Clues in Stone

Sequence a road cut using fossils, rock layers, and measured ages.

ESS.5.a "Analyze and interpret data to sequence events in Earth's history, including relative and absolute dating techniques, principles of superposition and crosscutting relationships, igneous intrusions, radiometric dating, and the fossil record."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline clues about what lies above or cuts another feature, circle each measured age, and number the four features in the table from oldest to youngest.

The Road Cut

1. At a road cut, a geologist sees clues to an ancient landscape. A sandstone layer lies beneath a shale layer. The sandstone contains a trilobite fossil, while the shale contains an ammonite fossil. Fossils help scientists compare rocks across locations, but a fossil alone does not give a rock an exact numerical age.

2. A granite dike slices through both sedimentary layers but ends beneath an ash bed. The ash rests on the shale and has no cut from the dike. A rock must exist before something cuts through it. The table records where each feature occurs and what laboratory dating found.

EVIDENCE FROM THE ROAD CUT

Feature	Field evidence	Measured age
Sandstone	Lowest layer; trilobite fossil	Not measured
Shale	Above sandstone; ammonite fossil	Not measured
Granite dike	Cuts both layers; stops below ash	110 million years
Ash bed	Above shale; uncut by dike	90 million years

3. The laboratory measured uranium-lead ages of zircon crystals formed in the magmas that produced the dike and ash. These ages help date the igneous events, not the times when the fossils lived. Use the layers' positions, the dike's path, and the measured ages together to reconstruct events without assigning exact ages to the sedimentary layers.

2 ANSWER WITH EVIDENCE

Use the passage

1. Which fossil is in the older sedimentary layer? What evidence establishes that order?

2. Did the granite dike form before or after the shale? Explain using a field observation.

3. Which formed first, the granite dike or the ash bed? Give both a field clue and a measured age that support your answer.

4. Can the dike's measured age give the shale an exact age? State what the age does tell you about the shale.

3 YOUR TURN

Your own words

Now suppose a fault cuts the ash bed, and a basalt dike dated to 70 million years ago fills the fault. In four or five sentences, sequence all six features from oldest to youngest and justify your order with at least two kinds of evidence.

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PART 1 · READ AND MARK

Underline clues about what lies above or cuts another feature, circle each measured age, and number the four features in the table from oldest to youngest. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which fossil is in the older sedimentary layer? What evidence establishes that order?	**The trilobite is in the older layer because its sandstone lies beneath the shale containing the ammonite.**
2	Did the granite dike form before or after the shale? Explain using a field observation.	**After the shale. The dike cuts through it, so the shale had to exist first.**
3	Which formed first, the granite dike or the ash bed? Give both a field clue and a measured age that support your answer.	**The dike formed first. It stops below the uncut ash, and its measured age is 110 million years, compared with 90 million years for the ash.**
4	Can the dike's measured age give the shale an exact age? State what the age does tell you about the shale.	**No. The shale is older than 110 million years because the 110-million-year-old dike cuts through it.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The sandstone formed first, followed by the shale, because the sandstone lies beneath it. The 110-million-year-old granite dike came next because it cuts both layers, and the 90-million-year-old ash followed because the dike does not cut it. The fault formed after the ash because it cuts that bed. Finally, the 70-million-year-old basalt dike filled the fault, placing it last in a sequence that also agrees with the measured ages.

Accept equivalent sequences that place sandstone, shale, granite dike, ash bed, fault, and basalt dike in that order. Students should use layer position or crosscutting relationships and measured ages as evidence.