Quaternary Sediment Facies Distribution in Meandering River Environment: Study Case at The Kampar River, Rumbio Area and Surroundings, Riau Province

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Abstract. Study area is located on the Kampar river in the district Rumbio and surrounding areas, located on the upstream side which is about 100 kilometres from the source of the sediment that Bukit Barisan mountain, Kampar river has a length of 413.5 km, the average width of 143 m and a depth average 7.7 m. This river is a river with meanders type carrying supplies suspended sediment and bed - load (mixed load) together with a low energy. This study aims to investigate the characteristics of sedimentary facies sediment quarter and deployment. The method used is a field survey to obtain core data rocks (1-3 meters) by 8 points wells, and cross sections measured(trenching) which is a layer of sediment that have been exposed (1-8 meters), then performed the sieve analysis to determine the grain size and sedimentary facies analysis and continued with sedimentary facies distribution map-making quarters in the study area. The facies sediment formed that Channel with the characteristic blocky to fining up succession have dominant deployment is the southernmost area of research with a thickness of 200 – 320 cm. Deployment sediment sand bar with characteristic coarsening up succession is in the northeast and southeast regions of study area with a thickness of 125 - 145 cm Next oblique accretion with upward fining characteristics that are in the north-eastern part of the area of research with a thickness of 40 cm. As well as having overbank sediment that contains a lot of organic material such as roots, stems, and foliage, with its spread is in the west and southwest area of research with a thickness of 100-160 cm. meandering river system leads to changes in sedimentary facies laterally intensive.

1. Introduction

In the Rumbio Jaya sub-district a study was conducted focusing on the meander river environment, the Kampar River. Based on the morphology and characteristics of the sediment, this research area can be grouped into channels, sand bar deposits, overbanks, and oblique accretion for more than 80 years has been the subject of discussion by engineers and scientists in quantitatively characterizing the geography in the environment of the meanders [1].

In bed load flows, sediment material is deposited with a size that is smooth at the top or shallow and will be deposited on the top of the sediment deposits. the rough part of the bedload is carried by the current and is in the deepest part and will be deposited in the lowest layer of the sediment deposits. [2]. This will form natural levee, channel deposit, floodplain, point, and overbank, in the event of a
flood the sediment will be transported as suspended load and bed load [3–5], from the depositional environment present in the meander river the sedimentary sediment originated [6,7]. Have several complex external factors such as climate, vegetation, slope, and among others, can affect the flow and shape or environment in the river. [8]. During flood sediment events will be deposited with various different characteristics, at the point bar with good sorting will be deposited medium sand and its typical structure fining upward, the part flowed by the river flow will be dominated by the channel. [9]. these variations are the background discussed by geoscientists. The geometry of river channels and their flow style are controlled by a complex interplay of factors, including discharge, slope, climate and vegetation, amongst others [8].

This study was conducted to find out the characteristics of the quartz sediments located on the Kampar River, which are derived from different facies such as channels and sand bars. It will be determined the distribution of facies in the study sites based on sediment characteristics. Vertical changing and lateral deployment of sediment deposit on the study area can also be seen by looking at the physic and biology characteristics of these sediments [5].

2. Geological Setting
Kampar River which is located in Riau Province is one of the rivers with a meander system. the river that stretches from the hills of Bukit Barisan to the east coast, namely Riau. The Kampar River is divided into two, namely Kampar Kiri and Kampar Kanan before finally meeting in Pelelawan sub-district and continuing to flow to the Malacca Strait. This river flow is used as a power plant in the Koto Panjang area.

The river with a depth of 7.7 km is 143 m wide and has a length of 413 km. has a meander system with its environment, tropical rain forest, a place for fish production. besides being used as a power plant [4,10].

Rumbio is a district in Kampar Regency with elevation ranging between 25 to 50m above sea level. The landscape that developed in research area were channel, floodplain, natural levee, point bars, abandoned channel, and oxbow lake. This area is gently sloping and the occurrence of heavy rainfall may cause flooding.

Sediment distribution in research area shows by quaternary age landforms. Along The Kampar Kanan River was deposited Young Alluvium (Qh) during Holocene aged that consist of gravels, sands and clays. Old Alluvium (Qp) during Holocene aged that consist of gravels, sands, clays, and organic materials. And Minas Formation during Pleistocene that consist of gravels, pebble spreads, sands, and clays [11].

3. Data and Method
The research area is located at 9 points from Kampar Kiri River which consists of 8 points of drilling and 1 trenching point (Fig 1). There are three methods used in this research, the first is field survey with doing drilling using hand auger and trenching tools which are both lab analysis consisting of core analysis, sieve analysis, and facies analysis, and third literature study.

The first method is field survey, this is done by drilling, first done by determining and measuring the point that will be the drilling spot, then survey the location to see the condition of the drilling point. The method used for drilling is hand auger. The location of the drilling lies at 8 specified points aimed at obtaining sediment characteristics and different from any sediment deposition beneath the surface from the bottom layer to the top, ranging from 1.5 to 4 m. After that proceed with trenching around the drilling area which aims to see the layers of sediment that have been exposed surface, see the deposition of the sediment with a thickness of between 1-3 meters. The second method after all field data was obtained then the analysis consisted of core analysis result from drilling to determine the characteristic of sediment to determine the deposition facies, then sieve analysis that is the layer that has been sampled when trenching done sieve analysis by using mesh size 2.38 mm, 1.19 mm, 0.6mm, 0.297mm, 0.149mm, and 0.074mm, to know the dominance of the grains contained in the trenching location. Then study the literature on the research area.
4. Result and Discussion

Morphology found in the research area is a sloping ramp that is in the environment floodplain and abandoned channel from Kampar River. The diversity of deposited sediment material is not too different because of differences in the height of the study area that is not too different. As shown in the results of core analysis (RP 1 - 8) which has a fining up succession feature and indicates that the core points characterize the deposition environment of the channel, with its coarse sand-medium sand grains located at the bottom layer and smoothing on the top layer starting from very fine sand-clay.

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4.1. Sediment Facies

Based on core descriptions (Fig. 2), trenching data, and sieve analysis, so sediment facies can divided become eight sediment facies. They are pebble coarse sand, Silt to Clay with Oxidation sand, Clay sediment, Very Fine Sand with minor terrestrial organic matters, Silt with terrestrial organic matters.

Pebble coarse sand. The sand with a coarse to gravel size has blackhis brown colour and there is a thin intersection of reddish sand due to oxidation ad is found at a depth of 150 – 145 cm in RP – 01, 250 – 220 cm in RP – 02, 320 – 194 cm in RP – 05, 350 – 216 in RP – 08.

Silt to Clay with Oxidation sand. There are sediments with grain size from silt to clay which has a greyish brown colour at a depth of 145-120cm in RP-1, in this layer there is a thin inset of orange sand due to oxidation.
Clay sediment. The precipitate in these lithofacies is found in RP-7 at 242-162 cm depth, sediments deposited in the form of peat or carbon organic material, with clay grains, are black and there is a considerable amount of wood.

Very Fine Sand with minor terrestrial organic matters. Sand with grain size very fine sand has a brown colour, on RP - 1 at 120-134 cm depths there are orange red sand inserts and fine root roots. On RP-5 ranging from 139 cm -121 cm depth is very fine sand with the same characteristic as RP-1. The gray colour changes characterize very fine sand on RP-6 at 264-179 cm depth.

Fine sand with terrestrial organic matters and oxidation. Sand with fine grain size has a colour brownish, there are small plant roots, and found a thin insertion of red sand due to oxidation process. Found at a depth of 151-95 cm in RP-3, and at a depth of 92-42 cm in RP-5 but the colours on this layer are gray-brown and there are no reddish-coloured sand inserts.

Silt with terrestrial organic matters. With grain size silver has a reddish orange colour and overgrown with fine roots found at a depth of 100-67 cm, in RP-3, as for differences in RP-5 at 22-0 cm depth which has a gray colour and overgrown roots - fine roots. In the core RP-8 at 124-52 cm depth has a blackish brown colour and there is floating gravel with a size of 0.2-1 cm and also overgrown by fine roots.

Clay with terrestrial organic matters. Has a blackish brown colour, grain size clay and part of a fairly large plant. Found at a depth of 51-25 cm in RP-3.

4.2. Depositional Facies

Differences in the physical, chemical and biological properties of sediments to classify the sediments that are used as the determination of depositional facies associations. There are four facies association, they are channel deposit (stream channel), oblique accretion deposit, overbank deposit, and oblique accretion deposit.

4.3. Distribution of Depositional Facies

Channel deposit is located at the bottom of the layer with the finishing up succession and always begins with the grain size of coarse sand to the pebbles, in this facet found some lithofacies coarse sand powder, silt to clay with oxidation sand and clay sediment. Depositional facies are found in several cores, namely RP - 01, RP - 02, RP - 03, RP - 05, RP - 06, and RP - 08. The spread of depositional facies channel based on its thickness is located along the northeast - southwest, and is found at 6 stations with the thickest part contained in RP - 06 with a thickness of 311 cm and RP - 08 298 cm (Fig.3).
Sand bar deposits with their characteristic coarsening up succession, with fine grains of sand that lie under the coating to the top and also found traces of organic and oxides shown by the presence of reddish orange sand. The facies are found in several cores, namely RP - 01, RP - 02, and RP - 07. The depth map of the facies shows that the thickness of the sand bar is found in the southwest and southeast of the research area precisely in RP - 02 with 145 and RP - 07 with a thickness of 151 cm (Fig.4).

Overbank deposits are deposited on the top layer which is a sediment that is brought in during the flood and is always outside the channel, has a fine grain of silt and clay and overgrown with roots of plant or roots soil. In this facies found some lithofacies such as, fine sand with terrestrial organic matters and oxidation, silt with terrestrial organic matters, and clay with terrestrial organic matters. Found on several cores, namely RP - 01, RP - 03, RP - 05, RP - 07, RP - 08. (Fig.5).
5. Conclusion
In the research area which is a river with meander system found some Quarternary sediment facies such as pebble coarse sand, silt to clay with oxidation sand, clay sediment, very fine sand with minor terrestrial organic matters, fine sand with terrestrial organic matters and oxidation, silt with terrestrial organic matters, clay with terrestrial organic matters. And there are 4 depositional facies namely, channel, sand bar, overbank and oblique accretion. The sediment facies are found along the research area of Kampar River on the Rumbio Jaya District, Kampar regency, Riau.

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