

EART101: Functional Morphology and Substrate Adaptations

Name _____

This exercise includes hands-on evaluation of the effects of size, density, and shape on the ability of an organism to live on soft substrates. Answer the questions on the back or on a separate sheet and turn in your answers at the end of class.

Materials:

- 1 container with sediment
- 1 cup
- 1 wooden stir stick
- 1 set of metal bearings (small, medium, large)
- 1 piece of modeling clay

Instructions:

Slowly add water to the sediment and stir with the stir stick. You want to add just enough water to completely saturate the sediment, but not too much otherwise you will have a layer of standing water that obscures your view of the action. Add the water in small amounts.

Gently place the metal bearings on the sediment surface and observe if/how much they sink into the substrate. There may be spatial variations in the sediment, so try a couple times, stirring in between.

1. How does size affect sinking depth of the metal bearings? Compare the relative depth of sinking among the different sizes, i.e., is 25% of the sphere submerged, 50%, or more?
2. Why does that relationship exist?
3. Would you expect the same relationship between size and sinking depth for a shelly invertebrate organism? Why or why not?

Stir the sediment again to mix the water. Mold the modeling clay into a sphere about the same size as the large metal bearing and gently place it on the substrate.

4. Does the clay sphere sink more, less, or to about the same depth as the metal bearing?
5. What is the main factor affecting the sinking depth?

Stir the sediment again. Without adding or removing material, mold the modeling clay sphere into a narrow cone and place the pointed end on the substrate (you may have to brace it so it doesn't tip over).

6. Compare the sinking depth of the cone to the sphere. Why is there a difference?

Stir the sediment again. Still without adding or removing material, mold the modeling clay into a flat sheet.

7. Compare the sinking depth of the sheet to the previous results from the cone and sphere. Why is there a difference?

Clean up any drips on table, wipe down the bearings and clay, and drain as much water as you can down the sink (without draining the sediment itself). Move on to questions listed on the back of the page.

8. How do you think shell thickness (the thickness of the calcium carbonate shell itself, not of the entire organism's body) would vary in firm and soft substrates? Why?
9. Finer-grained marine sediments, like muds, tend to have greater porosity at the sediment-water interface than coarser-grained sandy sediments. Which type of sediment is likely to be softer, and why?
10. Where would you expect to find more snowshoe strategists, in shallow or deeper-water environments? Why?
11. There is evidence that the amount and depth of bioturbation (mixing of sediment by burrowing organisms) increased substantially during the Mesozoic. What effect would that have on the nature of substrates, and why?
12. Given the answer to question 11, what prediction would you make about the relative abundance of epifaunal organisms through the Mesozoic?