Name: _____ Date: _____

The Rock Cycle: A Pebble's Very Long Trip

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Halima was ten when she helped Mr. Bashir, the stonemason next door, rebuild his garden wall. She lifted a flat gray stone from the pile and stopped. Pressed into one face was the print of a seashell, and the nearest ocean was far, far away. "How does a seashell get inside a rock?" she asked. Mr. Bashir grinned. "You just asked about the rock cycle," he said. "Every rock on Earth is on a very long trip."

"Start at the bottom of a sea," he said. "Shells and coral, sand and mud, all sinking and settling in slow layers while sea animals live and die above them." Most of the grains in limestone are tiny broken pieces of shells and coral, left behind by sea animals when they died. Halima looked at the shell again. "I think your stone is limestone," said Mr. Bashir, "so it began as part of an old sea floor."

More layers piled on top, and their weight squeezed the layers below, while minerals seeped into the gaps and glued the grains together. Loose sand and mud had slowly become solid stone, which is called sedimentary rock. "That is why your shell is still there," said Mr. Bashir. Halima ran her thumb over the ridges of the print and frowned. "Would a shell survive in a rock that melted?" she asked. "No," he said. "The heat would erase it."

Next he tapped the gray step by his door. "Different story," he said. Deep in the Earth, rock can get hot enough to melt. Melted rock underground is called magma, and when it cools and hardens it becomes igneous rock. Halima looked at the step through a hand lens and saw that it was speckled with crystals big enough to see. That is granite, and its crystals grew big because the magma cooled slowly, deep underground.

He pointed to a black stone in the wall. "Basalt," he said. "Lava cooled fast on the surface, so the grains are too small to see." Halima held the two stones up, one in each hand, and Mr. Bashir told her that both are igneous rock, and how fast each one cooled is a big reason they look so different. Basalt is the most common volcanic rock on Earth, and the Hawaiian islands and much of the ocean floor are made of it.

"The third kind needs no melting," he said. "Picture limestone buried deep. Heat and pressure squeeze it, but it does not melt." Rock that is changed that way, without ever melting, is called metamorphic. Limestone buried deep and squeezed becomes marble, the white stone that covers the outside of the Taj Mahal. Mud changed the same way becomes slate, which splits into thin sheets. Halima found a slate chip in the pile and peeled a layer off with her fingernail.

Halima drew a circle in the dust: igneous, sedimentary, metamorphic, with arrows between them. Mr. Bashir smudged it with his boot, and while Halima stared at the smudge he said, "More like a web." Any kind of rock can be pushed deep, melted, and made again as igneous

rock. Any kind can be broken into sand. There is no fixed order, because a rock goes wherever the places it finds itself take it.

"What pushes rocks around?" she asked. "The ground itself," said Mr. Bashir. Earth's outer shell is cracked into seven or eight huge pieces called plates, and they move about as fast as your fingernails grow. Where one plate slides down under another, rock is carried deep into the Earth, and some of it melts. Where plates push together, rock is squeezed and lifted. A trip around the cycle can take far longer than any person lives.

That is how a sea floor reached the top of the world. The summit of Mount Everest is limestone, with pieces of ancient sea animals in it, including trilobites. India crashed into Asia, and the old sea floor was shoved upward. Everest is still rising, by about 2 millimeters a year. Halima looked at the stone in her hand. "A mountain," said Mr. Bashir, "is a sea floor lifted into the sky."

Mr. Bashir showed her a photo of the Grand Canyon. Nearly forty rock layers make up its walls, like pages in a very tall book, and the upper ones came from ancient shores and seas. "Walking down is walking back in time," he said. "But the first pages are missing." The rock cycle has recycled most of what came before. The oldest rocks found so far are about four billion years old, while the Earth is 4.54 billion.

Halima kept the shell stone. She picked up the other pebbles from the pile, one at a time, and looked closely at each one. Does it have layers? Does it have crystals? Does it look like glass, or like a sponge? Those clues help geologists guess the kind of rock, though sometimes even they cannot tell without special tools. What will her stone become a hundred million years from now? Nobody knows.

Questions

1. How does the book say a seashell can end up inside a rock?

A. Someone glued it there
B. Lava carried it up
C. Sea animals leave shells that become part of limestone

2. What makes a rock metamorphic?

A. It cools from lava
B. It is changed by heat and pressure without melting
C. It is washed by a river

3. Why does Mr. Bashir smudge Halima's circle drawing?

A. Rocks can go many ways, so the cycle is not one fixed circle
B. He does not like drawing
C. Rocks only move in one direction

4. Why do granite crystals grow big enough to see?

A. Lava cooled fast

B. The magma cooled slowly underground

C. Frost cracked the rock

5. Why are the oldest rocks younger than the Earth?

A. The Earth is not very old

B. The rock cycle has recycled most of the older rock

C. Scientists lost them

Words to know

magma: melted rock underground
sedimentary: layered rock
metamorphic: changed by heat
plates: Earth's shell pieces
limestone: seashell rock
geologist: rock scientist

Answer key: The Rock Cycle: A Pebble's Very Long Trip

1. C. Sea animals leave shells that become part of limestone
2. B. It is changed by heat and pressure without melting
3. A. Rocks can go many ways, so the cycle is not one fixed circle
4. B. The magma cooled slowly underground
5. B. The rock cycle has recycled most of the older rock