



GCE A LEVEL

A480U10-1



TUESDAY, 3 JUNE 2025 – MORNING

GEOLOGY – A LEVEL COMPONENT 1

Geological Investigations

2 hours 15 minutes plus your additional time allowance

Surname

First name(s)

Centre Number

Candidate Number

2

ADDITIONAL MATERIALS

- the Resource Sheet
- the Mineral Data Sheet
- the Photographs of Specimens
- SPECIMENS C, D, F and G
- geological equipment for testing specimens
- a strip of plain paper
- a calculator
- a ruler
- a protractor

INSTRUCTIONS TO CANDIDATES

Answer ALL questions.

Use black ink, black ball-point pen or your usual method.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces on the previous page.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

(Turn over)

INFORMATION FOR CANDIDATES

This paper is in 2 sections, A and B.

Section A: 30 marks. Answer BOTH questions. You are advised to spend about 35 minutes on this section.

Section B: 75 marks. Answer ALL questions. You are advised to spend about 1 hour 40 minutes on this section.

The geology is NOT designed to represent any particular area.

The Mineral Data Sheet and MAP 1 are provided on separate resource sheets.

Four specimens, C, D, F and G, are provided for use.

The number of marks is given in brackets at the end of each question or part-question.

The assessment of the quality of extended response (QER) will take place in questions 2 and 6.

(Turn over)

SECTION A

Answer ALL questions.

1 FIGURE 1a opposite is a graph showing the relationship between the temperature and time after burial of a source rock required for oil and gas to form.

(a) Refer to FIGURE 1a.

(i) State the minimum temperature which must be reached for gas formation to begin in a source rock buried for 200 million years. [1 mark]

(ii) State the time after burial when oil formation will begin, if a source rock has been heated to 60°C. [1 mark]

(Turn over)

1 (a)(iii) Explain how oil is converted to gas at higher temperatures. [1 mark]

1 (b) FIGURE 1b opposite is a cross-section through the Ekofisk oil field in the North Sea.

(i) Complete TABLE 1 by stating the ROCK UNITS that act as the source, reservoir and cap rock in the Ekofisk oil field. [3 marks]

TABLE 1

Feature of the oil field	Rock unit
source rock	•
reservoir rock	•
cap rock	•

(Turn over)

1 (b)(ii) State the environment and climatic conditions required for the deposition of chalk.

[2 marks]

Environment _____

Climatic conditions _____

(Turn over)

- 1 (b)(iii) Account for the shape of the halite deposit within the Ekofisk oil field shown in FIGURE 1b. [2 marks]**

- (c) FIGURE 1c opposite shows the results of a geophysical survey to locate hydrocarbon deposits in the North Sea.**

- (i) Name the type of geophysical survey used to collect the data shown in FIGURE 1c. [1 mark]**

(Turn over)

1 (c)(ii) State the name of ONE type of hydrocarbon trap shown in FIGURE 1c.

Draw a vertical line on FIGURE 1c to indicate the best location for a vertical borehole to be drilled to establish whether hydrocarbons are present in this hydrocarbon trap.

Explain your choice of location. [3 marks]

Type of trap _____

Explanation _____

(Turn over)

1 (d) Describe how geologists use microfossils when prospecting for oil and gas. [3 marks]

17

(Turn over)

2 FIGURE 2a opposite shows a drawing of a fossil sketched by the geologist William Smith.

(a) State the fossil group shown in FIGURE 2a. Give ONE reason for your answer. [2 marks]

Fossil group _____

Reason _____

(Turn over)

2 (b) FIGURE 2b opposite shows a rock outcrop in Scotland, used by the geologist James Hutton to develop the principle of uniformitarianism.

- (i) Measure the apparent dip angle of the bedding planes in Rock Unit 2. [1 mark]**



- (ii) Describe how the true dip angle and direction of the bedding planes in Rock Unit 2 could be measured by a geologist visiting the site shown in FIGURE 2b. You may wish to use an annotated diagram(s) in your answer. [4 marks]**

(Turn over)

2 (c) Describe:

- the rock cycle processes that have formed the geological features that can be seen in **FIGURE 2b**
- how the principle of uniformitarianism enabled James Hutton to demonstrate at this outcrop that geological processes take place over millions of years.

You may wish to use an annotated diagram(s) as part of your answer. [6 QER marks]

(Turn over)

13

SECTION B

Answer ALL questions.

3 SPECIMEN D is a cast of a fossil collected from ROCK UNIT D on MAP 1.

(a) Draw a diagram of SPECIMEN D using the scale provided. [5 marks]



(Turn over)

**3 (b) FIGURE 3 opposite is a fossil identification key.
State the name of SPECIMEN D using FIGURE 3.**

[1 mark]

SPECIMEN D _____

(Turn over)

**3 (c) Suggest the probable mode of life of SPECIMEN D.
Give TWO reasons for your answer. [3 marks]**

Mode of life _____

Reason 1 _____

Reason 2 _____

9

(Turn over)

- 4 A student investigated a fossil species found at LOCALITY 1 and LOCALITY 2 in ROCK UNIT D on MAP 1. TABLE 2 shows the number of fossils, the maximum length of each fossil and the percentage of unbroken fossils at the two localities.

TABLE 2

	LOCALITY 1	LOCALITY 2
Total number of fossils	22	12
Maximum length of each fossil (mm)	24, 34, 37, 38, 31, 29, 32, 34, 28, 33, 41, 38, 32, 34, 30, 29, 31, 38, 29, 35, 34, 28	27, 47, 22, 34, 51, 21, 44, 25, 21, 39, 32, 19
Percentage of unbroken fossils (%)	78	45

(Turn over)

4 (a) Refer to TABLE 2. The student intended to test the null hypothesis that

“there is no significant difference between the maximum length of the fossils at the TWO localities.”

Suggest the most suitable statistical test to use by ticking ONE of the boxes below. Give a reason for your answer. Tick (✓) only ONE box.

[2 marks]

Spearman's Rank

☐

Chi-squared

☐

Mann-Whitney U test

☐

Reason _____

(Turn over)

4 (b) The student concluded that the fossils at LOCALITY 1 are more likely to be a death assemblage than the fossils at LOCALITY 2. Evaluate this statement.

[3 marks]

5

(Turn over)

5 SPECIMEN C was collected from ROCK UNIT C at LOCALITY 3 on MAP 1.

**(a) State the name of the rock forming SPECIMEN C.
Give TWO reasons for your answer. [3 marks]**

Rock name _____

Reason 1 _____

Reason 2 _____

(Turn over)

5 (b) ROCK UNIT C forms an igneous body. A student concluded that it is a lava flow.

Evaluate this statement using evidence from SPECIMEN C and MAP 1. [3 marks]

6

(Turn over)

- 6 Plan a field investigation to collect evidence from the area within Box M on MAP 1. Your investigation must enable the relative age relationships between ROCK UNIT C and ROCK UNIT A to be determined.**

For each piece of evidence state:

- **what you would observe/measure**
- **how you would collect the data**
- **why you are collecting the data.**

You may wish to use an annotated diagram(s).

[9 QER marks]

(Turn over)

9

7 SPECIMEN G was collected at LOCALITY 4 on MAP 1.

(a)(i) Refer to the Mineral Data Sheet. Complete TABLE 3 by:

- **stating the result of the described lustre observation**
- **describing ONE other diagnostic test/observation, and stating the result, to confirm the identity of the mineral forming SPECIMEN G.**

[3 marks]

TABLE 3

Description of test/observation	Results of test/observation
scratch with a fingernail and copper coin	not scratched by fingernail but is scratched by copper coin
observe the reaction with dilute HCl	no reaction
observe the lustre (the appearance of the surface in reflected light)	•
•	•

(Turn over)

7 (ii) Name the mineral forming SPECIMEN G. [1 mark]

Mineral _____

(b) Explain why SPECIMEN G was formed at LOCALITY 4. [3 marks]

7

(Turn over)

8 SPECIMEN F was collected from ROCK UNIT F on MAP 1.

(a)(i) Describe the texture of SPECIMEN F. [3 marks]

(ii) Name ONE rock-forming mineral found in SPECIMEN F. [1 mark]

(Turn over)

8 (b) SPECIMEN F is a metamorphic rock. A student concluded that it was formed as a result of:

- regional metamorphism
- of limestone
- at a high grade
- following burial to a maximum depth of 100m.

Evaluate the student's conclusion, giving reasons for your answer. [4 marks]

(Turn over)

8

- 9 MAP 2 shows the area of MAP 1. The key for the rock units is the same as for MAP 1.**

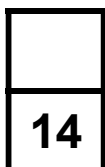
On MAP 2 opposite clearly mark and label the position of THREE synformal fold axial plane traces using the symbol in the key. [3 marks]

3

10 The topographic profile opposite was taken along the line X–Y on MAP 1.

Construct the geological cross-section along this line using MAP 1 and the BOREHOLE DATA on the Resource Sheet.

- **Draw the rock units. Use similar ornament, or letters, for those on MAP 1.**
- **Draw and label any FOLD AXES, with the correct symbol.**
- **Draw any FAULTS.**
- **PROJECT the rock units and structures ABOVE the ground surface to illustrate any cross-cutting relationships. [14 marks]**



11 A core sample was obtained from ROCK UNIT A on MAP 1. The sample was tested by compressing the ends of the core and measuring the strain. The results are shown in FIGURE 11a opposite.

(a) Describe the relationship between stress and strain shown in FIGURE 11a opposite. [2 marks]

(b) State the type of strain between the following points on FIGURE 11a: [2 marks]

0 and J _____

J and L _____

(Turn over)

- 11 (c) Complete FIGURE 11b opposite by sketching TWO cores to show the shape of the core that would be expected if the stress was removed having reached a point between 0 and J, and a point between J and K on FIGURE 11a. [3 marks]
- (d) The geological structures formed at LOCALITY 5 and LOCALITY 6 in ROCK UNIT A on MAP 1 can be related to the experimental data on FIGURE 11a.
- (i) Complete TABLE 4 by adding ONE tick (✓) in the LOCALITY 5 COLUMN to match the geological feature at LOCALITY 5 to the section of the graph. Tick only ONE box. [1 mark]

TABLE 4

Section of FIGURE 11a	LOCALITY 5	LOCALITY 6
Between 0 and J		
Between J and K		✓
Between K and L		
At point L		

(Turn over)

11 (d)(ii) Give a reason for your choice in TABLE 4 for LOCALITY 5 and justify the tick in TABLE 4 for LOCALITY 6. [2 marks]

Reason for LOCALITY 5

Justification for LOCALITY 6

(Turn over)

11 (e) Suggest and explain the conditions that caused ROCK UNIT A to behave differently during deformation at LOCALITY 5 and LOCALITY 6.

[4 marks]

14

END OF PAPER

(Turn over)

Acknowledgement

FIGURE 2b Photograph Stuart Sutherland

(Turn over)

QUESTION NUMBER	ADDITIONAL PAGE, IF REQUIRED. WRITE THE QUESTION NUMBER(S) IN THE LEFT-HAND MARGIN.

(Turn over)

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(Turn over)

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For Examiner's use only			
	Question	Maximum Mark	Mark Awarded
Section A	1	17	
	2	13	
Section B	3	9	
	4	5	
	5	6	
	6	9	
	7	7	
	8	8	
	9	3	
	10	14	
	11	14	
	Total	105	

FIGURE 1a

Time after burial (10^6 years)

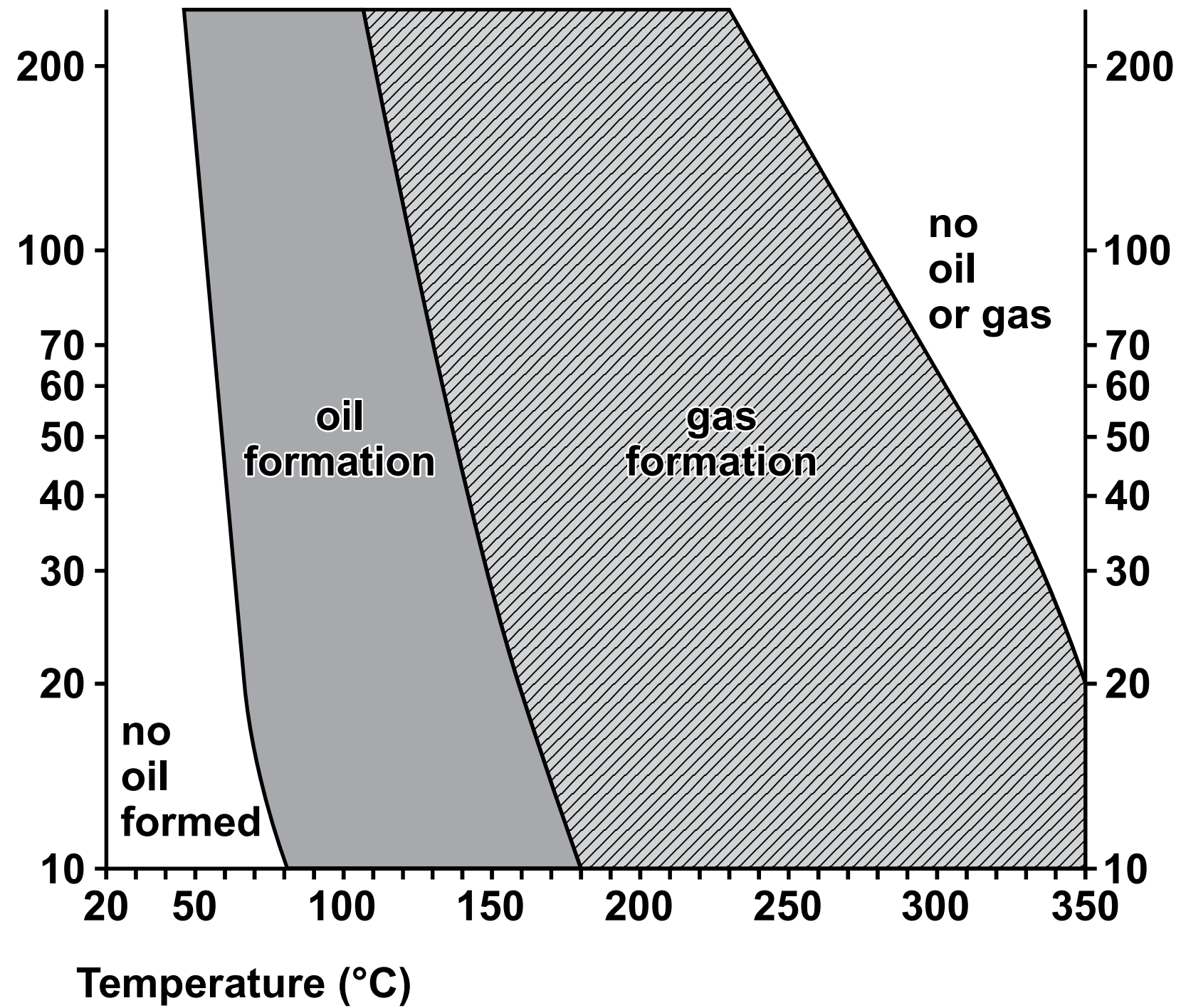


FIGURE 1b

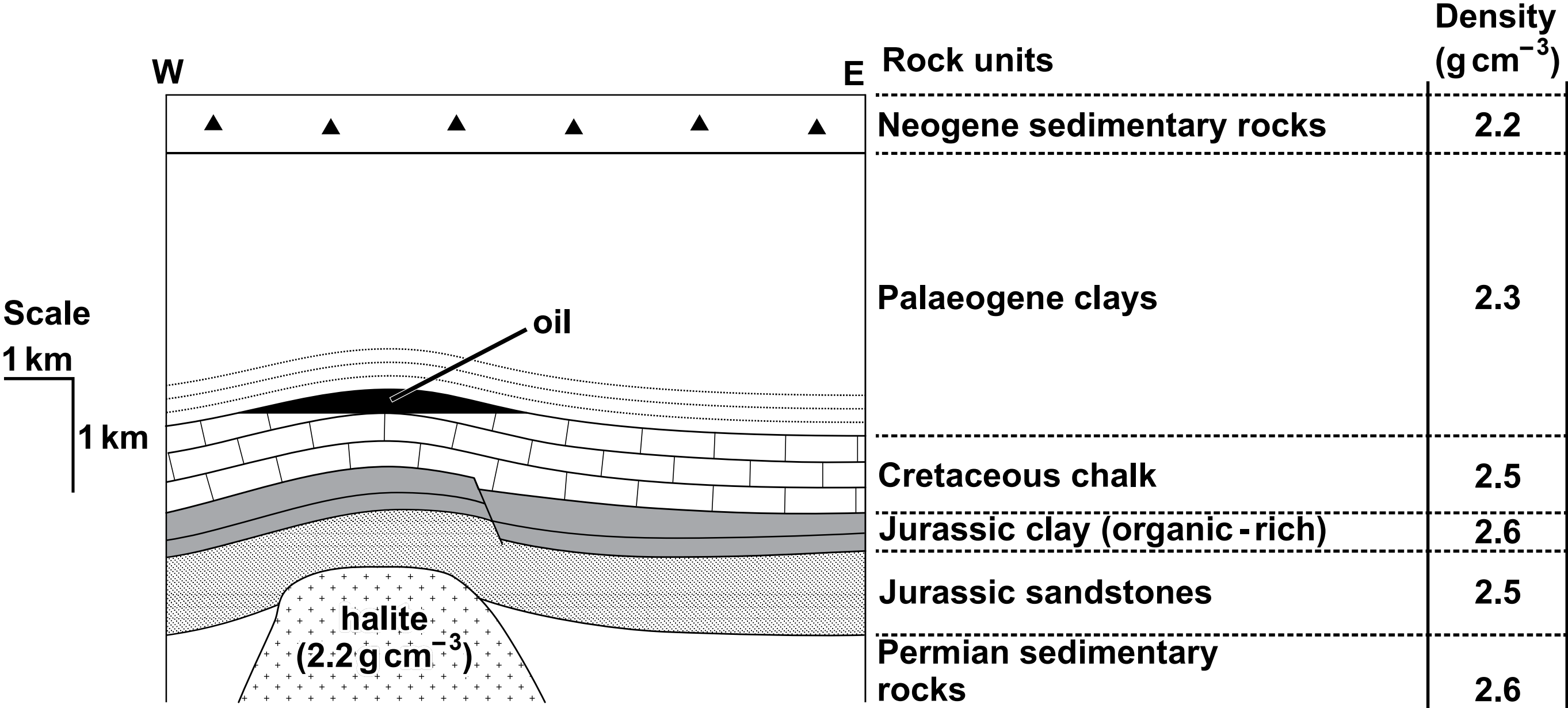


FIGURE 1c

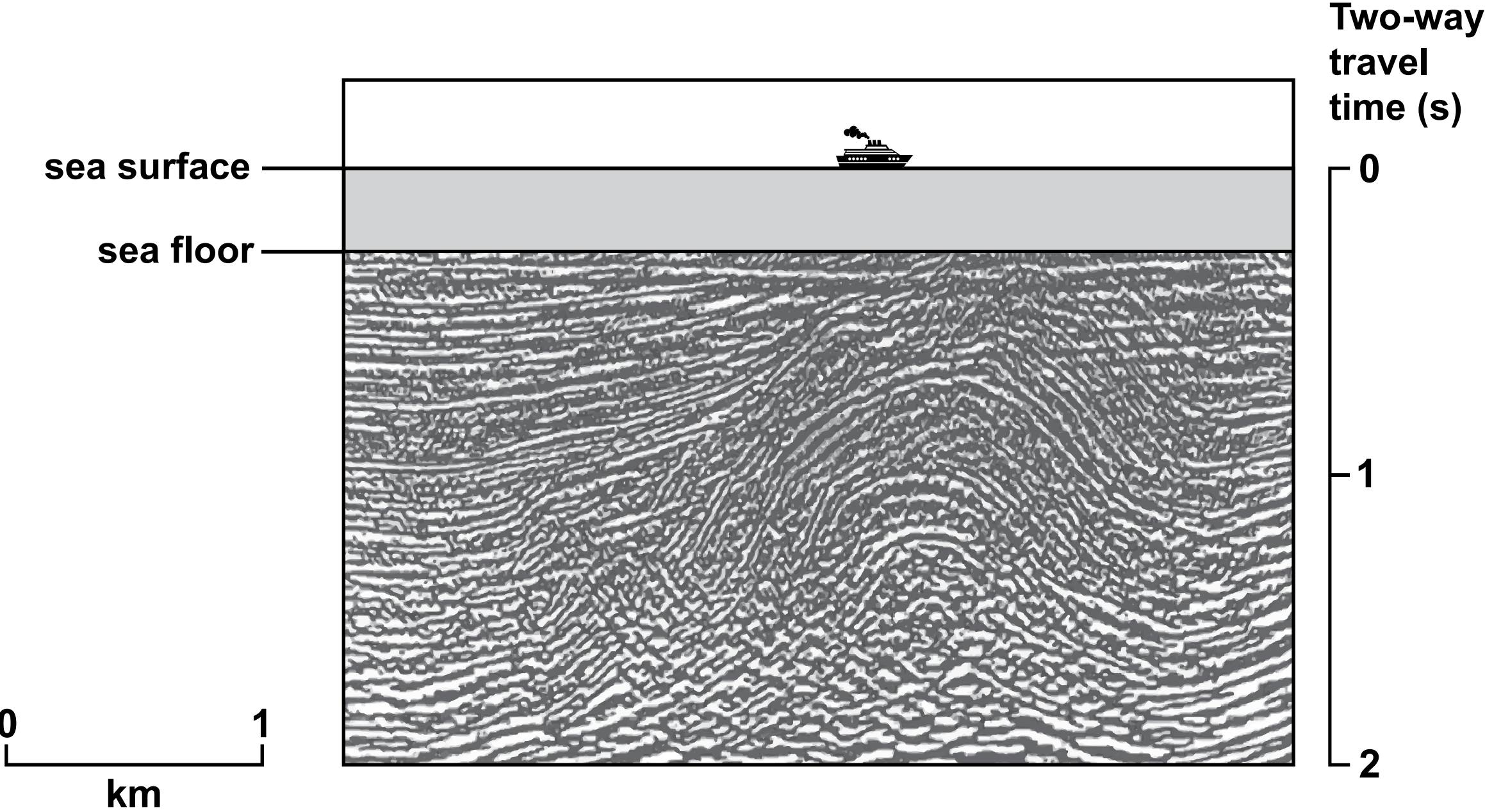


FIGURE 2a

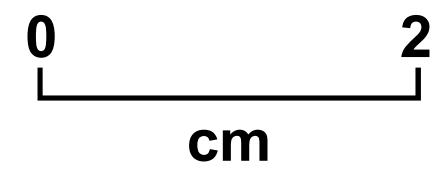
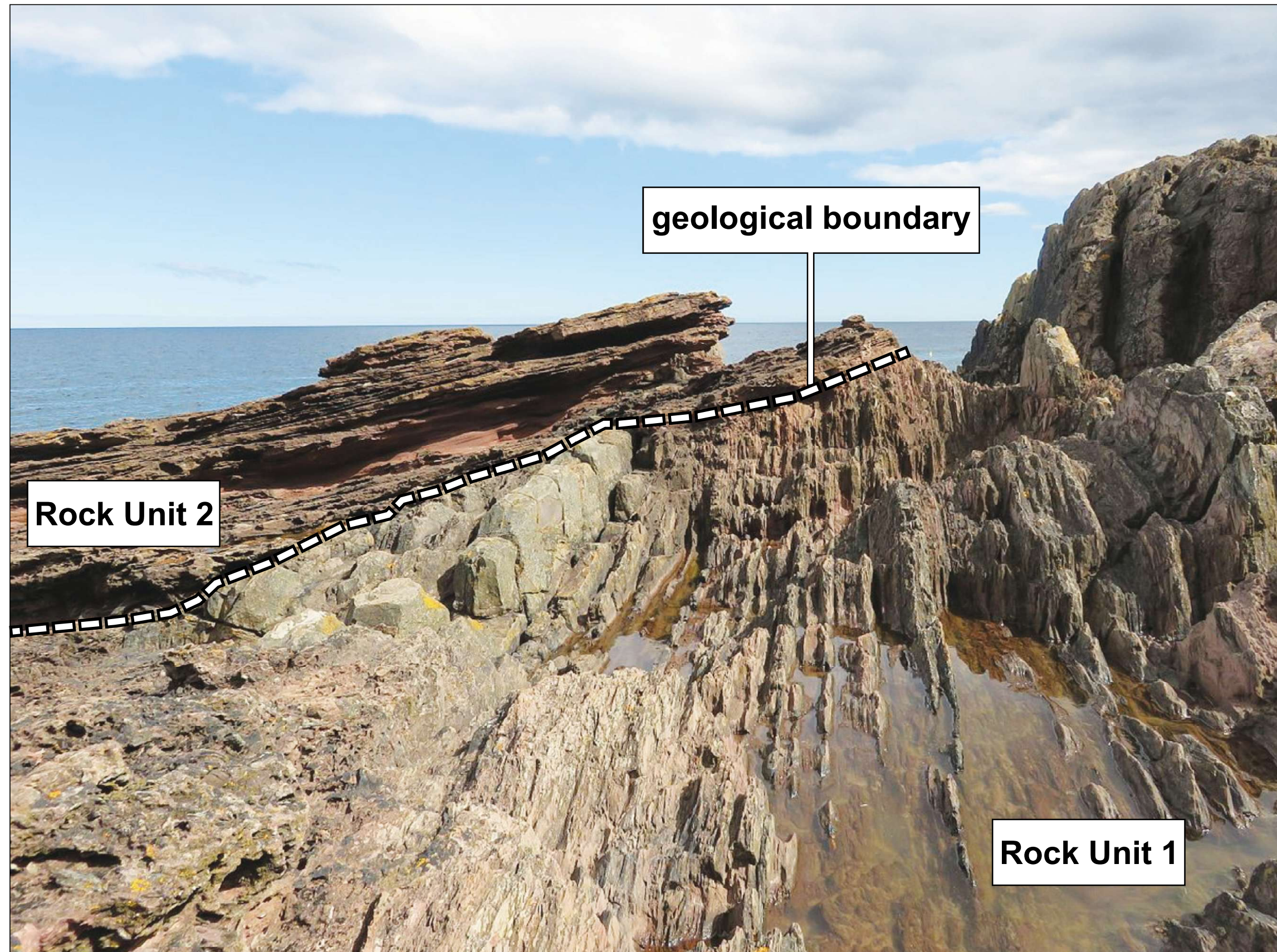
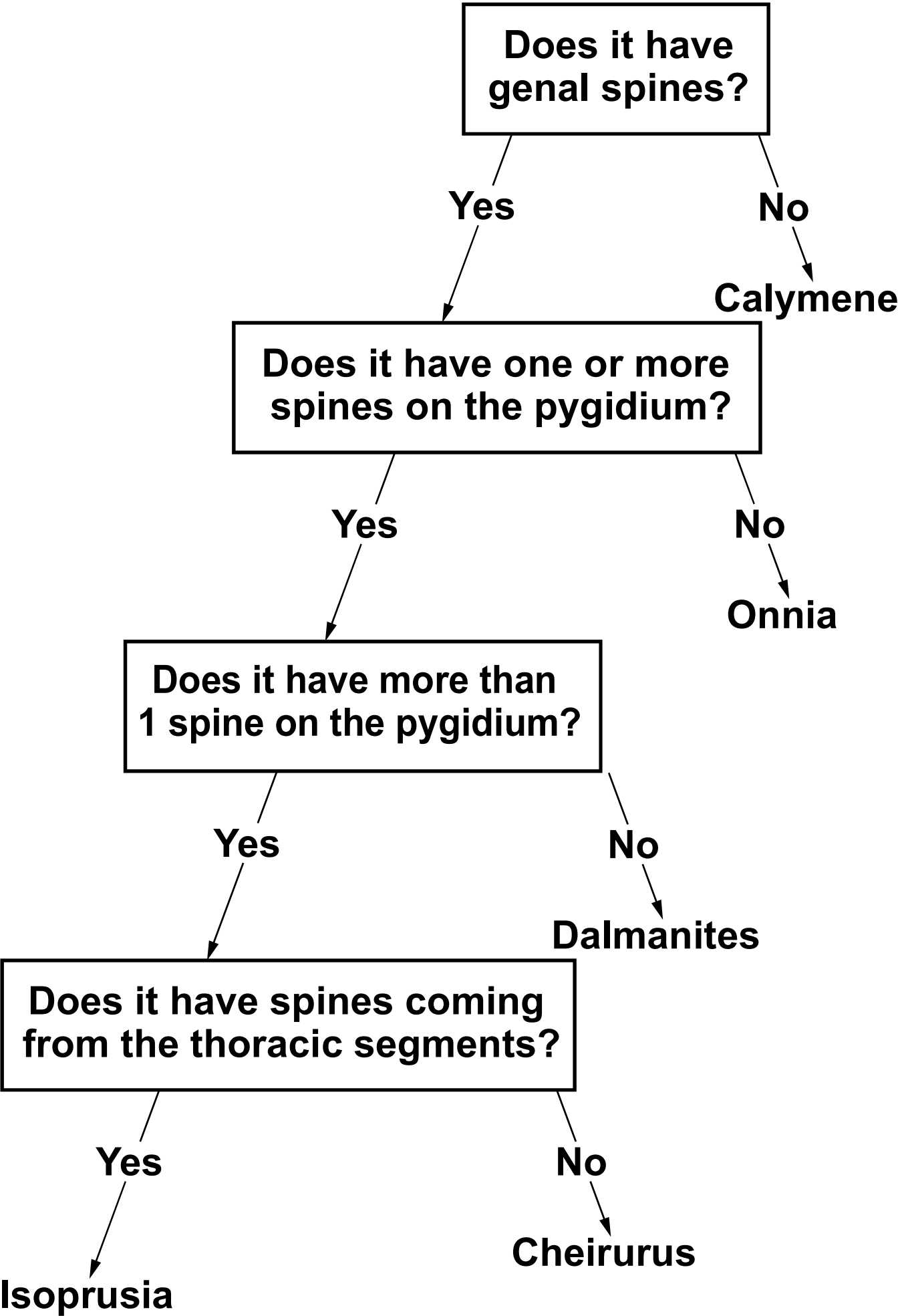


FIGURE 2b

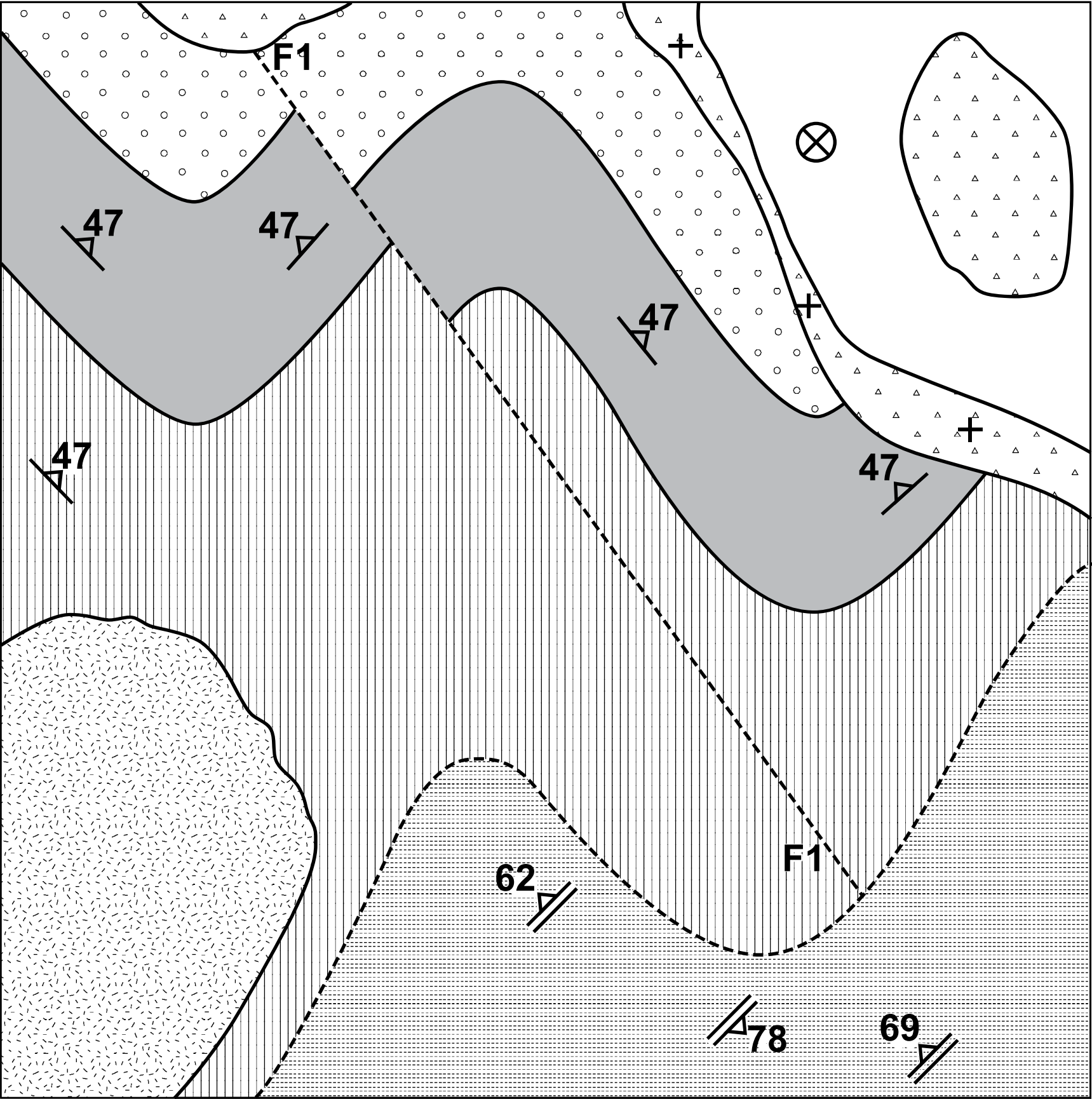


0 2
m

FIGURE 3



MAP 2



Key:
~~✕~~ synform

Metres relative to sea level

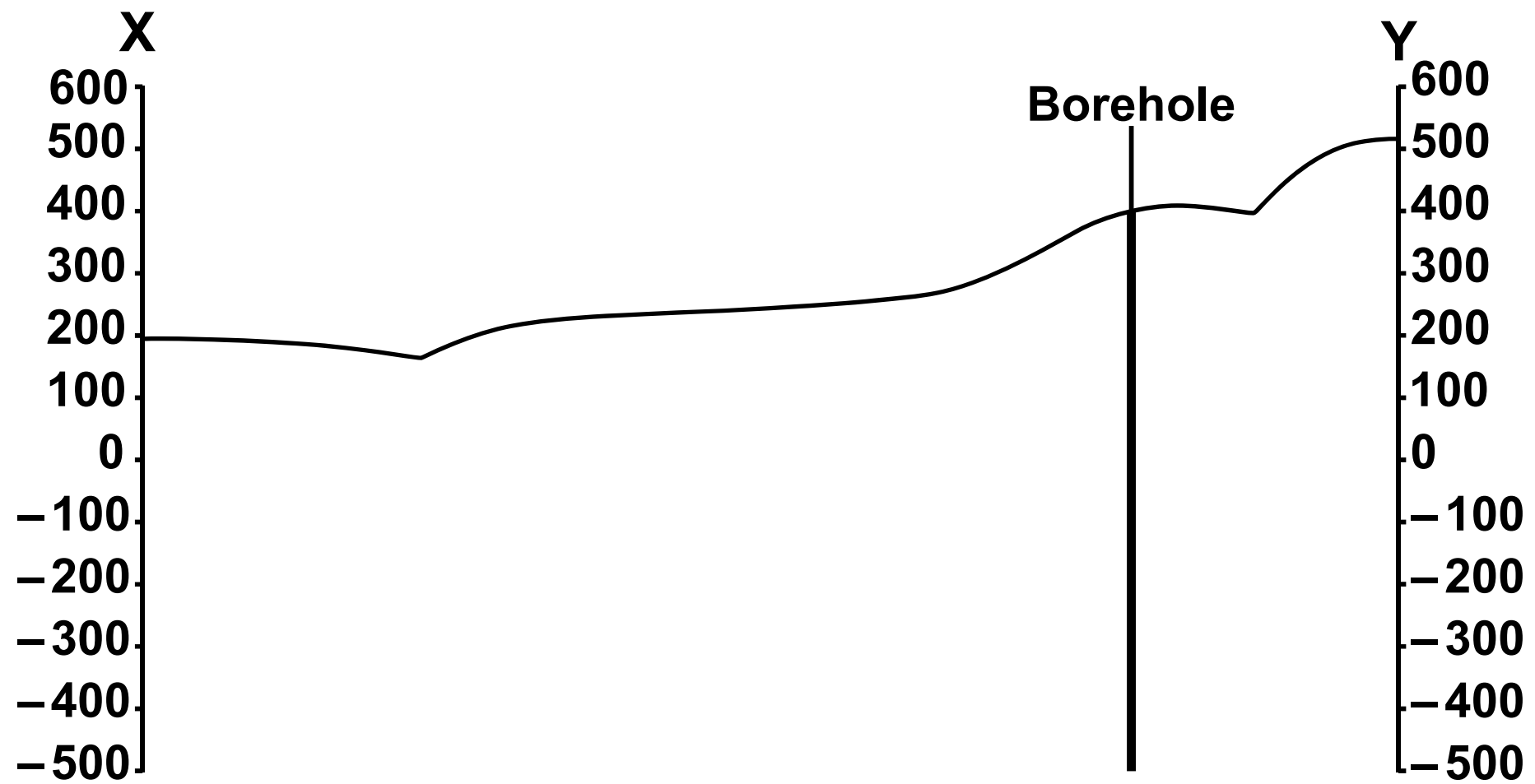


FIGURE 11a

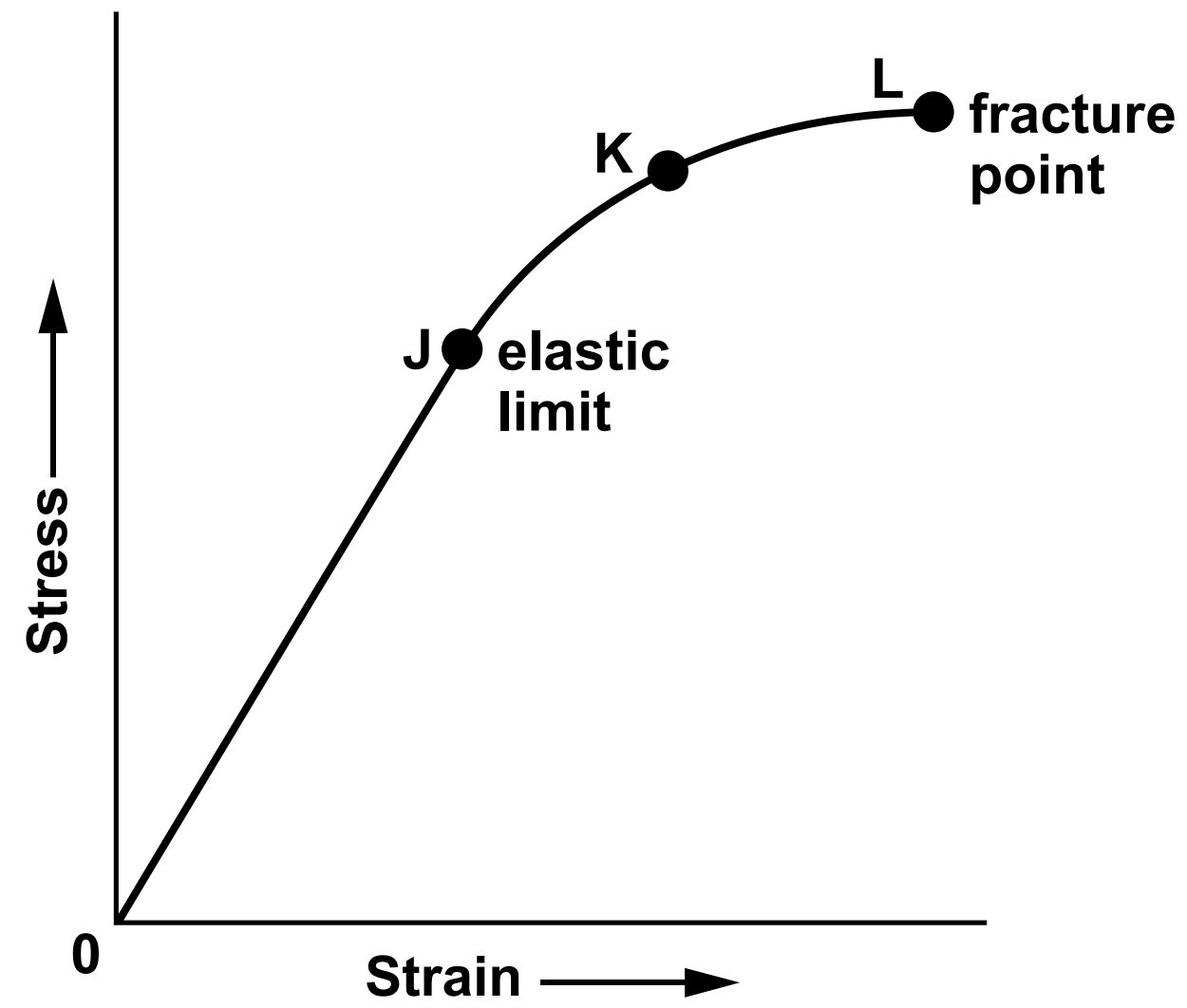
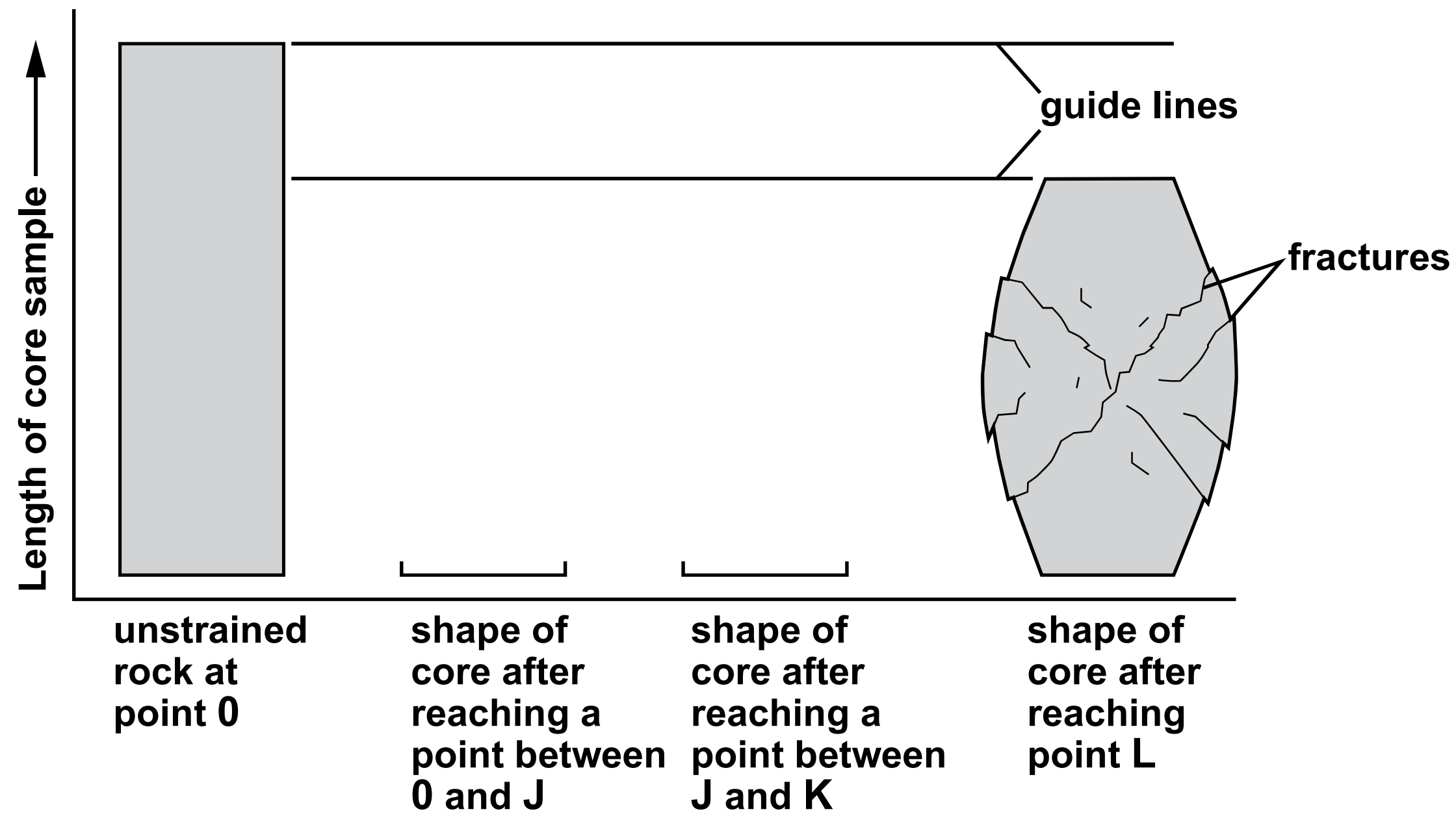


FIGURE 11b



(The cores at 0 and L are drawn for comparison.)