Volume 3 No.2, February 2013 ISSN 2224-3577

International Journal of Science and Technology

http://www.ejournalofsciences.org

Suitability of Borno Bentonites as Drilling Mud

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ABSTRACT

This paper discusses the industrial suitability of Borno bentonites as drilling mud. The oxide geochemical investigation indicated that the samples have high montmorillonite content. The qualitative laboratory suitability studies showed that Borno bentonites are suitable for drilling mud production. Bentonitic clays occur in Dikwa, Ngala, New Marte, Mongonu and Mafa areas of Borno State, Nigeria.

Keywords*: Bentonite, drilling mud, montmorillonite, Borno State*

I. INTRODUCTION

Borno State lies in latitudes 10^0 00' and 14^0 00' and longitudes 12^0 00' and 14^0 00' in the North-eastern part of Nigeria (Figure 1). Borno Bentonites occur as the weathering products of volcanic ash materials. Borno Bentonites are rich in montmorillonite with few gangue materials.

Bentonites occur in Dikwa, Ngala, New Marte, Mongonu and Mafa areas of Borno State, Nigeria. The field samples have dominant whitish colour, though with pockets of brownish earth stains in some places.

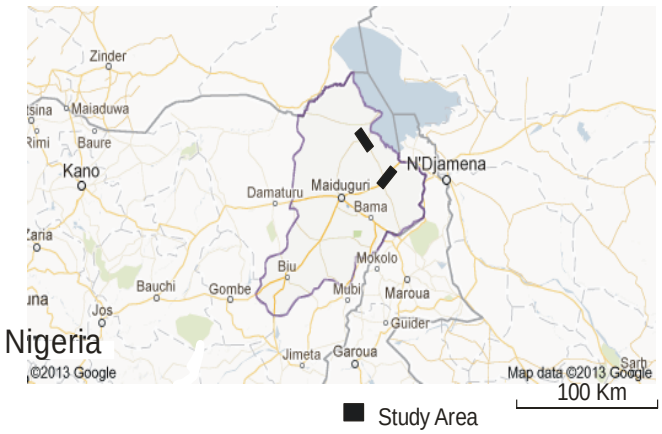

Figure 1. Location Map of Borno Bentonites

II. LITERATURE REVIEW

Drilling fluid is defined as a fluid used to aid the drilling of boreholes into the earth. The liquid drilling fluid is often called drilling mud. The use of drilling mud is to avoid formation damage and limit corrosion [1]. Bentonite is a water-based mud also popularly called "gel" in the oilfield industry [1]. The study of the swelling-shrinking behaviour of montmorillonite clay film in aqueous electrolyte solution using quartz resonators indicated that the swelling-shrinking property can be electrochemically controlled [2]. Some researchers who concentrated their study on the rheological and filtration tests on some bentonitic samples from Pindiga Formation in Borno Basin of Nigeria concluded that the beneficiation of the clay samples gave good promise for drilling [3].

III. MATERIALS AND METHODS

The materials for this study include the following: metric tape rule, field note book, hand lens, geological hammer, compass, GPS, sampler, sample bags, eye goggles, hand gloves, field booths, etc.

Atomic absorption spectrophotometer (AAS) GBC model machine was used for oxide analysis of the samples.

IV. RESULT AND INTERPRETATION

The result of the analysis of the bentonite samples are given in Table 1. From the result, it could easily be noticed that the average Al_2O_3 content is very high (59.23%). This could be attributed to the high montmorillonite content of the clays. The MnO is in trace amount in all the samples. The percentage of Fe_2O_3 is very negligible. This probably is responsible for the whiteness of the samples. P_2O_5 and TiO_2 are absent. CaO has an average value of 0.53%. MgO value ranged between 3.02% - 3.22% with an average value of 3.12%. The value of MgO has significant implication. This high content is suggestive of the amount of montmorillonite mineral species present in the samples.

Na_2O ranged from 1.98% - 2.01% with an average value of 1.99%. This high value of soda (Na_2O) is suggestive of high montmorillonite content. K_2O value ranged between 0.98% - 1.01% with an average value of 0.99%.

V. DISCUSSION

Mineral deposits are composite of elemental oxides. The oxide geochemistry, therefore, is a finger-print of the mineral species present. The average high Al_2O_3 content of 59.23% is a pointer to the high montmorillonite content of the clays.

The suitability tests carried out on these samples were made to qualitatively study under laboratory conditions requisite physical properties such as grain size, grain size distribution, dissolvability and viscosity. Most of the field samples were collected in compact form. But grain to grain cement is weak; therefore, they are easily disintegrated mechanically. The grain sizes are fine and well distributed. The samples were easily dissolved in water and have high viscosity, which is a good suitability property for their use as drilling mud.

VI. CONCLUSION

Bentonites occur in commercial quantities in Borno State, North-eastern Nigeria. The bentonitic clays have very high content of montmorillonite. The result of the analysis of these samples agreed with local and international standard for industrial drilling mud.

VII. RECOMMENDATIONS

The following recommendations are hereunder proffered:

- Beneficiation and rheological studies of the clays are imperative.
- The government should provide road infrastructures and services to the areas of these mineral occurrences to encourage their early development.

Table 1: AAS Results of Borno Bentonites

ELEMENT/SAMPLE NO.	NM2	D4
SiO_2	24.21	26.30
Al_2O_3	60.05	58.40
MnO	TRACE	TRACE
Fe_2O_3	0.03	0.01
P_2O_5	-	-
TiO_2	-	-
CaO	0.60	0.45
MgO	3.02	3.22
K_2O	1.01	0.98
Na_2O	1.98	2.01
LOI	9.10	7.71
TOTAL	100.00	99.08

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