gravity (S.G) was not investigated for this study it could easily meet 4.2g/cm^3 requirment for oil and gas industry or at least of 3.2g/cm^3 for glass and paint industry.

4.2 Further Discussions

In discussing the nature of sulphide mineralizations in the basement, Akpeke et al., 2006 revealed the nature and origin of barite mineralization in Akpet area of the Oban massif of southeastern Nigeria and attributed it to the role of basinal brine fluid which extract barium from basement sources and sulphates from sea water or evaporates. Given the similar tectonic setups of the Akpet and Tola areas, it is likely that basinal fluids from the bounding Benue trough leaching elements from the basement rocks transported the barium in solution and formed mineralization in presence of reducing sulphate.
It should be noted that in areas bounding the Benue trough or known to have been invaded by seawater that sulphide mineralizations is also known to occur with (Ofoegbu and Odigi, 1985) noting that deformation that affected the sediments were strong enough that they deformed bounding basement rocks. Some examples of these sediment adjacent mineralizations include the Akpet baryte, the Gulani Cu (El-nafaty, 2015) and Lessel Mbato Baryte(Oden, 2012).

CONCLUSION

Field investigations have shown the occurrence of baryte bearing veins in basement rocks of Tola, Northeastern Nigeria. The baryte bearing vein trends 40^{o}NE and strikes at a length of 180m. The baryte ore under hand specimen observation is white with the cystral being cloudy with impurities. It shows a simple paragenesis in association with gangue quartz. The deposit has good enough quality that it can be used for industrial purposes although the Specific gravity (S.G) was not investigated for this study it could easily meet 4.2g/cm^3 requirment for oil and gas industry or at least of 3.2g/cm^3 for glass and paint industry.

Further studies using stream sediment geochemical survey to further trace the mineralization in the Tola area, specific gravity to constraint its industrial use and isotope studies (Strontium and Sulphur) to constraint its origin is ongoing.

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REFERENCES

Akpeke, G.B., Ekwueme, B.N. and Ephraim, B.E. (2006): The Nature and Origin of Baryte Mineralization in Akpet Area, Oban Massif, Southeastern Nigeria. Global Journal of Geological Sciences, vol. 4, No. 2, pp 139 – 146

Andrew, S. (2003): Barium Minerals in Industrial Minerals and Rocks, Journal of Society for Mining, Metallurgical and Exploration, inc Littlon, Colorado, vol 6, pp 125 - 134.

Carter, J.D., Barber, D.F.M., Tait, E.A. (1963): The Geology of parts of Adamawa, Bauchi and Bornu provinces in North-eastern Nigeria. Geol. Surv. Nigeria Bull., No 30.

Edu, E. E. (2006): Interim report on assessment of barite resources in Taraba State, Nigeria. N.G.S.A Report (unpublished).

Ekwueme, B.N. (1993): An Easy Approach to Igneous Petrology, University of Calabar Press, Calabar, Nigeria. 127p.

El-Nafaty, J.M., 2015: Rare earth element and stable sulphur (34 S) isotope study of baryte–copper mineralization in Gulani area, Upper Benue Trough, NE Nigeria. J. Afr. Earth Sci. http://dx.doi.org/10.1016/j.jafrearsci.2015.03.007

Falconer, J.D. (1911): The Geology and Geography of Northern Nigeria. Macmillan Publishing Co. London

Liu, Y. S., Hu, Z. C., Gao, S., 2008: In Situ Analysis ofMajor and Trace Elements of Anhydrous minerals by LA-ICP-MS without Applying an Internal Standard.*Chemical Geology*, 257(1/2): 34–43

Oden, M.I. (2012): Barite Veins in the Benue Trough: Field Characteristics, the Quality Issue and Some Tectonic Implications. Environment and Natural Resources Research Vol. 2, No. 2.

Ofoegbu, and Odigi M.I. (1985), Basement controls and Ore mineralization in Benue Trough Structure and Evolution. Friedr. Vieweg and Sohn.

Woakes, M and Bafor, B.E. (1982): Primary Gold Mineralization in Nigeria. In Gold 82: The Geology, Geochemistry and Genesis of Gold Deposits. Foster (Ed). Geol. Soc. Zimbabwe, Spec. Pub. No. 1