

New York: A view from below
Short Performance Assessment

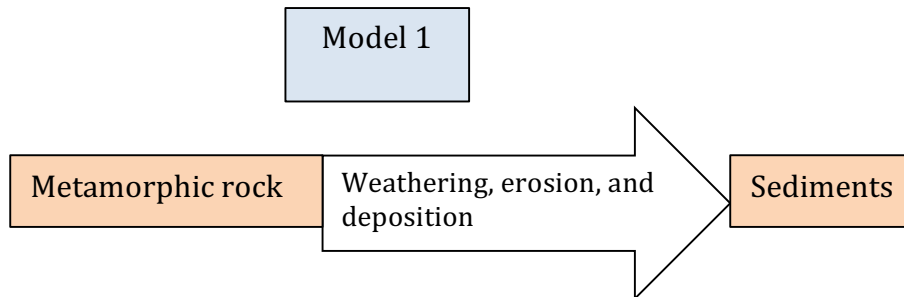
A group of students in New York City are learning about earth science. They believe that processes they are learning about can only be seen in wild and far-away places. But, in fact, evidence of ways that matter is cycled through the earth can be seen in even the biggest cities and busiest neighborhoods.



The picture shown here is New York City's Coney Island. The sand came from a 1.1-billion-year old metamorphic rock. A glacier broke the rock into pieces (sediments or sand) and moved it to this beach.

In this task, you will use what you know about the processes that change the earth to show the students evidence of billions of years of cycling of matter through the earth that can be seen all over their city.

Begin with the sand on Coney Island. To help the students understand how this sand is an example of the cycling of matter, you show them Model 1 below.

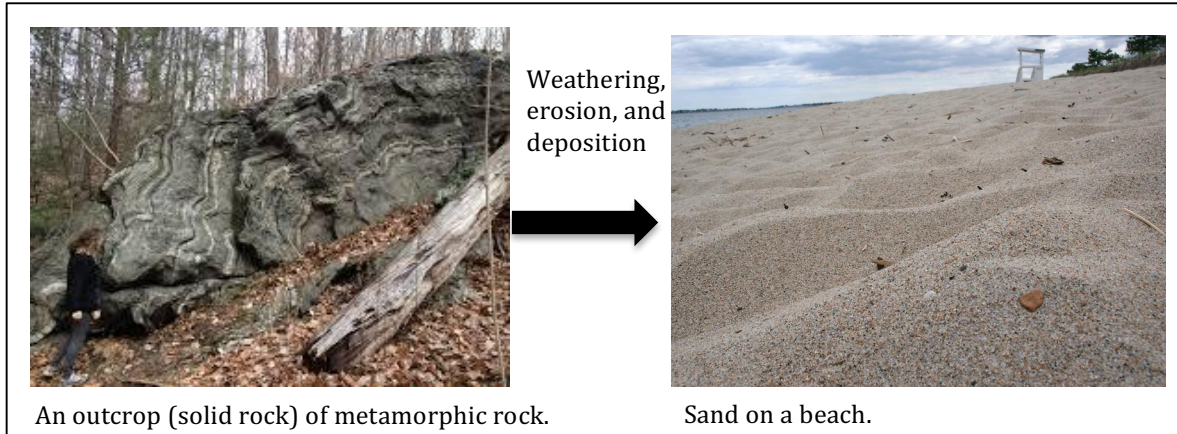


1. Describe to the students what Model 1 shows about how matter was changed to form sand on Coney Island.

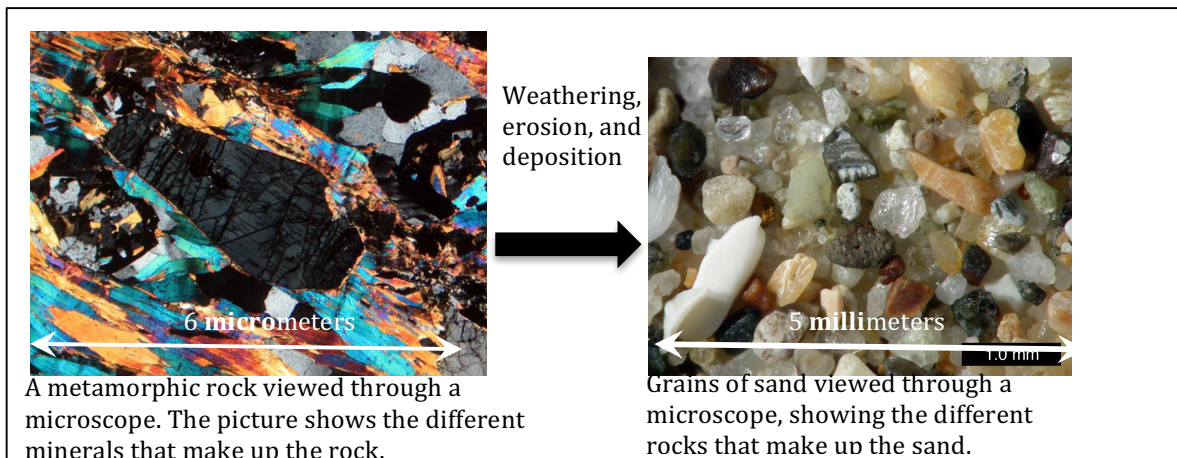
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When you are exploring how rocks changed over time it can help to show changes at different scales. The models below show the changes that the Coney Island sand went through at a large scale and a small scale.

Large-scale model



Small scale model (pictures were taken through a microscope)



2. You have already used one kind of model to describe how matter changed. What new information can you get from examining models at different scales? Use evidence from the model to support your ideas.

a. What does the **large-scale** model show about how the sand formed?

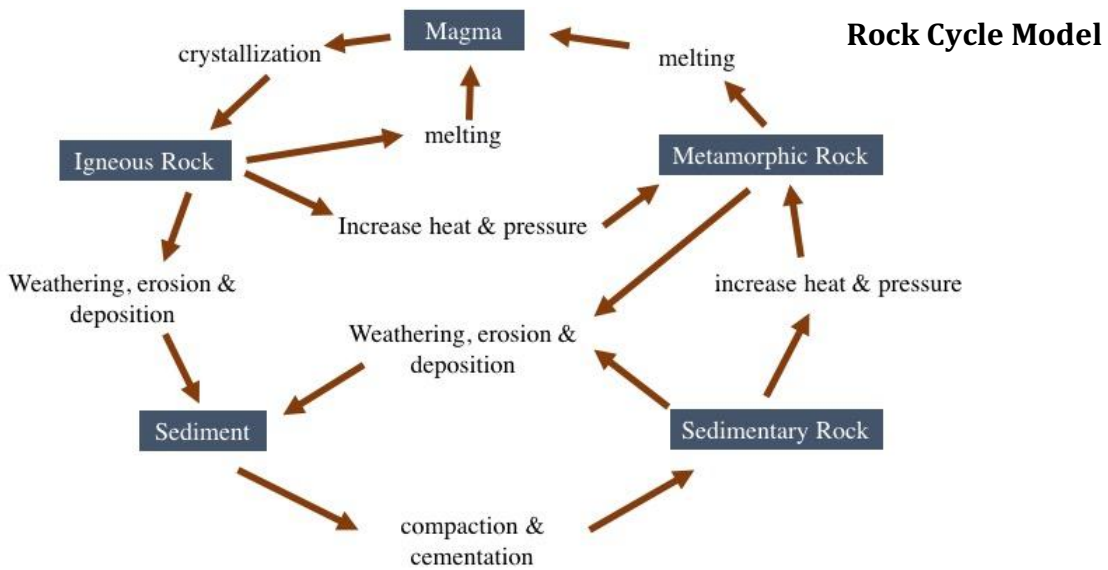
b. What does the **small-scale** model show about how the sand formed?

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3. Glaciers changed some of the bedrock into sand in New York, but some bedrock is still there. In fact, most of the tall buildings in the city sit on parts of the 450-million-year-old bedrock shown here, called Manhattan Schist.

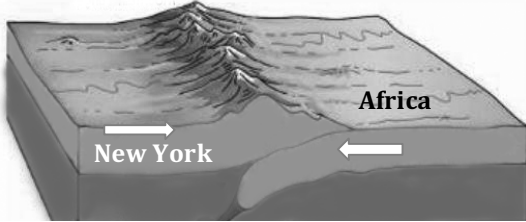
This rock did not always look the way it does today. Two processes that formed it are described in the table below. Answer the questions in the table to describe some of the ways matter was changed over time to form the Manhattan Schist.



You can use the rock cycle model **above** to help you answer the questions in the second column of the table.

How the Manhattan Schist formed	Analysis of changes
<p>Sediments were broken from the land by wind and water and were moved into the ocean at the edge of New York. The sediments were buried deeper under more and more sediments.</p>	<p>What type of new rock formed?</p> <p>What process caused the new rock to form?</p>

Later, the African Plate began moving toward the North American Plate until the two continents collided. This collision compressed all of the rock at the edges of the continents, including the new rock that had formed under the ocean next to New York.



What type of new rock formed?

What process caused the new rock to form?

4. The processes that changed the rocks over time and eventually formed the Manhattan Schist are an example of the movement of matter through the earth system.

Draw a model with arrows and labels that shows how matter was changed over time to form the Manhattan Schist. Your model should use the information you wrote in the table above.

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Energy from the sun is transferred to the earth by sunlight, and this energy drives some of the processes that change rocks.

5. Find a place in your model on the previous page where energy from the sun helped to change the rocks. Label that place with an **S**.

How does energy from the sun help to change the rocks where you put your **S**?



Image credits:

Images for Large-scale model: sites.temple.edu

celestecota.photoshelter.com

http://4.bp.blogspot.com/-92B_90upLQw/UObmlaUTW0I/AAAAAAAAAZQ/q1oqtm5w1EE/s1600/areia01.jpg

Images for Small-scale model: pugnacitas.blogspot.com

<http://www.alexstrekeisen.it/english/meta/amphibolitefelsic.php>