INVESTIGATION INTO THE USE OF LOCAL CLAYS IN DRILLING OPERATIONS

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ABSTRACT
Local clays were treated with chemical additives. Their rheological and thixotropic properties evaluated to determine their suitability for drilling operations. Properties examined included the Swelling Index, Apparent Viscosity, Plastic Viscosity and the Yield point. Result shows that that the Nigerian indigenous clays are suitable. More research is recommended.
Keyword: rheological properties, Nigerian clay, drilling clays

INTRODUCTION
Clays are hydrous silicates of Aluminum characterized by sheet silicate structures of composite layers. They may be products of extensive chemical weathering, hydrothermal or pneumatolytic alteration of different rock types. Clay results from the erosion of the earth's crust over vast spans of time. What was originally the mineral feldspar in igneous rocks, primarily granite, breaks down over time and becomes the microscopically fine-particled clay. Clay deposits are located in several towns in Nigeria. Modest estimate of the reserve by Aliyu, 1996, Aigbedion & Iyayi, 2007 place the reserve at 166.9 million metric tons. The more common locations of clay in Nigeria include:

- Ozubulu, Ihiala and Nnewi (Anambra State)
- Enugu
- Kankara (Katsina State)
- Maraba-Rido (Kaduna State)
- Onibode, Lisabi and Miroko (Ogun State)
- Jos and Ropp (Plateau State)
- Biu and Maiduguri (Borno State)
- Ukwunzu (Delta State)
- Bende, Umuahia and Ohaozara (Abia State)
- Nsu (Imo State)
- Garkidda (Taraba/Adamawa)
- Dawakin, Minjibar and Tsanyawa (Kano State)
- Illo and Kaoje (Sokoto state)
- Ifon and Igbotako (Ondo State)
- Shaki (Oyo State)
- Ijero Ekiti (Ekiti State)

LITERATURE REVIEW
Drilling fluid is used while drilling into the interior of the earth. It is often used while drilling wells in search for hydrocarbon and natural gas. (Wikipedia 2010)
There are three main categories of drilling fluids, namely:

1. water-based muds (which can be dispersed and non-dispersed),

2. non-aqueous muds, usually called oil-based mud,
3. And gaseous drilling fluid, which involves the use of a wide range of gases

The main functions of drilling fluids include among others the following:

1. Providing hydrostatic pressure and thus prevent formation fluids from entering into the well bore, which may cause blowout
2. Keeping the drill bit cool and clean during drilling,
3. Carrying out drill cuttings
4. Suspending the drill cuttings while drilling is paused and when the drilling assembly is brought in and out of the hole.

The drilling fluid used is selected to minimize formation damage and limit corrosion. water based drilling fluid is often called drilling mud.

DRILLING MUD

Drilling fluid among other additives and water contain clay. This research was conducted to ascertain the suitability of the local indigenous clays obtained from two villages in Nigeria; Akperhe-Olomu and Akokwa, for their suitability for drilling operations. Preliminary test conducted on the clay samples includes mud weight determination using the convectional mud balance. The mud weight of any clay used in drilling fluid must demonstrate its ability to provide sufficient hydrostatic head. Other tests conducted on the sample include marsh funnel viscosity, gel strength, sand content and mud viscosity. These tests were conducted on the samples before treatment with 1.0 g drispac and 1.0 g potash. Values obtained for these parameters were compared with the foreign clays samples normally used by major producing companies in Nigeria.

CALCULATION

Swelling Index = $\dfrac{Clay\_Volume(ml)}{Water\_Volume(ml)}$

Apparent Viscosity, AV =Dial reading at $\dfrac{\phi 600}{2}$

Plastic Viscosity, PV =ϕ600 - ϕ300
Yield point=ϕ300 -PV

Power law Index, n = 3.32 Log $\left(\dfrac{\phi 600}{\phi 300}\right)$

CONCLUSION

Swelling index analysis examines the tendency to swell (hydrate) over a period of time. In this research it was conducted over a 4 days period. It showed that the local clays have acceptable swell index factors. The test also revealed that the n factors were acceptable. The consistency factor test indicates the hole cleaning ability at a low shear rate, differs from the standard. The difference was not of great significant. Clay sample X exhibited a mud density (8.5) slightly below the API standard of 8.6-9.6. It however showed good results on treatment with densifers to exhibit a density after treatment of 8.71

Results suggest that the indigenous clays when collected from a suitable depth can be used in drilling operations. There is however need for more research and experiments into this.

REFERENCES

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
locations	(gram)	% sand	Ph	Temp.	SWELLING INDEX TEST				Density	Viscometer reading (centipoises)		gel strength		Mash funnel viscosity	PV (cp)	AV (cp)	YP (Ib/100ft3)	Power law Index (n)
				deg C	DAY 1	2	3	4	(Ib/gal)	600 reading	300 reading	10 sec	10 min	(sec/qt)				
Akokwa	17.5	0.280	5	25.3	0.75	0.85	1.76	1.21	8.61	2.7	1.9	0.1	0.1	25.5	0.80	1.35	1.10	0.51
	21	0.344	5	25.4					8.7	2.1	1.4	0.1	0.2	24.9	0.70	1.05	0.70	0.58
	24.5	0.382	5	24.7					8.92	2.6	1.8	0.3	0.3	25.1	0.80	1.30	1.00	0.53
Akperhe-Olomu	17.5	0.250	5	25.2	0.78	1	1.08	1.21	8.47	2.4	1.7	0.2	0.2	25.2	0.7	1.2	1	0.50
	21	0.252	5	25.4					8.60	2.6	2	0.2	0.2	26.0	0.6	1.3	1.4	0.38
	24.5	0.375	5	26.6					8.60	2.7	2	0.1	0.3	26.0	0.7	1.35	1.3	0.43
Clay Sample X	17.5	0.32	6	24.0	1.26	3.5	4.4	5.4		1.9	1.1	0.10	0.10	25.6	0.8	0.95	0.3	0.79
	21	0.32	6	25.2						2.3	1.1	0.00	0.00	26.9	1.2	1.15	-0.1	1.06
	24.5	0.35	6	24.0						3	1.1	0.20	0.10	26.0	1.9	1.5	-0.8	1.45
Imported Aqua gel bentonite	17.5	0.30	9	25.0	5.7	30	37	105	8.7	17.7	10.2	0.1	1.5	42	7.5	8.85	2.7	0.79
	21	0.30	9	25.2					8.7	21.1	11.6	0.2	5.1	44	9.5	10.55	2.1	0.86
	24.5	0.30	9	25.0					8.7	31.4	18.5	0.7	12.1	46	12.9	15.7	5.6	0.76

parameter and their values for the samples before treatment

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
locations	**gram**	**% sand**	**Ph**	**Temp.**	**Density**	Viscometer reading (centipose)		gel strength		Mash funnel viscosity	PV (cp)	AV (cp)	YP (Ib/100ft3)	Power law Index (n)
				deg C	**(Ib/gal)**	600 reading	300 reading	**10 sec**	**10 min**	(sec/qt)	600 reading-300 reading	600 reading/2	300 reading -PV	3.32Log(600 reading/300 reading)
Akokwa	17.5	0.30	9.0	25.0	8.7	15.9	9.6	0.1	0.3	40	**6.30**	**7.95**	**3.30**	0.73
	21.1	0.30	9.0	25.2	8.72	18.5	10.4	0.3	6.2	44	**8.10**	**9.25**	**2.30**	0.83
	24.5	0.30	9.0	25.0	8.72	28.7	18.2	0.7	11.9	45	**10.50**	**14.35**	**7.70**	0.66
Akperhe-Olomu	17.5	0.250	12	25.0	8.60	33	20.9	0.3	0.4	41	**12.1**	**16.5**	**8.8**	0.66
	21	**0.250**	**12**	25.2	8.60	32	19	0.3	0.4	42	**13**	**16**	**6**	0.75
	24.5	**0.375**	**12**	25.0	8.60	35.5	18.9	0.5	0.6	44	**16.6**	**17.75**	**2.3**	0.91
Clay Sample X	17.5	0.26	10	25.6	8.6	30	20.9	0.3	0.8	41	**9.1**	**15**	**11.8**	0.52
	21	**0.26**	**10**	26.4	8.6	33.4	17	0.3	3.4	46	**16.4**	**16.7**	**0.6**	0.97
	24.5	**0.38**	**10**	26.0	8.6	35.5	18	0.5	8.6	46	**17.5**	**17.75**	**0.5**	0.98
Imported Aqua gel bentonite	17.5	0.3	9.5	25.6	8.7	246.1	156.4	30.2	41.5	46	**89.7**	**123.05**	**66.7**	0.65
	21	**0.3**	**9.5**	26.2	8.7	287.2	160.2	38.3	59.1	46.8	**127**	**143.6**	**33.2**	0.84
	24.5	**0.3**	**9.5**	26.0	80.7	300	179.3			49.2	**120.7**	**150**	**58.6**	0.74
parameter and their values for the samples after treatment														