

FOR OFFICIAL USE

Centre No.	Subject No.	Level	Paper No.	Group No.	Marker's No.
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Total

[C043/SQP085]

Intermediate 2 Time: 2 hours
Geology
Specimen Question Paper
for use in and after 2005

NATIONAL
QUALIFICATIONS

Fill in these boxes and read what is printed below.

Full name of centre

Town

First name and initials

Surname

Date of birth

Day Month Year

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Candidate number

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Number of seat

- 1 You should attempt **all** of the questions.
- 2 All answers should be written in the spaces provided in this answer book and should be written clearly and legibly in ink.
- 3 The marks allocated to each question or part of a question are shown at the end of each question or part of a question.
- 4 Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.

All questions should be attempted.

Marks

1. How would you tell the difference between the following pairs of minerals and rocks?

(a) **Haematite and pyrite**

Property of haematite:
.....

Property of pyrite:
.....

1

(b) **Granite and dolerite**

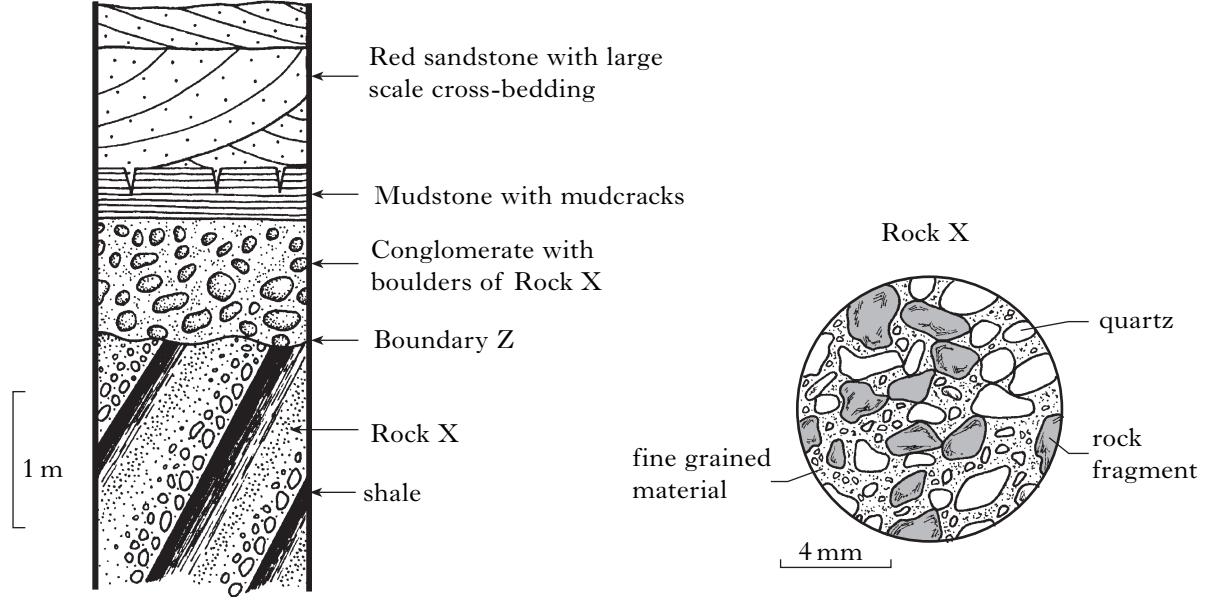
Property of granite:.....
.....

Property of dolerite:.....
.....

1

Marks

2. The diagram on the left shows a sequence of rocks.
The diagram on the right is a magnified view of Rock X.



(a) Give **two** pieces of evidence from the diagrams which suggest that Rock X is sedimentary.

- 1.....
-
- 2.....
-

2

Marks

2. (continued)

(b) Which **two** statements correctly describe features shown in the diagram of the sequence of rocks?

A The rocks below Boundary Z have been turned upside down by folding.

B The conglomerate is younger than the mudstone.

C Boundary Z is an unconformity.

D The shale was deposited in shallow water.

E Boundary Z is a thrust fault.

F The mudstone and sandstone were deposited under arid conditions.

Give only the letters: and

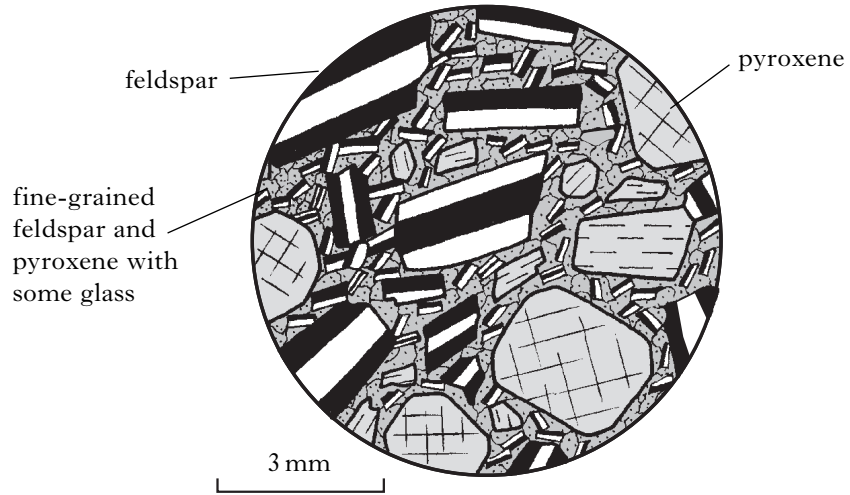
2

(c) Use diagrams to explain how graded bedding is formed.

3

Marks

3. The diagram shows a magnified igneous rock.



(a) What is a phenocryst?

.....
.....

1

(b) Describe the conditions under which the igneous rock cooled.

.....
.....
.....

2

(c) Name the rock.

.....

1

Marks

3. (continued)

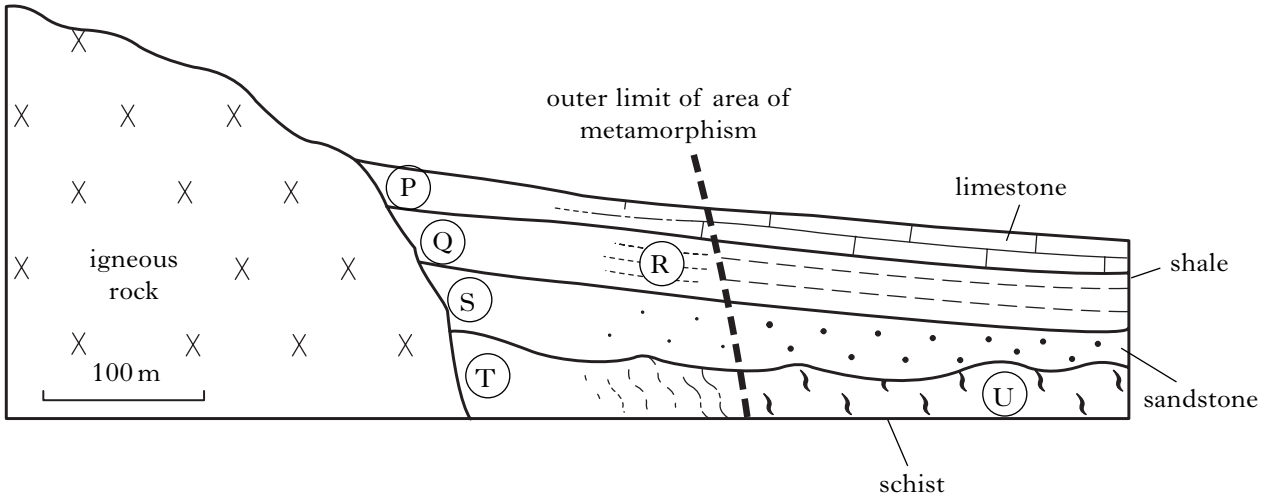
- (d) In the field, how would you distinguish between a sill and a lava flow?
Give **three** ways.

Diagrams may be used.

3

Marks

4. The diagram shows how an igneous intrusion affects the rocks round about it.



(a) Name rocks (P) and (S) .

Name of rock (P) :

Name of rock (S) :

1

(b) Name rocks (Q) and (R) and describe **one** way in which they differ.

Name of rock (Q) :

Name of rock (R) :

2

One way in which the rocks differ:

.....

1

(c) Describe **one** way in which rock (T) differs from rock (U) .

.....

.....

1

Marks

4. (continued)

(d) Which statement is correct?

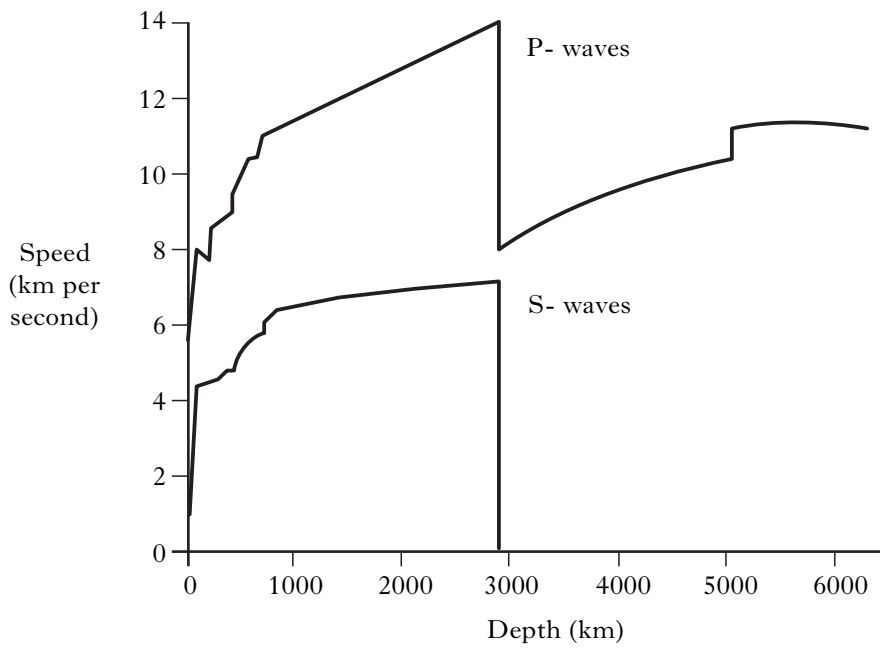
- A The area of metamorphic rock around an intrusion is called a metamorphic aureole.
- B Large intrusions cause a form of metamorphism called regional metamorphism.
- C Igneous rocks are not affected by metamorphism because they are already crystalline.
- D Mylonite is commonly formed by the thermal metamorphism of volcanic ash.

Give only the letter:

1

Marks

5. The diagram shows how P- and S- wave speeds change with depth into the Earth.



(a) (i) Explain why the speeds of P- and S- waves decrease between the depths of 50 and 250 km.

.....

1

(ii) Explain why the speed of S- waves falls to zero at a depth of 2900 km.

.....

1

(iii) Explain why the speed of P- waves increases at a depth of 5150 km.

.....

1

Marks

5. (continued)

The table gives the speeds of P- waves as they pass through different materials.

<i>Material</i>	<i>P- wave speed (km per second)</i>
air	0.34
water	1.5
quartz	6.0
feldspar	6.7
pyroxene	7.3
olivine	8.5
sandstone	3.0

- (b) The sandstone is made up of quartz grains. Give **one** to explain why P- waves travel more slowly through the sandstone than through quartz.

.....

1

- (c) From the table, give **one** reason to explain why P- waves travel faster in the mantle than in the crust.

.....

1

- (d) How fast would you expect P- waves to travel in granite?
 Give a reason for your answer.

Speed:

Reason:

.....

2

Marks

5. (continued)

- (e) The magnitude of an earthquake is a measure of the amount of energy released. Every time the magnitude scale increases by one, the amount of energy given off increases by 30 times. (For example, an earthquake of magnitude 6 gives off 30 times as much energy as an earthquake of magnitude 5.)

How much more energy was given off by the magnitude 5 earthquake at Assisi, Italy in October 1997 than by the magnitude 2 earthquake on the Ochil Fault, Clackmannanshire in April 1998?

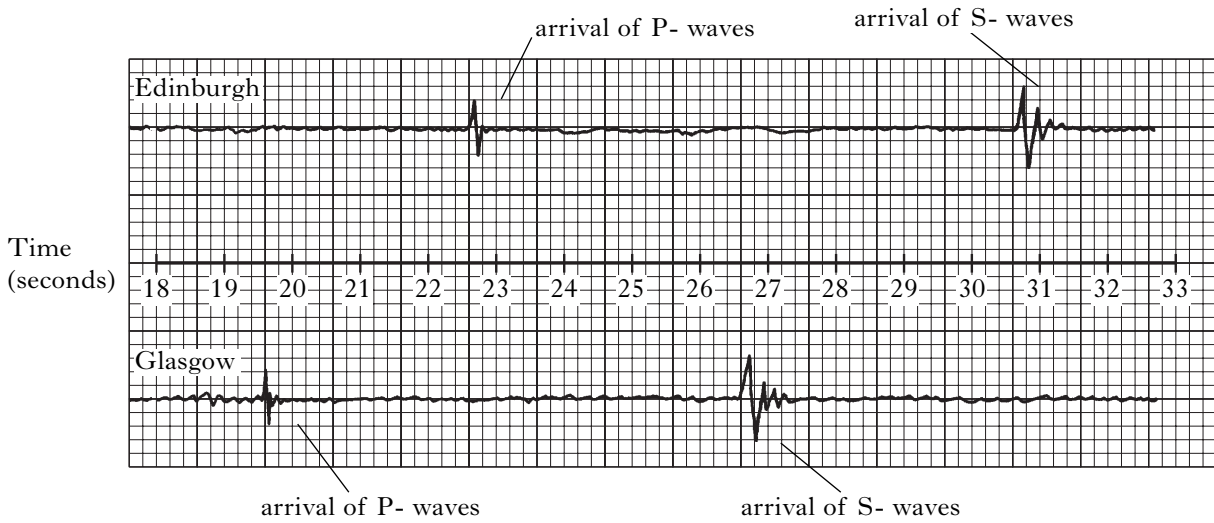
.....

Space for working

1

Marks

6. The diagram shows seismograms recorded at Edinburgh and Glasgow for an earthquake which took place in Scotland.



- (a) (i) What is the time interval between the arrival of the P- and S- waves at Edinburgh?

.....

1

- (ii) What is the time interval between the arrival of the P- and S- waves at Glasgow?

.....

1

- (b) Use this equation to find the distances between the seismometers and the epicentre of the earthquake:

$$\text{distance (km)} = \left(\begin{array}{l} \text{time interval between} \\ \text{arrival of P- and} \\ \text{S- waves (seconds)} \end{array} \right) \times 8.5$$

Distance between Edinburgh and epicentre :

Distance between Glasgow and epicentre :

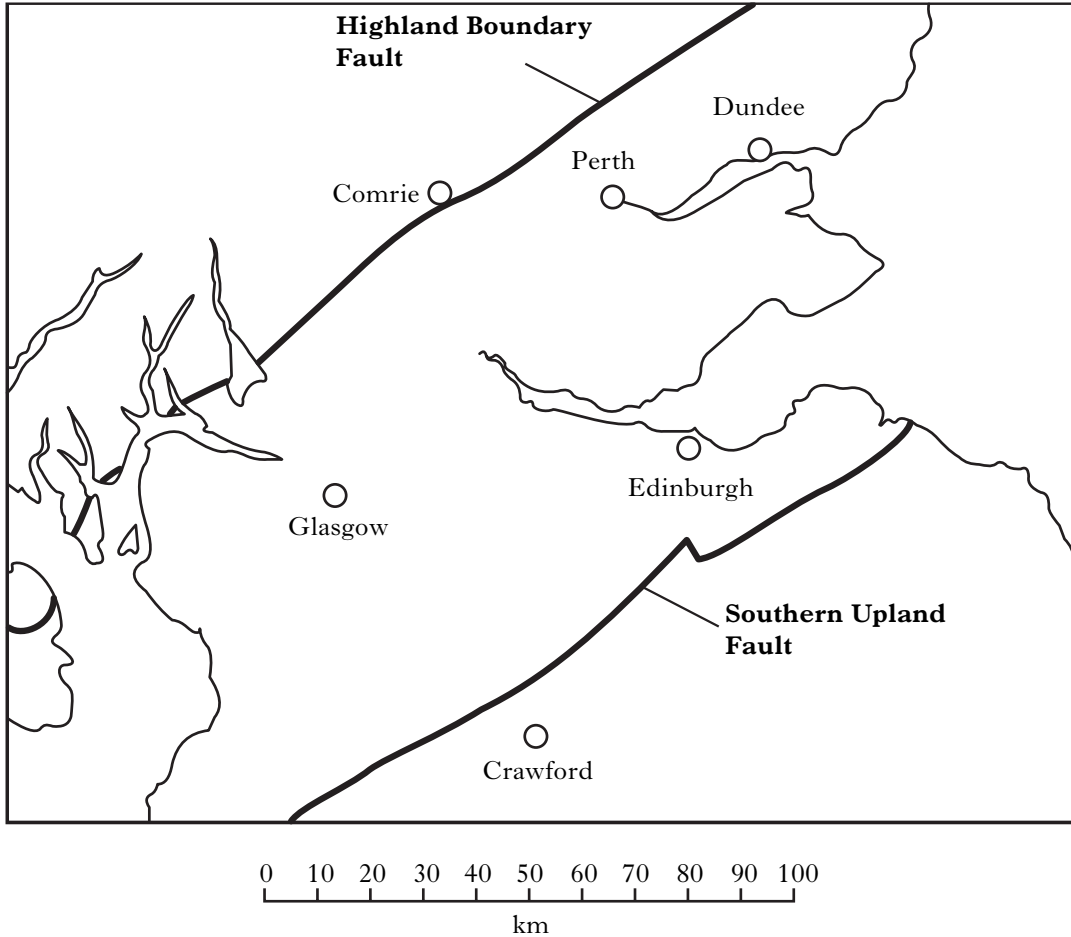
1

Space for working

6. (continued)

Marks

- (c) (i) On the map, draw circles centred on Edinburgh and Glasgow which have radii equal to the distances between the cities and the epicentre of the earthquake.



1

- (ii) Which **two** towns are possible positions for the epicentre?

.....

1

- (iii) Which town would you choose as the more likely for the position of the epicentre? Give a reason for your answer.

Town:

Reason:

.....

2

- (iv) How could you find out the actual position of the epicentre?

.....

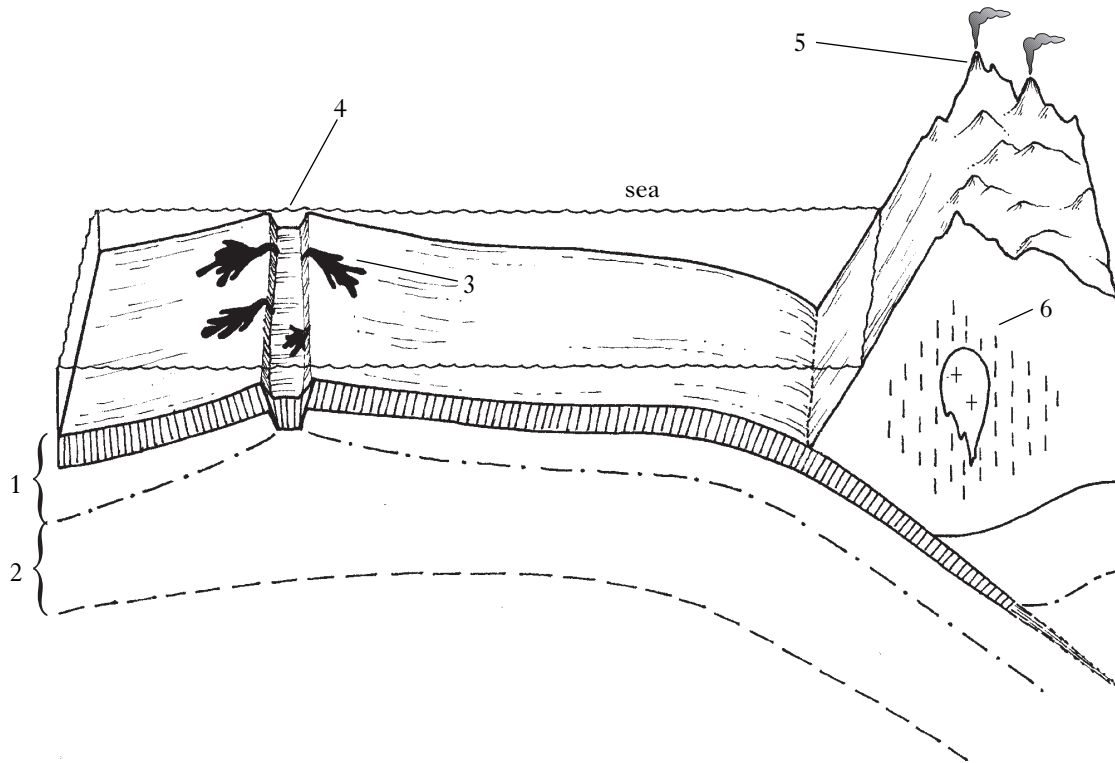
.....

.....

2

Marks

7. Study the diagram.



(a) Use the following to complete the table to name the labelled features on the diagram.

- Constructive plate margin
- Effusive volcanic activity
- Area of regional metamorphism
- Lithosphere
- Asthenosphere
- Central vent volcanic activity

<i>Labelled feature</i>	<i>Name of feature</i>
1	
2	
3	
4	
5	
6	

3

(b) How many plates are shown on the diagram?

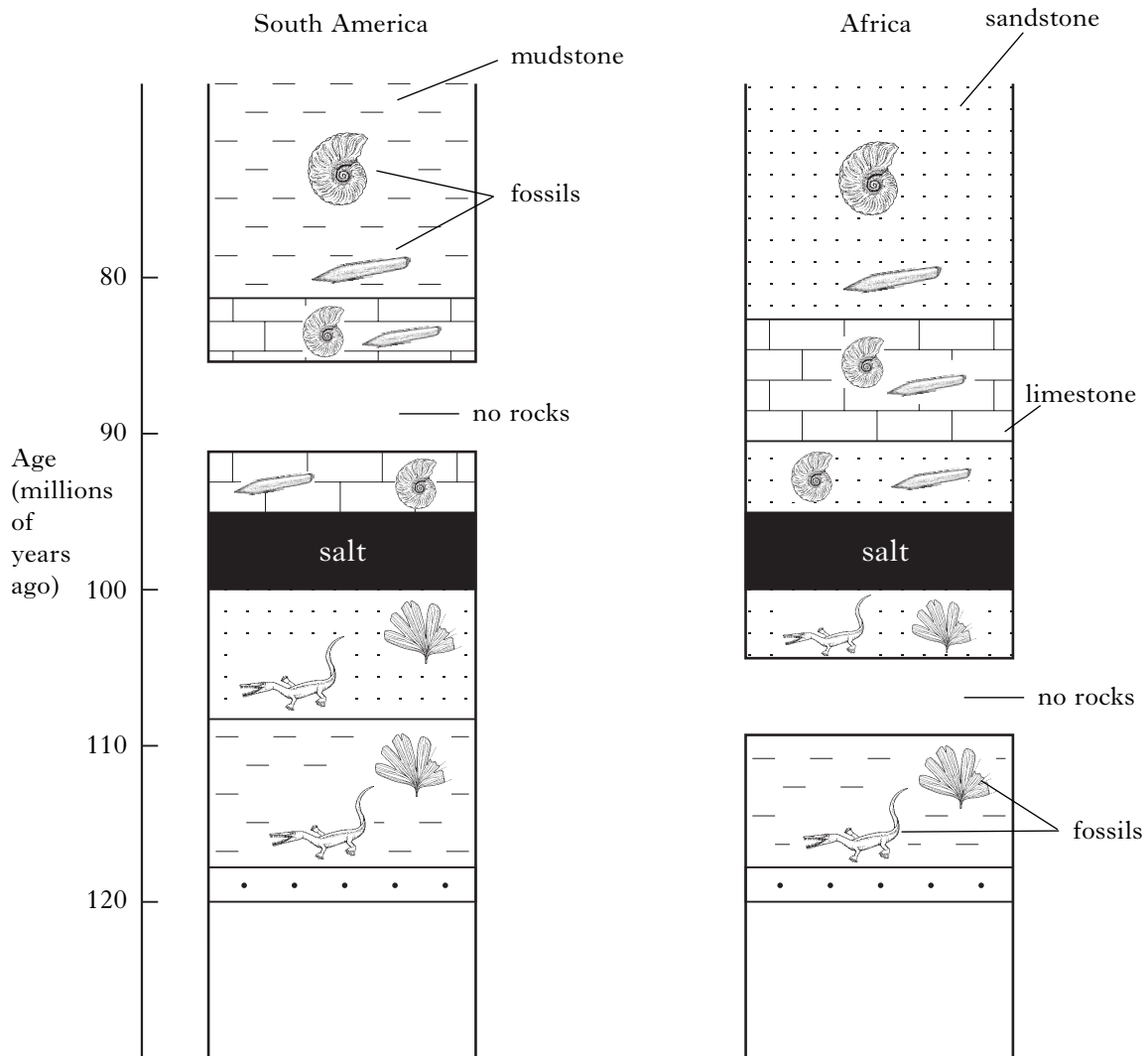
.....

1

Marks

7. (continued)

(c) The diagram shows sequences of sedimentary rocks found on the Atlantic margins of South America and Africa.



When did the continents move apart?

Give **two** reasons for your answer.

Time of separation:

Reason 1

.....

Reason 2

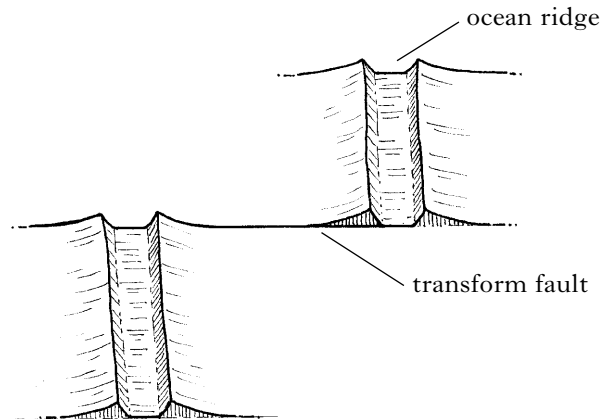
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3

Mark

8. (a) On the diagram, use arrows to show the movement direction on each side of the transform fault.

1



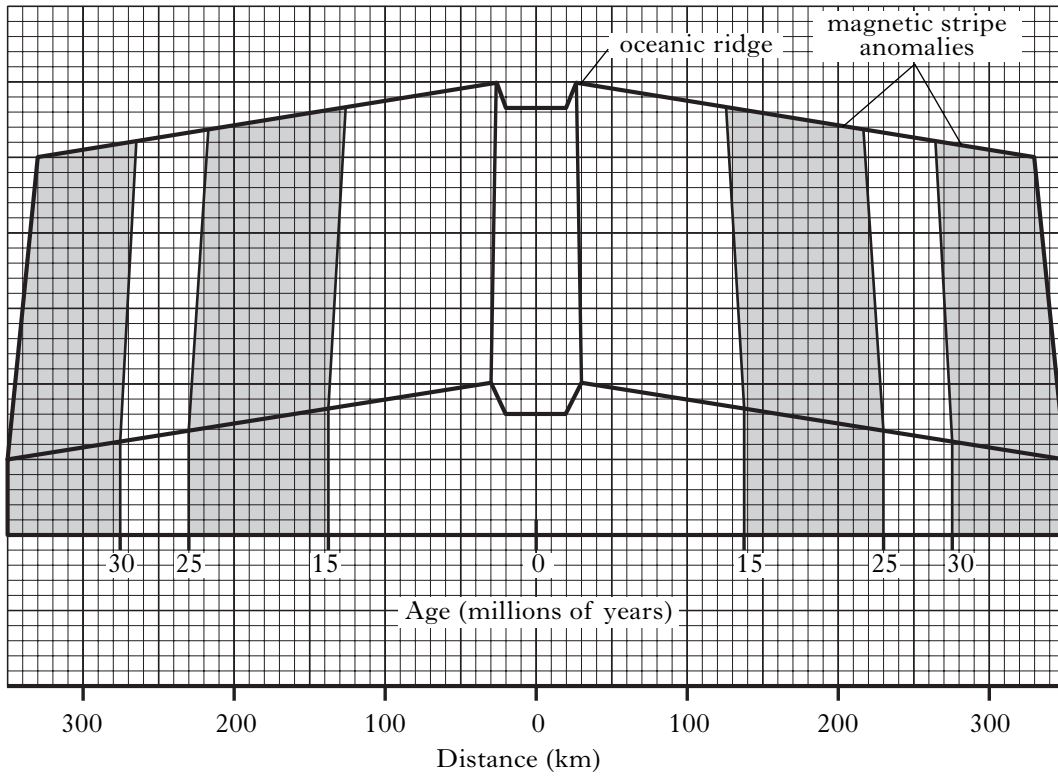
- (b) Use diagrams to explain why magnetic stripe anomalies are symmetrical about oceanic ridges.

3

8. (continued)

(c)

Marks



Calculate the rate of sea-floor spreading (in km per million years) from the oceanic ridge shown in the diagram.

.....

2

Space for working

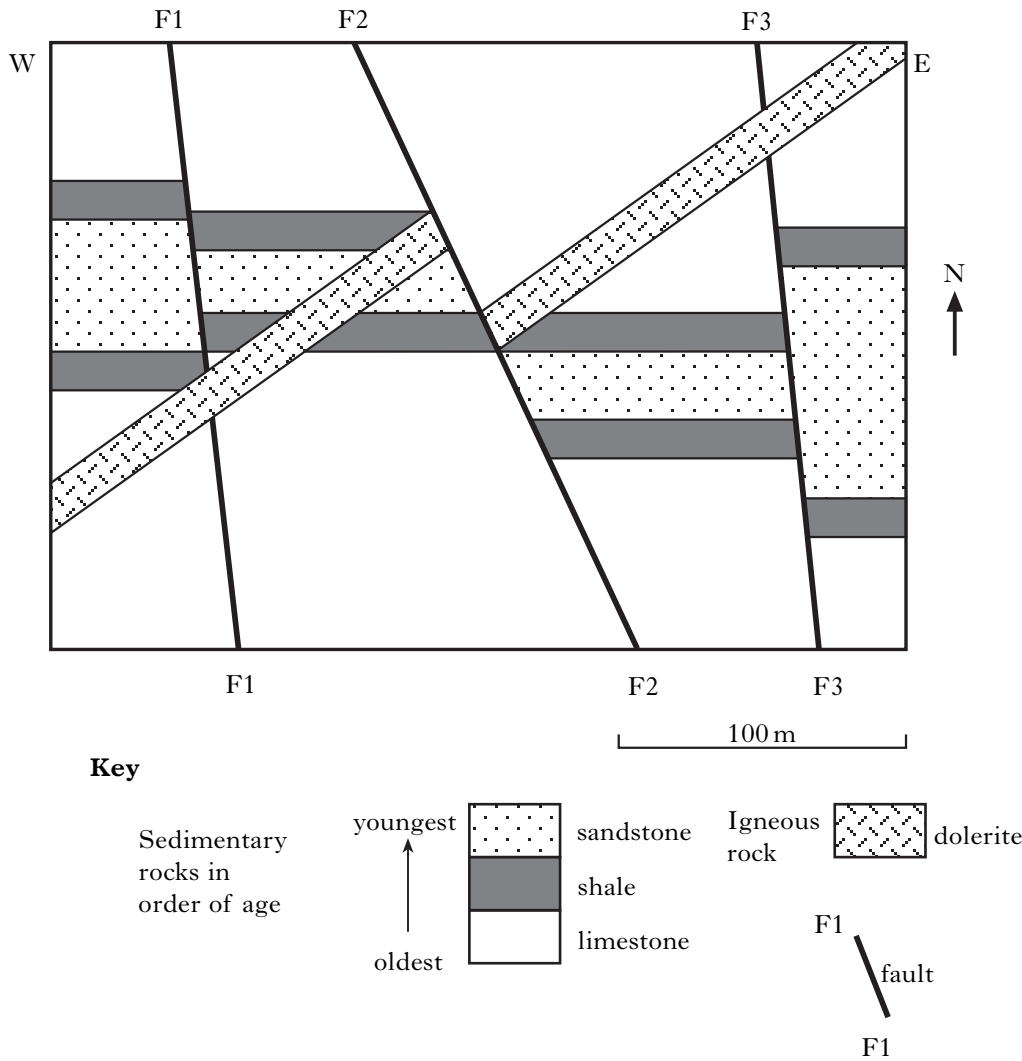
9. Use diagrams to explain how an atoll is formed.

Marks

3

Marks

10. Study the geological map.



(a) Describe the movement directions on faults F1, F2 and F3.

Movement on F1:

.....

Movement on F2:

.....

Movement on F3:

.....

3

10. (continued)

Marks

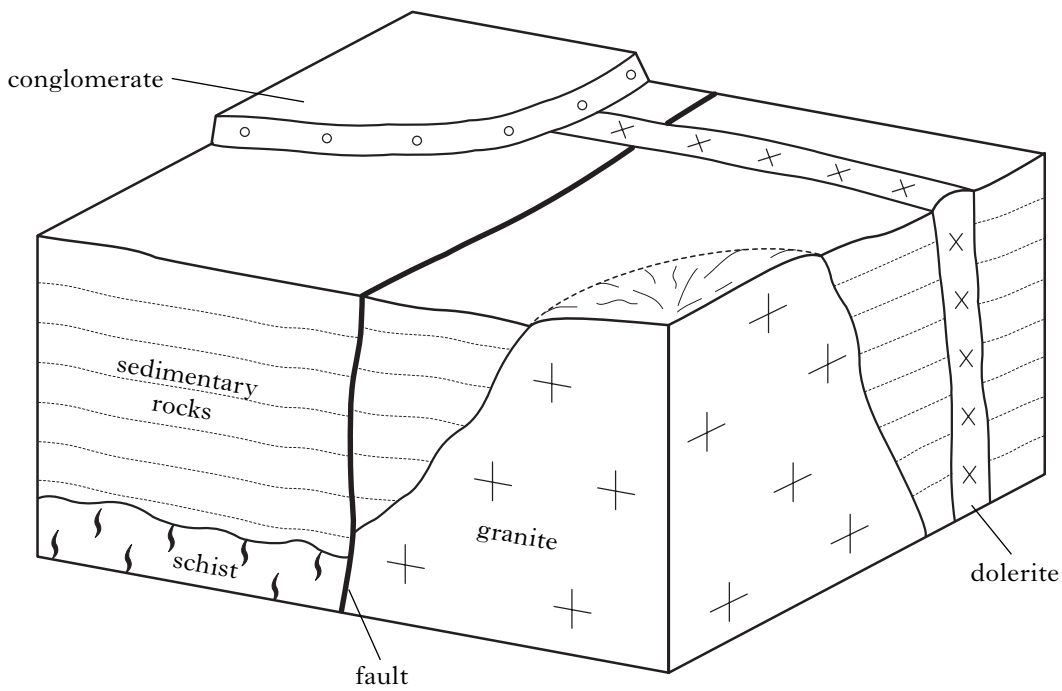
(b) Which statement is correct?

- A The faults are all of the same age.
- B Fault F2 is younger than Fault F3.
- C Fault F2 is older than Fault F1.
- D Fault F1 is younger than Fault F3.

Give only the letter:

1

(c) Study the block diagram.



Place the following events in order from oldest to youngest.

- A Movement on the fault
- B Deposition of conglomerate
- C Intrusion of granite
- D Formation of schist
- E Intrusion of dolerite

Give only the letters:

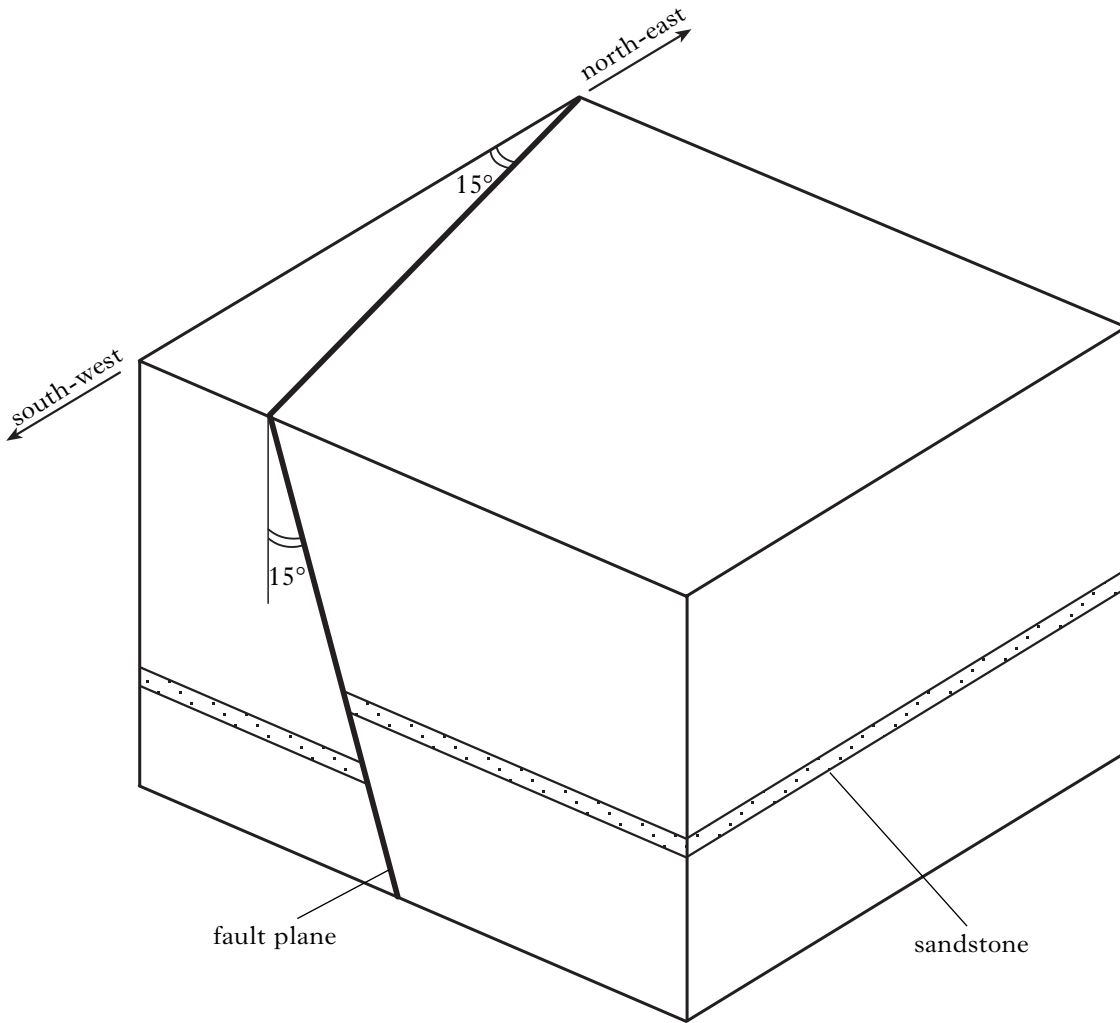
..... → → → →

oldest youngest

2

Marks

11. Study the diagram.



(a) (i) What is the direction of strike in degrees of the fault plane?

.....

1

(ii) What is the angle and direction of dip of the fault plane?

Angle of dip:

Direction of dip:

2

(b) (i) What type of fault is shown on the diagram?

.....

1

(ii) Describe the forces which formed this fault.

.....

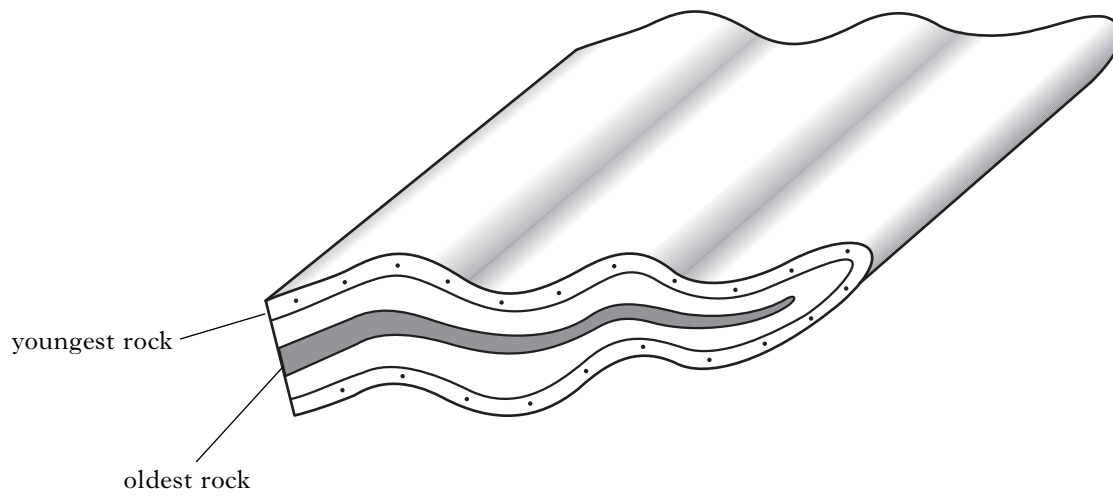
.....

1

Marks

11. (continued)

(c)



Which statement correctly describes the stages of folding which formed the folds shown in the diagram?

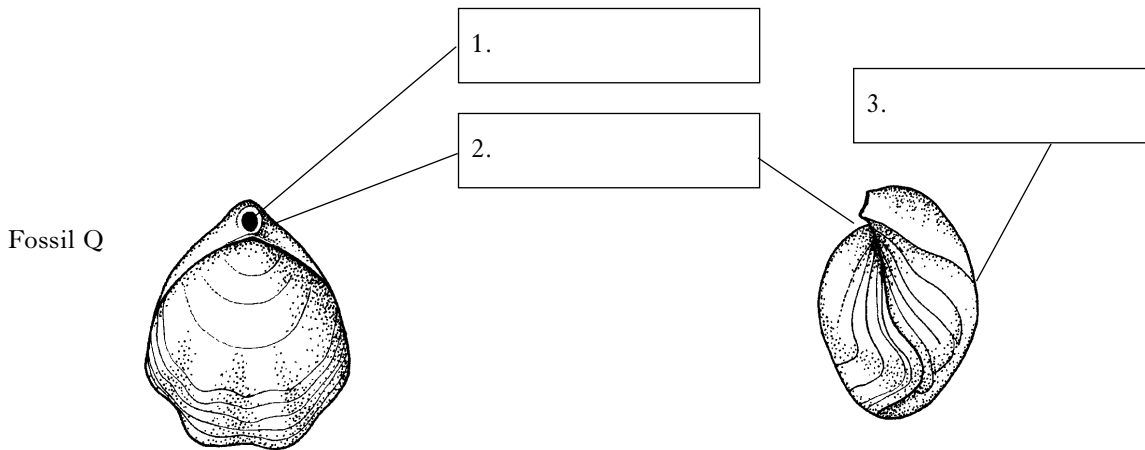
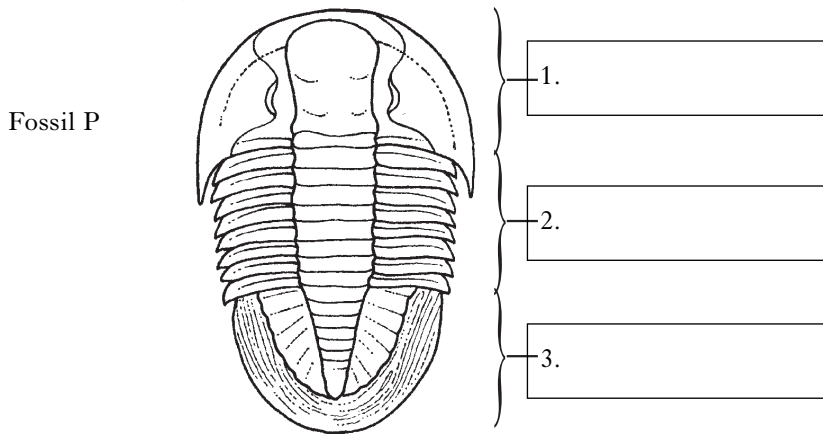
- A Folding to form a syncline → folding to form anticlines and synclines.
- B Folding to form anticlines and synclines → folding to form a syncline and synclines.
- C Folding to form an anticline → folding to form anticlines and synclines.
- D Folding to form anticlines and synclines → folding to form an anticline and synclines.

Give only the letter:.....

1

Marks

12. (a) Name the parts of the fossils shown.



3

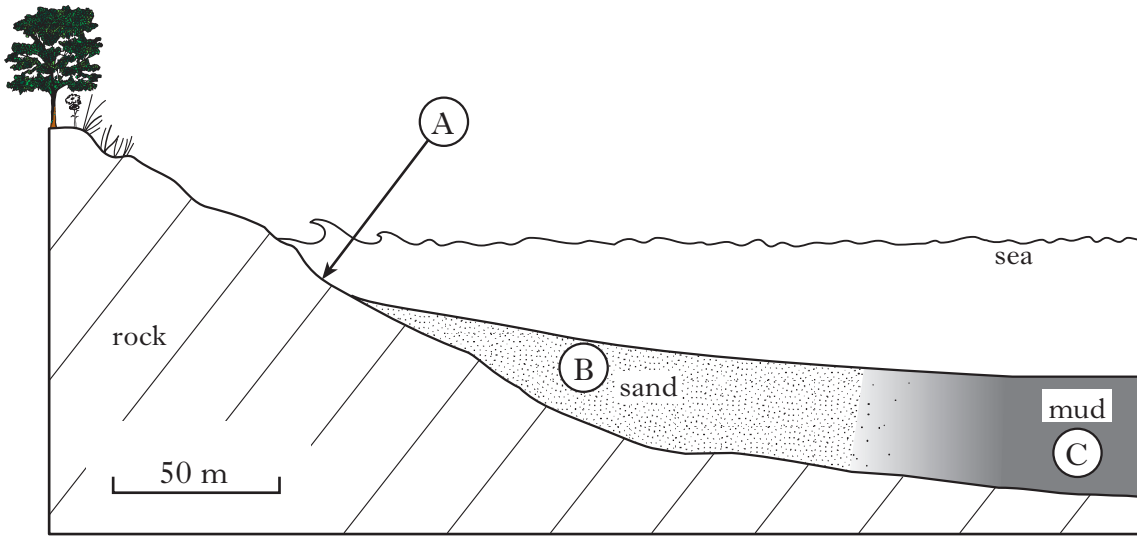
(b) Name fossils P and Q.

Name of fossil P:

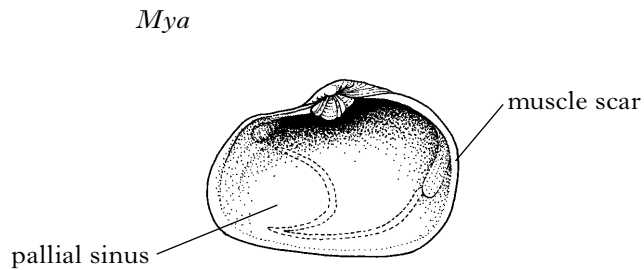
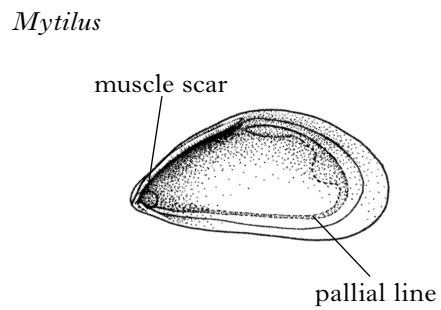
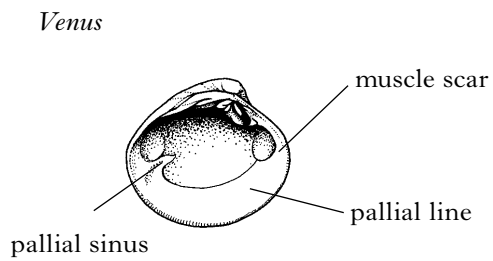
Name of fossil Q:

1

13. The diagram is a section through a shore.



The sketches show bivalves which live on the shore.



Marks

13. (continued)



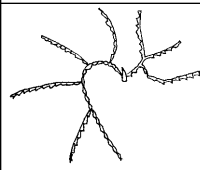
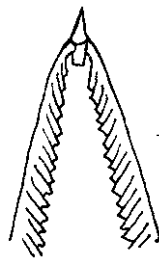
Complete the table to show the places in the diagram where the bivalves live.
Give a reason for each answer.

<i>Position on diagram</i>	<i>Name of bivalve which lives at this position</i>	<i>Reason for answer</i>
A		
B		
C		

3

Marks

14. The table shows the distribution of four types of graptolite in Ordovician rocks.

Age of rocks	Type of graptolite			
	<i>Diplograptus</i>	<i>Dicellograptus</i>	<i>Nemagraptus</i>	<i>Didymograptus</i>
Upper Ordovician				
Middle Ordovician				
Lower Ordovician				

(a) Give **one** reason to explain why graptolites are useful fossils for dating Ordovician rocks.

.....

1

(b) Which graptolite shown in the table would be most useful for zoning?
 Give a reason for your answer.

Name of graptolite:

Reason:

.....

1

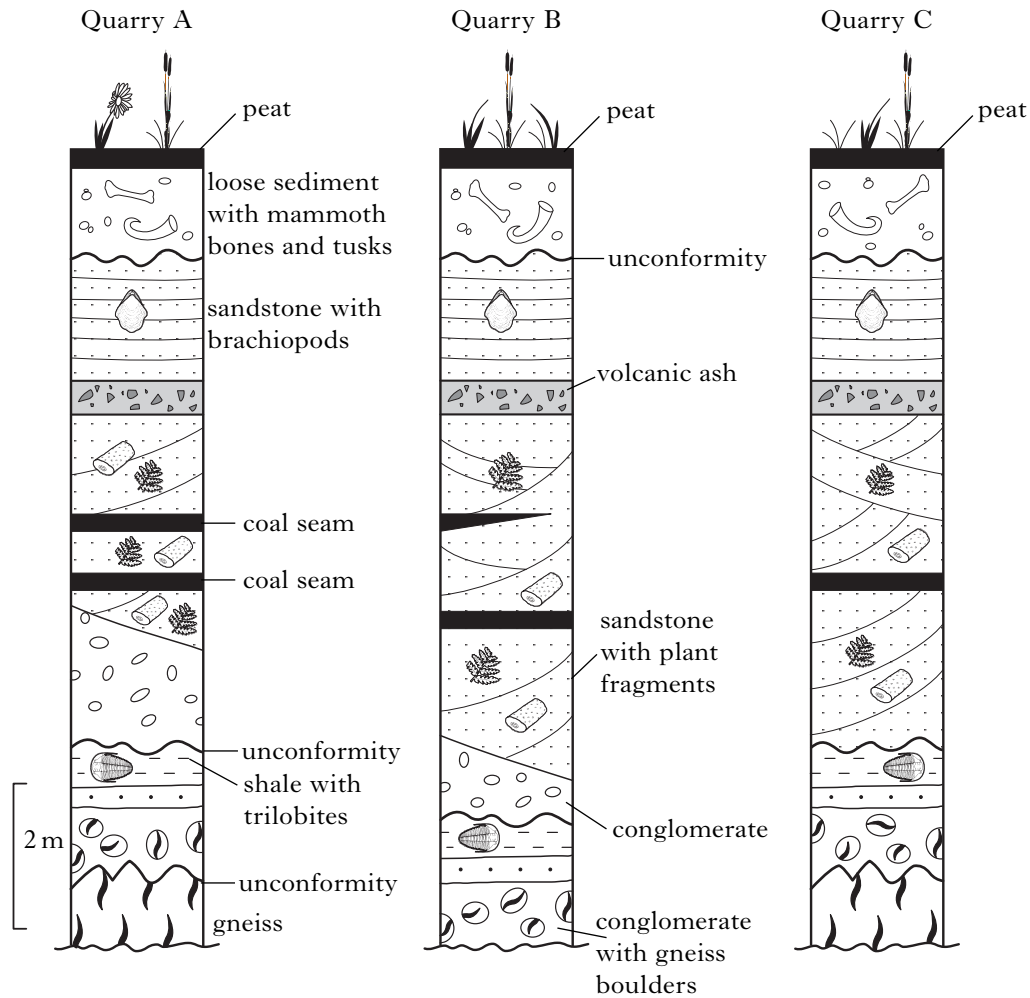
(c) A rock contains fossils of all of the graptolites shown in the table.
 What age is the rock?

.....

1

Marks

15. The diagrams show rock sequences found in three quarries.



(a) Describe the events which formed the rocks in Quarry A.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

4

(b) On the diagram, draw lines between the rocks in the quarries to match up the sequences.

3

Marks

15. (continued)

(c) Describe **four** safety precautions you would take when visiting a working quarry.

1

2

3

4

2

Marks

16. Fossil gastropods of the same species were collected from a sequence of sedimentary rocks. Details of the rocks and of the fossils are shown in the table.

Rock	Average grain size of sedimentary rock (mm)	Averages of measurements on gastropods			Number of gastropods per cubic metre of rock
		Height (mm)	Width (mm)	Shell thickness (mm)	
P	0.001	40.0	21.0	1.0	82
Q	0.1	36.0	20.0	1.2	120
R	3.0	30.0	18.0	2.1	8
S	10.0	24.0	16.0	2.4	4
T	40.0	no fossils found			0

- (a) Calculate the ratios of height/width for the gastropods in Rocks P, Q, R and S.

Ratios:

Rock P Rock Q

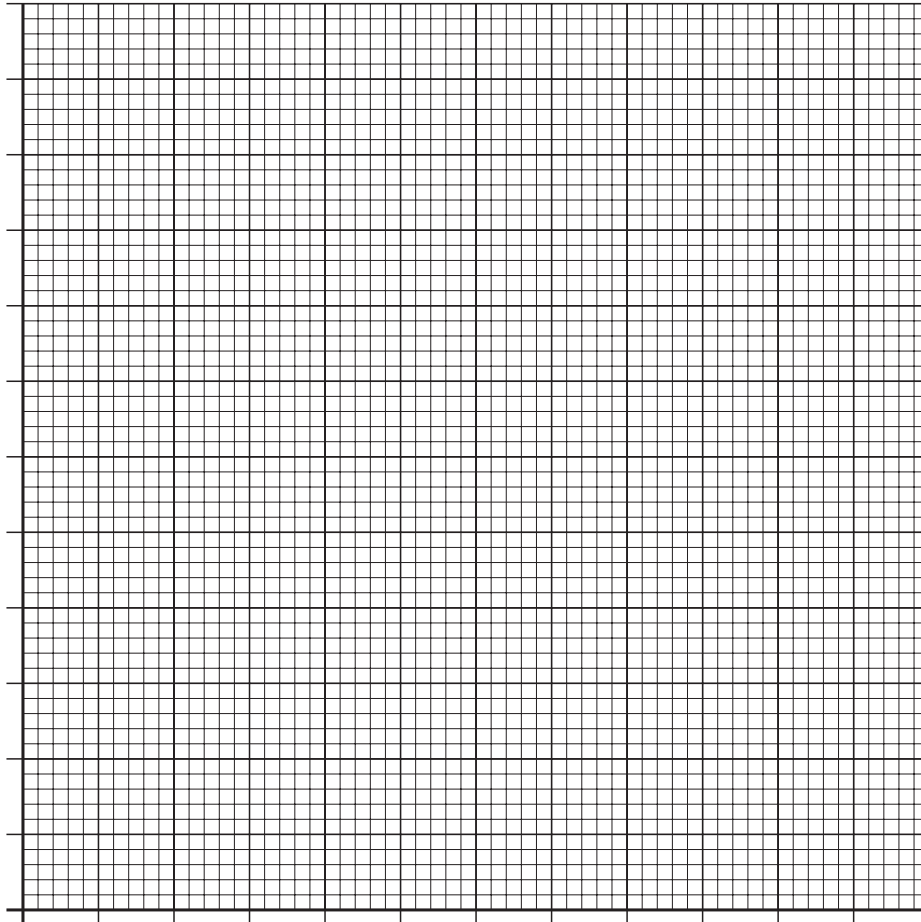
Rock R Rock S

2

Marks

16. (continued)

- (b) (i) On the graph paper below, draw a line graph to show how the height/width ratio changes with shell thickness.



2

- (ii) Describe the relationship shown on the graph.

.....
.....

1

- (c) (i) Describe the relationship between the shape of the shell and the strength of the currents which deposited the sediments.

.....
.....

1

Marks

16. (c) (continued)

- (ii) Describe the relationship between the thickness of the shell and the strength of the currents which deposited the sediments.

.....
.....

1

- (d) (i) Give a reason to explain why Rock T has no fossils.

.....
.....

1

- (ii) Give a reason to explain why Rock Q has more fossils than finer and coarser rocks.

.....
.....

1

[END OF QUESTION PAPER]

[C043/SQP085]

Intermediate 2
Geology
Specimen Marking Instructions

NATIONAL
QUALIFICATIONS

1. Accept any distinguishing properties, eg:

- (a) Haematite: Red-brown streak; colour iron-grey, black or red-brown
Pyrite: Greeny-black streak; colour brassy-yellow 1 mark
- (b) Granite: Coarse-grained; made up of quartz and feldspar
Dolerite: Medium-grained; made up of pyroxene and feldspar 1 mark

2. (a) 1 Made up of fragments
2 Shows bedding 2 marks
- (b) C, F 2 marks
- (c) Diagrams —1 mark Explanation —2 marks

As a turbidity current slows the largest particles are deposited first. These are followed by progressively smaller particles. From bottom to top, bed shows progressive decrease in grain size.

or

As a river current slows the largest particles are deposited first. These are followed by progressively smaller particles. From bottom to top, bed shows progressive decrease in grain size.

3 marks

3. (a) In an igneous rock, a crystal which is much larger than the main mass of crystals making up the rock. 1 mark
- (b) Slow cooling (allowed growth of large crystals) 1 mark
followed by
Rapid cooling (which produced fine-grained matrix) 1 mark
- (c) Basalt 1 mark
- (d) Accept any three distinguishing features, eg:

Sill

Rocks above and below metamorphosed.

Chilled margins top and bottom.

May be transgressive.

Top and bottom not rubbly.

No fossil soil on top.

No weathered surface.

Younger than rocks above and below.

Lava flow

Underlying rocks metamorphosed.

No chilled margins or chilled on lower surface only.

Not transgressive.

Top and bottom may be rubbly or brecciated.

May be fossil soil on top.

Top may be weathered **before** next rock deposited or eruption of next lava flow.

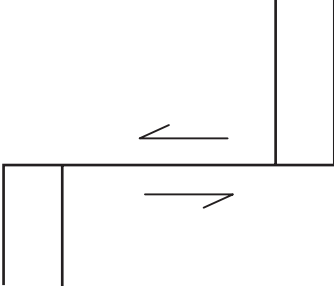
Younger than rock below but older than overlying rock.

3 marks

4. (a) (P) : marble
 (S) : quartzite **or** metaquartzite **or** metamorphic quartzite 1 mark
- (b) (Q) : hornfels
 (R) : spotted rock **or** spotted shale 2 marks
- Accept any distinguishing feature, eg:
- | | | |
|--|---|--------|
| <i>Hornfels</i> | <i>Spotted rock</i> | |
| No spots | Spotted | |
| Completely crystalline | Partly crystalline | |
| No sign of pre-existing sedimentary features | Sedimentary features (eg bedding) still evident | |
| Breaks into splinters | Breaks into flakes | |
| Very hard | Fairly soft | 1 mark |
- (c) Accept any distinguishing feature, eg:
- | | | |
|--|---|--------|
| Rock (T) | Rock (U) | |
| No foliation present | Foliation present | |
| Minerals characteristic of thermal metamorphism (eg andalusite may be present) | Minerals characteristic of regional metamorphism (eg garnet may be present) | 1 mark |
- (d) A 1 mark
5. (a) (i) Accept any reasonable explanation, eg:
 The mantle is weak in this area.
 The mantle is soft in this area.
 The mantle is partly molten in this area.
 The mantle in this area has a small proportion of liquid. 1 mark
- (ii) Here, the waves reach the liquid outer core. S-waves cannot travel through a liquid. 1 mark
- (iii) Here, the P-waves meet the solid inner core. P-waves travel more quickly in solids than in liquids. 1 mark
- (b) Accept any reasonable explanation, eg:
 There is air between the grains. The air will slow the P-waves.
 There is water between the grains. The water will slow the P-waves.
 The grains are separate from each other. There may be points of weakness or looseness at grain contacts which slow the P-waves. 1 mark
- (c) The mantle consists mostly of olivine and pyroxene. P-waves travel quickly in these minerals.
 The crust consists largely of quartz and feldspar. P-waves travel slowly in these minerals.
or
 The mantle consists of crystalline rock. The crust has lots of sedimentary rock such as sandstone.
 P-waves would be expected to travel more quickly in igneous than in sedimentary rock. 1 mark
- (d) Speed: Accept $6.1 - 6.6 \text{ km s}^{-1}$
 Reason: Granite consists of quartz and feldspar. The speed would be expected to be between the speeds recorded in pure quartz and pure feldspar. 2 marks
- (e) 27,000 times more. 1 mark

6. (a) (i) Time interval for Edinburgh : 8 s 1 mark
(ii) Time interval for Glasgow : 7 s 1 mark
- (b) Distance between Edinburgh and epicentre : 68 km
Distance between Glasgow and epicentre : 59.5 km 1 mark
- (c) (i) Drawing of circles 1 mark
(ii) Comrie, Crawford 1 mark
(iii) Comrie 1 mark
- It lies on the Highland Boundary Fault. Movement on the fault could have produced the earthquake. 1 mark
- (Crawford lies about 8 km south of the Southern Upland Fault. Since Crawford lies on an area of stable crust it is not likely that an earthquake would have an epicentre here.)
- (iv) Draw a circle centred on another seismometer station. The third circle would intersect the other two at the epicentre. 2 marks

7. (a) 1 Lithosphere
2 Asthenosphere
3 Effusive volcanic activity
4 Constructive plate margin
5 Central vent volcanic activity
6 Area of regional metamorphism 3 marks
- (b) 3 1 mark
- (c) Time of separation: About 100 Ma ago
Reason 1: Salt deposits indicate onset of marine conditions. So continents separated by narrow sea.
Reason 2: The rocks older than 100 Ma old contain land and freshwater fossils. After this time the rocks contain marine fossils. 3 marks

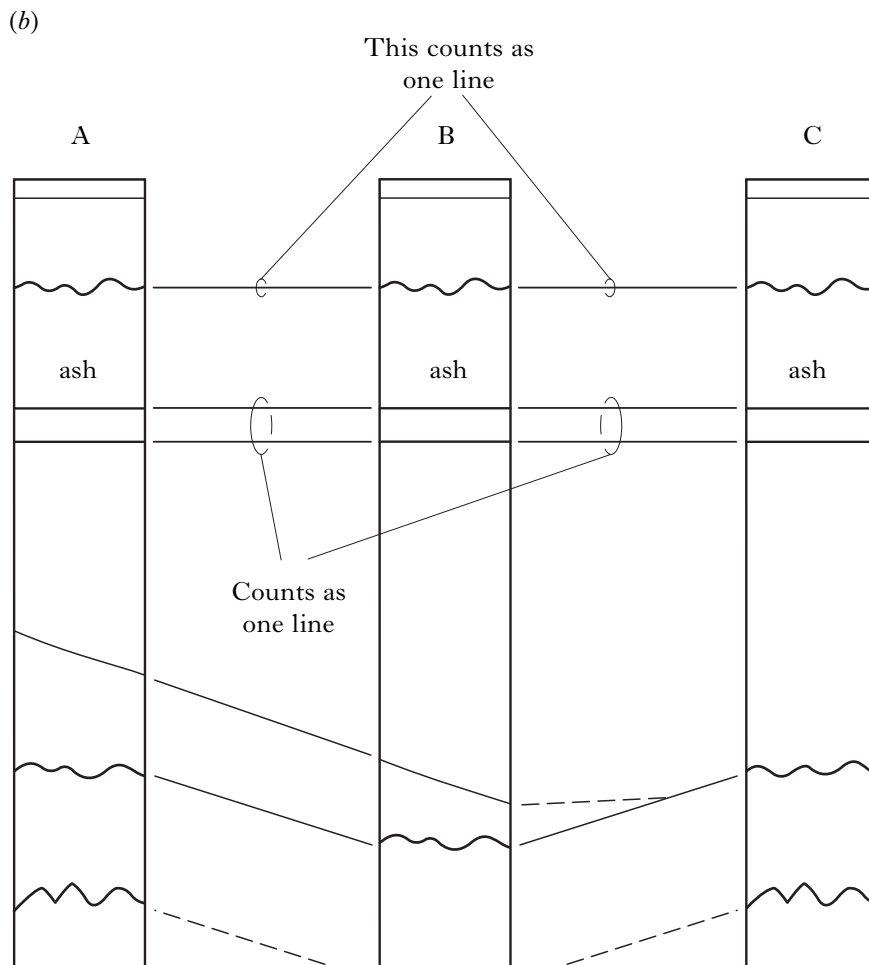
8. (a)  1 mark

- (b) Diagrams 1 mark
Symmetrical spreading at oceanic ridge 1 mark
Lavas magnetised in direction of prevailing field } 1 mark
Field reversals create pattern of symmetrical magnetic anomalies } 3 marks
- (c) Spreading: 230 km in 25 Ma = 9.2 km Ma⁻¹ 2 marks

9. Diagrams: 1 mark
 Volcano erupted onto sea floor builds up to form an island } 1 mark
 Volcano sinks }
 Coral growth keeps pace with sinking so that ring-shaped reef eventually forms 1 mark 3 marks
10. (a) F1: Down on west
 F2: NE side moved horizontally to SE
 F3: Down on east 3 marks
- (b) B 1 mark
- (c) D → C → A → E → B
 Order not position important
 5 in correct order 2 marks
 4 or 3 in correct order 1 mark
 2 in correct order 0 mark 2 marks
11. (a) (i) 30° or 210° 1 mark
 (ii) Angle of dip: 75°
 Direction of dip: Towards SE (or 120°) 2 marks
- (b) (i) Reverse fault 1 mark
 (ii) Compressive forces (acting NW – SE) 1 mark
- (c) C 1 mark
12. (a) Fossil P : 1 Cephalon Two or three labels correct 1 mark
 2 Thorax Four or five labels correct 2 marks
 3 Pygidium Six labels correct 3 marks
- Fossil Q: 1 Foramen
 2 Pedicle valve
 3 Brachial valve
- (b) Fossil P: Trilobite
 Fossil Q: Brachiopod Both correct for 1 mark
13. A *Mytilus* Lack of pallial sinus indicates very short siphons retained within the shell. The organism would not burrow. Rather, it would be attached to rocks.
- B *Venus* The small pallial sinus indicates short siphons which would extend only a short distance outside the shell. This is indicative of a shallow burrower.
- C *Mya* The large pallial sinus indicates long siphons which would extend a long way out of the shell. This is indicative of a deep burrower. 3 marks

14. (a) Accept any reasonable answer, eg
- 1 Graptolites evolved rapidly and rapidly became extinct.
 - 2 Each species existed for only a short time.
 - 3 They are widespread (because they were planktonic).
 - 4 They are common and easy to identify.
- 1 mark
- (b) *Nemagraptus*
- It existed for the shortest time (and so would define the narrow band of rocks).
- 1 mark
- (c) Middle Ordovician
- 1 mark

15. (a) From old to young:
- | | | |
|--|---------------------|---------|
| High grade metamorphism deep in crust forms gneiss. | Eight events in | |
| Uplift, erosion and deposition of conglomerate and marine sediments. | correct order | 4 marks |
| Uplift, erosion and deposition of second conglomerate. | Six or seven events | |
| Deltaic deposition forms cross-bedded sandstone and coal seam. | in correct order | 3 marks |
| Volcanic eruption leaves layer of ash. | Four or five events | |
| Marine deposition to form sandstones. | in correct order | 2 marks |
| Uplift, erosion and deposition of sediment in cold climate. | Two or three events | |
| Followed by peat formation. | in correct order | 1 mark |



1 mark for each correct line.
 (Do not award full marks if there are additional lines not in the correct positions.)

3 marks

15. (continued)

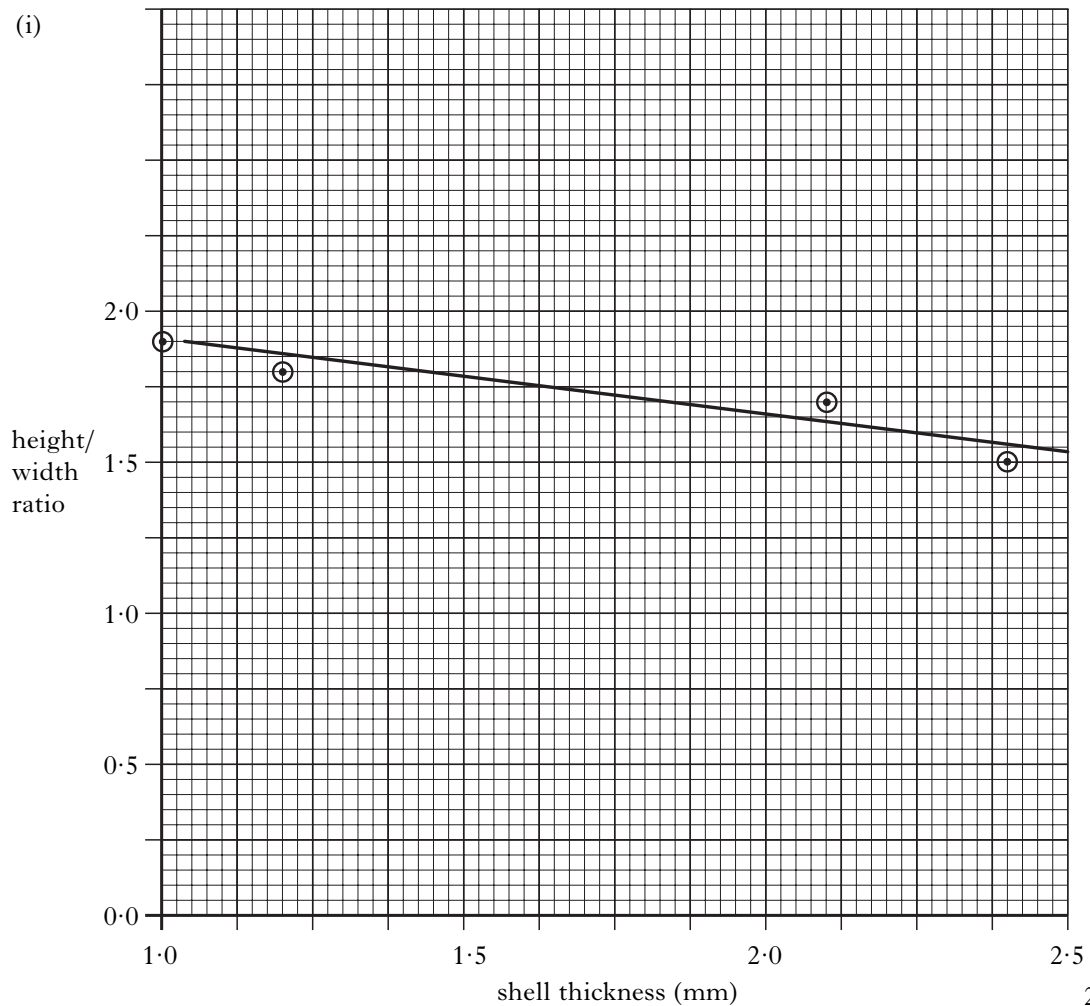
- (c)
- 1 Use a member of the quarry staff as a guide.
 - 2 Wear hard hats.
 - 3 Wear fluorescent jackets.
 - 4 Strictly adhere to instructions given by guide and by teacher/lecturer.
 - 5 Keep away from machinery.
 - 6 Be aware of the movement of lorries.
 - 7 Keep back from working faces.
 - 8 Keep off the tops of working faces.
 - 9 Carry a first-aid kit.
 - 10 Carry a mobile phone so you can quickly summon help.
- Accept other reasonable precautions.

1 correct	no mark
2 or 3 correct	1 mark
4 correct	2 marks

16. (a)
- | | |
|---|-----|
| P | 1.9 |
| Q | 1.8 |
| R | 1.7 |
| S | 1.5 |

2 marks

- (b) (i)



2 marks

- (ii) As the height/width ratio decreases, the shell thickness increases.

1 mark

16. (continued)

- (c) (i) As the current strength increases, the shell becomes rounder (decreased length/width ratio). 1 mark
- (ii) As the current strength increases, the shell becomes thicker. 1 mark
- (d) Accept any reasonable answers, eg
- (i) The very coarse grain size indicates a very high energy environment. Shells would be crushed by rolling pebbles and little food would be available. 1 mark
- (ii) There may have been more food than in the coarser sediment.
There may have been more oxygen than in the finer sediment. 1 mark

TOTAL: 95 marks

[END OF MARKING INSTRUCTIONS]