EART 120: Unidirectional bedform types **Name: _____**

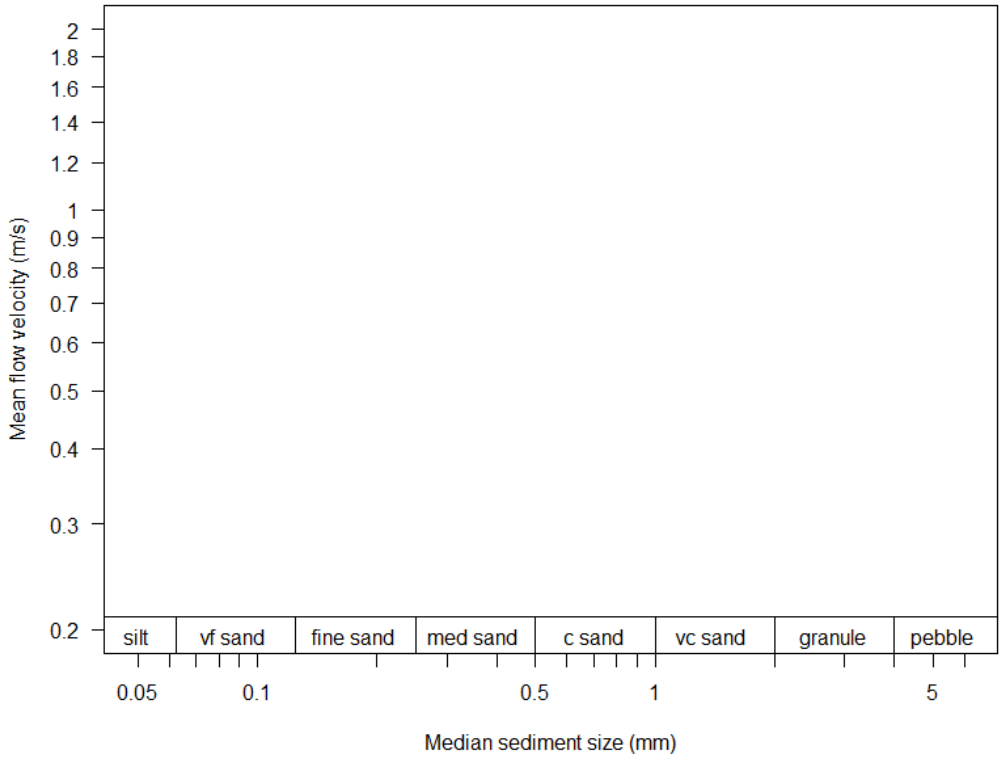
Unidirectional water flow is the most important mechanism of sediment transport and deposition, occurring in a wide variety of environments from fluvial to submarine fan. Movement of sediment as bedload (in traction) produces characteristic bedforms, such as ripples or dunes, which can be preserved as sedimentary structures. Those sedimentary structures are key pieces of evidence for interpreting ancient depositional environments, so it's important to understand the conditions under which specific bedforms are created.

Bedforms include ripples, dunes, lower plane bed, upper plane bed, and antidunes. Their formation is governed by grain size, flow velocity, and water depth. We'll ignore water depth and consider the relationship between grain size, flow velocity, and bedform type at shallow (approximately 30 cm) water depths. Note that the transitions between different bedforms will occur at slightly different water velocities when the depth differs from 30 cm (in particular, dunes or upper plane bed tend to form instead of antidunes when the water is deeper).

Instructions:

Go to this website: http://people.ucsc.edu/~mclapham/earth120/bedform.html. You enter grain size (in mm) and water velocity (in m/s), without the units, and it will output the type of bedform expected under those conditions (at 30 cm water depth).

Try entering various values for current velocity and grain size, and plot the resulting bedforms on the graph. There are five possible bedforms (ripples, dunes, lower plane bed, upper plane bed, antidunes), as well as no movement, so use six different symbols. Make sure to include a legend when you are done. The transitions are approximate (and depend on water depth), so you only need enough points to draw approximate lines separating the different bedforms.



Use your results to answer these questions:

1. Under what range of grain sizes do ripples form? Use the descriptive terms like fine sand or granule, rather than the actual particle diameters.

2. Contrast the grain size range of lower plane bed with that of ripples. Why does lower plane bed form in place of ripples at those grain sizes?

3. Describe the nature of the transition (i.e., where does it occur, does it occur at the same point for all grain sizes, etc.) from ripples to upper plane bed. What causes this transition?

4. In the same way, describe the nature of the transition from ripples to dunes. What factors influence the shape of this bedform transition?

5. Under what range of grain sizes do dunes form? Use the descriptive terms like fine sand or granule, rather than the actual particle diameters.

6. How does the minimum current velocity required for dune formation vary with grain size? What causes that trend?

7. Why do antidunes nearly always form when the flow depth is shallow?

8. Describe the transition between dunes and upper plane bed? For more of a challenge, explain why this transition occurs. Hint: think about suspended sediment and flow turbulence.