DETERMINATION OF ROCK PROPERTIES FOR RESERVOIR EVALUATION AND ENVIRONMENT OF DEPOSITION OF XY-WELL USING SIDE WALL SAMPLES

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Abstract

Sedimentological analysis of sidewall samples from XY-well located within the Greater Ughelli Depobelt of the Niger Delta Basin was carried out to determine rock properties and environment of deposition. 31 samples were obtained between the ranges of 8484ft to 11,0694ft. A x10 hand lens and microscope was used for the study. Results confirm the presence of 2 main lithologies, Sandstone and Shale and one subordinate Heterolith lithology. The grain sizes ranges from fine to medium and medium to coarse. The grain shapes ranges from angular to sub-round. Grains possess a characteristic brown color. The shale member ranges from massive to platy, and color is grey. Associated materials are coal particles, carbonate particles and mica flakes. All these characteristics are typical of a transitional to marine environment. From the lithologic description, a potential Petroleum system containing a source rock, reservoir rock and a seal can be observed. Potential source rocks can be seen at depths 10,054ft to 10,694ft with occurrence of sand lenses within the interval. Potential reservoir rocks at depths 8748ft to 8870ft and 9420ft to 9872ft, with occurrence of some shale units within the interval. Potential seal structures occurred at 9896ft to 10,056ft, 9060ft to 9270ft and at 8748ft.Appropriate relative timing of formation of these elements and the processes of generation, migration and accumulation are necessary for hydrocarbons to accumulate and be preserved. This study gives an understanding of the reservoir's depositional environment, rock properties, and reservoir characterization for accurate evaluation of the hydrocarbon potential of the well.

Keywords: Depositional Environments, Lithofacies, Niger Delta, Petroleum system, Reservoir, Sidewall samples

Introduction

Sandstones are common reservoirs for oil and gas, and thus they are a class ofsedimentary rocks of great economic importance. A knowledge of their properties is essential in the exploration for, and the production of, subsurface fluids. The primary properties of texture, composition, sedimentary structures, and morphology are determined largely by the source materials and by the environment of deposition. These properties, in turn, control the production of fluids through a borehole. All the properties, then, have economic significance, and knowledge of sandstone properties is essential to understanding the reservoir and its capacity for oil or gas production.Many reservoir studies require that geologic variables be handled in a quantitative manner. For the purpose of analysis, it is important to categorize reservoir rock properties so that interrelationships among the variables may be recognized. Three main classes of rock properties can be established (Berg 1975).The first group of properties may be called primary or definitive properties (Table 1} because these are the fundamental characteristics of the reservoir. The definitive properties are mineral composition, texture, sedimentary structures, and morphology, or size and shape of the reservoir body. These fundamental properties exert a primary control on other reservoir properties, which may therefore be thought of as secondary or dependent properties. The dependent properties include porosity,permeability, fluid saturation, and bulk density.

Exploration for and development of sandstone reservoirs requires, above all, a reasonable prediction of sandstone occurrence and morphology. The morphology, in turn, is largely determined by the environment of deposition, and the environment is interpreted from the observed sequence of primary rock properties as displayed in cores from the subsurface. A depositional environment describes the combination of physical, chemical and biological processes associated with the deposition of a particular type of sediment and therefore the type of rock that forms after lithification (Maju-Oyovwikowhe and Lucas, 2019a).

Table 1. Selected reservoir rock properties, symbols, and customary units of measurement

Primary (definitive)	Secondary (dependent)	Tertiary (latent)
Composition (%)	Porosity, ϕ (%)	Resistivity, R (Ωm)
Texture (mm)	Permeability, k (md)	Spontaneous potential, SP (mV)
Sedimentary structures (m)	Saturation, S (%)	Radioactivity, γ (counts/sec)
Morphology (descriptive)	Bulk density, ρ_b (g/cm^3)	Sonic travel time, Δt (μsec/ft)

The best interpretations are based on detailed knowledge of composition, texture, and sedimentary structures. Of these properties, the sedimentary structures are of greatest importance because they indicate most directly the nature of the processes that last acted upon the sediment and were largely responsible for its local distribution. The sequence of textural change is of next importance, and finally the composition may help to confirm the interpretation of process as well as to indicate the controls on porosity and permeability. The interpretation may be supported by other knowledge such as the regional stratigraphic setting, the nature of adjacent sediments, especially shales, the types of associated fossils, and observation of the lateral variations of the sandstone unit. The environmental interpretations from cores can be correlated with well logs for the purpose of mapping and predicting reservoir morphology and continuity.

The Petroleum System consists of a mature source rock, migration pathway, reservoir rock, trap and seal. A Reservoir is subsurface body of rock having sufficient porosity and permeability to store and transmit fluids. A reservoir is a critical component of a complete petroleum system. The seal (cap rock) is an impermeable rock that acts as a barrier to further migration of hydrocarbon liquids. They are rocks that form a barrier or cap above and around reservoir rock forming a trap such that fluids cannot migrate beyond the reservoir. The permeability of a seal capable of retaining fluids through geologic time is ~ 10^{-6} to 10^{-8} darcies. They are commonly shale, mudstone, anhydrite and salt. A seal is a critical component of a complete petroleum system. The trap is a configuration of rocks suitable for containing hydrocarbons and sealed by a relatively impermeable formation through which hydrocarbons will not migrate. Traps are described as structural traps (Hydrocarbon traps that form in geologic structures such as folds and faults) and stratigraphic traps (Hydrocarbon traps that result from changes in rock type or pinch-outs, unconformities, or other sedimentary features such as reefs or buildups). A trap is an essential component of a petroleum system. Exploration plays and prospects are typically developed in basins or regions in which a complete petroleum system has some likelihood of existing. Reservoir rocks should be analyzed to determine if they possess these characteristics for proper reservoir and environment of deposition evaluation for accurate evaluation of the hydrocarbon potential of the well. Accurate core description can be critical to understanding the reservoir's depositional environment, petrophysical properties, and reservoir characterization.

Identification of lithologies and fluid content associated with the lithological bed prediction are among the processes carried out by reservoir Engineers and Geoscientists to have accurate information in order to intelligently judge the risk and opportunity involved in the development of a reservoir (Tahiru et al.,). Thus, the delineation of lithology of geological beds is a very important step in reservoir characterization (Abbey et al., 2018).

Efemena and Maju-Oyovwikowhe (2022), defined Core analysis as the laboratory measurement of the physical and chemical properties of samples of recovered core, for purposes of multiple disciplines. They maintained that the result of core description is the subdivision of cores into lithofacies, based on lithology, grain size, sedimentary structures (physical and biogenic), and stratification produced by different processes during deposition.

Side wall coring (SWC) has been around for many decades, the cores providing the real rock from the subsurface for lab analysis. Sidewall cores provide an effective method for obtaining geological data (Collier, 1989). For petrophysical and reservoir properties analysis in lab to cover the wide spectrum of core analysis, a decent volume and size of rock is needed, that is traditionally derived from the drill-core in the form of plugs. However, acquiring the conventional drill-core has its own inherent challenges associated with recovery and cost constraints. Koepf (1961) presented a detailed account of how sidewall core analysis adds to formation evaluation. Fens (1998) discussed that contrary to core, that is usually only taken over the reservoir interval, sidewall cores are taken in reservoir sections as well as in the cap-rock and source rock samples for age-dating and to evaluate cap-rock sealing capacity and source-rock potential. SWC is done with excellent depth control and the zones of interest can be selected precisely with prior run logs (Shrivastava, 2013). Over the last few years, many practices have been developed which greatly increase the utility of the sidewall cores (Arora, 2011). Shafer (2013) writes that due to the high cost of obtaining whole core, it is generally not taken on-the-fly, especially in the exploration wells. Typically the well is drilled to TD, logged, sidewall cores taken, then with the information needed to justify the expense of cutting conventional whole core if need be, the well may be sidetracked or the next well could have the full-core plans in limited intervals. In unconventional reservoirs, most of the objectives of the coring program can be achieved with sidewall cores of adequate size. Various tests are being performed on rotary cores in shale reservoirs, such as desorption isotherms, tight rock analysis, rock-mechanics, geochemistry, XRD, SEM, acid solubility etc. (Vasilache, 2008). Britt (2004) showed how rotary sidewall cores could be used as a cost effective method for determining rock mechanical properties. The aim of this study is to use Sedimentological analysis to determine environment of deposition and lithostratigraphic succession interpretation using side wall samples. The key objective of this study is to use sedimentological and petrophysical information analyzed from side wall samples to investigate the reservoir potential of the selected sandstone reservoir.

Location of Study Well

The study area is located within the greater ughelli depobelt of the Niger Delta Basin (Figure 1).

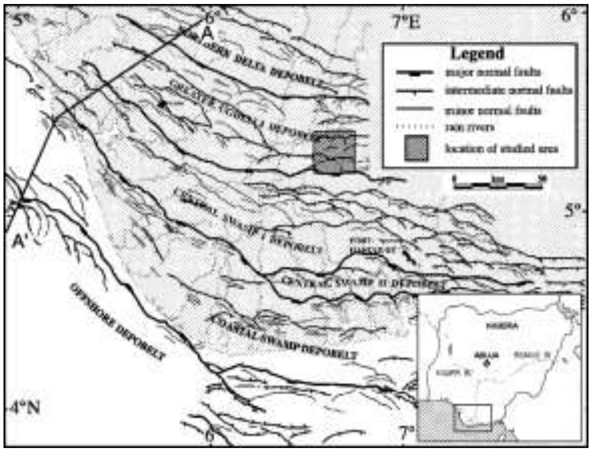

Fig.1: Location of XY- Well

Lithologically, the upper portion of the Niger Delta Province which makes up the Benin formation is sandy while the middle Agbada formation comprises an intervening unit of alternating sandstone and shale with the lower Akata formations predominantly shale. According to Short and Stauble (1967) "These three units extend across the whole delta and each ranges in age from early Tertiary to Recent. They are related to the present outcrops and environments of deposition". They further pointed out that the Tertiary section of the Niger Delta Province of Nigeria is divided into three litho-stratigraphic formations, representing prograding depositional facies that are distinguished mostly on the basis of sand-shale ratios. Tuttle, Charpentier and Brownfield (1999) investigated the hydrocarbon potential of the Niger Delta. They noted that the "Petroleum in the Niger Delta is produced from sandstone and unconsolidated sands predominantly in the Agbada Formation. Characteristics of the reservoirs in the Agbada Formation are controlled by depositional environment and by depth of burial." Magbagbeola (2005) studied the depositional sequence of the Niger Delta and found that Tertiary Niger Delta deposits are characterized by a series of Depobelt that strike northwest southeast, sub-parallel to the present day shoreline. He also observed that Depobelt become successively younger basin ward, ranging in age from Eocene in the north to Pliocene offshore of the present shoreline. As at 1999, the Niger Delta Province of Nigeria was estimated to hold recoverable oil and gas of around 35 billion barrels (bbl) and 94 trillion standard cubic feet (ft^3) gas respectively with production from sandstone facies within the Agbada Formation.

The Niger Delta Province includes Nigeria, Cameroon and Equatorial Guinea. The province is situated in the Gulf of Guinea with one petroleum system, identified so far, and designated in Nigeria as the Tertiary Niger Delta (Akata-Agbada) petroleum system. Tuttle, Charpentier and Brownfield (1999) described the period of the formation of the Niger Delta. They outlined that the delta formed at the site of a rift triple junction related to the opening of the southern Atlantic starting in the Late Jurassic and continuing into the Cretaceous. They noted "The delta proper began developing in the Eocene, accumulating sediments that now are over 10 kilometers thick. The primary source rock is the upper Akata Formation, the marine-shale facies of the delta, with possibly contribution from interbedded marine shale of the lower most Agbada Formation". The Niger Delta covers an aerial stretch of over 70,000 km² within the Federal Republic of Nigeria and constitutes about one-fourteenth of the total land mass of the country. In Nigeria, originally, the Niger Delta constituted what were then Bayelsa, Delta and River States until its modification in the year 2000 to include a number of other states.

The geologic history of the Niger Delta Province dates from Eocene period to recent times and remains the youngest of three depositional cycles leading to the development of the coastal sedimentary basin of Nigeria. The deposition of sediments within this period lasted from about 56 to 34 million years ago up till recent times bringing about three stratigraphic subdivisions, namely the Benin formation, the Agbada formation and the Akata formation (Table 2).

Table 2: Formations of the Niger Delta Province of Nigeria

No	Formation	Lithology	Period of Occurrence	Source	Depth	Location
1	Akata	-Thick shale sequence - turbidite sand - clay and silt	Paleocene through recent	Lowlands when terrestrial organic matter and clays were transported to deep water areas characterized by low energy conditions and oxygen deficiency (marine Origin)	7000m	Base of the Delta
2	Agbada	Shale and sandstone	Eocene to recent		3700m	Middle layer, major petroleum-bearing unit
3	Benin	sand	Eocene to recent	Alluvial and upper coastal plain	2000m	Upper layer of the delta

Materials and Methods

30 Sidewall samples recovered from XY-Well were used for the study.

Standard procedures for the evaluation of sidewall core samples were observed. They include:

Well Site Analysis: This involves the following:

1. ***Handling*****:**The sidewall sample tool was brought to the surface and the samples were properly removed from the tool, The depth from which they were obtained was properly noted. Samples were then stabilized by freezing and jacketing in aluminium foils.
2. ***Shipping*****:** Samples were properly transported in padded cardboard boxes from well site to the laboratory for further analysis.

Laboratory Analysis: Samples were subjected to various tests to ascertain their petrophysical characteristics. Materials used for the analysis are petri dish, grain size comparator, dilute HCl, hand gloves, hand lens, electron microscope, mortar and pestle and spatula.

Colour Test: The Rock color chart was used to confirm the true color of each sample.

***Disaggregation*:** Samples were washed and oven dried upon arrival in the laboratory. Oven dried samples were then disintegrated using the fingers, however lumpy samples were crushed lightly using the mortar and pestle, it should be noted that the crushing was systematically done so as not to destroy individual grains and thus affect the degree of sorting.

Carbonate Test: Dilute hydrochloric acid (HCl) was used to test for the presence of Carbonates in each sample. Samples containing carbonates exhibited effervescence of gas which confirmed the presence of carbonate particles in them.

***Determination of Degree of Sorting, Roundness and Grain Size*:** The Grain Size Comparator, a chart showing various degrees of sorting, roundness and grain sizes was used to ascertain the degree of Sorting, Roundness and the general grain size of the each sample. This was done by first crushing a portion of each sample and comparing it megascopically with the Grain Size Comparator, the correct sorting, size and roundness that properly represented each sample was recorded.

***Morphoscopic Study*:** This is the study of the shapes and degrees of roundness and sphericity of individual grains contained in each sample. This study was carried out using the microscope, individual grains were viewed under the microscope and their various shapes and characteristics were noted. The grain shape was determined by considering the relationship between the long axis, intermediate and short axis of each grains. Also associated minerals were identified when samples were viewed under the microscope.

Thin Section Study

Petrophysical property determination of sidewall samples requires adapted laboratory techniques and procedures. Sidewall core samples can be evaluated for mud invasion prior to analysis. The first step in analyzing side wall samples is the preparation of thin sections. A thin section is made by grinding down a slice of rock which has been glued to aglass slide until it reaches a thickness of about 0.03mm (30 microns).At this thickness most minerals become more or less transparent and can therefore bestudied by a microscope using transmitted light.In many areas of geological study such as mineralogy, petrography, sedimentology and so on, thin section preparation is needed in order for samples to be examined microscopically in order to analyse the characteristics of the soil or rock. This analysis is normally carried out using transmitted polarised light which creates a need for thin sections of known and exact thickness. Reflected light microscopy is also widely used.

Petrography

The geological description of sidewall samples is usually carried out using slides mounted on Petrographic microscope. Some samples were also viewed without slide preparation. Immersion oil is used to rub on the slide if samples can't be clearly viewed. Mineral types, grain sizes and shapes were documented. Basically when using lower magnification microscope objective lenses (4x, 10x, 40x) the light refraction is not usually noticeable. However, once you use the 100x objective lens, the light refraction when using a dry lens is noticeable. If you can reduce the amount of light refraction, light passing through the microscope slide will be directed through the very narrow diameter of a higher power objective lens. In microscopy, more light = clear and crisp images. By placing a substance such as immersion oil with a refractive index equal to that of the glass slide in the space filled with air, more light is directed through the objective and a clearer image is observed (Using Microscope Immersion Oil | Microscope World Resources).

Precautions

In order to obtain valid and correct results and ensure safety during the processing stage of a core analysis programme, the following precautions were adhered to;

- Laboratory protective jacket, hand gloves, protective eye glasses and respiratory masks were used to ensure body protection.
- Be very careful during the crushing stage in order not to destroy individual grains

Results and Discussion

Results obtained from the various tests and analysis carried out on the 31 samples used for the study in the laboratory is summarized in table 3.

Table 3: Result of Sedimentological analysis carried out on Side-wall samples obtained from well XY.

S/N	DEPTH FT ALN	SAND %	SHALE %	LITHOLOGY	LITHLOCICAL DESCRIPTION
1	8484	100	0	sand stone	light brown, poorly sorted, sub-rounded, very coarse grains
2	8495	100	0	sand stone	light brown, sub angular - sub-rounded, well sorted, coarse grain
3	8748	0	100	Shale	grey, platy
4	8767	80	20	sand stone	light brown , poorly sorted, sub-rounded, medium grains
5	8784	100	0	sand stone	light brown, well sorted, medium grain sizes, sub-rounded
6	8790	100	0	sand stone	light brown , poorly sorted, sub-rounded, coarse grains
7	8822	20	80	Shale	grey, massive
8	8844	100	0	sand stone	light brown, well sorted, medium grain sizes, angular
9	8852	100	0	sand stone	light brown, moderately sorted, coarse grain sizes, angular
10	8856	100	0	sand stone	light brown, well sorted, fine grain sizes, angular
11	8862	90	10	sand stone	Light- brown, moderately sorted, coarse-grain sizes, sub angular to sub-rounded
12	8870	100	0	sand stone	light brown , poorly sorted, sub angular, coarse grains
13	9060	0	100	Shale	grey, platy
14	9270	0	100	Shale	grey, platy
15	9420	80	20	sand stone	light brown, angular, well sorted, coarse grain
16	9474	90	10	sand stone	light brown, well sorted, fine grain sizes, angular
17	9610	80	20	sand stone	light brown , poorly sorted, sub-rounded, coarse grains
18	9678	0	100 1	Shale	grey, platy
19	9753	90	10 1	sand stone	light brown, angular, moderately sorted, medium grain
20	9849	0	100 1	Shale	grey, platy
21	9862	100	0	sand stone	light brown, angular, well sorted, medium grain
22	9872	100	0	sand stone	light brown, well sorted, fine grain sizes, sub angular
23	9883	60	40	sand stone	light brown ,well sorted, sub-rounded, coarse grains
24	9896	0	100 1	Shale	grey, massive
25	10056	0	100 1	Shale	grey, massive
26	10062	100	0	sand stone	light brown, well sorted, fine grain sizes, sub-rounded
27	10072	60	40	sand stone	light brown, poorly sorted, sub angular - sub-rounded, coarse grains
28	10092	0	100 1	Shale	grey, massive
29	10098	100	0	sand stone	light brown, rounded, moderately sorted, coarse grain
30	10600	0	100 1	Shale	grey, platy
31	10694	0	100 1	Shale	grey, platy

Discussion

Lithology

From table 3, it is evident that the well is dominated by sandstone and shale lithologic units. The sandstones are brownish in colour, grain shape ranges from angular to rounded grains with traces of coal and carbonate material. Sorting is well sorted to poorly sorted. Grain size ranges from fine to coarse. The presence of mica and quartz crystal overgrowth suggests that the sands are texturally matured. The shale member on the other hand ranges from platy to massive with a grey colour. This suggests deposition in a slightly oxygen deficient environment.

Lithofacies

Sand, shale and heterolith are the lithofacies encountered in the well of study. Below is a brief analysis of all the 31 samples used for the study.

Sample 1

Obtained at a depth of about 8484ft. Contains 100% sand grains, is very coarse grained, poorly sorted with sub-rounded grains. Associated with plenty mica.

Sample 2

Obtained at a depth of about 8495ft. Contains 100% sand grains, it is well sorted with sub angular to sub rounded grains. Grains are generally coarse and are associated with traces of ferruginized materials and mica. Sample is sand.

Sample 3

Obtained at a depth of 8748ft, is platy and fissile with very fine grained particles and a grey colouration. Sample is shale.

Sample 4

Obtained at a depth of 8767ft contains about 80% sands and 20% shale. It is poorly sorted with sub-rounded grains and flakes of mica. Grain size is medium grained. Sample is sand.

Sample 5

Obtained at a depth of 8784ft, contains about 100% sand grains. It is well sorted with sub-rounded coarse grains and ferruginized materials. Sample is sand.

Sample 6

Obtained at a depth of 8790ft, contains about 100% sand grains poorly sorted with sub-rounded coarse grains. Sample is sand.

Sample 7

Obtained at a depth of 8822ft, contains about 20% sands and 80%Shale. It is massive and contains mica flakes and ferruginized materials. Sample is sand.

Sample 8

Obtained at a depth of 8844ft, contains about 100% sand grains. It is moderately sorted, coarse grained, sub-rounded with mica and ferruginized materials. Contains carbonate particles. Sample is sand.

Sample 9

Obtained at a depth of 8852ft, contains about 100% sand grains. It is moderately sorted, coarse grained, sub-rounded with mica and ferruginized materials. Sample is sand.

Sample 10

Obtained at a depth of 8856ft, contains about 100% sand grains. It is well sorted, fine grained, angular grains with growing quartz crystals and ferruginized material. Sample is sand.

Sample 11

Obtained at a depth of 8862ft, contains about 90% sand and 10% shale. It is moderately sorted, coarse grained, sub-angular to sub-rounded grains with traces of mica and ferruginized material. Sample is sand.

Sample 12

Obtained at a depth of 8870ft, contains about 100% sand grains. It is poorly sorted, coarse grained with growing quartz crystals and ferruginized material. Sample is sand.

Sample 13

Obtained at a depth 9060ft, sample is platy and fissile with very fine grains and ferruginized material. Sample is sand.

Sample 14

Obtained at a depth of about 9270ft, sample is platy and fissile with fine grains and ferruginized material. Sample is sand.

Sample 15

Obtained at a depth of about 9420ft, contains about 80% sand and 20%shale. It is well sorted, coarse grained with mica flakes, coal and growing quartz crystals. Sample is sand

Sample 16

Obtained at a depth of 9474ft, contains about 90% sand and 10% shale. It is well sorted, fine grained, and angular shaped with mica flakes and coal particles. Sample is sand.

Sample 17

Obtained at depth 9610ft, contains about 80%sand and 20%shale. It is poorly sorted, coarse grained and sub-rounded to angular shaped with carbonates and coal particles. Sample is sand.

Sample 18

Obtained at a depth of about 9678ft, sample is platy and fissile with very fine grains. Sample is shale.

Sample 19

Obtained at a depth of 9753ft, contains about 90% sand and 10% shale. It is moderately sorted, coarse grained and angular shaped with plenty coal and mica. Sample is sand.

Sample 20

Obtained at a depth of about 9849ft, sample is platy and fissile with very fine grains. Sample is shale

Sample 21

Obtained at a depth of 9862ft, contains about 100% sand grains. It is well sorted, angular shaped medium grains. Sample is sand.

Sample 22

Obtained at a depth of 9872ft, contains about 100% sand grains. It is well sorted, angular; medium grained with mica flakes, coal and ferruginized particles. Sample is sand.

Sample 23

Obtained at a depth of 9883ft, contains about 60%sand and 40%shale. Sand member is well sorted, sub-rounded, coarse grained with traces of mica, coal particles and growing quartz crystals. Shale member is massive. Sample is heterolith

Sample24

Obtained from a depth of 9896ft, sample is massive with traces of mica and ferruginized material. Sample is shale

Sample 25

Obtained from a depth of 10,056ft, sample is massive, fine grained with traces of mica. Sample is shale

Sample 26

Obtained from a depth of 10,062, contains about 100% sand grains. It is well sorted, fine grained, sub-rounded with mica flakes and growing quartz crystals. Sample is sand

Sample 27

Obtained at a depth of about 10,072ft, contains about 60% sand and 40% shale. It is generally poorly sorted, with sub-rounded coarse grains and mica particles and growing quartz crystals. Sample is heterolith

Sample 28

Obtained at a depth of 10,092ft, sample is grey, fine grained and massive. Sample is shale

Sample 29

Obtained at a depth of 10,098ft, contains about 100% sand grains. It is moderately sorted, coarse grained with ferruginized particles. Sample is a sand.

Sample 30

Obtained at a depth of about 10,600ft, sample is grey, very fine grained and platy. Sample is shale

Sample 31

Obtained at a depth of about 10.694ft, sample is grey, very fine grained and platy. Sample is shale.

Energy of Deposition

Rock properties interpreted from the analysis shows that the energy regime at play as at deposition is medium to low energy regime. Because the grain sizes of the samples range from very coarse to fine in the sand units and very fine in the shale units, it can be inferred that a medium to low energy regime deposited the sands and a very low and quiet energy regime deposited the shale.

Environment of Deposition

The analysis of the physical properties gave results that confirm the environment of deposition of the Reservoir.

Colour: Ranging from brown for sands and grey for shale

Sorting: Ranging from well sorted to poorly sorted

Grain Shape: Ranging from sub-angular to sub-rounded

Grain Size: Ranging from coarse to fine grains

Associated Material: Coal particles, Carbonate Particles, Mica Flakes.

All these characteristics are typical of a transitional to marine environment. It can therefore be inferred that the sediments were deposited in a Barrier Beach to Deltaic to Shallow marine environment.

Hydrocarbon Play Potential

From the lithologic description, a potential hydrocarbon system containing a source rock, reservoir rock and a seal can be observed. Potential source rocks were observed at depths 10,054ft to 10,694ft with sand lenses occurring within. Potential reservoir rocks occurred at depths of 8748ft to 8870ft and 9420ft to 9872ft with some shale units occurring within. Potential seal structures occurred at 9896ft to 10,056ft, 9060ft to 9270ft and 8748ft.

Conclusion

The objective of core analysis is to help reconstruct the most accurate picture possible of the reservoir and its productive potential. By subjecting representative samples from sidewall cores to the tests carried out in this study, it was possible to measure some of the physical properties of the reservoir rock. The study carried out on the 31 sidewall samples, can be used by oil-companies in detecting hydrocarbon reservoirs in the Niger Delta area, these analysis helps geologist to locate the right spot where drilling could be carried out and to estimate the depth to be drilled. The XY-Well was found to be a prolific reservoir because of the thickness of the reservoir layers, high porosity and permeability due to the absence of fine sediments or rock particles that can block pores, thereby reducing porosity and permeability.

Cores should be taken from wells and analyzed before development of the wells to avoid wasting time and funds on less productive wells whose reservoir thickness may be shallow, possess clogged pores that reduce porosity and permeability and other reduced reservoir properties. Sidewall samples gives optimum results, cheaper to acquire, gives information on zones that were previously cored, but information has been lost and a fast core acquisition. Reservoir rocks should be analyzed to determine their environment of deposition and rock properties for accurate evaluation of the hydrocarbon potential of the well. Accurate core description can be critical to understanding the reservoir's depositional environment, petrophysical properties, and reservoir characterization.

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Conflict Of Interest

No conflict of interest detected by the authors

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