International Journal of Engineering Science Invention (IJESI)
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org ||Volume 7 Issue 1|| January 2018 || PP. 28-32

Grain sizeanalysis of sediments and its implicationon erosionalong Qua Iboe River/ Estuary Bank Southeastern Nigeria.

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ABSTRACT*:Sixty (60) sediment samples were collected from ten (10) different locations (S1-10) along Qua Iboe River /Estuary Bank in Southeastern Nigeria . Textural grain size analysis was carried out on the different sediments in order to infer the vulnerability of the different areas to erosion. The statistical grain size parameters show that the mean grain size (M_z), ranges from 1.60to 2.73with an average value of 2.06indicating medium to fine grained sand, standard deviation (sorting, σ_1) has a mean value of 0.58(ranges from 0.38-0.79) whichinfer well to moderately well sorted sediments, while Skewness(S_{KI}) and kurtosis (K_G) have range values of -0.04 - 0.27 and 0.74-1.23 with mean values of 0.04 and 1.00 respectively, which depict coarse skewed to very fine- skewed of Platykurtic – leptokurticsediments. These results suggest that Okoro - Utib and Ukpenekang sediments are medium grain size in nature, deposited in a moderate energy condition and are less venerable to erosional forces.The other investigated areas are dominantly fine grain sediments, deposited in a low energy condition hence more vulnerable to erosion.*

KEYWORDS:*Sediment samples, Qua Iboe River/Estuary Bank,erosion,grain size parameters, moderate energy.*

Date of Submission: 21-01-2018 Date of acceptance: 05-02-2018

I. Introduction

Analysis of coastline erosion and accretion can be carried out using grain size analysis (Kadib, 1969). Coastal erosion is the main process that supplies sediments to the coastal systems and to the adjacent estuary and river banks. River bank/Estuary closer to coastal zones may serve wide range of functions such as recreational centres, catchment centres/ fishing camps, landing ground for river transporters. Erosion on these areas can hamper the afore-mentioned activities.The causes of coastal erosion in these areas aregenerated by both natural and human settings. These includes; wind, waves, tidal changes, land reclamation, construction of harbours, sand excavations

The grain size is one of the most reliable parameters in understanding the provenance/source, transportation mechanisms and depositional setting of the sediments. The exits a relationship between the mean grain size and the transporting medium together with the depositional environment (Nordstrom, 1975). This infer that finer grain size are deposited in a low energy condition,as they are easily eroded than the coarse grain size. which are of high energy setting.This study was carried out in some selected locations that are prone to erosion along Qua Iboe River/ Estuary Banks (Fig.1), in order to make the work plausible on physical grounds.

Figure 1: Eyet-Urua (S-2), one ofthe study areasprone to erosion.

The thrust of this research work is to make an attempt to determine the grainsize distribution along Qua Iboe River/ Estuary Bank, with the aim of understanding the geologicsensitivity of these sediments to the forces of erosion.

II. The description of the study area

The area under studied is the Qua Iboe River / Estuary Bank in Ibeno Local Government Area of AkwaIbom State, Southeastern Nigeria(fig.2).Ten (10) selectedareas used under this investigation are; IkotInwang(S-1), Eyet-Urua (S-2), Okoro - Utib (S-3), Okputuwa (S-4), Boundary between Okputuwa, Itak-Abasi(S-5), Itak-Abasi 1(S-6),Itak-Abasi 2 (S-7),Mkpanak (S-8), Ukpenekang (S-9) and Ibeno (S-10).The geographic coordinates of these areas lies between Latitude 04º30^{I}N and 05º30^{I}N and Longitude 007º30^{I}E and 008º15^{I}E.TheQua Iboe River / Estuaryextend southwards into the Atlantic Ocean around Ibeno Coastal zone. The climate of the study area has daily temperature that varies between 20°C and 30°C and characterized by heavy annual rain fall (2500mm-4500 mm) which occurs from April to October, with predominance of south-westerly wind conditions (Iyayi,2004).The climate also hasa shorter dry season that last from November to February. This is a typical rainforest climatic zone. The major land use types in the Qua River basin include oil exploitation, fishing, forestry and agriculture.Qua Iboe River / Estuaryis therefore one of the richest wetlands in the world (Iyayi, 2004).

The mouth of the Qua Iboe River is about 100-150metres wide (Ifunanya, 2010). The region is highly estuarine and deltaic in nature. It is made of mangrove swamps and low-lyingarea that is prone to erosion. The geology of thestudy area falls withinthe Coastal Plain Sand (Benin Formation/Sand) of the Tertiary Petroliferous Niger Delta Basin in Southeastern Nigeria(Short and Stauble, 1967).

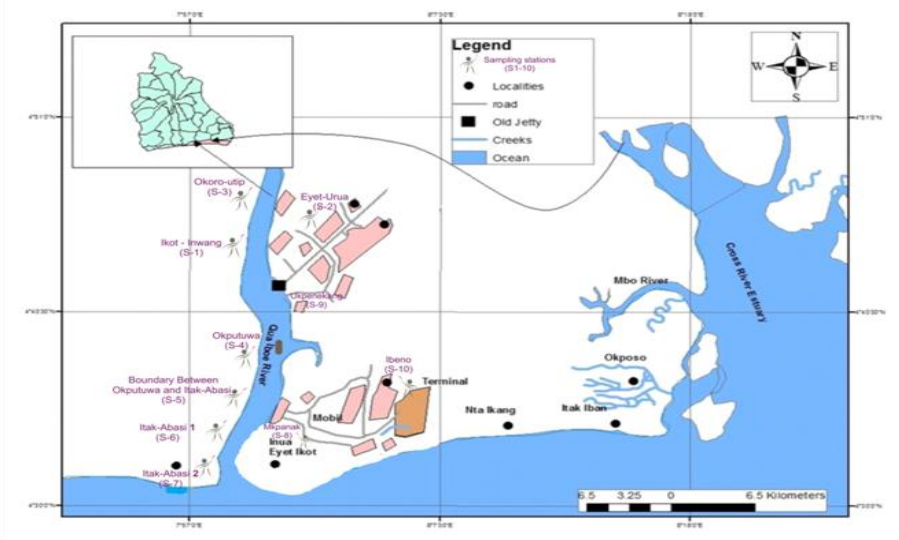

Figure 2: Map of the study showing sample locations.

III. **Methodology**

A total number of sixty (60)sediments samples obtained from ten (S1-10)different locationsat the rate ofsix (6) samples per location were used for this study.Samples were retrieved from uniform shallow trenches of 20cm depth by the use of sediment corer. At each sampling station, the geographic coordinates were taken using Global Positioning System (GPS). The samples were collected both vertically and horizontally along the bank in order to infer variations in grainsize. Grain size analysis was carried out on the retrieved sixty (60) sediment samples using the standard method of grain size analysisof Folk(1966 and 1984). The analysis was carried out in the Sedimentological Laboratory of the Department of Geology, University of Calabar, Calabar, Nigeria.The various average statistical parameters of Mean Grained Size (M_Z), Inclusive Graphic Standard Deviation(σ_1), Inclusive Graphic Skewness(S_{KI}) and Graphic Kurtosis(K_G) of Folk and Ward (1957) andFolk(1966 and 1984) were computed for each of the ten (10) locations(table 1).

Table 1: Statistical parameter and interpretation of the average grain size analyzedfrom Qua IboeRiver/ Estuary Bank

Location	**Mean (M_Z)ϕ**	**Sorting (σ_I) ϕ**	**Skewness (S_{K1})**	**Kurtosis (K_G)**
S - 1	2.70 Fine Sand	0.65 moderately well sorted	0.00 Near symmetrical,	0.82 Platykurtic.
S - 2	2.47 Fine Sand	0.74 Moderately sorted	0.03 Near symmetrical,	0.97 Mesokurtic
S - 3	1.97 Medium Sand	0.55 Moderately well sorted	-0.10, Near symmetrical	1.23 Leptokurtic
S - 4	2.73 Fine Sand	0.58 Moderately well sorted	0.07 Near symmetrical	0.77 Platykurtic.
S - 5	2.30 Fine Sand	0.51 Moderately well sorted,	0.15 Positive skewed	1.16 Leptokurtic.
S - 6	2.30 Fine Sand	0.38 Well sorted,	0.08 Near symmetrical	0.98 Mesokurtic.
S - 7	2.47 Fine Sand	0.52 Moderately well sorted	0.27 Positive skewed	1.23 Leptokurtic
S - 8	2.67 Fine Sand	0.57 Moderately well sorted	0.14 Positive skewed	0.74 Platykurtic.
S - 9	1.60 Medium Sand	0.79 Moderately sorted,	-0.04 Near symmetrical	0.89 Leptokurtic

S - 1 0	2 . 1 3 Fine Sand	0 . 5 1 Moderately well sorted	- 0 . 2 5 Negative skewed	1 . 1 6 Leptokurtic.
A V G	**2 . 0 6 Fine Sand**	**0 . 5 8 Moderately well sorte**	**0 . 0 4 Near symmetrical**	**1 . 0 0 Mesokurtic.**

Legend: M_Z = Mean Grained Size, σ_1 = Inclusive Graphic Standard Deviation (Sorting), S_{K1} =Inclusive Graphic Skewness, K_G =Graphic Kurtosis and AVG = Average

IV. Results and Interpretations

Friedman (1961) and Folk (1966 and 1984) inferred that statistical parameters of grain size distribution are the major indicesin delineating the influence of depositional processes. Many authors have used the mean grain size as a reflection of competenceof transport dynamic system while standard deviation and skewness are generally considered as environmental sensitive indicators.

The result shows that the Mean Grain Size (M_Z) values from the study area rangesfrom1.60ϕ to 2.73ϕ with average value of 2.06ϕ.This infer predominant of fine grained sediments over the medium grained sand. The medium grained sediments were only observed in Okoro-Utib (S-3) and Ukpenekeng (S-9) and this constitutes 20% of the total samples studied. Themedium grained sizeinfers moderate energy condition and less vulnerable to erosion. The remaining 80% of the sediment analyzed were fine grained sand, inferring low energy condition and more susceptible to erosion (Abdulkarim*et al*.,2014). The Inclusive Graphic Standard Deviation (σ_I) has average and range values of 0.58ϕ and 0.38ϕ - 0.79ϕ respectively, inferring well to moderately well sorted sediments.The almost uniformly of the grain size indicates that if a similar erosive force acts on the sediments, eventually all of them may be eroded out. The Skewness(S_{K1}) values ranges from – 0.04 to 0.27 (average 0.04) inferringboth coarser and finer materials. Kurtosis (K_G) values lies between 0.77-1.77 with an average value of 1.00.This indicates a sub-population and contributionof sand grain sediments from different sources. This implies that not all the areas are prone to erosion since the sources contribution differs, with finer grained size more vulnerable to erosion than the medium grained sand.

V. Conclusion

Sediments sourced from ten (10) differentlocations along the Qua Iboe River / Estuary Bankof Southeastern Nigeria was investigated in order to infer their vulnerability to erosion. Ten (10) studied areas include;IkotInwang(S-1), Eyet-Urua (S-2), Okoro - Utib (S-3), Okputuwa (S-4), Boundary between Okputuwa and Itak- Abasi(S-5), Itak- Abasi 1(S-6),Itak- Abasi 2 (S-7),Mkpanak (S-8), Ukpenekang (S-9) and Ibeno (S-10). Among the studied areas, Okoro-Utib (S-3), and Ukpenekang (S-9) have mean grain size values of 1.97 ϕ and 1.60 ϕ inferring medium grain sand, deposited in a moderate energy condition and less susceptible to erosion. The rest of the studied area are fine grain sediments deposited in low energy environment and are more vulnerable to erosion. The result of this research work and the knowledge derived can be useful in curbing the erosional menace of the prone areas.

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