Fluvial Geomorphology

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GEOB 309

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Table Of Contents

1| Introduction

This assignment focused on studying fluvial geomorphological effects along three different locations of the Cheakamus River. These three locations included the Cheakamus above the Cheekye, at the Cheekye (from the point of confluence between the Cheekye and Cheakamus river), and the Cheakamus below the Cheekye. From the data we collected we were able to draw conclusions about the three areas that were studied.

2| Results

2.1 Grain Size and Histograms

Cheakamus Above Cheekye River
D_{50}: 36.8mm
D_{90}: 76.0mm

Cheekeye River
D_{50}: 41.2mm
D_{90}: 352.3mm

Cheakamus River Below Cheekye:
D_{50}: 81mm
D_{90}: 190mm

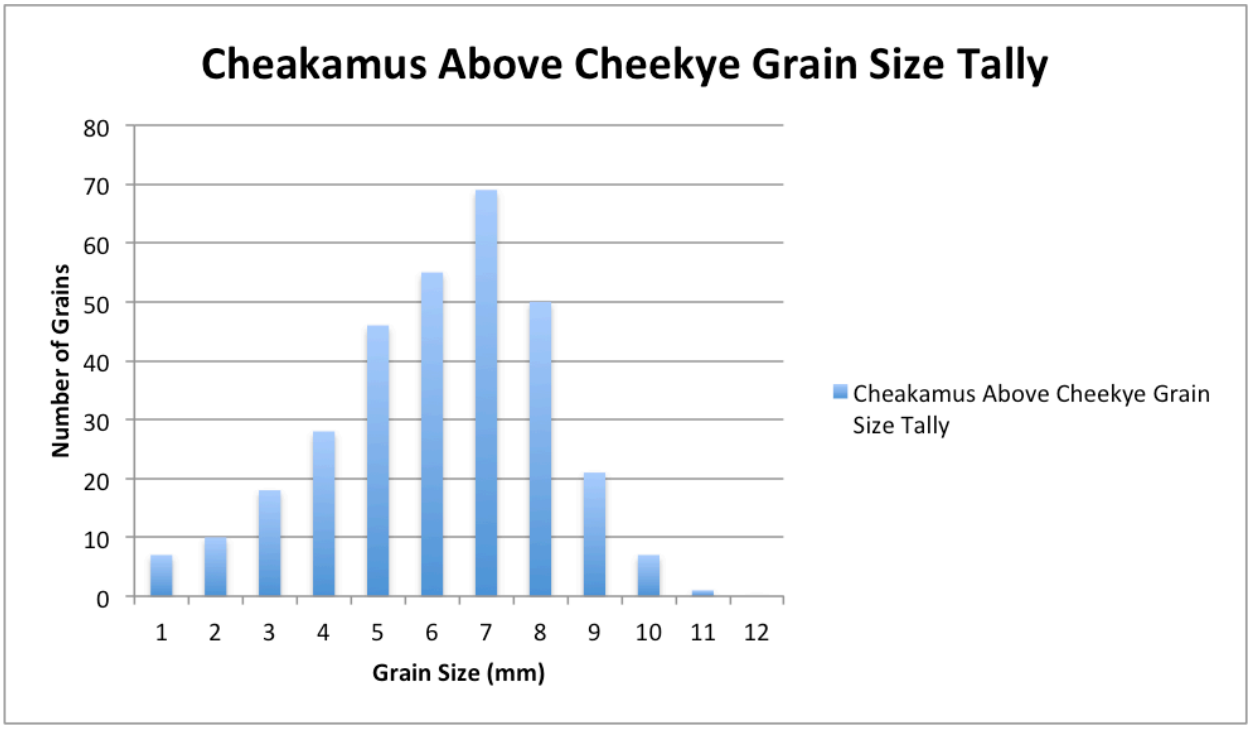

Figure 1: Cheakamus River grain size above the Cheekye.

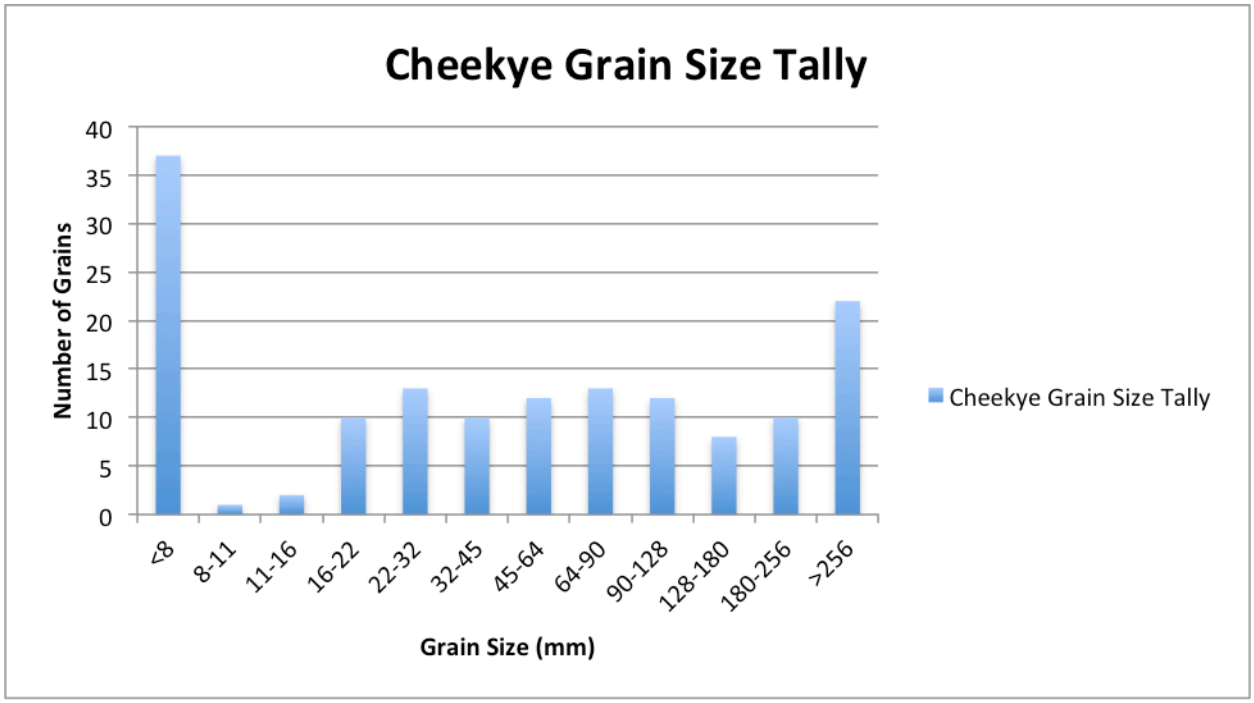

Figure 2: Cheekye grain size.

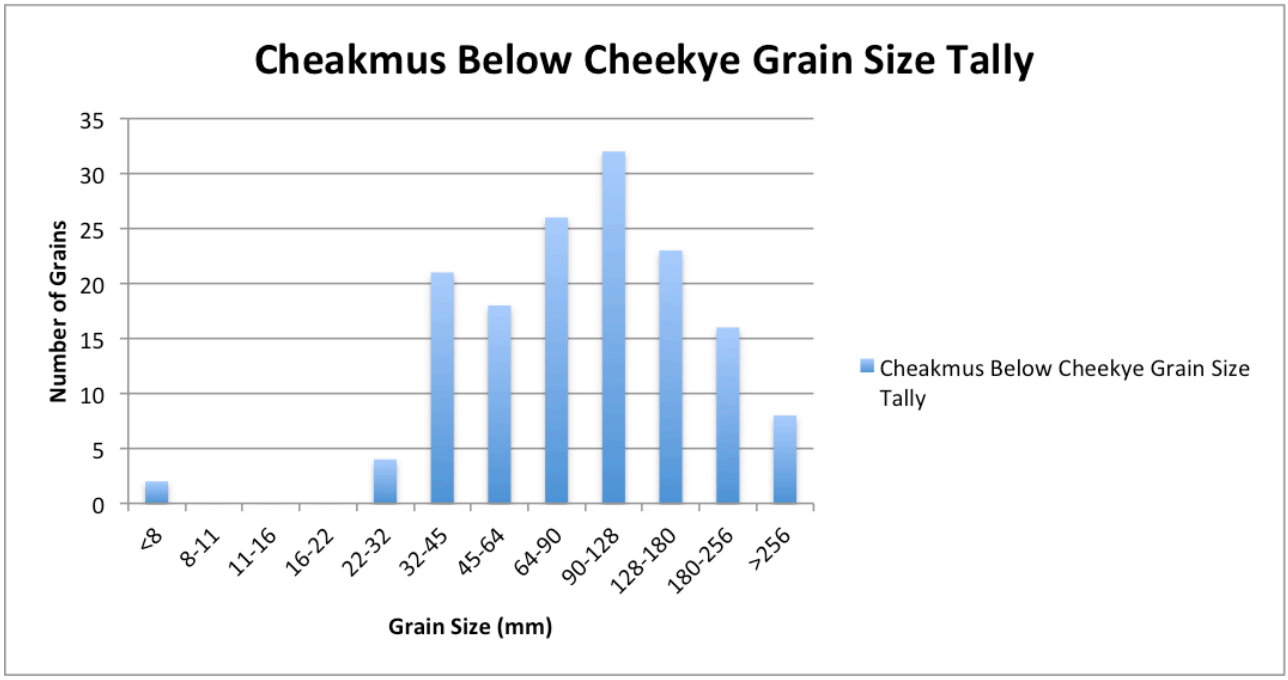

Figure 2: Cheakamus River grain size below the Cheekye.

2.2 Stream Gradient Comparison

The differences in average gradients between sites is as follows:

Cheakamus Above Cheekye River: 0.21%
Cheekye River: 14.4%
Cheakamus River Below Cheekye: 4.50%

2.3 Stream Channel Morphology

Cheakamus Above Cheekye River

Figure 1: Cheakamus River Downstream View

Figure 2: Cheakamus River Upstream View

This area of the river has a low gradient and is described as a riffle pool. Looking at the stream, we viewed sections that flowed faster (riffle) and slower (pool) in velocity. The material found in this area was medium coarse, forming bars along the outer edges of the river.

Cheekye River

Figure 3: Cheekye River Downstream View

Figure 4: Cheekye River Upstream View

This river merges with the Cheakamus River and has a steep gradient. Large boulders and material from mass wasting events form step like features that cause the water to flow from one elevation to the other. It is described as a boulder cascade. Due to observations noted it is difficult to classify this stream as a step pool because the steps are not fully formed.

Cheakamus River Below Cheekye

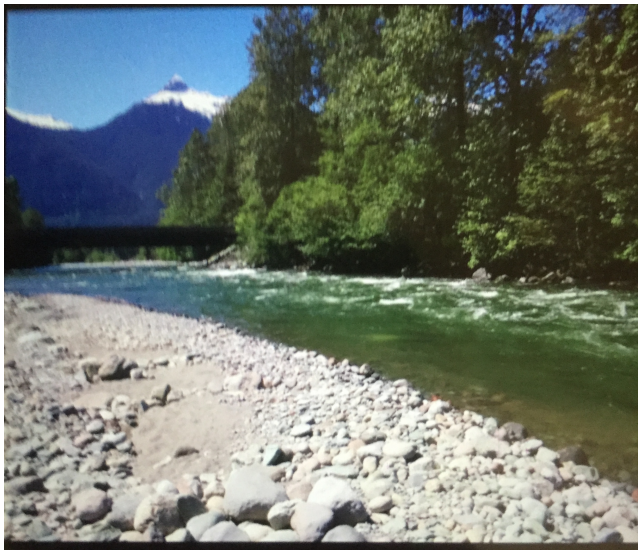

Figure 5: Cheakamus River Downstream View

This area of the river has a steeper gradient than the Cheakamus River above the Cheekye. It is described as a plane bed. Looking at the stream we viewed whitewater, which indicates that there was a very strong current, and because of this it cannot be a riffle pool. The material found in this area was medium to larger coarse forming bars along the outsider edges of the river.

2.4 Other Differences Between Sites

The vegetative growth of the Cheakamus River and the Cheekye River are distinctively different. At the Cheakamus river the tree stands by the banks are full of old growth and tall conifers. The Cheekye River contains low to medium height deciduous trees near the bank and taller conifers farther out of the bank. As deciduous trees grow easier on actively changing banks, the estimated observation trunk width and height of the deciduous trees along the Cheekye River bank could provide a rough time indicator to when a debris flow may have occurred in the region.
Another difference noted between the two streams is that the Cheekye River is unregulated, therefore there is more active mass wasting processes such as debris flows occurring down the channel. The Cheakamus River is regulated by a dam upstream which can reduce and prevent effects of mass wasting. The dam would also reduce discharge and sediment supply downstream of the dam allowing for less rapid waters which could explain the riffle-pool morphology at the Cheakamus River above the Cheekye.

3| Discussion

Within the three sites visited, Cheekye River has the highest gradient at an average of 14.44%. Cheakamus River below the Cheekye River has the lowest average gradient of 0.21%. The upstream location of Cheakamus River has an average gradient of 4.5%.
At the upstream location (Cheakmus above Cheekye), we would expect to have steeper slopes and a more rapid flow of water than downstream, but the data shows this is not the case. Instead, the water is calmer and represents a riffle-pool structure. At the Cheekye, the gradient is high as there are large boulders in random distributions along the sides and in the middle of the flow. The large boulders act as steps and create a boulder cascade. This eventually causes higher velocity flows feeding into the Cheakamus River at the point of confluence. At the downstream location (Cheakamus below Cheekye), the river flows as a plane bed. This area of the river has been fed by the high gradient Cheekye River, which brings medium-coarse grained sediment to the Cheakamus River. This raises the gradient of the river from the increased sediment supply and is a reason of why the gradient is higher downstream versus upstream. The observed pattern of stream gradients do not follow the standard conceptual model because the Cheekye is unregulated and is known to have mass wasting events. The mass wasting processes has steepened the river channel at the merging of the Cheekye and Cheakamus as well as below the Cheekye River.

Due to the Cheekye River being unregulated, this allows for mass wasting events and the subsequent creation of active debris flows. Large boulders and fine sediments are deposited downstream at the confluence point of the Cheekye and the Cheakamus River. This creates a debris fan and consequently narrows the Cheakamus River, causing higher velocities at this area. Further downstream, some boulders are carried and deposited in the Cheakamus. The degree of scour at the merge point of the two rivers is also controlled by the large boulders around the bed, reducing the velocity at which the currents travel at.

With the standard conceptual model, stream gradients show gradual gradient decrease downstream. Typically, these channels are expected to be narrow and steep upstream, as well as meandered and wider downstream. However, in this case, the Cheakamus River does not follow this model due to the merging of the unregulated Cheekye River. At the location of the merge (midpoint of the upstream and downstream location), the stream gradient suddenly increases. It is important to note that this measurement is only within a 1km distance and does not capture the full extent of the gradient changes. A typical measurement of stream gradient would need to be taken from various points along the stream at longer distances to provide an accurate assessment.