Investigation 6: Deltas and Floodplains

Reflect and Revise Question 6.3

Goal Facet

Moving water, and to a lesser extent, wind, act to move (or transport) Earth's particles from one location on the landscape to another.

The force of gravity acts to pull Earth's rocks/particles to the lowest surface possible. Material tends to accumulate where the land is flatter.

Discussion Moves for Reflect and Revise Questions	
To prompt student questioning	
Identifying confusion	After thinking about this question and listening to your classmates, what still confuses you about...?
Inviting further investigation	If we were to conduct another investigation on this topic, what question would you most like to answer?
To invite students to explain their thinking and reasoning	
Eliciting prior experience	What have you experienced or read about that might lead you to conclude…? What does [topic/process] make you think of that you understand pretty well?
Eliciting reasoning	Why might response [a, b, c, d] make sense to someone? How do you know that…? Can you say more about what you know or have observed in the investigation that leads to you to conclude that…? Do you think [response a, b, c, or d] is *always* true? How might we find out?
To encourage the class to take responsibility for advancing understanding	
Adding on	Can anyone add to this idea?
Weighing perspectives	Who would like to argue against the idea that…? Let's start our responses to _____'s idea by saying, "I agree because" or "I disagree because".
Restating/revoicing	Can you restate _____'s idea in your own words? Who can clarify for us what _____ just said?
Moving to consensus	Can someone summarize what the class knows about…? How do we know what we know about…? How did we decide this was our understanding? Can someone summarize what the class still is struggling to understand about…?

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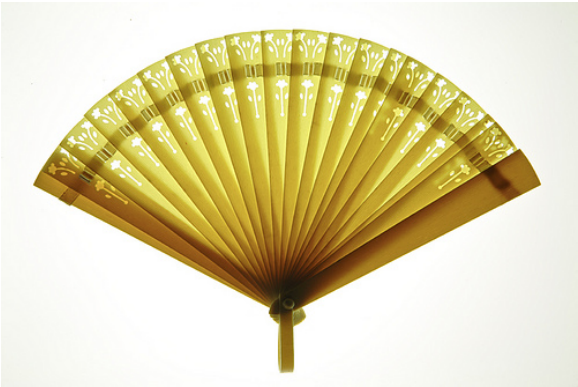
Pose the Question



The green areas marked above show the place where a river flows into an ocean. Why does this river look like a triangle (or fan) where it flows into the ocean? Be prepared to explain your response.

a. Sediment is settling there as the land becomes flatter.
b. The water can flow all over the place just before it meets the ocean.
c. The river is transporting sediment to the ocean.
d. Finer sediments suspended in the water are being deposited there.

Image source: : http://en.wikipedia.org/wiki/File:Nile_River_and_delta_from_orbit.jpg

Spark Discussion

Discussion prompt: Explain why a, b, c, d might occur?

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Listen for Goal and Problematic Facets

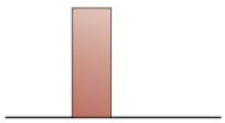
Response a: Students may recall that sediment settles where the land is flatter. In addition, water flows more slowly as it meets the ocean, and they may conclude that when water flows slowly, there is more deposition of sediment that is transported in the river (the process of erosion).

Response b: Students may point to evidence in the picture that lots of different river channels (called "distributary channels") have formed in the alluvial fan. This does not mean, however, that water can flow anywhere; the number and shape of channels has to do in part with the rate of flow of the water in the river and larger body of water.

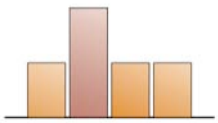
Response c: Students may recall that rivers do transport sediment all the way to the ocean. Though not clearly visible on this image, sediment is evident in the image presented as part of the starter question for this investigation. If all the material were deposited into the ocean, however, a fan like this one would not have formed.

Response d: Students may now that even fine-grained sediments are deposited at the bottom of rivers and oceans; however, in this case, if sediments are suspended in the water, they may be carried out to the ocean, rather than being deposited into the fan.

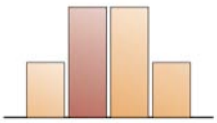
Decide and Act



Pose the next reflect and revise question.



Count off students to form groups and discuss their responses, reviewing their text and notes as resources for thinking. Have each group present its thinking to the class, then ask all students to respond to the question again.



Ask all students to choose to join a group to represent the two most popular responses. Each group develops an explanation to support its response and tries to convince the other group of its position. The other group can pose questions and critique the first group's response. At the conclusion of the discussion, ask all students to respond to the question again.

Contingent Activity: Deposition Patterns

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Goal Facets Addressed by the Activity

Landforms change naturally over time when more material is removed from an area than supplied to the area (erosion), and when more material is supplied to an area than is taken away (deposition).

The force of gravity causes rocks and particles to migrate toward the lowest surface possible. Material tends to accumulate where the land is flatter.

Moving water, and to a lesser extent, wind, act to move (or transport) Earth's particles from one location to another.

Other things being equal, the heavier or bigger the particles, the slower they will be moved by water or wind.

Other things being equal, the faster and the greater the volume of flowing water or moving air, the faster the water or air will move the particles.

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STEP 1. Prompt and review.

Explain to students that an animation will be used to help them understand deposition. Point out that animations can be models of scientific events.

Prompt students about key characteristics of models:

- Represent things that can't be seen (easily)
- Involves cycles of refinement as new evidence is gathered
- Are not perfect representations of phenomena
- Are often intended to have explanatory or predictive power

STEP 2. Present the animation showing deposition patterns to students.

Have students view the following animation in small groups:

http://www.classzone.com/books/earth_science/terc/content/visualizations/es0604/es0604page01.cfm?chapter_no=visualization

Assign the following focus question to guide students' viewing of the animation.

- Can you see any pattern in the grain size of the particles and where they settle?

Have students refer to the animation sequence to show evidence that supports their explanations.

STEP 3. Ask students to interpret and explain the animation.

Have students work in small groups to write a response to the following question:

- In the animation, what do you think best explains the patterns of where the different sized particles settle?

Encourage students to refer to the *Digging Deeper* section in Investigation 6 (pages R49 – R50) to find information that supports their explanations.

STEP 4. Students share interpretations with others.

Guide the discussion using the following questions. Continue with the questions until all the groups have finished presenting their ideas.

- What were the different explanations for the pattern we observed in the animation?
- How did (Group A) explain the observed pattern of where the different particles settled? *Continue until all groups have explained their reasoning.*
- What aspects of the explanation did every group include? Which aspects did some groups put in but others did not?
- Do you disagree with anything a group included in their explanation? If so, explain.

Listen:

When students share their explanations with the class, listen for the following:

Goal Facets	Problematic Facets	Goal Facets
Students understand that the stream flows more slowly as the water gets deeper. As the stream loses speed, it deposits sediment.	Students are not able to describe the pattern that explains how the different particles are deposited.	Students understand that the stream flows more slowly as the water gets deeper. As the stream loses speed, it deposits sediment.
Because gravel is larger and heavier, it gets deposited sooner and closer to the shore; because clay particles are smaller and lighter, the stream carries them for a longer distance before they are deposited.	Students think that all sediments move at the same speed regardless of their size and the speed with which the water moves.	Because gravel is larger and heavier, it gets deposited sooner and closer to the shore; because clay particles are smaller and lighter, the stream carries them for a longer distance before they are deposited.

STEP 5. Ask students to make a prediction about deposition patterns.

Distribute a copy of the following picture to students. (Alternatively, a diagram showing where a river enters a large body of water can be distributed to students).

Working in groups, students respond to the following prompt.

Source: http://en.wikipedia.org/wiki/River_delta

In this picture, where would you expect to find gravel? Where would you expect to find sand? Clay?

Label the image to indicate the locations for gravel, sand, and clay.

Write a 2-3 sentence explanation for why you would expect to find gravel, sand, and clay at the locations you have marked in your diagram.

Student groups write their explanations and submit them to the teacher at the end of the lesson.

Evaluate evidence of student understanding

On the labeled diagrams, students should have marked:

- ✓ The finest particles (clay) as likely to be deposited in the larger body of river
- ✓ The medium-sized particles (sand) in the small delta
- ✓ The largest particles (gravel) in the channel at the bottom of the picture.

Students' explanations should note that:

- ✓ The stream flows more slowly as the river gets wider and the water gets deeper
- ✓ As the stream loses speed, it deposits sediment
- ✓ Because gravel is larger and heavier, it gets deposited sooner and closer to the shore
- ✓ Because clay particles are smaller and lighter, the stream carries them for a longer distance before they are deposited
- ✓ Because sand grains tend to be medium-sized and weigh less than gravel but more than clay, the stream carries them to a distance between the gravel and the clay