

ECOS Inquiry

1. CONTRIBUTOR'S NAME: JOHNNY MACLEAN

2. NAME OF INQUIRY: COMPARING GRAVELS

3. GOALS AND OBJECTIVES:

a. Inquiry Questions: How do rounded river rocks, angular river rocks, and glacial till differ? Why?

b. Ecological Theme(s): The physical environment directly affects ecosystems and habitats. Earth processes contribute to the continual change in the physical environment.

c. General Goal: Students will begin to make connections between biotic and abiotic processes. They will learn one way to deduce ancient environments from observations of breccias and conglomerates.

d. Specific Objectives: Students will make observations regarding gravel morphology (size and shape of rock particles) of gravels from glacial till, a riverbed collecting gravel from a nearby source, and a riverbed with well-traveled gravel. They will conclude from their observations which environment will produce which morphology. They will infer possible ancient environments by observing breccias and conglomerates from Western Montana.

e. Grade Level: 4,5

f. Duration/Time Required:

→ Prep time: 30 minutes

→ Implementing Exercise During Class: 30 minutes

→ Assessment: 10 minutes

4. ECOLOGICAL AND SCIENCE CONTEXT:

Background: Geologists deduce ancient environments by studying the size, shape, and sorting of clasts within breccias and conglomerates (definitions provided below). Students can infer ancient environments as well, once they learn the reasoning involved. There are 2 main concepts to review: roundness and sorting.

Roundness is obviously how rounded a rock is. Gravel that has been transported for many miles in a river typically undergoes physical erosion, causing the sharp corners to break off. The river system acts as a tumbler, and the gravel becomes quite rounded. Alternatively, a river that collects gravel from a nearby mountain will contain angular gravel because it has not yet undergone the physical erosion. Geologists can look at a conglomerate or breccia and determine whether the source mountain for the gravel was close to where the gravel ended up, or whether the gravel traveled miles and miles from the source mountain.

Sorting refers to whether the gravel particles are all the same size, or whether there are 2 or more sizes of particles present. A well-sorted gravel has particles that are all the same size: a poorly-sorted gravel has particles of multiple sizes. River rocks typically have two sizes of particles: one size of gravel and one size of sand. Glacial till typically has multiple sizes of particles. Geologists can discern ancient environments by studying the sorting of breccias and conglomerates.

5. MOTIVATION AND INCENTIVE FOR LEARNING:

Students get to observe rocks and use the same scientific techniques as real geologists. And who doesn't like to 'play with rocks?'

6. VOCABULARY (from www.wikipedia.com):

- Breccia—a sedimentary rock composed of angular fragments in a matrix that may be of a similar or a different material.
- Clasts—broken pieces of older weathered and eroded rocks.
- Conglomerate—sedimentary rocks consisting of rounded fragments and are thus differentiated from breccias, which consist of angular clasts. Both conglomerates and breccias are characterized by clasts larger than sand (>2 mm).
- Glacial till—rock debris, fallen or plucked from a mountain and transported by glaciers or ice sheets.

7. SAFETY INFORMATION:

Students should not throw rocks.

8. MATERIALS LIST (including any handouts or transparency masters):

Rounded river rocks
Angular river rocks
Poorly sorted glacial till
Well-sorted conglomerate (from an ancient valley river)
Well-sorted breccia (from an ancient mountain river)
Poorly-sorted conglomerate (from an ancient glacier)
Data sheet (attached)

9. METHODS/PROCEDURE FOR STUDENTS:

a. Pre-investigation work: Teacher leads students in a discussion of the difference between three environments—mountain glaciers, mountain rivers, and valley rivers. They discuss what types of organisms live in each environment. Then they discuss how these environments could have changed through time, and why people may be interested in what the environment was like a long time ago. Students are then presented with 3 rocks: a poorly-sorted conglomerate, a well-sorted conglomerate, and a well-sorted breccia. They should focus especially on the clasts within the rock. They are asked, “Which rock came from an ancient glacier, which from an ancient mountain river, and which from an ancient valley river? Why did you guess the way you did?”

b. Investigation work:

1) What evidence (data, samples) do students collect? Students discuss and collect observations regarding the three rocks. They make predictions based on their observations as to which rock corresponds to which environment. Then they should come up with (or be led to ask) the question of what current gravels look like in each of the three environments. The teacher presents the three types of gravel, and tells them where they came from (if there are rivers nearby, a short fieldtrip to the river could be very useful). The students make more observations regarding the sizes and shapes of the clasts.

2) How do students present the evidence (data)? Students are to draw pictures and write down observations regarding the clasts’ shapes and sizes in each rock and in each gravel sample. This can be done on the observation sheet or in their science journal.

3) What conclusions are drawn from the evidence students collect? Students draw conclusions regarding which gravel sample corresponds to which rock sample based on their environments.

10. ASSESSMENT:

The teacher should oversee discussions and observations of rock samples and gravels. They should also review the observation sheets or science notebooks.

11. EXTENSION IDEAS:

Students could find different rivers around Missoula and discern whether it contains well-traveled gravel (rounded) or gravel from a proximal source (angular). There are also areas with glacial till near Missoula that parents could take their children to.

Students could discuss the ancient environments around the Missoula area based on the presence of glacial till. The organisms that inhabit western Montana are affected by its climate and physical landscape.

12. SCALABILITY

This inquiry could be scaled to older ages by incorporating more variables such as composition, and by relating all variables to plate tectonic processes.

13. REFERENCES:

www.wikipedia.com

14. EVALUATION/REFLECTION BY FELLOWS AND TEACHERS OF HOW IT WENT:

COMPARING GRAVELS

DATA SHEET

Name _____

Write down your observations in the appropriate box.

Observations of Rock Sample #1	Observations of Rock Sample #2	Observations of Rock Sample #3

Observations of Gravel A	Observations of Gravel B	Observations of Gravel C