

Where the Sediment Goes: Make a Layer, Then Cut a Canyon

Investigation question: When moving water erodes a pile of mixed sediment, where does each size of grain end up, how do repeated flows build layers, and what do the walls of a channel cut through those layers show?

Classroom field investigation

Groups of 4

1 session

Setup 10 · Activity 35 · Cleanup 10 min

MS-ESS2-2 · practice

MS-ESS1-4 · supports

Name _____

Group _____

Date _____

Your role today

- ☐ **Pourer:** Pours the measured water onto the mound at the agreed height and rate, using the pinhole cup for slow flow and the open cup for fast flow, and calls out when the pour starts and ends.
- ☐ **Timer and measurer:** Times each pour, then measures the length of the deposit, the farthest gravel and the layer thicknesses on the channel walls with the ruler.
- ☐ **Observer:** Watches the mound and the deposit during each pour, says aloud where grains are moving and where they stop, and uses the hand lens to check grain sizes.
- ☐ **Recorder and sketcher:** Records every measurement, sketches the tray from above after each run and draws the channel wall in cross section.

Safety

- Water on hard floors is a slip hazard: keep the bucket under the low end of the tray, wipe spills at once, and walk, never run, with the pitcher.
- Keep sand damp to avoid dust; dry fine sand and silica dust should not be breathed. Do not blow on the tray.
- Sand and grounds never go down a sink; they clog drains. Pour used water through a cloth into the bucket and dump outside on soil or into the sand-drying tub.
- Wash hands after the activity; keep hands away from eyes while handling sand. Safety glasses are optional for the fast pour, which can splash.
- Outdoor survey: stay in the designated area, away from roads, drains and standing water; sun protection if needed.

Procedure

1. Set the tray on the blocks so the upper end is 5 cm higher than the lower end. At the upper end, build a mound of 2 parts damp sand to 1 part gravel, about 10 cm wide and 4 cm high, mixed evenly. Mark the mound's lower edge with two toothpicks. Leave the rest of the tray empty.

2. Run 1, erosion and deposition. The Pourer holds the assigned cup (slow pinhole or fast open) about 5 cm above the top of the mound and pours 500 mL of water onto it; the Timer records the pour time. The Observer narrates: where grains leave the mound, which path they take, where they stop. When the water drains, measure the length of the deposit from the toothpicks to its far edge and the distance to the farthest gravel. Use the hand lens to check which grain size lies nearest the mound and which farthest. Record and sketch from above.
3. Run 2, a second layer. Without disturbing the deposit, spread a 1 cm cap of coffee grounds over what is left of the mound. Pour another 500 mL the same way as Run 1. Watch where the dark grounds settle. When the water drains, note whether the dark layer lies on top of the first deposit or beneath it, measure how far it traveled, and sketch.
4. Run 3, cutting a channel. Switch to the open cup. The Pourer pours 300 mL in one narrow, steady stream onto the middle of the deposit so that the water runs as a single stream across it. Watch the stream cut a channel. When it drains, look at the two walls of the channel. If a wall has slumped, use the ruler edge to cut a clean vertical face along it.
5. Record the layers on the left wall and on the right wall of the channel, top to bottom, with each layer's material and thickness in millimeters. Note whether the layers on the two walls match. Draw a cross section of one wall.
6. Report your Run 1 numbers (deposit length, farthest gravel, pour time, flow condition) on the class board so the slow and fast groups can be compared.
7. Survey (15 minutes outdoors, or a second session). In the designated area, find one place where water has moved sediment: a fan of sand below a downspout, a tiny gully on a bare slope, or layered silt at a puddle edge. Sketch it, measure its length, and record which grain sizes are near the source and which are far. Identify which of your three runs it most resembles.
8. Answer the analysis questions individually, then compare within the group.
9. Cleanup: pour the water through a cloth into the bucket, scoop the sediment into the drying tub, wipe the tray and the floor, and return the cups and rulers.

Record your observations

Lab 3 recording sheet: Where the sediment goes

Record what you **see** during each pour, then measure after the water drains. Keep observations (the gravel stopped 6 cm from the mound) separate from explanations (the water slowed down there).

The three runs

Run	Flow (slow or fast)	Water (mL)	Pour time (s)	Deposit length (cm)	Farthest gravel (cm)	What settled on top of what
1: erosion and deposition		500				
2: second layer (dark grounds)	slow	500				
3: channel	fast, narrow stream	300				

-  Top view of the tray after Run 2: draw the mound, the first deposit and the dark second deposit, and label where gravel, sand and grounds ended up. Below it, draw a cross section of one channel wall after Run 3, with each layer labeled and its thickness in millimeters.

Channel walls after Run 3 (top layer first)

Layer from top	Left wall: material	Left wall: thickness (mm)	Right wall: material	Right wall: thickness (mm)	Do they match? (yes/no)
1					
2					
3					

Schoolyard survey

Feature found	Where	Length (cm)	Grain sizes near the source	Grain sizes far from the source	Which run it resembles

1. During Run 1, where in the tray did erosion happen, where did deposition happen, and what made the grains stop moving?

2. After Run 2, which deposit is on top? State the rule from the lesson that this demonstrates and explain why it could not have come out the other way.

Analysis questions

3. The class pooled its Run 1 data (teaching dataset): slow-flow groups averaged a deposit 18 cm long with the farthest gravel at 6 cm; fast-flow groups averaged 31 cm with the farthest gravel at 14 cm. Calculate how many times farther the fast flow carried the gravel, and explain the difference in terms of the energy of the moving water.

4. In your deposit, which grain size settled nearest the mound and which farthest? If a geologist finds a rock layer that is gravel at one end and grades into fine sand at the other, what can she infer about the water that deposited it, and in which direction did it flow?

5. Did the layers on the two walls of your channel match in order and thickness? Name the rule this demonstrates. Is the channel older or younger than the layers in its walls, and which rule says so?

6. Suppose at one spot in a tray you found a dark grounds layer underneath a sand layer, the reverse of what you expect. Give two different events that could produce this, and say what extra observation would tell them apart.

7. Your channel formed in about 30 seconds; the Grand Canyon took millions of years. Name two things the tray model shows well and two things it cannot show about a real canyon cut through real strata.

8. Describe the feature you found in the schoolyard survey. Which of your three runs did it most resemble, and what evidence (grain sizes, shape, layering) supports the match?

9. A single storm can leave a 10 cm layer of sand in a stream bed, while a quiet lake bottom gains about 1 mm of mud per year. If you found a 10 cm sand layer and a 10 cm mud layer in a cliff, what can you say about how long each took to form? What does this tell you about using layer thickness as a clock?
