

The Boundary Committee: Deciding Where Deep Time Gets Divided

Investigation question: Given a record of which fossil groups occur in each of twelve rock layers, where should the major boundaries of a time scale be drawn, and what rule should a committee use to decide?

Data-driven decision

Groups of 4

1 session

Setup 5 · Activity 40 · Cleanup 5 min

MS-LS4-1 · practice

MS-ESS1-4 · practice

Name _____

Group _____

Date _____

Your role today

- ☐ **Data reader:** Reads the presence table layer by layer, naming which groups are present, which are new, and which have disappeared since the layer below.
- ☐ **Calculator:** Counts groups per layer, computes groups lost and percent lost ($\text{lost} \div \text{groups in the layer below} \times 100$), and records them in the tally table.
- ☐ **Grapher:** Plots the number of groups against layer number as a line graph and marks every drop with its percent.
- ☐ **Committee chair:** Records the committee's rule before any calculating, runs the vote on each candidate boundary, and writes the decision table and the one-paragraph decision statement.

Safety

- Paper and pencils only; no chemicals, heat or sharp tools beyond a ruler.
- No physical hazards. If groups move to present at the board, keep bags and chairs out of the walkway.

Procedure

1. Before any counting, look at the presence table and record in q1 where your group thinks the biggest change in the fossil record happens, by eye alone.
2. As a committee, set a rule for what counts as a boundary-sized loss, and have the chair write it in q2 before calculating. A rule must be a number (a percent or a count of groups lost) that can be checked.
3. For each layer from 1 to 12, the data reader names the groups present. The calculator counts them and records the number in the tally table.
4. For each layer from 2 to 12, list the groups present in the layer below that are absent in this layer (lost) and the groups present in this layer that were absent in the layer below (new). Record both counts.
5. Compute percent lost for each layer: $\text{groups lost} \div \text{number of groups in the layer below} \times 100$, rounded to a whole number. Check that layers with no losses read 0 percent.

- ## Record your observations

The fossil groups and layers below are **invented for this investigation** (a teaching dataset). An X means fossils of that group were found in that layer. Layer 1 is the oldest and layer 12 the youngest. Percent lost = groups lost ÷ number of groups in the layer below × 100.

Fossil-presence table (teaching dataset, simulated)

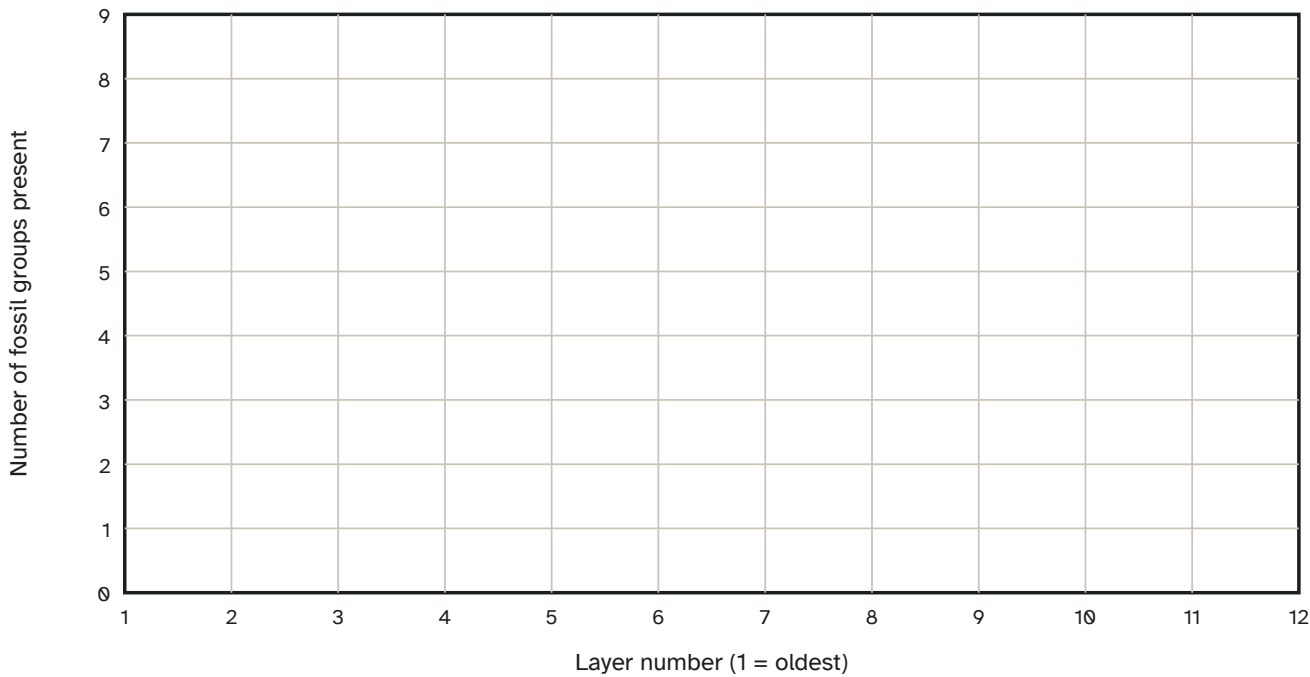
Simulated teaching dataset: the numbers are invented to be realistic, not measured.

[illegible]

Tally table

Layer	Number of groups present	Groups lost since the layer below (names)	Number lost	Percent lost	New groups (names)
1		-	-	-	-
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Number of fossil groups present in each layer



Decision table

Candidate boundary (between layers)	Groups lost	Percent lost	Passes our rule? (yes/no)	Vote (for/against)	Rank among passing boundaries

1. Before counting: looking at the table by eye, between which two layers does the biggest change seem to happen? Why do you think so?

2. Our committee's rule for a boundary-sized loss (write it as a number that can be checked):

Analysis questions

3. Between which two layers is the largest loss? Give the number of groups lost, the number in the layer below, and the percent lost, with the calculation.

4. Between which two layers is the second-largest loss? Show the percent calculation. Did it pass your rule?

5. One group, the armored fish, disappears between layers 7 and 8 (a 20 percent loss). Give one reason a committee might count this as a boundary and two reasons it might not, including a cause other than extinction that could make one group vanish from a layer.

6. Which group is present in every layer, and which group survives both of the large losses after first appearing? What can and cannot be concluded about a group that survives?

7. Look at where new groups first appear. Describe the pattern you see after each large loss, and give an explanation for it.

8. Your boundaries are in layer order only. If you could measure an absolute age from two volcanic ash beds in this sequence, where would you want them, and what would each date let you say that you cannot say now?

9. A neighboring committee used a different rule and drew three boundaries instead of two. Can both committees be doing science correctly? What would settle the disagreement?

10. Of the twelve fossil groups, how many are present in layer 12, and what percent of all twelve is that? How many groups appeared somewhere in the sequence and later vanished? Show your work.
