



Solid Mineral Status In Rocks Of Akko Local Government Area, Gombe State, Nigeria

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ABSTRACT

The composition of rock samples collected from Akko Local Government Area, Gombe State were assessed for their mineral contents. The mineral contents were determined using energy dispersive X-Ray fluorescence (EDXRF) spectrophotometer capable of determining the elemental composition of rocks in their oxide forms. The results of the analysis shows that the rocks are silicate rocks, because of their high SiO₂ contents ranging from 63.21±0.06% to 70.55±0.20% and appreciable value for the other oxides; Al₂O₃, Fe₂O₃, MgO, CaO, Na₂O, and K₂O. The rocks are enriched in mafic mineral which comprises of Biotite, Amphibole, Pyroxene, etc. and felsic minerals which comprises of quartz, muscovite, and orthoclase as indicated by the presence of silica, Alumina, and Iron oxides in the rocks. Comparative analysis between rocks in these area and similar rocks elsewhere, the results shows that they compares favourably with respect to their elemental composition. The rocks are classified as been felsic in Kumo and intermediate in Panda and Pindiga sampled locations. The results of this study revealed that the studied area is endowed with several industrial minerals.

Keywords: Solid minerals, Status, Akko LGA

INTRODUCTION

Rock is made up of chemical substance called minerals. A few rocks are made up of only one mineral but most have two or more minerals in them. At a granular level rock are composed of grains of mineral which in turn are homogenous solid formed from a chemical compound that are arranged in an orderly manner (Debon and Lefort, 1983). The aggregate minerals forming the rocks are held together by chemical bonds (Scott, 1984). The types and abundance of mineral in a rock are determined by the manner in which the rocks are formed (Hall, 1987).

Many rocks contain silica (SiO₂) that forms about 74% of the Earth Crust (Pidwirny, 2006). This mineral forms Crystal with other compounds in the rock (Klein and Cornelius, 1985). The proportion of silica in rocks and minerals is a major factor in determining their name and properties (Pipkin and Trent, 2001).

Nigeria is endowed with so many mineral deposits Federal Ministry of Mine and Steel Development have found over five hundred (500) locations of mineral deposits in the country. The solid mineral resources cover a wide range of varieties which are widely distributed in all the states of the Federation including Gombe State and Akko Local Government Area (Kogbe and Obialo, 1976). These solid mineral resources have not received sufficient attention in terms of exploration and exploitation. Nigeria use to spend huge amount of money annually on importation of some solid mineral raw materials for her industries though their qualities were not better than the local raw materials not exploited (MSMD, 2000). This work therefore assesses the quality of mineral in rocks and determined the elemental composition of these minerals.

MATERIALS AND METHOD

Materials

The samples were obtained from hilly and mountainous region of Akko Local Government Area of Gombe State, Nigeria. Locations identified includes; Kumo, Panda and Pindiga. The sampling procedure described by (Swanson and Huffman, 1976) was adapted for this work. Five sampling points at distance of about 200 metres apart were identified per location, followed by collection of samples weighing about 200g.

The rock samples collected were dried on an oven a 32° for 48 Hours. The dried rock samples were broken into manageable size using chisel and Hammer, Crushed using Jaw Crusher, grinded into powder using vertical pulverize, and Sieved through 120 British mesh sieve. The sieved powder was kept in an tight containers for analysis.

Analysis of rock by energy dispersive x-ray fluorescence (EDXRF) spectrophotometer

This was done by the methods described by (Nelson, 1994 and Funtua, 1999). About 20.0g of the sample was added to 0.40g of stearic acid powder so as not to allow the sample to disperse. The sample was grinded and thoroughly mixed. An Aluminium sample cup of the spectrophotometer was filled with the sample and inserted into hydraulic compressing machine for compression for a period of 10 seconds to form a pellet. The form pellet was inserted into the energy dispersive X-ray fluorescence spectrophotometer. Sample chamber and measurement of the unknown sample was done. The results were obtained through the window of the computer attached to the EDXRF spectrophotometer. The result displayed was in the form of their oxides.

RESULTS AND DISCUSSION

Results of the composition of major elements in rocks of Table 1. The results are the percent composition which explain basis of the elements measured within the analytical windows of the energy dispersive X-ray fluorescence spectrophotometer detector. The results of the analysis shows that SiO₂ is the most abundant component in the rocks from Akko which ranged from 63.21±0.06% to 70.55±0.20%) from Kumo and least content (63.21±0.06%) found in Panda. The mean concentration ranges for Al₂O₃ was found to be 8.84±0.14% to 11.60±0.14% with the highest content (11.60±0.14%) found in Panda, and least content (8.84±0.14%) found in Kumo.

The content of Fe₂O₃ of the samples ranged from 13.36±0.11% to 16.28±0.22%, the highest content (16.28±0.22%) found in Pindiga and lowest content (13.36±0.11%) found in Kumo, the result showed that Pindiga have the highest content of Fe₂O₃ as compared to other sampling locations.

The mean concentration ranges for CaO was found to be 0.81±0.04% to 4.26±0.13% with the highest content. (4.26±0.13%) found in Panda and the least content (0.81±0.04%) found in Pindiga, the results showed that CaO content in Pindiga and Kumo are higher compared to the other sampled location.

Manganese oxide (MnO) and Titanium oxide (TiO₂) content ranged between (0.03±0.00% to 1.60±0.01% and 0.12±0.02% to 0.30±0.01% respectively. Also SO₃ and P₂O₅ content also ranged between ND to 0.02±0.001% and ND to 0.24±0.02% respectively. The results showed that the concentrations of TiO₂, MnO, SO₃, P₂O₅ are generally low and fall below 1% in all the sampled locations, with the exception of Panda which showed the MnO content (1.60±0.01%).

The K₂O and Na₂O content ranged between 0.22±0.01% to 0.71±0.01% and 0.94±0.02% to 2.61±0.05% respectively. The result showed the highest content of K₂O (0.71±0.01%) was found in Kumo, the lowest content (0.22±0.01%) found in Pindiga, the result also showed the highest content of Na₂O (2.61±0.05%) was found in Pindiga and the lowest content (0.94±0.02) was found in Kumo. The loss of Ignition (LOI) also ranged between 1.20±0.04% to 1.29±0.05% with the highest value found in Pindiga. The results revealed that the content SiO₂, Al₂O₃, K₂O, Na₂O, MgO and Fe₂O₃ compares significantly from one sampling location to another the order of occurrence of the mineral oxides are, SiO₂>Fe₂O₃>Al₂O₃>CaO>Na₂O>K₂O>MgO>MnO>TiO₂>P₂O₅>SO₃. However, all the rock samples in the studied area, are generally enriched in mafic minerals which comprises of Biotite, Amphiboles,

Pyroxene (Augite Olivine) and Felsic minerals which comprises of quartz, muscovite, orthoclase and Plagoclase (Albite), as indicated by the present of silica, alumina, and iron oxides in the rocks.

Table 1. Major Elemental composition of Rock samples in Akko area (%)

LOCATION	SiO ₂	Al ₂ O ₃	K ₂ O	Na ₂ O	CaO	TiO ₂	MnO	SO ₃	P ₂ O ₅	MgO	Fe ₂ O ₂	LOI
KUMO	70.55 ±(0.20)	8.84 ± (0.03)	0.71 ± (0.01)	0.94 ± (0.02)	3.91 ± (0.12)	0.30 ± (0.01)	0.16 ±(0.001)	ND	ND	1.22 ± (0.03)	13.36 ± (0.11)	1.20 ± (0.04)
PANDA	63.21 ±(0.06)	11.60 ± (0.14)	0.54 ± (0.01)	1.97 ± (0.03)	4.26 ± (0.13)	0.21 ± (0.02)	1.60 ± (0.01)	0.02 ± (0.001)	ND	2.68 ± (0.02)	14.28 ± (0.50)	1.22 ± (0.05)
PINDIGA	63.75 ±(0.22)	11.20 ± (0.13)	0.22 ± (0.01)	2.61 ± (0.05)	0.81 ± (0.04)	0.12 ± (0.02)	0.03 ± (0.001)	ND	0.24 ± (0.02)	3.44 ± (0.03)	16.28 ± (0.22)	1.29 ± (0.05)
RANGE	63.21 ±(0.06)	8.84 ±(0.14)	0.22 ±(0.01)	0.94 ±(0.02)	0.81 ±(0.04)	0.12 ±(0.02)	0.03 ±(0.001)	ND	ND	1.22 ±(0.03)	13.36 ±(0.11)	1.20 ±(0.04)
	70.55 ±(0.20)	11.60 ±(0.14)	0.71 ±(0.01)	2.61 ±(0.05)	4.26 ±(0.13)	0.30 ±(.01)	1.60 ±(0.01)	0.02 ±(0.001)	0.24 ±(0.02)	3.44 ±(0.03)	16.28 ±(0.22)	1.29 ±(0.05)

(±) Values are the Standard Deviation of three replicate analyses

Range = Limits between values

LOI = Loss of Ignition

ND = Not Detected Values less than the detection limit of the machine.

CONCLUSION

The results of this study revealed that in all the sampled locations analysed the rocks contains high SiO₂ content and appreciable value for the other oxides; Al₂O₃ Fe₂O₃ MgO, CaO, Na₂O and K₂O. The rocks are classified as been felsic in Kumo, and intermediate in Panda and Pindiga sampled locations, using the silica content classification scheme, the rocks are enriched in felsic and mafic minerals.

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