ORGANIC MATTER DISTRIBUTION IN THE SEDIMENT OF TWO RIVERINE LAKES OF KAHAYAN RIVER, CENTRAL KALIMANTAN

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INTRODUCTION

To reveal repeated patterns and mechanisms those exist and control the structure and function is an everlasting task of limnology as one branch of aquatic ecology. Tropical limnology is an ever-exhausted source of inspiration for limnological study. Riverine lakes, either it is a temporary or permanent ones, are the water bodies that were characterised by strong influenced of water level fluctuation in adjacent river. Habitat types that can be classified as riverine lakes include floodplain and oxbow lakes. In the past, publication on limnological aspects of the riverine lakes in Indonesia is very rare, but recently various limnological aspects of tropical oxbow lakes in Central Kalimantan are receiving more attention. Those limnological studies included the conservation and basic water quality parameters (HARTOTO 2000a, AWALINA & HARTOTO 2000b, KURASAKI *et al.* 2000), nitrogen and phosphorus nutrient variation (YUSTIAWATI & HARTOTO 2000, HARTOTO & AWALINA 1999), humic acid (YUSTIAWATI & HARTOTO 1998), FISH ecology (KOMATSU *et al.* 2000, HARTOTO *et al.* 1999), plankton ecology (KUSAKABE *et al.* 2000, SULASTRI & HARTOTO 1998, SULASTRI & HARTOTO 2000, GUMIRI *et al.* 2000), heavy metal contamination of water body and fish (HARTOTO & AWALINA 1998) and other aspects.

Meanwhile, the study on oxbow lakes sediment characteristics is still lacking, although it is understood that the sediment in any lakes can function as a sink or source of any materials. The results of the study on sediment chemical characteristics probably also can be used to retrace the historical ecological event in the past. Riverine lake sediment is suspected to exchange energy and material with overlaying water component. It also interesting to know what is the vertical distribution pattern of organic matter in the sediment and what is the repeated processes that play dominant role in the development of riverine lake sediment. The bottom sediment of the lake usually developed through the deposition of material originated from autochthonous bio-production in the upper water layer or soil material carried by surface run off.

To initiate the database on sediment quality of tropical riverine lake system, this study was aimed to reveal the vertical distribution pattern of the water content and organic matter in the sediment of two oxbow lakes and a floodplain lake of Kahayan River system. The oxbow lakes under study are Lake Rengas and Lake Takapan. Lake Rengas is the representatives of Oxbow

Lakes Types II and Lake Takapan is the representatives of Oxbow Lakes Types III (HARTOTO 2000). Lake Tabiri (around 150 hectares) is a floodplain lake that exchanges water with Lake Takapan and River Kahayan.

MATERIAL AND METHODS

Description of study site

All three lakes is located in Palangkaraya Municipality in Central Kalimantan (Fig. 1) Lake Rengas (33.33 hectares) is an oxbow lakes that exchange water with River Rungan, a tributary of Lake Kahayan. This lake is a fishery reserve managed by Central Kalimantan Fishery Department. It has two connecting channels with River Rungan. AWALINA & HARTOTO (2000) reported detailed description of Lake Rengas morphology and limnological characters. Lake Tabiri is a floodplain lake that developed

Figure 1. The position of L. Takapan, L Tabiri and L. Rengas in River Kahayan floodplain near Palangkaraya

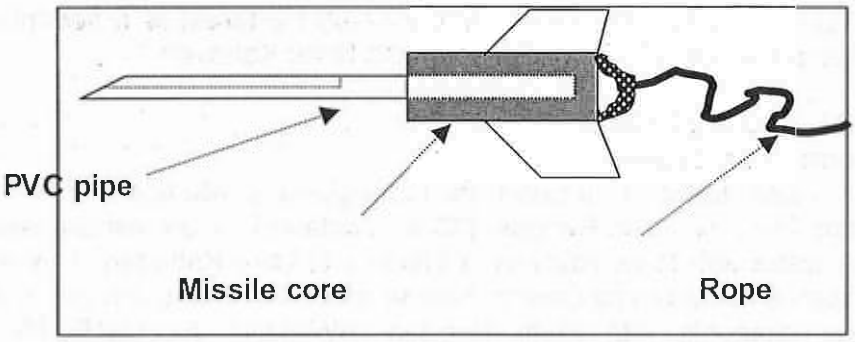

Figure 2. The design of the missile core used in the study

regularly but temporarily inundations of 2-2.5 m land depression with the over flow of river Kahayan water. Lake Tabiri (around 100 hectares) is known by local fisher as the spawning site of black water fishes such as Snakeheads (*Channa micropeltes*) and feeding ground of several species of white water fishes such as (*Osteochilus* spp, *Dangila spp, Puntius spp*, etc.). This lake is located in the disturbed peat swamp forest located in the area adjacent to L. Takapan. Besides exchanging water with River Kahayan, the lake also exchanging water with Lake Takapan. Lake Takapan is an oxbow lake Type III that exchanges water with both River Rungan and River Kahayan. Lake Takapan (50.42 hectares) is oxbow lakes that have two connecting channels with River Rungan and two connecting channels to River Kahayan. The water from one of the connecting channel flows to L. Tabiri before entering L. Takapan or vice versa. The morphology and limnological character of Lake Takapan were described by HARTOTO (2000).

Sampling methods

There are three sampling stations at Lake Rengas, three sampling station at Lake Takapan and two sampling station at Lake Tabiri (Table 1). Six randomly selected points were chosen as the sampling sites for each station of Lake Takapan and Lake Tabiri, but there are only three points used as the sampling sites for each station in Lake Rengas. The sampling in Lake Takapan-Lake Tabiri was conducted during the beginning of decreasing water level in Lake Takapan (14-5July 2000). The sampling time in Lake Rengas was conducted during the period of low water level in 15 September 2000.

Three hundred and thirteen sediment profile samples were collected from each sampling site using a *missile core sampler*. The missile core sample is a 25-cm iron tube that has three wings in one end, (Fig. 2) and PVC pipe in the other end. The PVC pipe has three quarter inches diameter, 40-cm length and was cut in to half and re-attached by adhesive tapes to facilitate sampling

of sediment section after each operation. A rope was tied to the wing end of the core and lowering down the core to the lake bottom operated the core. After the core was pulled up, the PVC tubes were open to expose the sediment samples in the shapes of a cylinder. Then the sediment cylinder was cut into several 2-cm long sediment segments. Started from the surface layer of the sediment, the first to two cm sediment layer were refers as the sediment samples of the depth 0-cm, the second (2-4 cm) as the sediment samples of the depth 2-cm and so on respectively. Each sediment segment was put in separate polyethylene bags. 315 sediment samples were collected by these methods for further analysis during this study in 2000.

Methods of sample analysis

Analysis of water contents and organic matter concentration in the sediment was conductive with Gravimetric Methods. Two to fourteen grams of sediment samples were weighed before dried at 105 ^{0}C for two hours and the re-weighed and re-dried until constant weight. The proportion of weight loss to initial weight calculated water content percentage. Pre dried sample was ignited at 600 ^{0}C for two hours, re-weighed

Table 1. The water content and organic matter concentration in the sediment of L. Tabiri and L. Takapan (14-15 July 2000)

a. Station A, Middle of Lake Tabiri (Position: S: 02° 08' 12.8 "; E:113° 55' 18.1", z_{max}=2.1m)

Depth	Water content (% w/w, wet)							Organic matter concentration (% w/w, dry)						
(cm)	Sites						Average	Sites						Average
	A1	A2	A3	A4	A5	A6		A1	A2	A3	A4	A5	A6	
0	77.72	76.38	75.7	53.87	74.90	70.95	71.59	29.28	24.84	32.96	16.70	27.92	29.11	26.80
2	74.41	72.90	75.42	51.66	73.99	68.58	69.49	33.72	29.43	39.37	13.71	42.3	29.77	31.38
4	73.33	75.28	75.34	44.82	73.21	66.85	68.14	34.03	26.35	40.64	13.26	43.09	32.43	31.63
6	72.25	72.83	73.89	37.75	72.52	67.20	66.07	34.29	43.77	42.50	19.59	38.35	34.96	35.58
8	70.82	73.37	71.79	46.18	71.60	67.21	66.83	33.48	43.02	38.68	13.81	39.48	36.35	34.14
10	69.61	74.09	73.11		70.34	67.03	70.84	31.87	49.17	41.09		43.31	35.26	40.14
12	75.72	75.7	84.45		91.14	74.84	80.37	45.82	56.96	53.52		39.61	42.87	47.76
14	88.02	79.27	83.56		69.95	71.92	78.54	71.17	46.13	29.60		43.23	36.80	45.39
16					71.77	71.50	71.64					44.35	39.80	42.08
18						78.95	78.95						44.92	44.92
20						79.17	79.17						41.41	41.41
Average	75.24	74.98	76.66	46.86	74.38	71.29	72.88	39.21	39.96	39.80	15.41	40.18	36.70	38.29
Conf. Limit	4.00	1.51	3.28	5.54	4.24	2.72	3.17	9.56	8.12	4.90	2.37	3.30	3.05	4.00

b. Station B: Mouth of connecting channel (R. Tabiri) of L. Tabiri to L. Takapan (Position: S: 02°08' 37.9 "; E: 113° 55' 18.4'',

Depth (cm)	Water content (%, w/w, wet)							Organic matter concentration (% w/w, dry)						
	Sites						Average	Sites						Average
	B1	B2	B3	B4	B5	B6		B1	B2	B3	B4	B5	B6	
0	58.11	59.76	54.22	62.55	58.44	50.37	57.24	11.25	11.11	7.28	11.01	10.76	11.52	10.45
2	39.18	56.78	56.97	58.34	55.25	49.25	52.63	49.41	13.25	11.7	11.83	11.69	11.63	12.02
4	67.82	56.78	58.62	58.09	50.02	42.88	55.70	15.44	11.81	12.53	11.92	11.52	11.83	12.51
6	62.88	54.74	59.81	54.41	44.25	40.49	52.76	15.77	5.18	11.37	12.12	12.09	11.1	11.27
8	55.77	52.83	50.00	52.30	40.89	37.42	48.20	14.12	3.51	10.04	11.86	10.99	12.23	10.46
10	58.60	48.84	51.32	47.30	40.93	36.24	47.21	12.70	10.39	4.26	11.39	11.13	11.29	10.19
12	67.20	47.69	50.47	49.51	38.73		50.72	17.64	23.19	12.76	12.17	11.29		15.41
14	66.25	53.03	50.62	48.09	38.56		51.31	17.44	13.91	10.69	11.78	12.11		13.19
16	56.35	54.16	49.6	48.69			52.20	12.72	13.21	12.83	12.12			12.72
18	54.90	52.56	50.38	47.22			51.27	11.80	8.91	12.79	12.38			11.47
20	68.61	53.08	52.04	43.67			54.35	12.81	26.25	13.97	12.82			16.46
22	49.23	53.98	63.96	33.75			50.23	12.24	13.02	18.97	13.4			14.41
Average	58.74	53.69	54.00	50.30	45.88	42.78	51.99	13.99	12.81	11.60	12.07	11.44	11.60	12.25
Con. Limit	4.91	1.87	2.68	4.32	5.36	4.75	1.63	5.91	3.66	2.03	0.35	0.34	0.32	1.14

c. Station C: Middle of L. Takapan (Position: S: 02°08' 46.7"; E: 113° 54' 50.6", z_{max}=5.0m))

Depth (cm)	Water Content(% w/w, wet)							Organic Matter Concentration (% w/w, dry)						
	Sites						Average	Sites						Average
	C1	C2	C3	C4	C5	C6		C1	C2	C3	C4	C5	C6	
0	75.23	70.12	55.01	70.01	74.40	62.28	67.84	20.95	16.43	18.16	18.74	19.3	18.49	18.68
2	74.99	64.23	60.19	70.02	71.01	58.02	66.41	20.12	18.08	15.47	19.61	18.42	20.67	18.73
4	66.81	57.67	56.54	59.93	60.43	51.64	58.84	19.75	15.26	15.53	18.07	16.06	18.12	17.13
6	56.38	53.00	55.35	38.02	54.58	47.53	50.81	14.32	13.35	14.95	6.81	14.66	12.42	12.75
8	52.45	52.62	52.61	25.24	55.64	48.25	47.80	13.63	12.53	12.80	3.01	14.84	14.24	11.84
10	37.63	49.80	50.39		50.90	47.19	47.18	13.44	11.25	12.66		12.20	12.37	12.38
12	44.84	52.39	51.00		45.39	50.71	48.87	13.05	12.59	12.44		12.56	12.38	12.60
14	71.04	54.75	48.63		48.03		55.61	14.19	12.79	12.49		12.03	12.82	12.86
Average	59.92	56.82	53.72	52.64	57.55	52.23	55.42	16.18	14.04	14.31	13.25	15.00	15.19	14.62
Conf. Limit	9.89	4.81	2.62	17.65	7.26	4.28	5.72	2.37	1.61	1.43	6.79	1.93	2.34	2.08

d. Station D: Plumes of connecting channel (R. Tabiri and R. Kahayan) in L. Takapan (Position: L. Tabiri Plumes, z_{max}= 4.8 m, S: 02° 08' 34.8"; E: 113° 55'23. 2", L. Kahayan Plumes, z_{max}= 3.6 m, S: 02° 08'30.3 "; E: 113o 55'26. 2")

Depth (cm)	Water Content(% w/w, wet)								Organic Matter Content (% w/w, wet)							
	Tabiri Plumes				Kahayan Plumes				Tabiri Plumes				Kahayan Plumes			
	Sites			Avg.	Sites			Avg.	Sites			Avg.	Sites			Avg.
	D1	D2	D3		D4	D5	D6		D1	D2	D3		D4	D5	D6	
0	57.57	56.24	50.37	54.73	40.85	50.71	60.54	50.70	10.37	12.16	9.48	10.67	7.87	8.34	11.80	9.34
2	55.29	57.64	59.39	57.44	49.45	49.65	56.38	51.83	10.73	11.08	10.62	10.81	8.19	8.45	11.05	9.23
4	54.39	57.12	58.13	56.55	46.94	43.93	54.92	48.60	11.42	12.05	11.27	11.58	8.20	7.90	10.70	8.93
6	56.03	55.35	58.88	56.75	52.26	52.32	52.45	52.34	11.78	11.59	11.64	11.67	11.71	11.85	10.94	11.50
8	53.55	54.25	56.07	54.62	46.38	52.07	51.42	49.96	12.97	11.42	11.03	11.81	8.84	10.9	11.90	10.55
10	52.75	52.95	53.14	52.95	45.04	48.59	51.76	48.46	11.67	15.90	10.49	12.69	9.15	10.17	11.33	10.22
12	53.32	53.86	54.32	53.83	40.27	10.19	51.89	34.12	12.46	12.4	11.67	12.18	7.46	8.62	12.10	9.39
14	51.62	52.61	48.26	50.83	51.18	50.61	50.12	50.64	11.82	11.86	9.32	11.00	11.47	9.74	10.67	10.63
Average	54.32	55.00	54.82	54.71	46.55	44.76	53.69	48.33	11.65	12.31	10.69	11.55	9.11	9.50	11.31	9.97
Conf. Limit	1.33	1.31	2.82	1.53	3.06	9.85	2.37	4.09	0.58	1.05	0.62	0.48	1.12	0.97	0.39	0.62

e. Station E, Lake Takapan, the Junction of R. Rungan and L. Takapan (Position: S:02° 09' 12.05, E: 113° 54'47.3", z_{max}= 6.7 m)

Depth m	Water Content (% w/w, wet)							Organic Matter Content (% w/w, wet)						
	E1	E2	E3	E4	E5	E6	Average	E1	E2	E3	E4	E5	E6	Average
0	59.92	58.12	53.11	55.62	55.38	58.46	56.77	12.91	13.17	12.97	12.38	12.23	12.44	12.68
2	56.98	57.24	55.18	54.02	54.87	56.34	55.77	13.57	14.10	12.75	11.17	12.74	13.31	12.94
4	57.83	55.60	53.28	50.74	50.39	58.67	54.42	13.65	13.59	12.34	10.33	11.37	13.35	12.44
6	58.19	52.82	47.52	51.84	45.54	55.31	51.87	16.20	13.40	9.06	11.12	9.10	14.12	12.17
8	55.08	51.10	33.53	45.56	37.86	53.21	46.06	14.69	13.20	5.10	7.85	6.29	13.21	10.06
10	31.02	53.04	34.08	28.39		53.17	39.94	13.36	13.70	4.17	2.68		13.61	9.50
12	52.90	52.40		26.07		52.3	45.92	18.79	13.31		2.14		12.87	11.78
14	48.82	50.79				53.18	50.93	12.33	12.79				13.31	12.81
Average	52.59	53.89	46.12	44.61	48.81	55.08	50.21	14.44	13.41	9.40	8.24	10.35	13.28	11.8
Conf. Limit	6.09	1.79	7.21	8.43	5.72	1.63	3.76	1.37	0.26	2.90	2.89	2.09	0.32	0.85

Table 2. The water and organic matter concentration in the sediment of L. Rengas

a. Station A: At the mouth of connecting channel of L. Rengas and R. Rungan (Position: S: 02° 08' 46.0"; E: 113° 52'53.9", z_{max}=2.1m)

Depth (cm)	Water Conc. (% w/w, wet)				Organic Matter Conc. (% w/w, dry)			
	Sites			Avg.	Sites			Avg.
	A1	A2	A3		A1	A2	A3	
0	79.79	64.85	63.85	69.50	14.31	15.43	14.66	14.80
2	64.41	58.20	68.34	63.65	16.60	14.93	15.62	15.72
4	58.74	58.07	65.20	60.67	13.29	13.90	13.75	13.65
6	57.02	62.22	65.04	61.43	14.00	14.02	14.42	14.15
8	58.63	59.96	61.57	60.05	13.64	16.84	14.11	14.86
10	56.11	58.42	58.75	57.76	14.16	14.90	14.84	14.63
12	54.85	58.16	59.37	57.46	14.58	16.20	14.02	14.93
14	52.53	56.73		54.63	13.74	14.76		14.25
Average	60.26	59.57	63.16	60.64	14.29	15.12	14.49	14.62
Conf. Limit	5.97	1.86	2.39	3.13	0.71	0.70	0.43	0.43

b. Station B: Middle of L Rengas (Position: S: 02°09' 09.1"; E: 113° 53' 18.2", Z_{max}= 3.1 m)

	B1	B2	B3		B1	B2	B3	
0	53.42	73.35	60.04	62.27	17.90	19.99	16.01	17.97
2	69.56	64.80	71.13	68.50	17.06	16.29	17.00	16.78
4	68.11	66.21	68.03	67.45	17.30	16.90	16.23	16.81
6	69.03	67.71	64.71	67.15	19.12	16.89	18.13	18.05
8	64.01	66.94	65.16	65.37	20.72	18.25	15.44	18.14
10	64.53	69.67	60.87	65.02	19.17	21.03		20.10
12	58.48	63.97		61.23	18.22	16.14		17.18
14	56.82	60.04		58.43	15.46	14.92		15.19
Average	63.00	66.59	64.99	64.43	18.12	17.55	16.56	17.53
Conf. Limit	4.22	2.74	3.37	2.42	1.11	1.43	0.91	0.98

c. **Station C:** L. Rengas (Position: S: 02°09' 16.4"; E: 113° 53' 39.8", at the mouth of southern channel that was closed from R. Rungan water flows, Z_{max}= 5.0 m)

Depth (cm)	Water Content (% w/w,wet)				Organic Matter Concentration (% w/w, dry)			
	Sites			Avg.	Sites			Avg.
	C1	C2	C3		C1	C2	C3	
0	69.42	69.55	70.07	69.68	14.98	15.84	16.04	15.62
2	68.24	68.66	65.36	67.42	15.77	16.57	15.79	16.04
4	65.49	66.32	59.76	63.86	15.36	15.67	16.21	15.75
6	64.77	65.48	62.32	64.19	15.48	15.87	16.75	16.03
8	62.00	63.59	63.25	62.95	16.12	16.12	16.24	16.16
10	59.29	64.86	61.34	61.83	14.79	16.71	15.07	15.52
12	58.57	70.57	53.44	60.86	15.16	23.3	15.23	17.90
14	57.50		55.16	56.33	14.75		14.98	14.87
Average	63.16	67.00	61.34	63.39	15.30	17.15	15.79	15.99
Conf. Limit	2.92	1.68	3.47	2.63	0.31	1.76	0.41	0.57

Table 3. Relationship of Water Content and Depth in the sediment of L. Takapan-L. Tabiri system

Depth (cm)	Water content (% w/w. wet)				
	Station				
	A	B	C	D	E
0	71.58	57.24	67.84	52.71	56.77
2	69.49	56.63	66.41	54.63	55.77
4	68.14	55.70	58.84	52.57	54.42
6	66.07	52.76	50.81	54.55	51.87
8	66.82	48.21	47.8	52.29	46.06
10	70.84	47.21	47.18	50.71	39.94
12	80.37	50.72	48.87	43.98	45.92
14	78.54	51.31	55.61	50.73	50.93
Average	71.48	52.47	55.42	51.52	50.21
Coeff. cor	0.62	-0.78	-0.75	-0.65	-0.70
Slope	0.666	-0.601	-1.257	-0.446	-0.830
Intercept	66.816	56.684	64.224	54.644	56.018

Depth vs A	Water content(%)=66.816 + 0.666depth(cm)
Depth vs B	Water content(%)=56.684-0.601depth(cm)
Depth vs C	Water content (%) =64.224-1.257 Depth(cm)
Depth vs D	Water content (%) =54.644-0.446 Depth(cm)
Depth vs E	Water content (%) = 56.018 -0.830 Depth(cm)

Table 4. Relationship of organic matter concentration and depth in The sediment of L. Tabiri- L. Takapan

Depth (cm)	Organic matter concentration (%, w/w. dry)				
	Station				
	A	B	C	D	E
0	26.8	10.49	18.68	10.00	12.68
2	31.38	12.02	18.73	10.02	12.94
4	31.63	12.51	17.13	10.26	12.44
6	35.58	11.27	12.75	11.59	12.17
8	34.14	10.46	11.84	11.18	10.06
10	40.14	10.19	12.38	11.45	9.50
12	47.76	15.41	12.60	10.79	11.78
14	45.39	13.19	12.86	10.81	12.81
Average	36.60	11.943	14.62	10.76	11.80
Cor. Coef.	0.95	0.46	-0.84	0.59	-0.36
Slope	1.405	0.1671	-0.515	0.075	-0.094
Intercept	26.764	10.772	18.228	10.234	12.456
Depth vs A	Organic Matter (%, dry weight) = 26.764 + 1.405 Depth(cm)				
Depth vs B	Organic Matter (%,dry weight) = 10.773 + 0.167 Depth(cm)				
Depth vs C	Organic Matter (%, dry weight) = 18.228 - 0.515 Depth(cm)				
Depth vs D	Organic Matter(%, dry weight) = 10.234 + 0.076 Depth (cm)				
Depth vs E	Organic Matter (%,dry weight) = 12.457 - 0.094 Depth (cm				

Table 5. Relationship of water content and depth in the sediment of L. Rengas

Depth (m)	Water content (% w/w, wet)		
	Station		
	A	B	C
0	69.50	62.27	69.68
2	63.65	68.50	67.42
4	60.67	67.45	63.86
6	61.43	67.15	64.19
8	60.05	65.37	62.95
10	57.76	65.02	61.83
12	57.46	61.23	60.86
14	54.63	58.43	56.33
Average	60.64	64.43	63.39

Cor. Coef.	-0.94	-0.60	-0.96
Slope	-0.864	-0.430	-0.795
Intercept	66.690	67.439	68.955

Depth vs A Water content (% w/w, wet) = 66.690 - 0.864 Depth (m)

Depth vs B Water content(% w/w, wet)= 67.439 - 0.430 Depth (m)

Depth vs C Water content (% w/w, wet) = 68.954 - 0.795 Depth (m)

Table 6. Relationship of Organic Matter Concentration and depth in the sediment of L. Rengas

Depth (m)	Organic Matter Concentration (%w/w,dry)		
	Station		
	A	B	C
0	14.80	17.97	15.62
2	15.72	16.78	16.04
4	13.66	16.81	15.75
6	11.16	18.05	16.03
8	14.86	18.14	16.16
10	14.63	20.10	15.52
12	14.93	17.18	17.90
14	14.25	15.19	14.87
Average	14.25	17.53	15.99
Cor. Coef.	-0.023	-0.154	0.115

Table 7. Bulk density (g/cm³, dry) profile of the sediment from L. Tabiri- L. Takapan Complex

Depth	A1	A2	A3	A4	A5	A6	Avg.
0	0.237	0.227	0.192	0.767	0.250	0.324	0.332
2	0.281	0.395	0.320	0.894	0.321	0.415	0.438
4	0.338	0.356	0.347	1.106	0.422	0.461	0.505
6	0.366	0.391	0.389	1.045	0.396	0.523	0.518
8	0.405	0.363	0.421	1.061	0.443	0.382	0.512
10	0.479	0.439	0.474		0.442	0.452	0.457
12	0.358	0.333	0.258		0.472	0.379	0.360
14	0.139	0.274	0.155		0.556	0.443	0.313
Average	0.325	0.347	0.319	0.975	0.413	0.422	0.430
Depth	B1	B2	B3	B4	B5	B6	Avg.
0	0.381	0.545	0.824	0.474	0.648	0.527	0.566
2	0.823	0.726	0.715	0.593	0.659	1.008	0.754
4	0.469	0.681	0.553	0.654	0.796	1.135	0.715
6	0.553	0.713	0.454	0.679	1.079	1.081	0.760
8	0.614	0.760	0.831	0.727	1.155	0.772	0.810
10	0.582	0.877	0.859	1.020	1.113	1.191	0.940

12	0.500	0.968	0.925	0.708	1.270		0.874
14	0.503	0.853	0.914	0.996	1.137		0.880
Average	0.553	0.765	0.759	0.732	0.982	0.953	0.788
Depth	C1	C2	C3	C4	C5	C6	Avg.
0	0.123	0.205	0.507	0.385	0.404	0.365	0.332
2	0.266	0.472	0.709	0.421	0.407	0.724	0.500
4	0.626	0.587	0.827	0.707	0.461	0.655	0.644
6	0.680	0.958	0.811	1.285	0.646	1.003	0.897
8	0.896	0.990	0.999	1.563	0.867	0.971	1.048
10	0.973	1.101	0.969		0.917	0.913	0.975
12	1.115	1.068	0.940		0.983	1.023	1.026
14	0.685	0.971	1.039		0.997	1.022	0.943
Average	0.670	0.794	0.851	0.873	0.710	0.834	0.788
Depth	D1	D2	D3	D4	D5	D6	Avg.
0	0.734	0.802	0.476	0.730	1.030	0.636	0.735
2	0.667	0.719	0.557	0.840	0.794	0.628	0.701
4	0.821	0.705	0.746	0.973	0.826	0.834	0.818
6	0.686	0.696	0.669	0.785	0.833	0.798	0.745
8	0.780	0.745	0.798	0.882	0.838	0.733	0.796
10	0.737	0.935	0.835	1.092	0.907	0.810	0.886
12	0.736	0.767	0.791	0.900	0.978	0.775	0.825
14	0.754	0.919	0.798	0.786	0.660	0.803	0.787
Average	0.739	0.786	0.709	0.874	0.858	0.752	0.786
Depth	E1	E2	E3	E4	E5	E6	Avg.
0	0.536	0.647	0.747	0.661	0.902	0.648	0.767
2	0.597	0.674	0.814	0.920	0.851	0.741	0.796
4	0.614	0.631	0.808	0.777	0.731	0.658	0.824
6	0.681	0.784	1.007	1.098	0.999	0.789	0.859
8	0.870	0.788	1.504	0.840	1.129	0.850	0.895
10	1.123	0.845	1.288	1.644		0.891	0.901
12	0.977	0.750		1.343		0.736	0.827
14	0.737	0.818				0.794	0.752
Average	0.767	0.742	1.028	1.040	0.922	0.763	0.827

Table 8. Bulk density (g/cm^3) of the sediment in Lake Rengas

Station A	Sites			
Depth	A1	A2	A3	Average
0	0.286	0.995	0.282	0.521
2	1.008	1.301	0.368	0.892
4	1.168	1.068	0.302	0.846
6	1.095	1.177	0.333	0.868
8	1.288	1.134	0.321	0.914
10	1.243	1.177	0.333	0.918
12	1.15	1.184	0.335	0.890
14	1.349	1.348		1.346
Average	1.073	1.173	0.325	0.9

Conf. Limit	0.233	0.079	0.019	0.154
Station B		Sites		
Depth	B1	B2	B3	Average
0	0.62	0.453	0.817	0.63
2	0.603	0.897	0.815	0.771
4	0.722	0.861	0.899	0.827
6	0.965	0.823	1.085	0.957
8	1.019	1.03	1.108	1.052
10	0.904	0.772		0.838
12	1.058	1.122		1.090
14	1.222	1.018		1.120
Average	0.889	0.872	0.944	0.911
Conf. Limit	0.154	0.143	0.099	0.120
Station C		Sites		
Depth	C1	C2	C3	Average
0	0.779	0.689	0.763	0.744
2	0.9	0.621	0.785	0.768
4	0.977	0.667	1.139	0.928
6	1.097	1.173	1.173	1.148
8	1.184	0.928	1.144	1.085
10	1.037	0.995	1.204	1.078
12	1.173	1.166	1.186	1.175
14	0.963		1.269	1.116
Average	1.013	0.891	1.083	0.996
Conf. Limit	0.096	0.174	0.135	0.135

and re-ignited until constant weight. Organic matter concentration was calculated by dividing the weight loss to the weight of non-ignited but pre-dried sample.

RESULTS AND DISCUSSION

The highest average of water content (72.88 ± 3.17 %) in Lake Tabiri-Lake Takapan Complex was observed in Station A that was located in the middle of Lake Tabiri (Table 1). The particles of sediment that The lowest water content (51.99 %) was observed in Station B. Station B is the station that was located in the mouth of connecting channel that links Lake Tabiri with Lake Takapan. The samples that had already furnaced at 600° C for two hours will leave a non organic material, which is further refer as the "furnaced sediment". Preliminary observation on the appearance of the furnaced sediment in Station A show a whitish colour, that was suspected to be comprised of siliceous material. Meanwhile the colour of the furnaced sediment in Station B shows brownish red material that was probably consisted of iron containing material. Chemical analyses of the furnaced sediment will reveal the composition of this material.

Highest concentration of organic matter (38.2 %) was also observed in Station A but the lowest organic matter concentration (9.97 % dry) was found in Station D. Station D is the Lake Takapan area where we usually can observes the River Kahayan plumes. Actually the water that was flow to Lake Takapan in this station, either it was refer as Lake Tabiri Plumes (D1-D3) or River Kahayan Plumes (D4-D6) is similarly originated from River Kahayan that water have the yellowish-white colour (HARTOTO & YUSTIAWATI 1999). The yellowish -white colour of River Kahayan water indicate that it contain a lot of iron compound. Highest organic matter observed in Station A probably due to its location in the middle of Lake Tabiri peat swamp forest system.

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