

Fixing Dev's Field Report: Six Errors About Rock Layers

Learning target: I can find the errors in a student's report about a quarry wall, explain which rule each error breaks or misuses, and rewrite each statement correctly.

Error analysis

About 40 min

Individual

MS-ESS1-4 · practice

writing

independent practice

discussion

Name _____

Date _____

Period _____

Directions

Dev visited Hawk Ridge quarry and wrote a seven-statement report. Six statements contain an error; one is correct. Part A: decide which is which and name the rule or idea each wrong statement misuses. Part B: for each error, explain what went wrong and rewrite the statement so it is true. Part C: write Dev a short note about the one big idea he keeps missing. Use the figure and the clue list; everything you need is on this sheet.

You will need: This worksheet, Pencil

The quarry wall

Hawk Ridge quarry wall, top to bottom

D Gray limestone (1 m), not cut by the fault, cut by the dike	top
C Tan sandstone (4 m), the thickest layer; cut by the dike and the fault	
B Black shale with fossil K (1.5 m); cut by the dike and the fault	
A Red siltstone (2 m); cut by the dike and the fault; bottom not exposed	bottom

Layers A to D are flat and unbroken except where the dike and the fault cut them. Clues: the dike cuts A, B, C and D. The fault offsets A, B and C by 1 m and stops at the base of D. In a corner of the quarry, layers A and B are bent into a tight fold; at the top of the fold, B lies underneath A. A sand grain from layer C was tested by a lab and found to have 25% of its uranium-235 left (half-life 704 million years). Fossil K, a ribbed clam whose species existed for about 150 million years, is found in layer B here and in a layer in Nevada.

Dev's report (seven statements) — 1. Layer C is the thickest, so it is the oldest; a thick layer takes the longest time to pile up. 2. The fault goes deeper than any layer I can see, so it is the oldest feature in the quarry. 3. The dike is younger than layers A, B, C and D because it cuts through all of them. 4. In the folded corner, B is under A, and the law of superposition says the bottom layer is always oldest, so in that corner B is older than A and the rule still works. 5. Layer B here and the layer in Nevada both have fossil K, so they formed at exactly the same time. 6. The sand grain from layer C has 25% of its uranium-235 left, so layer C is 1,408 million years old. 7. After two half-lives, 50% plus 50% of the uranium has decayed, so none of it is left.

Part A: Diagnose

1. For each statement write 'correct' or 'error'. For each error, name the rule or idea it misuses (choose from: superposition, cross-cutting relationships, index fossil / fossil succession, absolute dating, half-life, original horizontality). 7 pts

Statement	Correct or error?	Rule or idea misused
1		
2		
3		
4		
5		
6		
7		

Part B: Explain and rewrite

For each wrong statement, write two or three sentences: first what Dev got wrong and why, then the statement rewritten so that it is true for Hawk Ridge.

2. Statement 1 (the thick layer). 2 pts

3. Statement 2 (the deep fault). 2 pts

4. Statement 4 (the folded corner).

2 pts

5. Statement 5 (fossil K in Nevada).

2 pts

6. Statement 6 (the sand grain).

2 pts

7. Statement 7 (two half-lives).

2 pts

Part C: A note to Dev

8. Several of Dev's errors come from the same habit: using a rule without checking the condition it needs, or using a number without asking what it measures. Write Dev a short note (four to six sentences) that names this habit, gives two examples from his report, and tells him one question to ask himself before he writes a conclusion.

4 pts

Test each statement against its rule

For every statement, find the rule Dev is using and write its full version, including any condition: 'In an UNDISTURBED stack, bottom is oldest.' 'A feature that CUTS rock is YOUNGER than that rock.' 'Same SHORT-LIVED fossil means ABOUT the same age.' 'Absolute dating works on IGNEOUS rock whose clock started when it formed.' 'Each half-life removes HALF OF WHAT IS LEFT.' Then ask whether the quarry meets the condition. If it does not, you have found the error.

Write statement 8

Dev did not notice that the fault stops at the base of layer D. Write a correct statement 8 that uses this clue to place the fault in the quarry's history relative to layers C and D and relative to the dike. Then explain why the fault and the dike cannot be the same age, and what you would look for at the spot where the dike crosses the fault to prove which came first.