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Bottom Sediment Analysis at Lhok Seudu Beach, Aceh Besar

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ABSTRACT

The research with the title Basic Sediment Analysis of Lhok Seudu Beach, Aceh Besar was conducted from March to April 2023. Lhok Seudu Beach is a bay beach in the area affected by the 2004 tsunami. This study aims to determine the characteristics of sediments as a basis for geological oceanography studies. The method used serves to analyze the shape of the bottom sediment with granulometric analysis. Granulometric analysis itself uses the sieve analysis method or multilevel screening to determine the results. The results of this study are the largest mean sediment of each station in each grain size is the type of medium sand with an average percentage of 0.2794029% and the smallest mean is the type of coarse silt with an average percentage of 0.05309625%. The conclusion obtained in this study is the divergence of the sediment in each station. The conclusion obtained in this study is that the differential found at EBA and WBA is influenced by topography and sediment transportation on sediment characteristics.

1. Introduction.

Indonesia with the title of the largest country in Southeast Asia also has a large maritime area. There are 17,000 islands owned by Indonesia as an archipelago with a sea area covering 5.8 million km^2 with a division of sovereign sea area and Exclusive Economic Zone area. As a maritime country, Indonesia itself has a coastline of around 81,000 km, supporting resources through coastal areas (Mutaqin et al., 2021).

The Lhok Seudu area is a coastal area in Leupung District, Aceh Besar Regency. This area was affected by the earthquake and tsunami disaster on December 26, 2004. Geographically Lhok Seudu is located at coordinates 5°21'30.2"- 5°21'34.3" LU and 95°13'52.9"- 95°13'58.9" East. The majority of the Lhok Seudu community are farmers and fishermen with a match of geological conditions in the area. This proves the dependence of the community on the conditions of the region, namely marine products and rice field management (Sitta et al., 2021).

Granulometric analysis can be used to determine the type of bottom sediment (Poizot et al., 2008). Granulometric analysis is divided into two, namely sediment grain size analysis and sediment type naming analysis. To determine the analysis of sediment grain size distribution, a statistical approach is taken using mean, kurtosis, sorting, and skewness. Naming sediments can be done by referring to the sediment triangle. The condition of the distribution of bottom sediments in a body of water can be known from analyzing the relationship between bottom sediments and current movements obtained from information on sediment distribution analysis, granulometric analysis, and observations of oceanographic parameters (Hadyan et al., 2015).

Sediment particle size is one of several physical parameters used to test sediment quality. The unit of sediment size is expressed in mm. Sediment particle distribution is the percentage of grains that pass the sieve of a certain size depicted in the form of a curve, the unit is expressed in percent. This data is an important parameter in the investigation of sediment problems. Differences in the size of sediment particles can indicate differences in transportation methods and sources (Zhang et al., 2021). Sediment particle size data is widely used for various purposes, including to calculate the specific gravity of sediment deposited in the reservoir, as well as to calculate the amount of sediment transport, supporting the calculation of erosion rates

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and soil erodibility factors (BSN, 2018).

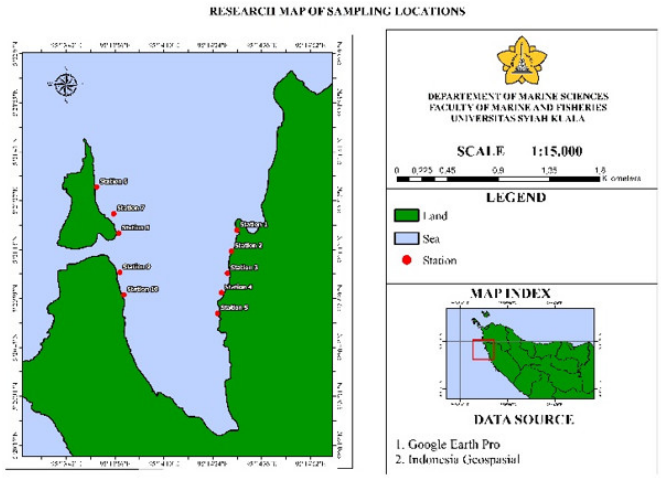
The treatment of sediment in the identification process with granulometric analysis is carried out using the Wentworth scale, (1922). This scale shows information in the form of classification of clastic sediments. On this scale, Wentworth also has many similarities in his classification with Udden (1914), so many researchers have combined their classifications under the name Udden-Wentworth Grain Size or U-W Grain Size. This classification also does not have an absolute standard to use because it is adjusted to the topic or case of the research to be carried out while still referring to Udden, Wentworth, or both.

This research aims to characterize sediments as a basis for geological oceanographic studies which provide benefits for decision making in development policies in the area.

2. Materials and Methods.

This research was conducted at Lhok Seudu Beach, Layeun Village, Leupung District, Aceh Besar Regency, Aceh Province.

Figure 1: Research Location Map.



Source: Authors.

2.1. Location Point Determination.

Determination of station location points in the Lhok Seudu Coastal Waters area, determined as many as 10 station points spread by following the coastline. Sampling was carried out by dividing into 2 areas (Wahab et al., 2016), namely the East Bay Area / EBA area consisting of 5 stations (st1, st2, st3, st4, st5) and the West Bay Area / WBA area consisting of 5 stations (st6, st7, st8, st9, st10). The distance between stations was randomized at each station.

2.2. Sampling.

Samples taken in this study using the coring technique using a 3.5-inch diameter PVC pipe with a sample layer thickness of 15 cm.

2.3. Granulometry Analysis.

Granulometric analysis is a grain size analysis performed on siliciclastic sediments. Sediment analysis is carried out using the graded sieving method (sieve analysis). This method uses a multilevel sieve tool. This analysis serves to show information on sediment grains at the research site.

In using granulometric analysis using the multilevel sieve method, the Udden-Wentworth scale is used as a reference in sediment classification (Wentworth, 1922). The purpose of using the Udden-Wentworth scale is to identify the type of sediment at each station. The following is a classification table using the Udden-Wentworth scale.

Table 1: Udden-Wentworth Scale.

mm	Phi (φ)	Udden-Wentworth Scale Grain Size Classification	
4096-256	-12 till -8	Chunks	Gravel
256-64	-8 till -6	Crust	
64-4	-6 till -2	Gravel	
4-2	-2 till -1	Grain	
2-1	-1 till 0	Very Coarse Sand	Sand
1-0.50	0 till 1	Coarse Sand	
0.50-0.25	1 till 2	Medium Sand	
0.25-0.125	2 till 3	Fine Sand	
0.125-0.0625	3 till 4	Very Find Sand	
0.0625-0.031	4 till 5	Coarse Silt	Silt
0.031-0.0156	5 till 6	Medium Silt	
0.0156-0.0078	6 till 7	Fine Silt	
0.0078-0.0039	7 till 8	Very Fine Silt	
0.0039-0.00006	8 till 14	Clay	Mud

Source: Authors.

3. Results and Discussion.

Table 2 shows the sieve results consisting of all stations taken in the East Bay Area (EBA) and West Bay Area (WBA) at the Lhok Seudu Beach location using a multistage sieve with the dry sieve method. Based on the Udden-Wentworth scale shows the overall percentage of the station is sand. The dominance of sediments in the average cumulation (mean) of each station in each sieve size (fraction) is topped by sediments with medium sand type with an average percentage of 29.84%, followed by coarse sand type with an average percentage of 19.1 %, then very fine sand type with an average percentage of 16.002 %, then fine sand type with an average percentage of 15.558%, there is also a type of very coarse sand with an average percentage of 7.6815%. Gravel is in the next order with the type of

Table 2: Weight distribution of sediment samples at Lhok Seudu Beach.

Station	Percentage of Sediment Weight by Fraction Size (%)								Type (Dominant)
	>2 (mm)	2-1 (mm)	1-0.5 (mm)	0.5-0.25 (mm)	0.25-0.125 (mm)	0.125-0.063 (mm)	0.063> (mm)	Total	
1	9.5	10	38	20.5	0.08	16.44	5.48	100	Sand (Coarse Sand)
2	3.5	9	22.5	31.5	2	23.61	7.89	100	Sand (Medium Sand)
3	7	10.5	26	29	4.5	17.3	5.7	100	Sand (Medium Sand)
4	5	9.5	29	28.9	7	15.85	5.15	100	Sand (Coarse Sand)
5	2.5	1.5	5	8.5	47.5	26.25	8.75	100	Sand (Fine Sand)
6	1.5	2.5	7.5	56.5	6	19.5	6.5	100	Sand (Medium Sand)
7	16	24.5	29.5	7.5	2	15.375	5.12125	100	Sand (Coarse Sand)
8	4.5	5.5	15.5	38.5	27.5	6.4	2.1	100	Sand (Medium Sand)
9	0.48	0.315	15	42	45	8.045	2.655	100	Sand (Medium Sand)
10	15.5	3.5	16.5	35.5	14	11.25	3.75	100	Sand (Medium Sand)
Average	6.548	7.6815	19.1	29.84	15.558	16.002	5.309625	100	

Source: Authors.

sand with an average percentage of 6.548 %, while in the last order there is silt in the form of silt with an average percentage of 5.309625%.

In Table 2, it can also be seen information in the form of sediment types from each station by looking at the dominance of the sediment type classification in the sieved samples. At station 1, the type of sediment produced in the measurement is coarse sand. At station 4, coarse sand type is produced again followed by fine sand type at station 5. At station 6, medium sand sediment type was produced followed by coarse sand type at station 7. The medium sand type dominates at station 8, station 9, and station 10.

The information shown in Table 3 are the results of the granulometric method representing the summit (st1, st2, st3, st4, st5). The mean weight or average value of each sieve size (fraction) at the summit is highest for the coarse sand type with an average percentage of 24.1%, followed slightly by the medium sand type with an average percentage of 23.68%. The very fine sand type ranks third with an average percentage of 19.89%, followed by fine sand with an average percentage of 12.216%. The very coarse sand type with an average percentage of 8.1% ranks fifth, just above silt with an average percentage of 6.594%. The lightest average percentage is in the grain type gravel with a result of 5.5%. From this information, it can be concluded that the sedimentary summit with coarse sand type dominates the area.

Table 4. displays information that represents WBA (st6, st7, st8, st9, st10). The results of the mean weight or average value of each sieve size (fraction) at WBA are the highest average in the medium sand type with an average percentage of 36%, followed by the fine sand type with an average percentage of 18.9%, and the coarse sand type ranks third as the most dominant type with coarse sand type with an average percentage of 14.1%. The very fine sand type with an average percentage of 12.114% and the gravel type in the form of grains with an average percentage of 7.596% come next. The very coarse sand type comes next with an average percentage of 7.263%, followed by the last category of silt with an average percentage of 4.02525%. From this information, it can be concluded that in the WBA sediments with medium sand type dominate the area.

According to (Yasin et al., 2016), the sediment distribution process is influenced by topography, sediment material sources and sediment transportation mechanisms. The differences found in the East Bay Area and West Bay Area show the resulting influence seen from topography and sediment transportation on Lhok Seudu Beach.

Conclusions.

The largest average (mean) sediment of each station in each grain size (fraction) is sand-type sediment in the form of medium sand with an average percentage 29.84% and the smallest average (mean) sediment of each station in each grain size (fraction) is silt-type sediment in the form of silt with an average

Table 3: Weight distribution of sediment samples at Lhok Seudu Beach, East Bay Area (EBA).

Station	Percentage of Sediment Weight by Fraction Size (%)								Type (Dominant)
	>2 (mm)	2-1 (mm)	1-0.5 (mm)	0.5-0.25 (mm)	0.25-0.125 (mm)	0.125-0.063 (mm)	0.063> (mm)	Total	
1	9.5	10	38	20.5	0.08	16.44	5.48	100	Sand (Coarse Sand)
2	3.5	9	22.5	31.5	2	23.61	7.89	100	Sand (Medium Sand)
3	7	10.5	26	29	4.5	17.3	5.7	100	Sand (Medium Sand)
4	5	9.5	29	28.9	7	15.85	5.15	100	Sand (Coarse Sand)
5	2.5	1.5	5	8.5	47.5	26.25	8.75	100	Sand (Fine Sand)
Average	5.5	8.1	24.1	23.68	12.216	19.89	6.594	100	

Source: Authors.

Table 4: Weight distribution of sediment samples at Lhok Seudu Beach, West Bay Area (WBA).

Station	Percentage of Sediment Weight by Fraction Size (%)								Type (Dominant)
	>2 (mm)	2-1 (mm)	1-0.5 (mm)	0.5-0.25 (mm)	0.25-0.125 (mm)	0.125-0.063 (mm)	0.063> (mm)	Total	
6	1.5	2.5	7.5	56.5	6	19.5	6.5	100	Sand (Medium Sand)
7	16	24.5	29.5	7.5	2	15.375	5.12125	100	Sand (Coarse Sand)
8	4.5	5.5	15.5	38.5	27.5	6.4	2.1	100	Sand (Medium Sand)
9	0.48	0.315	1.5	42	45	8.045	2.655	100	Sand (Medium Sand)
10	15.5	3.5	16.5	35.5	14	11.25	3.75	100	Sand (Medium Sand)
Average	7.596	7.263	14.1	36	18.9	12.114	4.02525	100	

Source: Authors.

percentage 5.309625%. East Bay area (EBA) is dominated by coarse sand and medium sand type sediments. West Bay area (WBA) is dominated by medium sand type sediments. Differentials in EBA and WBA are influenced by topography and sediment transport on sediment characteristics.

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