Grain Size Correlation to Metals and Bacteria Concentration in Hudson River Sediments

Lamont-Doherty Earth Observatory
COLUMBIA UNIVERSITY | EARTH INSTITUTE

J. Batta[1], T. Kenna[2], F. Nitsche[2], B. Mailloux[1]
Barnard College(1), Lamont-Doherty Earth Observatory(2)

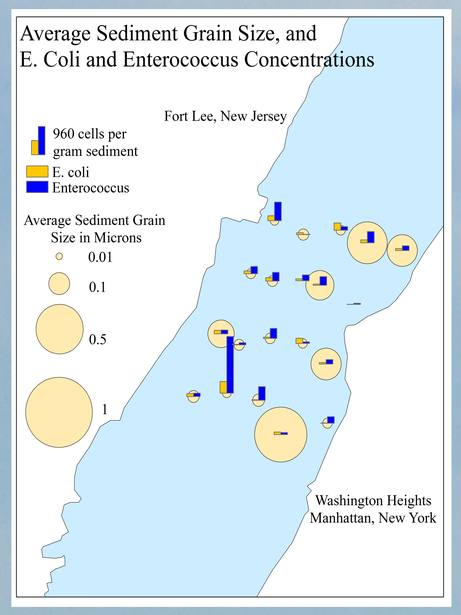
Abstract Hudson River Sediments are known as a sink for contaminants such as fecal bacteria and metals. It is also known that bacteria have an affinity for small particulate matter, which increases their rate of sedimentation (Gannon, 1983). To determine the strength of the correlation between grain size and bacteria, as well as grain size and metals, 20 sediment surface grabs were obtained from the George Washington Bridge area of the Hudson River. Grain size, bacteria and metal concentrations were measured. Bacteria, particularly enterococcus, used as the EPA standard for effluent water quality, showed greatest presence in grain sizes under .02 microns. Of the metals measured, Rubidium, Potassium and Titanium showed highest correspondence to grain size, while Calcium, Lead and Zirconium showed little correlation.

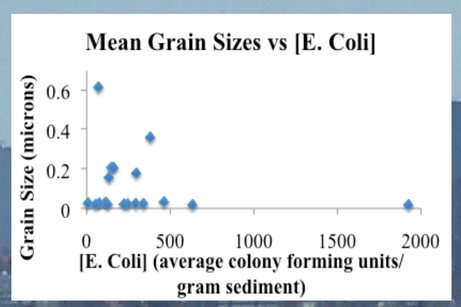
Bacteria

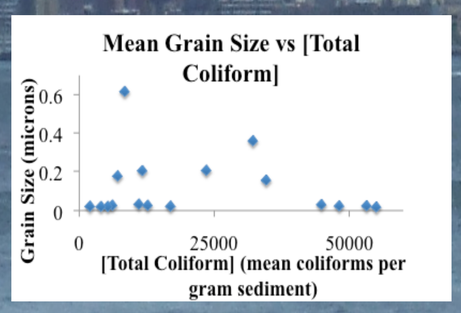
Methods Grain Size was determined by drying the sample overnight in an oven at 100° C, sieving, and processing the fine fraction with a Coulter Counter, which measures change in electrical resistance as particles are passed through a small opening. Bacteria concentration was determined by agitating sediment in a buffer solution, adding the enterolert or colilert reagent to the supernatant, and incubating to display positive cells.

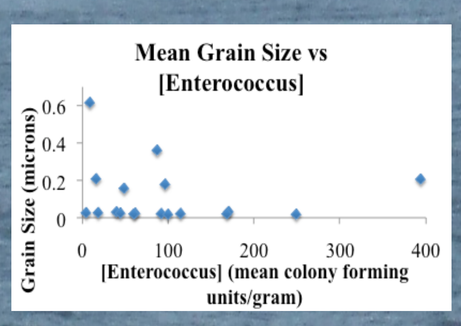
Results

Mean grain size In microns	Average Enterococcus cells per gram sediment
>.2	75.43
.2-.1	82.30
.09-.02	55.77
<.02	245.44





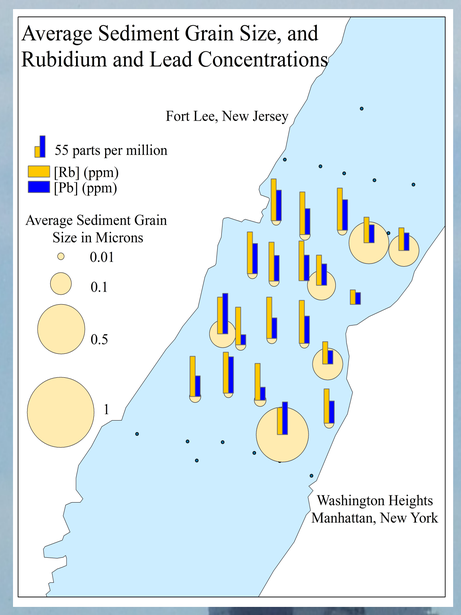




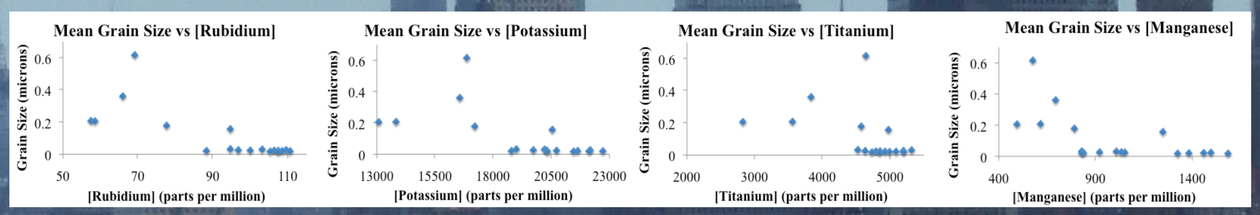
In the future, another 19 grabs from the Upper Hudson will be analyzed using the same procedures and gamma counting will enable dating.

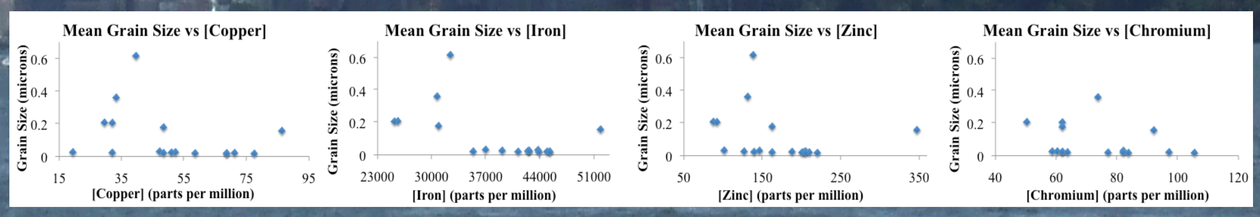
Metals

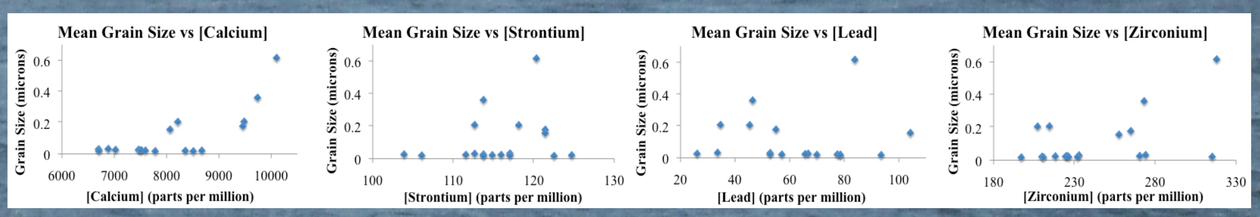
Methods Metal concentrations were measured using an x-ray fluorescent spectrometer, which bombards sediment with high-energy photons, causing the loss of an electron. An electron from an outer shell moves down to replace the lost electron, emitting measureable fluorescent x-rays specific to a single element.



Results







Conclusions Although a strong linear correlation is not observable, the sample with the smallest mean grain size had the highest bacteria counts in all three bacteria measures, suggesting that the range of grain sizes in the sample set may not be wide enough to adequately address the question. Certain metals including Rubidium, Potassium, Manganese, and Titanium show significant correlations to grain size, while others like Calcium and Zirconium show a weak correlation or none at all, raising a series of questions.