THE STANDARD

Cycling of Earth's Materials

Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

ANCHORING PHENOMENON

The Layered Highway Road Cut

A photo (or a field trip if you can swing it) of a highway road cut showing 20 distinct horizontal layers of rock, each a different color. The bottom layers are gray limestone full of tiny shell fragments. The middle layers are red sandstone. The top is dark shale. Students notice immediately that the layers look like a stack of pancakes and that each one used to be something at the surface. The question that sticks: how did all of this used to be loose stuff, and what's holding it together now?

> DRIVING QUESTION
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> *"How did 30 meters of solid rock get built up in layers, and how long did it take?"*

INVESTIGATIVE 1

Marble Countertops, Limestone Floors

A piece of polished marble next to a piece of polished limestone. Same atoms (calcium carbonate). Almost identical chemistry. But marble has swirly veins and a crystalline shine. Limestone has fossils and a duller surface. Use this one to sharpen the heat-and-pressure lens the anchor is pushing on. The marble used to be limestone before it got cooked and squeezed deep underground.

> DRIVING QUESTION
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> *"If marble and limestone are basically the same chemical, why do they look and feel so different?"*

INVESTIGATIVE 2

Yellowstone Hot Springs and the Grand Canyon

Two photos side by side. Yellowstone hot springs steaming and bubbling, fed by magma a few kilometers underground. The Grand Canyon, a mile deep, carved by the Colorado River over six million years. Same planet, two completely different energy sources making the landscape. Yellowstone is internal heat doing visible work. The Grand Canyon is solar energy (driving the water cycle, driving the river) doing visible work over deep time.

> DRIVING QUESTION
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> *"These two places are reshaping themselves right now. Where is the energy coming from in each one, and how does it connect to the rock cycle?"*