From Glacier to Bay: Magnetic Properties of Suspended Sediments Throughout the Puyallup Watershed

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Introduction

Why study sediments?

- Climate driven glacial erosion can increase the amount of sediment being brought into rivers and in return affects river health.

What was the goal?

- Compare and contrast the sediments found in Commencement Bay, Emmons Glacier, and in 3 spots throughout the Puyallup River (Maher 1994). This was done using isothermal remanent magnetization, magnetic coercivity, and magnetic susceptibility.

What did we think?

- Larger (sand and silt sized) sediments would be most prominent in the glacier and gradually less as it travels down the river, with the smaller, clay sized particles being what was most abundant in the bay.
- The sediments in the bay are coming from the glacier through the Puyallup River, meaning we expected the makeup of sediments to be similar throughout the watershed.

Map 1. Sample sites throughout the watershed.

Citations

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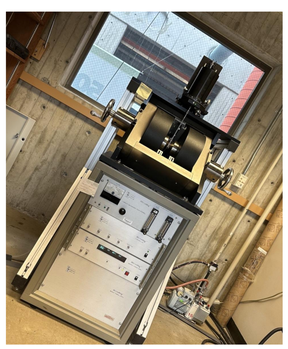
Methods

- Water samples were collected in 3 spots throughout the Puyallup River by placing a nalgene bottle at the end of a beam and filling it using water from the quickest flowing spot within the sample site (pic 1).
- Suspended sediments in these water samples were then separated into sand, silt, and clay sized particles to prepare for further analysis (pic 2).
- The sediment samples were then ran through a Princeton Measurements Corporation Micromag 3900 Vibrating Sample Magnetometer and a Bartington MS2B Susceptometer to get data on isothermal remanent magnetization (pic 3), coercivity, and magnetic susceptibility.
- The processing for hysteresis data followed the methods outline by Jackson and Solheid (2009)

Pic 1. Peter Selkin collecting river water sample for separation and analysis.

Pic 2. Collected water samples being vacuumed filtered to obtain clay sized separates.



Pic 3. Princeton Measurements Corporation Micromag 3900 Vibrating Sample Magnetometer used to get IRM and hysteresis data.

Results

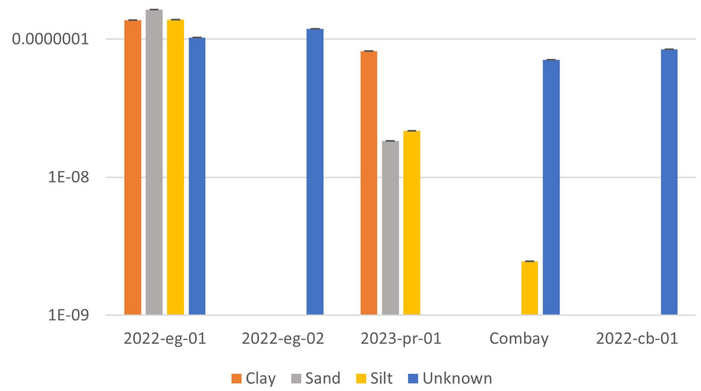


Fig. 1. Low frequency magnetic susceptibility data for clay, silt, sand, and unknown/mixed sized particles at different location (glacier, river, bay).

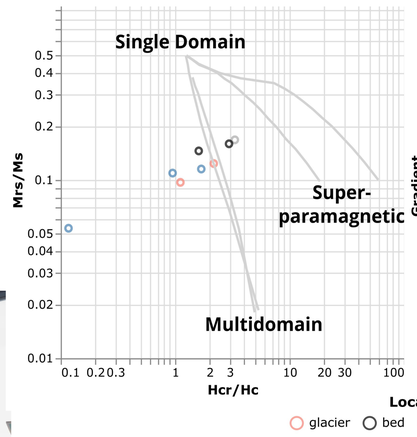


Fig 2. Day plot comparing Mrs/Ms and Hcr/Hc for bed, glacier, suspended, and bay samples.

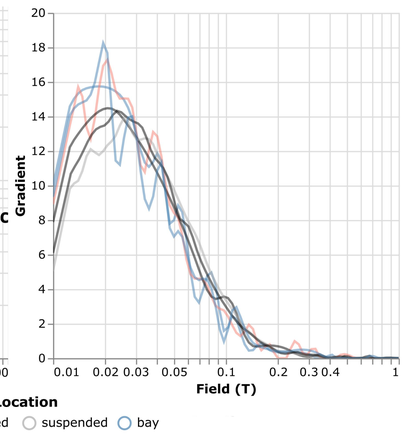


Fig 3. Magnetic coercivity data for glacier, bed, bay, and suspended samples

Discussion

Magnetic particle concentrations

- Sand and silt sized sediments have the highest concentration of iron oxides in Emmons Glacier and decrease as it moves down the river to the bay.
- Cay and unknown sized samples are relatively the same in all stations, only dropping slightly as it moves down the river to the bay (fig 1).
- These results are inconsistent with elemental analysis done on samples from the same sites that show higher iron oxide content in the bay than glacier (See S Renteria poster).

Grain size

- Most of the samples seem to fall along the mixed and single domain lines, with the bed and suspended sediments being more aligned with single domain (fig 2).
- The bed and suspended sediment also have higher peak coercivity, suggesting that it contains finer grained materials (fig 3).
- These results are consistent with one another as both multi domain and higher coercivity peaks suggest finer grained materials.

Acknowledgements

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Significance/Future study

What did we conclude?

- Emmons glacier is likely a source for the sediments found in the bay.

What's happening throughout the river?

- The suspended sediments found in the Puyallup river samples has some difference from the bay and glacier.
- There might be another influence for the river.

What can we do next?

- Repeat these tests at different times of the year to determine if seasonal changes influence sediment transport.