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ABSTRACT

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Keywords: river, basic sediment, usda.

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ABSTRACT

This study aims to investigate the high sedimentation in riverbed of Binaga Aron Samosir Regency, North Sumatra Indonesia. The investigation was carried out on identification of types sediment materials, sediment distribution, soil texture and sediment statistics based on USDA. Sediment sampling was performed in range points of 300 meters along the 1500 meters of the sampling area. The laboratory tests were carried out to determine the type of grain, sediment distribution, soil texture and sediment statistics. The results of the study shown four types of sedimentary materials, namely rock, sand, silt and clay. The average percentage of sediment grain types in the river bed of Binanga Aron River are: rocky 7.0%, rocky sand 3.50%, sand 18.43%, sandy silt 23.09%, silt 22.07%, silty clay 22.07% and clay 12.82% scattered in each points. The soil texture class for the bottom sediment of the Binanga Aron river is rocky sand. The sediment statistical value of sediment sorting results are poorly sorted, the sedimentary skewness is coarse and sedimentary kurtosis is blunt.

Keywords: river, basic sediment, usda.

Author

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I. INTRODUCTION

Geographically, the river around Samosir Regency, North Sumatra Indonesia, is crossed by several rivers, one of them is Binanga Aron river. The Binanga Aron was used as a means of transportation and a source of livelihood. After decades, the quality of water has decreased and in recent years has extreme silting to drought. Today, in several parts, the deserts and rocks are formed due to the clogged materials of deforestation around the river. The high base sediment material occurs by erosion [1,2,5,6,8,10,11].

The previous studies related to bed sedimentary materials have been carried out in the same basin. The sediment materials of Binaga Aron river are rock (7.0%), sandy rock (3.50%), sand (18.43%), sandy silt (23.09%), (silt 22.07%), silt clay (22.07%), clay (12.82%), sand (85. 99%), gravel (11.08%) and mud (2.93%). [1,2,6,10,11]. The dominant sedimentary materials on the coast of the river are rock, sand, and clay. Related to trapped sediment, it was found the dominant average sediment balance in the cross-river direction with an average mass of 28.00 grams [1,3,5.9,10,11]. Based on these previous findings, the sedimentation study will be carried out to identify the type of bed sediment materials. The sampling will be conducted for every 300 meters of the river along the 1500 meters of Binanga Aron. This is due to the lunge of drought along the

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1500 meter of Binanga Aron. This research is aimed to provide information about the sediment distribution and riverbed sediment material of Binanga Aron river.

1.1 Objective

The objective of this study is to investigate types sediment materials, sediment distribution, soil texture that related as impact of decreasing of Binanga Aron river water surface.

Literature Review

II. METHOD

2.1 Time and site of the study

This study was conducted from November 2017 to November 2018 in the Binanga Aron River, Samosir Regency. Sampling was performed at three points with each points are 300 meters along the 1500 meter of river. Figure 1 and 2 shows the site of study and sampling location.

Figure 1: The site of study

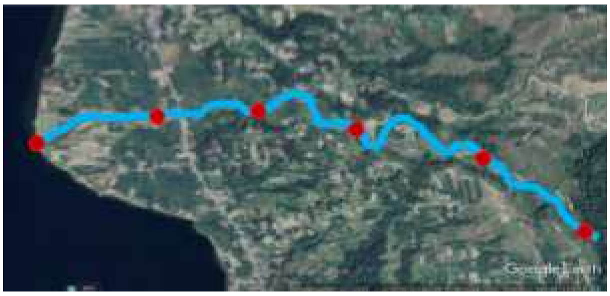


Figure 2: Sampling location

2.2 Tools and Materials

Tools and materials used in this study are: 1) sample bag to store sample research data; 2) distance binoculars to find out the width of the river; 3) stopwatch to find out the length of time used; 4) gauge; 5) digital scale to determine the weight of the sediment sample; 6) depth meter to measure the depth; 7) cloth as a container for drying sediment; 8) GPS to determine the coordinates of the research location; 9) Digital cameras are used to take photos of the research location situation and when conducting research; 10) Sediment grab is used to collect sediment data at the research location.

2.3 Laboratory Testing

The laboratory testing was carried out using these equipments: 1) oven with an adjustable temperature at 105 – 1100 C; 2) ASTM 152 H hydrometer; 3) distilled water; 4) measuring cup tube 1000 ml; 5) calgon (NaPO3) as reagent materials; 6) thermometer; 7) stopwatch; 8) vacuum or stove; 9) suspense mixer; 10) the scale with accuracy up to 0.01 grams; 11) Porcelain cup with pastel to break the clods into grains without damaging the granules; and 12). filter consisting of top and bottom covers.

III. DATA COLLECTION

3.1 Sediment Sampling

Sediment sampling was carried out in predetermined locations as shown in Figure 2. Sampling was taken in 6 points, namely Points 1a, 1b, and 1d; Points 2a, 2b, 2c and 2d; Points 3a, 3b and 3c; Points 4a, 4b and 4c; Points 5a, 5b, and 5c; and Points 6a, 6b, and 6c The distance between points is determined based on the width of the river then divided into 6 points. Sampling was performing along the 1500 meters of the river due to the erosion was high and more sediment was deposited [1,4.5,10.11]. The relationship between erosion and sediment is the accumulation of sedimentary materials in a location caused by erosion [4,5,9.10,11].

3.2 Treatment of sediment samples

3.2.1 Preparation

Samples were dried using an oven for about 24 hours. The dried sediment samples were filtered using a sieve number 10. The escaped grain of the sieve is separated by 50 grams. Five grams of reagent is put into a container that contains water. Then, the samples are put into water and reagent. The sample is left for ± 24 hours so that the sediment grains are broken down. Then, the sediment samples were shaken using a mixer for 10 minutes. The mixed sample was transferred to a measuring tube/glass and poured the rinsing water into the tube and added water until the volume became 1000 cm. The tube is closed and then shaken by turning the tube vertically 60 times. After shaking, the tube is placed on the table then runs the stopwatch, and is the deposition of T = 0.

The hydrometer is read when T = 2, T = 5, T = 30, T = 60, T = 250 and T = 1440. After hydrometer measurements of all samples, the samples contained in the tube is refiltered using a wet sieve number 200 until the clay content contained in the sample is completely filtered out. The sample left on filtered number 200 is transferred into a cup/container to be heated for ± 24 hours and cooled.

3.2.2 *Determination of sediment grain types*

The type of sediment grain is identified in the sieving results. The remaining sediment in the filter numbers 20, 40, 60, 80, 120, and number 200 are recorded and weighed. The grains left in the filter were recorded into the sieve analysis table. The percentage that appears on the sieve analysis chart was used as a reference for determining the type of sediment grain.

3.2.3 *Determination of soil texture*

The analysis of soil texture classes is classified using the USDA Soil Classification pyramid as shown in Figure 4. The percentage values for the types of sediment grains (rock, sand, silt, and clay) have been presented in Table 4 and referred to each point. The example of point 4a that reveals the silty clay texture was presented in Table 4, where the soil structure is dusty clay.

3.2.4 *Statistical determination*

The statistical classification of sediment (sorting, thickness and kurtosis) was determined by equations (1), (2) and 3 [5,6,10,11]:

$$\sigma_1 = \frac{\phi_{84} - \phi_{16}}{4} + \frac{\phi_{95} - \phi_5}{6.6} \qquad (1)$$

$$Sk_1 = \frac{\phi_{16} - \phi_{84} - 2\phi_{50}}{2(\phi_{84} - \phi_{16})} + \frac{\phi_5 + \phi_{95} - 2\phi_{50}}{2(\phi_{95} - \phi_5)} \qquad (2)$$

$$K_\sigma = \frac{\phi_{95} - \phi_5}{2.44(\phi_{75} - \phi_{25})} \qquad (3)$$

Where :

σ_1 = sorting

Sk_1 = skewness

K_σ = kurtosis

In line with the formula, the phi value at a frequency of 84% is transformed into the form of particle diameter, and so forth. After calculating, sediment statistics can be classified using a standard deviation table [1,2,5,6,10,11]. Table 1 is the classification of the value of sediment sorting. Table 2 is the classification of the value of sediment thickness and Table 3 is the value of sediment kurtosis.

Table 1: Sediment sorting, Skeweness and Kurtosis classification [1,2,3,7]

Sorting Classification		Skewness Classification		Kurtosis Classification	
Values	Categories	Values	Categories	Values	Categories
< 0.35	Very well sorted	+ 1 s/d + 0.3	Strongly fine skewed	< 0.67	Very platykurtic

0.35-0.50	Well sorted	+ 0.3 s/d + 0.1	Fine skewed	0.67 - 0.9	Platykurtic
0.50-0.71	Moderately well sorted	+ 0.1 s/d - 0.1	Nearly symmetrical	0.9 - 0.11	Mesokurtic
0.71-1.00	Moderately sorted	- 0.1 s/d - 0.3	Coarse skewed	1.11 - 1.5	Leptokurtic
1.00-2.00	Poorly sorted	- 0.3 s/d – 1	Strongly coarse skewed	1.5 - 3	Very leptokurtic
2.00-4.00	Very poorly sorted			> 3	More leptokurtic
>4.00	Extremely poorly sorted				

IV. RESULTS AND DISCUSSION

4.1 General analysis on baseline sediment grain percentage and sediment distribution

The clay type sediment has the smallest diameter and sedimentation rate compared to sand and silt. Based on the results of the study, it was found that the river bed sediment material was of rock, sand, silt, and clay. The percentages of the four types of sediment include rock 8% to 10%, sand 20% to 30%, silt 30% to 40% and clay 30% to 40%.

The average percentage of stone and sand for each section is more or less the same. Silt type sediment is the sediment that has the highest percentage compared to rock, sand, and clay types. It can be seen that the four types of sediment are scattered every 300 meters along the 1500 meters of the river. However, the percentage of scattered material is dissimilar, where the composition is rock 7%, sand 21.93%, silt 46.18% and clay 34.89%.

4.2 Sediment analysis based on soil texture class

The analysis of soil texture classes is classified using the USDA gradation concept using a soil classification pyramid. Based on the results of the study, there are two types of soil texture, namely dusty clay, and clayey clay dust. Table 4 shows the results of the soil texture. in the Binanga Aron River, is mostly sandy and silty rock. Unlike the others, points 2c, 4c, 5b, 4b, and 4a have dusty clayey clay textured soil. This is because at that point the percentage of stones, sand, clay is less than 30%, while the other points have a percentage of clay type material ranging from 30% to 40%. Of the 12 sampling points, the type of soil texture tends to be the same, namely dusty clay. The average percentage of sand for each section is approximately the same.

It was found that the silt type sediment is the highest percentage compared to sand and clay types. Those three types of sediment are scattered in every distance of every 300 meters along the 1500 meters of the Binaga Aron River. However, the material percentage is various, the silt was 30%, and clay and sand was 34%.

The sediment analysis based on class Analysis of soil texture class is classified using the USDA (United States Department of Agriculture) gradation concept, namely the USDA soil classification point 4a). From the results of the study, there are two types of soil texture, namely sandy sand and clay located in the Binanga Aron River, Samosir Regency. Unlike the other points, points 2c, 4c, 3b, 4b, and 4a have silty clay sand. This is because at that point the percentage is less than 30%, while the other points have a specific material percentage between 30% to 40%.

4.3 Sediment Statistical Analysis

Sediment statistical analysis was carried out to derive the sediment statistical classification as presented in Table 5. The value of the sampling sorting was dominated by the condition of the sediment in a less sorted state. It was said to be less unsorted because the grain size of the sediments was not uniform.

Based on the skewness value, the station has roughly skewness due to the most of dominant are fine and the sediment is deposited during low current conditions [6,7,8,11,12]. The strongly skewness was resulted due to the fine grains fill the spaces among the large grains. Based on the results of sediment processing, a kurtosis value of 0.8 was also obtained, with the range categories are blunt to quite blunt. It can be concluded in 1 that the overall average value of sediment kurtosis of Binaga Aron River is 0.79 that was fell in the blunt category. Table 1 also shows that the results of the sediment statistical analysis (sorting, skewness, and kurtosis) tend to be uniform.

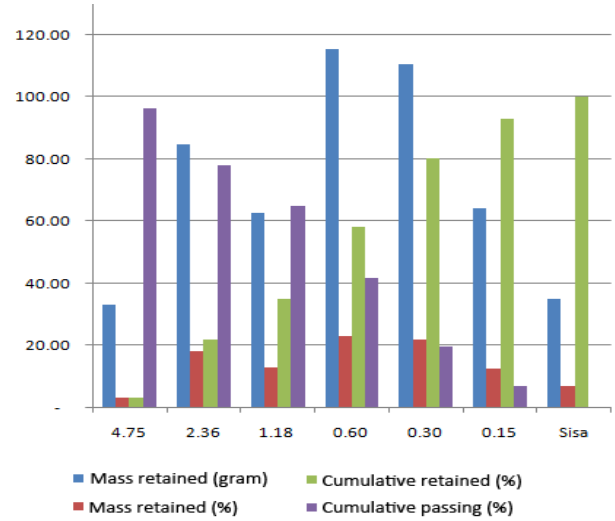


Figure 3: The percentage of basic sediment at the sampling point and the the type of soil texture

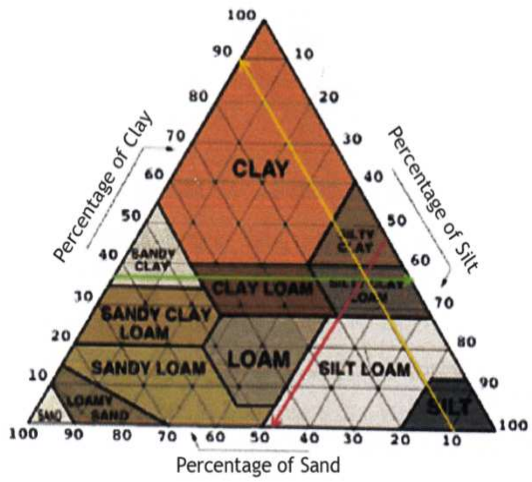


Figure 4: Soil classification

V. SEDIMENT STATISTICAL ANALYSIS

Based on sediment statistical classification, it was found that the sampling stations dominated by poorly sorted, because the size of the sediment grains was not uniform. Based on the skewness value, the average skewness was coarse because the sediment was more dominant in size and the sediment is deposited when the current conditions are low [1,2,5,6,8]. It is very coarse causing the fine grains to fill a large space based on the processing results. Sediment statistical data also obtained a kurtosis value between 0.7s.d 0.8 which is in the blunt to quite a blunt category. As shown in Table 10, it can be concluded that the overall average value of the sediment kurtosis value of the Binanga Aron River is 0.79. Moreover, the results of the sediment statistical analysis found that the sorting, skewness, and kurtosis tend to be uniform.

Based on the soil classification as shown in Figure 4, it was concluded that the residual samples are rocks due to retained on the filter. The 4.75 size filter is concluded as rocky sand, the filter size is 2.36 sand, the filter size 1.18 is called silt sand, the filter size 0.60 is called silt, the 0.30 size sieve is called silty clay and the 0.15 size sieve is called clay, below is the aggregate sieve analysis table obtained from the field, among others:

Table 2: Aggregate Sieve Analysis of Binaga Aron River 000 Meter Sample weight = 1000 grams

Sieve size (mm)	Mass retained (gram)	Mass retained (%)	Cumulative retained (%)	Cumulative Passing (%)
Sample I				
4.75	33.20	3.32	3.32	96.68
2.36	184.80	18.48	21.80	78.20
1.18	129.70	12.97	34.77	65.23
0.60	233.20	23.32	58.09	41.91
0.30	219.50	21.95	80.04	19.96
0.15	128.00	12.80	92.84	7.16
Residual	71.60	7.16	100.00	0.00

Total	1,000.00	100.00		
		MHB		
Sample II				
4.75	33.40	3.34	3.34	96.66
2.36	183.80	18.38	21.72	78.28
1.18	131.30	13.13	34.85	65.15
0.6	225.30	22.53	57.38	42.62
0.3	221.40	22.14	79.52	20.48
0.15	127.50	12.75	92.27	7.73
residual	77.30	7.73	100.00	0.00
Total	1,000.00	100.00		
		MHB		
Sample III				
4.75	33.20	3.32	3.32	96.68
2.36	184.80	18.48	21.80	78.20
1.18	129.70	12.97	34.77	65.23
0.60	233.20	23.32	58.09	41.91
0.30	219.50	21.95	80.04	19.96
0.15	128.00	12.80	92.84	7.16
Residual	71.60	7.16	100.00	0.00
Total	1,000.00	100.00		
		MHB		

** 1000 um (micro-meters) = 1 mm*

Table 3: Aggregate Sieve Analysis of Binaga Aron River 300 Meters Sample weight = 1000 gram

Sieve size (mm)	Mass retained (gram)	Mass retained (%)	Cumulative renained (%)	Cumulative Passing (%)
Sample I				
4.75	4.60	3.46	3.46	96.54
2.36	85.50	18.55	22.01	77.99
1.18	31.90	13.19	35.20	64.80
0.60	226.30	22.63	57.83	42.17
0.30	222.90	22.29	80.12	19.88
0.15	128.50	12.85	92.97	7.03
Residual	70.30	7.03	100.00	0.00
Total	1,000.00	100.00		
Sample II				
Sieve size (mm)	Mass retained (gram)	Mass retained (%)	Cumulative retained (%)	Cumulative Passing (%)
4.75	36.00	3.60	3.60	96.40
2.36	186.00	18.60	22.20	77.80
1.18	129.70	12.97	35.17	64.83
0.60	233.20	23.32	58.49	41.51
0.30	219.50	21.95	80.44	19.56
0.15	128.00	12.80	93.24	6.76
Residual	67.60	6.76	100.00	0.00
Total	1,000.00	100.00		
Sample III				

4.75	35.20	3.52	3.52	96.48
2.36	184.00	18.40	21.92	78.08
1.18	133.10	13.31	35.23	64.77
0.60	235.30	23.53	58.76	41.24
0.30	224.30	22.43	81.19	18.81
0.15	129.00	12.90	94.09	5.91
Residual	59.10	5.91	100.00	0.00
Total	1,000.00	100.00		

** 1000 um (micro-meters) = 1 mm*

Table 4: Aggregate Sieve Analysis of Binaga Aron River 600 Meters Sample weight = 1000 gram

Sieve size (mm)	Mass retained (gram)	Mass retained (%)	Cumulative retained (%)	Cumulative Passing (%)
Sample I				
4.75	33.00	3.30	3.30	96.70
2.36	183.00	18.30	21.60	78.40
1.18	129.70	12.97	34.57	65.43
0.60	233.20	23.32	57.89	42.11
0.30	219.50	21.95	79.84	20.16
0.15	128.00	12.80	92.64	7.36
Residual	73.60	7.36	100.00	0.00
Total	1,000.00	100.00		
Sampe II				
4.75	34.10	3.41	3.41	96.59
2.36	182.00	18.20	21.61	78.39
1.18	130.10	13.01	34.62	65.38
0.60	233.30	23.33	57.95	42.05
0.30	220.30	22.03	79.98	20.02
0.15	129.00	12.90	92.88	7.12
Residual	71.20	7.12	100.00	0.00
Total	1,000.00	100.00		
Sample III				
4.75	38.30	3.83	3.83	96.17
2.36	184.00	18.40	22.23	77.77
1.18	130.90	13.09	35.32	64.68
0.6	225.30	22.53	57.85	42.15
0.3	221.40	22.14	79.99	20.01
0.15	127.50	12.75	92.74	7.26
Residual	72.60	7.26	100.00	0.00
Total	1,000.00	100.00		

** 1000 um (micro-meters) = 1 mm*

Table 5: Aggregate Sieve Analysis of Binaga Aron River 900 Meters Sample weight = 1000 grams

Sieve size (mm)	Mass retained (gram)	Mass retained (%)	Cumulative retained (%)	Cumulative Passing (%)
Sample 1				
4.75	33.30	3.33	3.33	96.67
2.36	186.20	18.62	21.95	78.05
1.18	129.30	12.93	34.88	65.12
0.60	236.20	23.62	58.50	41.50
0.30	219.40	21.94	80.44	19.56
0.15	128.20	12.82	93.26	6.74
Residual	67.40	6.74	100.00	0.00
Total	1,000.00	100.00		
Sample II				
4.75	37.60	3.76	3.76	96.24
2.36	185.20	18.52	22.28	77.72
1.18	137.90	13.79	36.07	63.93
0.6	222.80	22.28	58.35	41.65
0.3	222.40	22.24	80.59	19.41
0.15	127.50	12.75	93.34	6.66
Residual	66.60	6.66	100.00	0.00
Total	1,000.00	100.00		
Sample III				
4.75	40.20	4.02	4.02	95.98
2.36	182.00	18.20	22.22	77.78
1.18	130.10	13.01	35.23	64.77
0.60	234.30	23.43	58.66	41.34
0.30	220.30	22.03	80.69	19.31
0.15	129.00	12.90	93.59	6.41
Residual	64.10	6.41	100.00	0.00
Total	1,000.00	100.00		

** 1000 um (micro-meters) = 1 mm*

Table 6: Aggregate Sieve Analysis of Binaga Aron River 1200 Meters Sample weight = 1000 grams

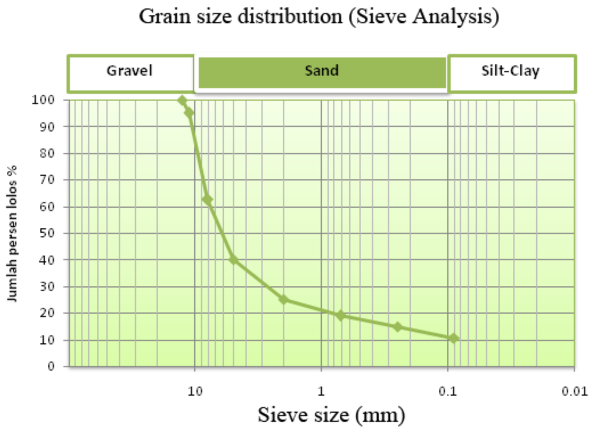
Sieve size (mm)	Mass retained (gram)	Mass retained (%)	Cumulative retained (%)	Cumulative Passing (%)
Sample I				
4.75	37.00	3.70	3.70	96.30
2.36	185.00	18.50	22.20	77.80
1.18	129.70	12.97	35.17	64.83
0.60	233.20	23.32	58.49	41.51
0.30	219.50	21.95	80.44	19.56
0.15	128.00	12.80	93.24	6.76
Residual	67.60	6.76	100.00	0.00
Total	1,000.00	100.00		
Sample II				
4.75	36.20	3.62	3.62	96.38
2.36	185.00	18.50	22.12	77.88

1.18	130.10	13.01	35.13	64.87
0.60	234.10	23.41	58.54	41.46
0.30	220.30	22.03	80.57	19.43
0.15	129.00	12.90	93.47	6.53
Residual	65.30	6.53	100.00	0.00
Total	1,000.00	100.00		
Sample III				
4.75	33.60	3.36	3.36	96.64
2.36	184.00	18.40	21.76	78.24
1.18	131.90	13.19	34.95	65.05
0.6	225.30	22.53	57.48	42.52
0.3	221.40	22.14	79.62	20.38
0.15	127.50	12.75	92.37	7.63
Residual	76.30	7.63	100.00	0.00
Total	1,000.00	100.00		
		MHB		

** 1000 um (micro-meters) = 1 mm*

Table 7: Aggregate Sieve Analysis of Binaga Aron River 1500 Meters Sample weight = 1000 gram

Sieve size (mm)	Mass retained (gram)	Mass retained (%)	Cumulative retained (%)	Cumulative Passing (%)
Sample I				
4.75	33.60	3.36	3.36	96.64
2.36	184.00	18.40	21.76	78.24
1.18	130.90	13.09	34.85	65.15
0.60	225.30	22.53	57.38	42.62
0.30	221.40	22.14	79.52	20.48
0.15	127.50	12.75	92.27	7.73
Residual	77.30	7.73	100.00	0.00
Total	1,000.00	100.00		
Sample II				
4.75	33.00	3.30	3.30	96.70
2.36	185.00	18.50	21.80	78.20
1.18	129.70	12.97	34.77	65.23
0.60	233.20	23.32	58.09	41.91
0.30	219.50	21.95	80.04	19.96
0.15	128.00	12.80	92.84	7.16
Residual	71.60	7.16	100.00	0.00
Total	1,000.00	100.00		
Sample III				
4.75	34.20	3.42	3.42	96.58
2.36	183.00	18.30	21.72	78.28
1.18	130.10	13.01	34.73	65.27
0.60	234.30	23.43	58.16	41.84
0.30	220.30	22.03	80.19	19.81
0.15	129.00	12.90	93.09	6.91
Residual	69.10	6.91	100.00	0.00
Total	1,000.00	100.00		



Name of organization	Gravel	Sand	Silt	Clay
		Grain size (mm)		
Massachusetts Institute of Technology (MIT)	>2	2 to 0.06	0.06 to 0.002	<0.002
U.S. Department of Agriculture (USDA)	>2	2 to 0.05	0.05 to 0.002	<0.002
American Association of State Highway and Transportation Officials (AASHTO)	76.2 to 2	2 to 0.075	0.075 to 0.002	<0.002
Unified Soil Classification System (U.S. Army Corps of Engineers, U.S. Bureau of Reclamation)	76.2 to 4.75	4.75 to 0.075	Fines (i.e., silts and clays) <0.075	

The average values of sieve sizes analysis is as follows:

Sieve size (mm)	Mass retained (gram)	Mass retained (%)	Cumulative retained (%)	Cumulative Passing (%)
4.75	33.32	3.50	3.50	96.50
2.36	84.82	18.43	21.93	78.07
1.18	62.66	13.09	35.02	64.98
0.60	115.47	23.09	58.11	41.89
0.30	110.36	22.07	80.18	19.82
0.15	64.09	12.82	93.00	7.00
Residual	35.01	7.00	100.00	-
Total	1,000.00	100.00		

** 1000 um (micro-meters) = 1 mm*

Standar Sieve Designation (ASTME 11)		Nominal Sieve Opening	
		mm	in
Coaurse Sieves			
Standard	Alternatif		
75.0 mm	3 in	75.00	3.000
63.0 mm	2-1/2 in	63.00	2.500
50.0 mm	2 in	50.00	2.000
37.5 mm	1-1/2 in	37.50	1.500
25.0 mm	1 in	25.00	1.000
19.0 mm	3/4 in	19.00	0.750
12.5 mm	1/2 in	12.50	0.500
9.5 mm	3/8 in	9.50	0.375
Fine Sieves			
4.75 mm	No. 4	4.750	0.1870
2.36 mm	No. 8	2.360	0.0937
1.18 mm	No. 16	1.180	0.0464
600 um*	No. 30	0.600	0.0234
300 um	No. 50	0.300	0.0117
150 um	No. 100	0.150	0.0059
Finest Sieve Normally used for aggregates			
75 um	No. 200	0.075	0.0029

Based on Table above, the classification of soils texture is ranging from clay to rock with the thickness as presented in Table4.

Table 8: Soil texture based on the percentage of sand, silt and clay in Binanga Aron River

Station/ Distance	Rock (%)	Sand (%)	Silt (%)	Clay (%)	Soil classification
1a	7,16	21.80	36,29	34.75	RSS
lb	7.73	21.72	35.66	34.89	RSS
lc	7.16	21.80	36.29	34.75	RSS
2a	7.03	22.01	35.82	35.14	RSS
2b	6.76	22.20	36.25	34.75	SSC
2c	5.91	21.92	36.84	35.33	SSC
3a	7.36	21.60	36.29	34.75	RSS
3b	7.12	21.61	36.34	34.93	RSS
3c	7.26	22.23	35.62	34.89	RSS
4a	6.74	21.95	36.55	34.76	SSC
4b	6.66	22.28	36.07	34.99	SSC
4c	6.41	22.22	36.44	34.93	SSC
5a	6.76	22.20	36.29	34.75	SSC
5b	6.53	22.12	36.42	34.93	SSC
5c	7.63	21.76	35.72	34.89	RSS
6a	7.73	21,76	35.62	34.89	RSS
6b	7.16	21.80	36.29	34.75	RSS
6c	6.91	21.72	36.44	34.93	RSS

Description: RSS = Rock Sand Silt; SSC = Sand Silt Clay

Table 9: Sediment classification based on the degree of sorting, skewness and kurtosis

Station/ Distance	Point	Sorting	Skewness	Kurtosis
0	1a	KT	FS	blunt
	1b	KT	CS	blunt
	1c	KT	SCS	blunt
300	2a	KT	SCS	blunt
	2b	KT	CS	blunt
	2c	KT	FS	blunt
600	3a	KT	SFS	blunt
	3b	KT	CS	blunt
	3c	KT	SCS	blunt
900	4a	KT	CS	blunt
	4b	KT	SCS	blunt
	4c	KT	CS	blunt
1200	5a	KT	SCS	blunt
	5b	KT	CS	blunt
	5c	KT	SCS	blunt
1500	6a	KT	CS	blunt
	6b	KT	SCS	blunt
	6c	KT	CS	blunt

Description: PS= Poorly sorted; CS= Coarse skewed; SCS= Strongly coarse skewed; FS= Fine skewed; SFS= Strongly fine skewed.

VI. CONCLUSION

The type of sedimentary materials found in Binanga Aron river is rock, sand, silt, and clay. The four types of material are scattered in a range of 300 meters along the 1500 meter of the sampling area, with a rock percentage of 7.0%. rocky sand 3.50%, sand 18.43%, sandy silt 23.09%, silt 22.07%, silty clay 22.07% and clay 12.82%. The average soil texture class of the Binanga Aron River is rock, sand, and dusty clay. Moreover, it was found that the sediment sorting value was classified as poorly sorted, while the slope of the sediment was categorized as strongly coarse to coarse skewness and sedimentary kurtosis tends to be blunt.

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