

BOARD OF STUDIES
NEW SOUTH WALES

HIGHER SCHOOL CERTIFICATE EXAMINATION

2000
GEOLOGY
2 UNIT

*Time allowed—Three hours
(Plus 5 minutes reading time)*

DIRECTIONS TO CANDIDATES

- Board-approved calculators may be used.

Section I—Core

- Attempt ALL questions.
- **Part A** 15 multiple-choice questions, each worth 1 mark.
Complete your answers in either blue or black pen on the Answer Sheet provided.
- **Part B** 10 questions, each worth 3 marks.
Answer this Part in the Part B Answer Book.
- **Part C** 6 questions, each worth 5 marks.
Answer this Part in the Part C Answer Book.
- Write your Student Number and Centre Number on the cover of each Answer Book.
- You may keep this Question Book. Anything written in the Question Book will NOT be marked.

Section II—Electives

- Attempt ONE question.
- Each question is worth 25 marks.
- Answer the question in a SEPARATE Elective Answer Book.
- Write your Student Number and Centre Number on the cover of the Elective Answer Book.
- Write the Course, Elective Name, and Question Number on the cover of the Elective Answer Book.
- You may ask for extra Elective Answer Books if you need them.

SECTION I—CORE

(75 Marks)

Attempt ALL questions.

PART A

Questions 1–15 are worth 1 mark each.

Instructions for answering multiple-choice questions

- Complete your answers in either blue or black pen.
- Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9
A B C D

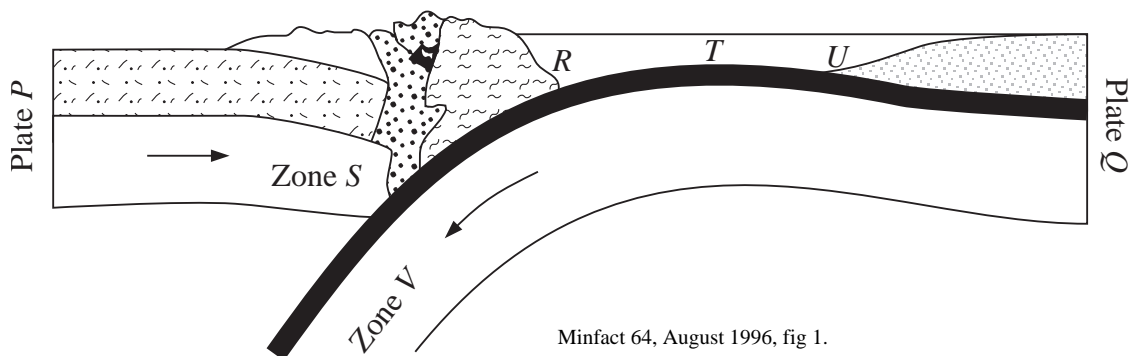
If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

A B C D
correct
↙




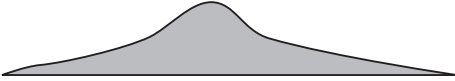
- 1 What is the asthenosphere?
- (A) A mobile zone in the upper mantle
 (B) A mobile zone immediately below the crust
 (C) A rigid zone in the upper mantle
 (D) A zone that does not transmit *S* waves
- 2 A rich gold-bearing ore body is being mined by open-cut methods. Which factor is LEAST likely to affect the economic viability of the mine?
- (A) Age of the mineralisation
 (B) Type of host rock
 (C) Tonnage of the ore body
 (D) Number of rainy days per year
- 3 The diagram shows a situation in which two lithospheric plates, *P* and *Q*, are colliding.

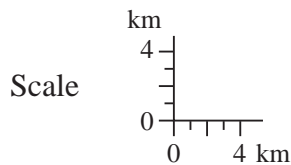


Which of the following correctly summarises the situation?

- (A) *P* is an oceanic plate, *Q* is a continental plate, and an island arc is located below *T*.
- (B) *P* is an oceanic plate, a Benioff zone is located at Zone *S*, and a trench is located at *U*.
- (C) *Q* is an oceanic plate, *P* is a continental plate, and a trench is located at *R*.
- (D) A Benioff zone is located at Zone *V*, a trench is located at *R*, and an island arc is located at *T*.

4 The diagrams in the table are all drawn to the same scale.

<i>Volcano shape and size</i>	<i>Composition of lava</i>	<i>Type of eruption</i>	<i>Typical plate tectonic setting</i>
A 	Basalt	Explosive	Convergent margin
B 	Rhyolite	Quiet	Continental hot spot
C 	Andesite	Quiet	Divergent margin
D 	Andesite	Explosive	Convergent margin



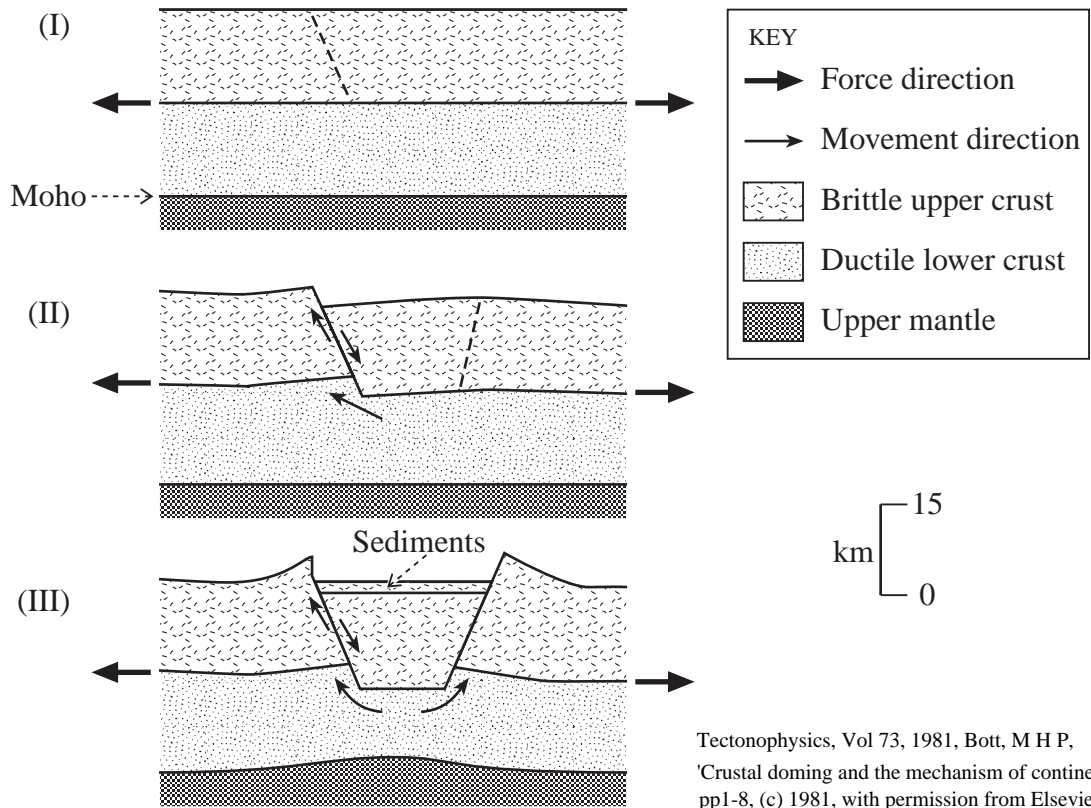
Only one row of information is correct. Which row is correct?

- (A) A
- (B) B
- (C) C
- (D) D

5 The mullock (waste rock) from a uranium mine commonly contains small amounts of radioactive material that can leach into the environment. What is the best method to prevent this material from contaminating the environment outside the mine site?

- (A) Screen the mine site, thus preventing access by animals that could move the mullock.
- (B) Crush the mullock and use it for road construction.
- (C) Plant vegetation on the mullock to stabilise it and prevent wind erosion.
- (D) Store the mullock in a covered pit with an impermeable lining.

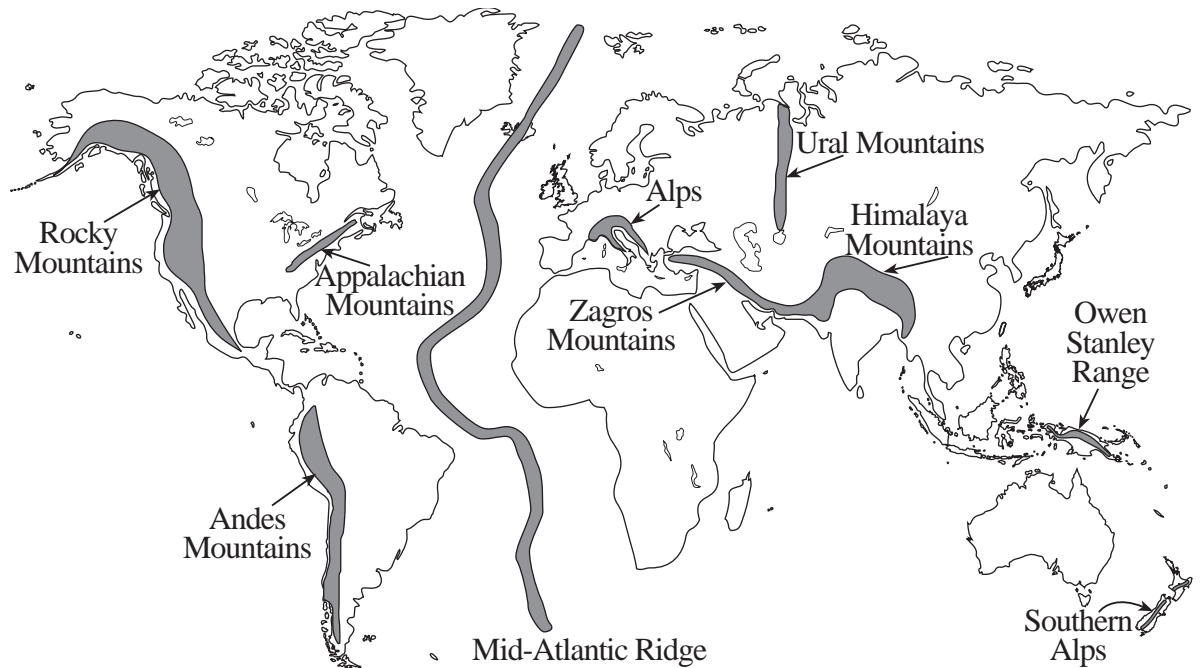
6 The cross-sections show the formation of a large-scale feature of the Earth's surface.



What feature is shown?

- (A) A rift valley, an example of which could be found in eastern Africa
 - (B) A mid-ocean ridge, an example of which could be found in the Atlantic Ocean
 - (C) A transform fault, an example of which could be found in western USA
 - (D) A trench, an example of which could be found in the Pacific Ocean
- 7 Which of the following rock types is most likely to be the best petroleum reservoir rock?
- (A) Granite
 - (B) Quartzite
 - (C) Sandstone
 - (D) Shale

8 The map shows some of the major mountain ranges of the world.



Weyman, D, Tectonic Processes, George Allen & Unwin, London, 1981.

Which of the following is a mountain range formed as a result of ancient, rather than current plate interactions?

- (A) Andes Mountains
 - (B) Himalaya Mountains
 - (C) Rocky Mountains
 - (D) Ural Mountains
- 9 Over what time span do fold mountain ranges generally form?
- (A) Tens of thousands of years (10^4 years)
 - (B) Hundreds of thousands of years (10^5 years)
 - (C) Tens of millions of years (10^7 years)
 - (D) Thousands of millions of years (10^9 years)

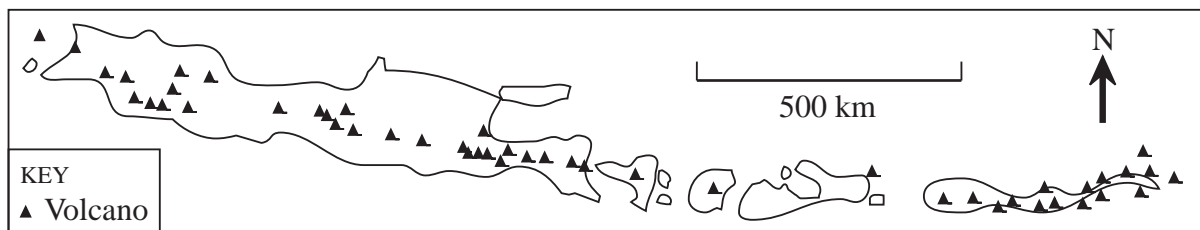
- 10 The diagram shows the pattern of magnetic reversals recorded in basaltic rocks in part of an ocean.



What is the dominant spreading direction for this pattern to form?

- (A) 
- (B) 
- (C) 
- (D) 

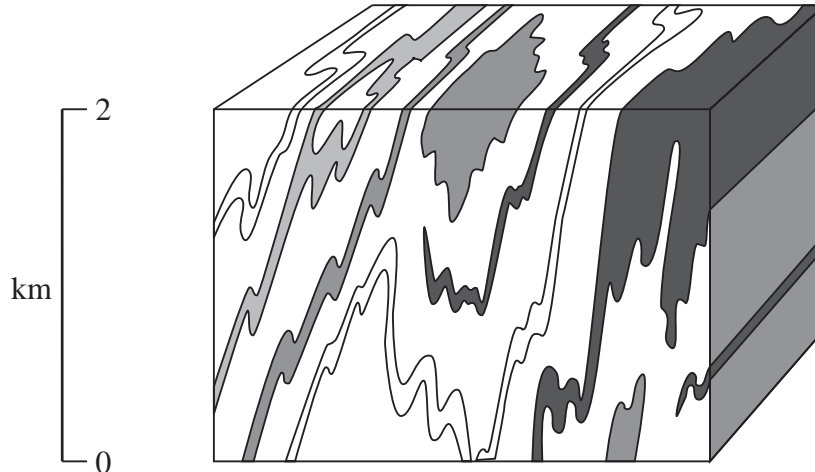
- 11 The map shows the distribution of currently active volcanoes in Java and adjacent islands.



To which feature are the volcanoes most likely related?

- (A) Continental rift zone
- (B) Convergent margin
- (C) Hot spot
- (D) Mid-ocean ridge

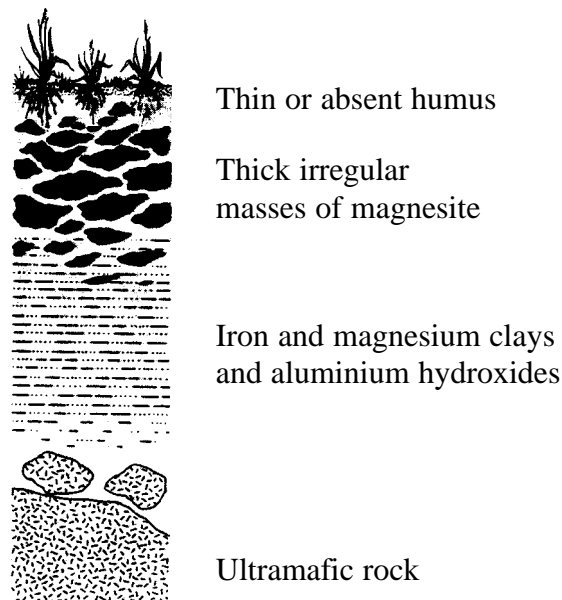
- 12 The diagram shows rock structures observed in a block of the Earth's crust.



Hamblin, W K & Howard, J D, Exercises in Physical Geology, Burgess Publishing Minnesota, 1975, 4th ed, p 57, fig 110.

Where would the structures shown in the diagram have formed?

- (A) At a mid-ocean ridge
 - (B) At a continental rift zone
 - (C) At an ocean-continent convergent zone
 - (D) At a continental hot-spot volcano
- 13 The diagram shows a sketch of a section through a magnesite (magnesium carbonate) deposit. Magnesium carbonate is an insoluble substance. These deposits form in hot wet climates.



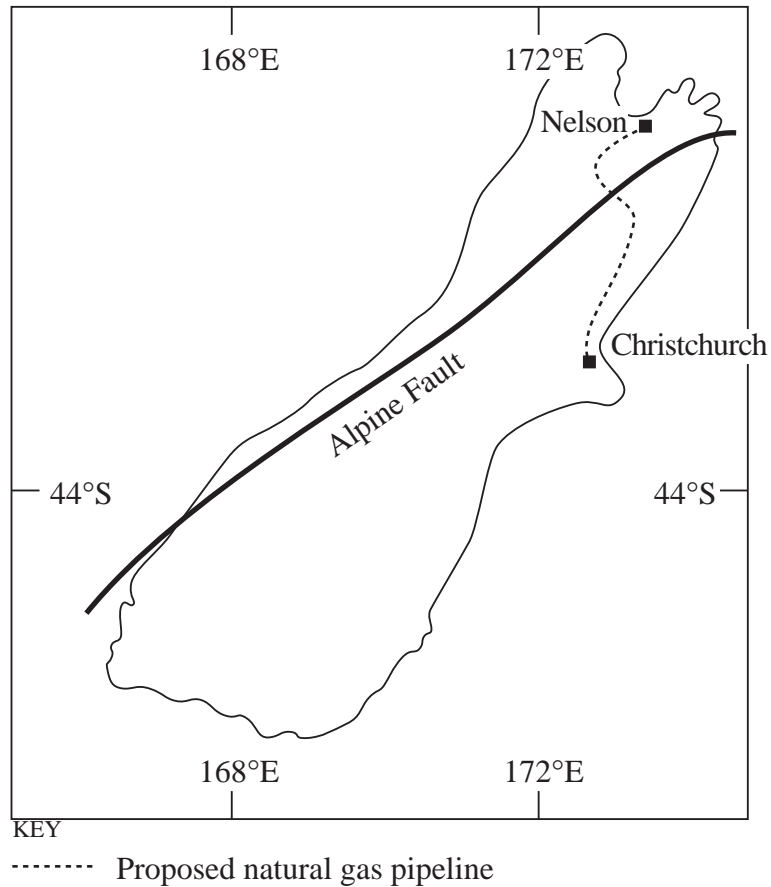
McLeish A, Geological Science, Blackie & Son, Glasgow, 1986, p 277.

How would this magnesite deposit have formed?

- (A) As a placer deposit
- (B) As a residual deposit
- (C) By hydrothermal activity
- (D) By igneous activity

- 14 The map shows the proposed position of a major gas pipeline from Christchurch to Nelson in the South Island of New Zealand. The pipeline will cross the Alpine Fault.

The Alpine Fault is a major transform fault.

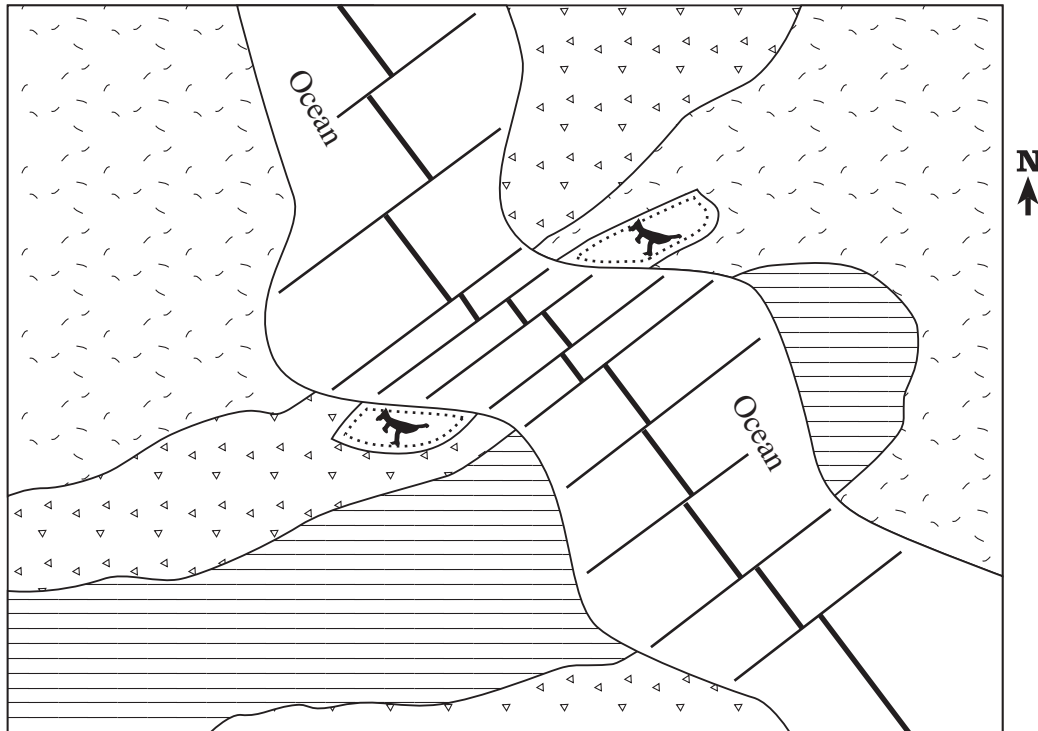


New Zealand Journal of Geology and Geophysics 33, 2, 1990 p 202 (c) SIR Publishing, the Royal Society of New Zealand


What is the dominant movement that the pipeline must be designed to withstand?

- (A) Compressional movement
- (B) Horizontal shear movement
- (C) Tensional movement
- (D) Vertical shear movement

- 15 The map shows a mid-ocean ridge that separates two continental masses that were previously joined. The ridge has been active over the last five million years.



KEY

 Active mid-ocean ridge and transform faults

 Early Tertiary sedimentary basin

 Precambrian fold belt

 Mesozoic sedimentary basin

 Early Palaeozoic fold belt

 *Allosaurus* fossil

Which piece of land-based evidence is INCONSISTENT with the continental drift and plate tectonic hypotheses?

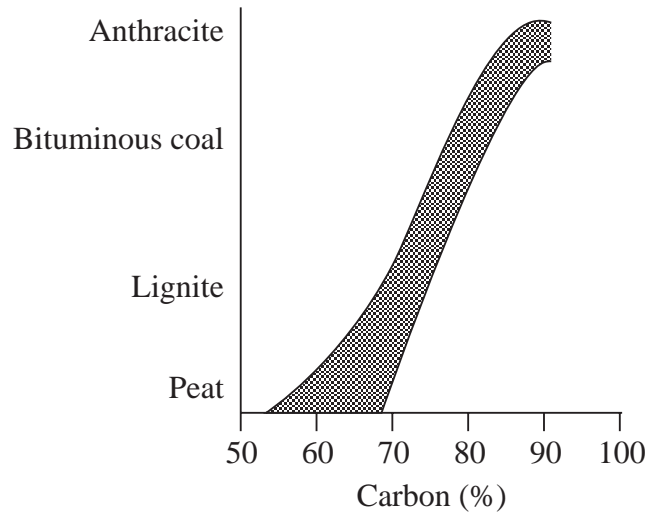
- (A) The locations of the *Allosaurus* fossils
- (B) The locations of the Mesozoic sedimentary basin
- (C) The locations of the early Tertiary sedimentary basin
- (D) The locations of the Precambrian fold belt

PART B

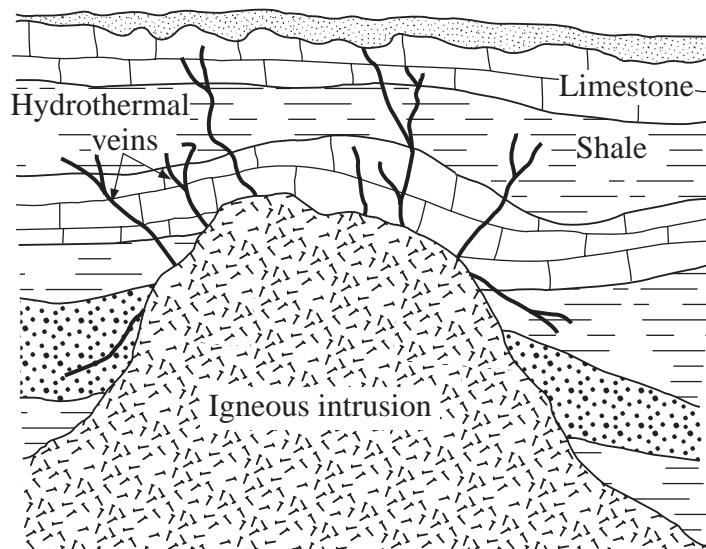
Questions 16–25 are worth 3 marks each.

Answer this Part in the Part B Answer Book.

- 16 The graph shows the weight percentage of carbon in coals of increasing rank.



- (a) Describe the trend shown in the graph.
- (b) Explain the trend shown in the graph.
- (c) How does anthracite differ in appearance from peat?
- 17 The diagram shows a section through an igneous intrusion with associated hydrothermal veins. The intrusion contains 0.01% copper, whereas the veins contain 5% copper.

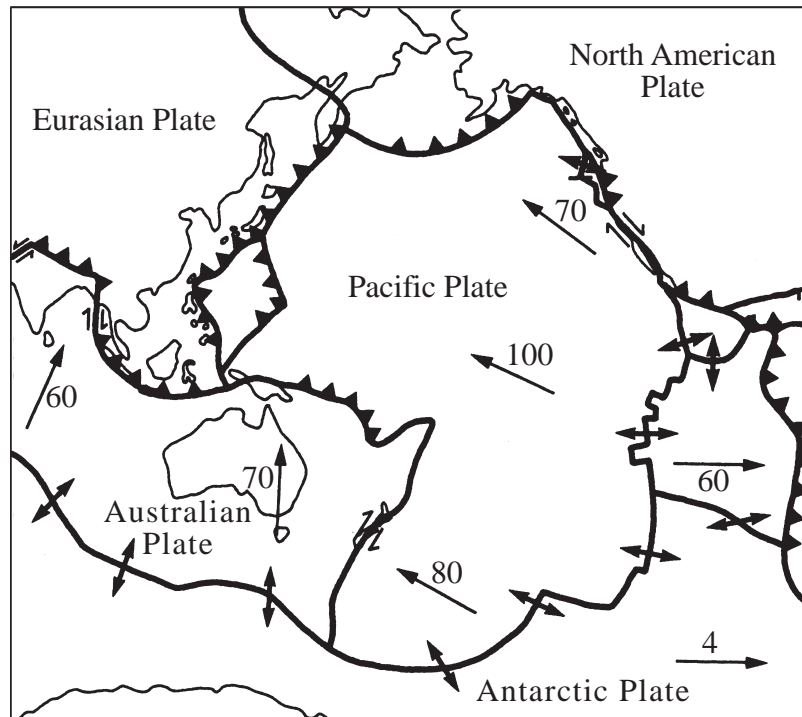


Montgomery, C W, Fundamentals of Geology, 3rd ed, Wm C Brown, Dubuque, Iowa, 1997, p 53.
Reproduced with permission of The McGraw-Hill Companies.

- (a) Explain how the copper became concentrated in the veins.
- (b) Name TWO other metals that could be concentrated in a similar way.

- 18 (a) (i) Name ONE physical property of the asthenosphere that is different in the lithosphere.
- (ii) Briefly describe how it is different.
- (b) Outline how our knowledge of the asthenosphere allows us to explain plate motion.

- 19 The diagram shows the plate boundaries in the Pacific Ocean region.



KEY

- Divergent boundary
- Convergent boundary
- Conservative boundary
- 40 Plate velocity (mm per year)

Montgomery, C W, Fundamentals of Geology, 3rd ed, Wm C Brown, Dubuque, Iowa, 1997, fig 9.5.
Reproduced with permission of The McGraw-Hill Companies.

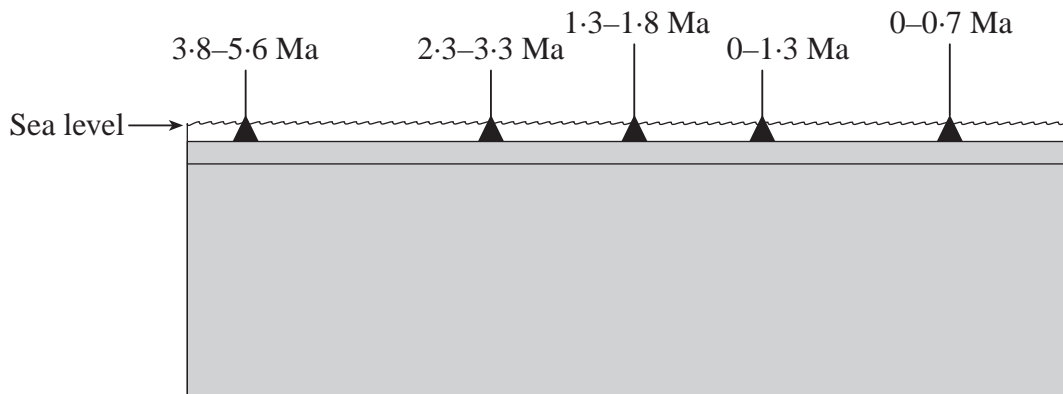
- (a) Name the type of boundary that would form if the directions of movement were reversed along the Australian Plate–Antarctic Plate boundary.
- (b) Describe TWO features characteristic of the type of plate boundary you named in part (a).

- 20** In 1900, it was believed that the Southern Atlantic Ocean was ancient and unchanging. It is now known that the Southern Atlantic Ocean is widening, and that South America and Africa are moving apart.

Describe **THREE** pieces of ocean-based evidence that support this present view of the Southern Atlantic Ocean.

- 21** (a) State **TWO** distinctive characteristics of a shield area.
 (b) Describe the process by which a shield area forms.

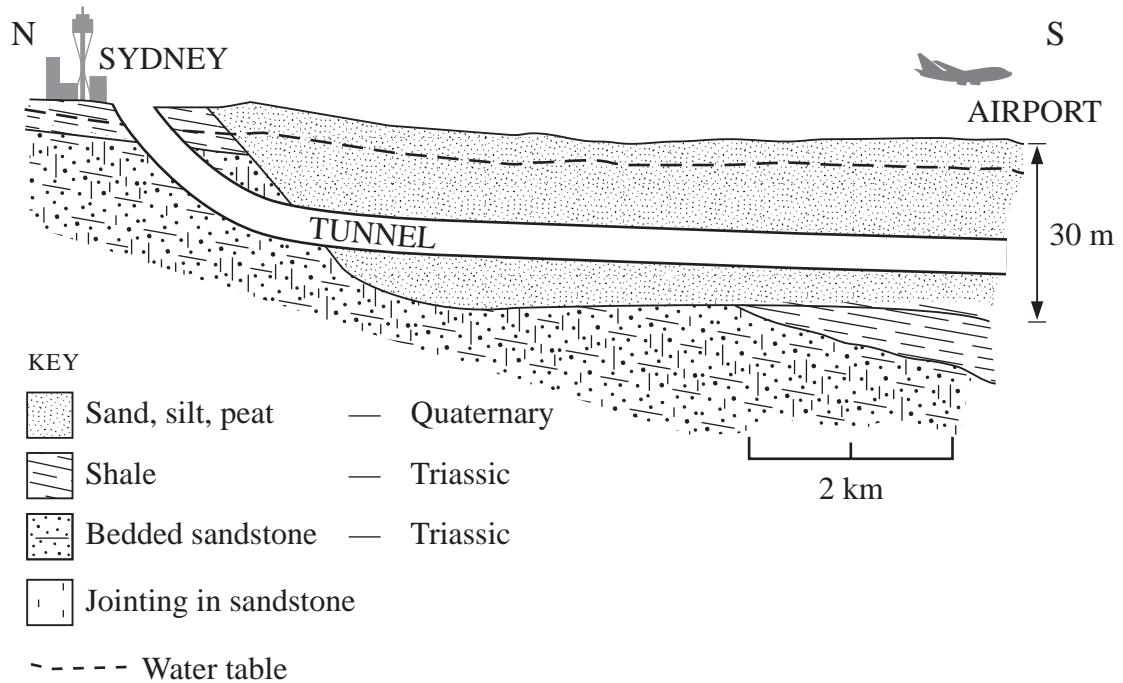
- 22** The diagram shows a schematic cross-section through an oceanic plate, the position of five volcanic islands, and their ages.



- (a) On the diagram in the Part B Answer Book, draw an arrow to indicate the direction of plate movement.
- (b) (i) For this type of volcanic island chain, state the composition of the lava erupted.
 (ii) Sketch the shape of a typical volcano formed in this setting. Relate this shape to the characteristics of the eruptions that produced it.

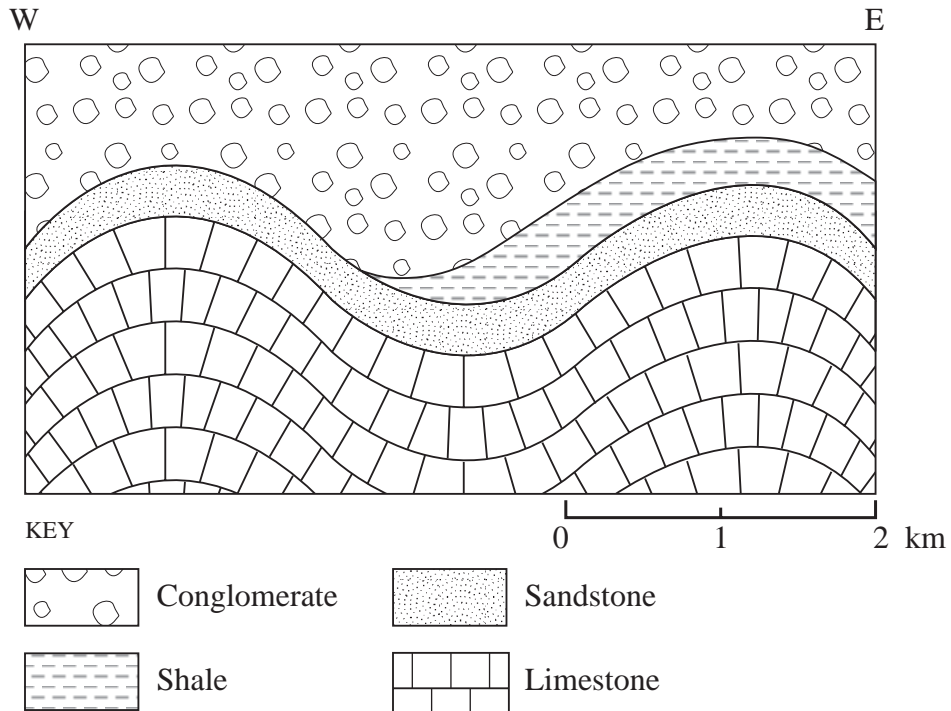
- 23 A major engineering project recently completed in Sydney was the Airport Rail Link. This was constructed as an underground tunnel through rock and soft, waterlogged sediments.

A section of the tunnel and surrounding geology is shown.



Describe THREE different geological problems that needed to be overcome in constructing this tunnel.

- 24 The diagram shows a geological cross-section of a region that has the potential to produce oil and gas.



- (a) On the diagram in the Part B Answer Book, draw a line to represent a drill hole that would most likely strike oil and/or gas.
- (b) Give TWO reasons why you chose this site.
- 25 The elevation of the Himalaya Mountains is maintained by two processes, plate convergence and isostasy.

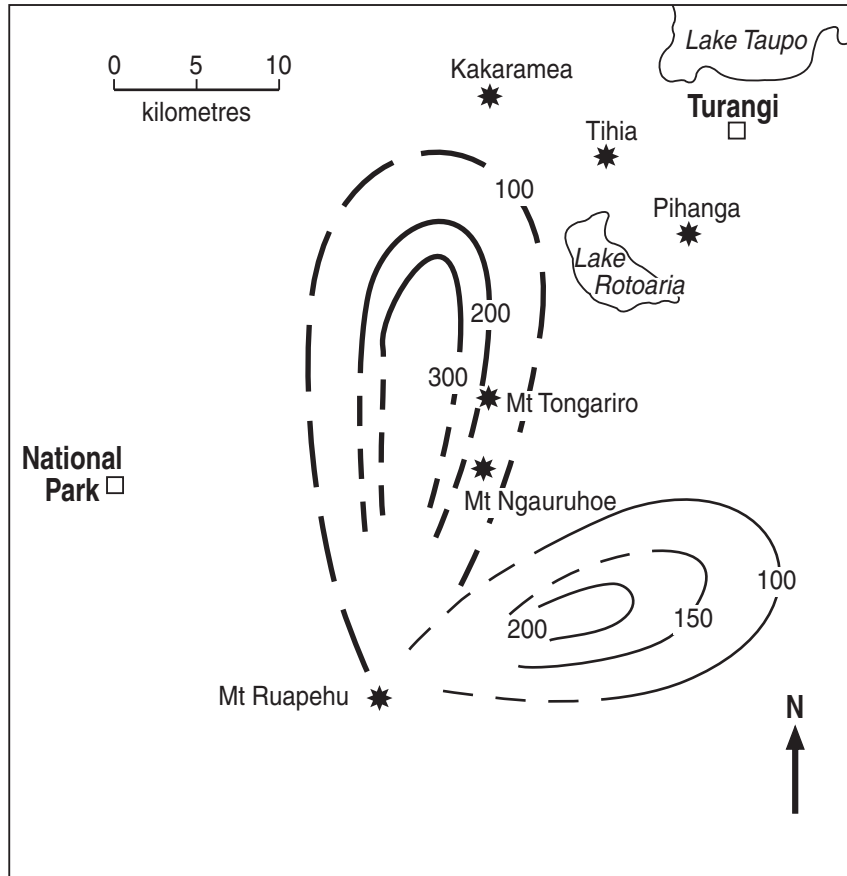
Explain the role of isostasy in maintaining the elevation of the Himalaya Mountains.

PART C

Questions 26–31 are worth 5 marks each.

Answer this Part in the Part C Answer Book.

- 26 The diagram shows several vents in the Tongariro volcanic zone, New Zealand, and isopachs for two ash units, OK2 and OK3. Isopachs are lines of equal ash thickness. The Tongariro volcanic zone is related to a *subduction zone*.



KEY

★ Volcanic vent

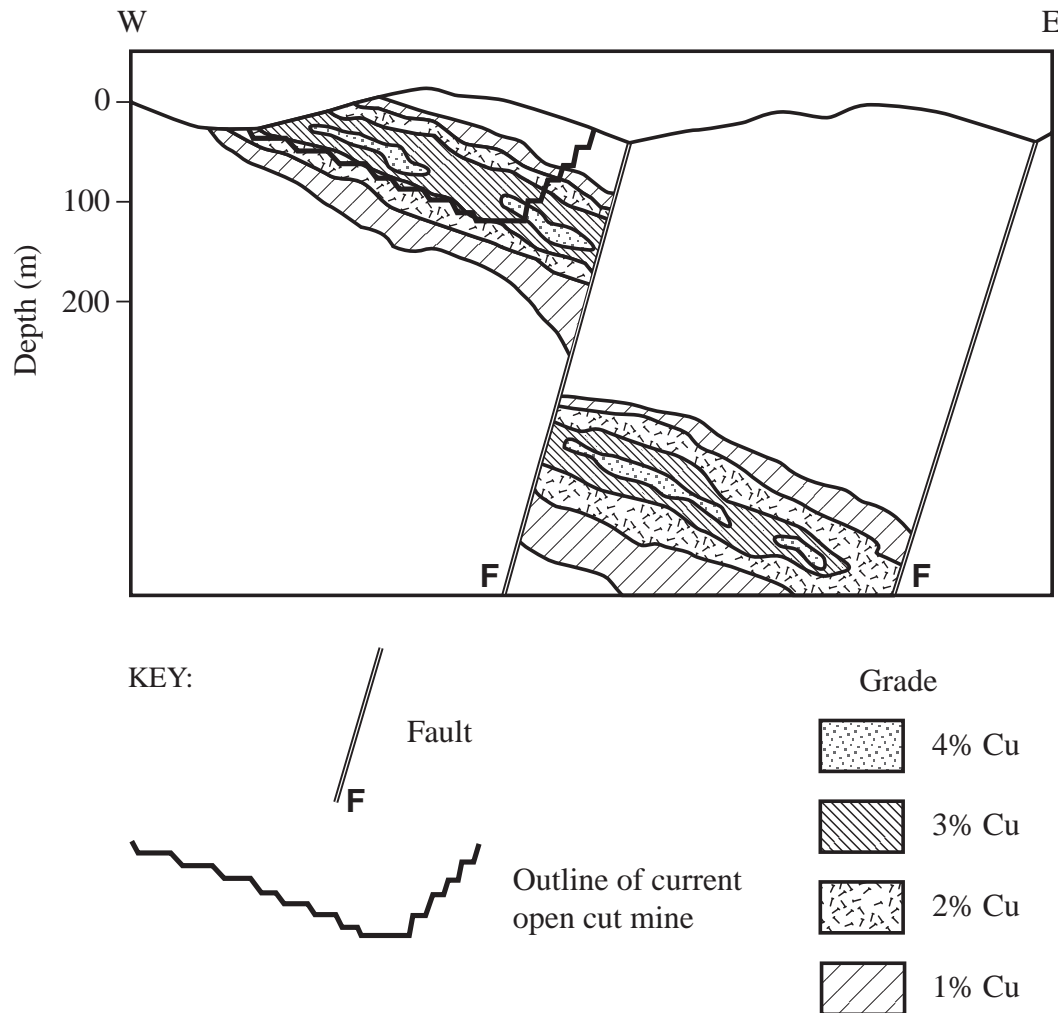
— ash isopach with ash thickness in millimetres

- - - ash isopach with ash thickness in millimetres

New Zealand Journal of Geology and Geophysics 16, pp 397-423.

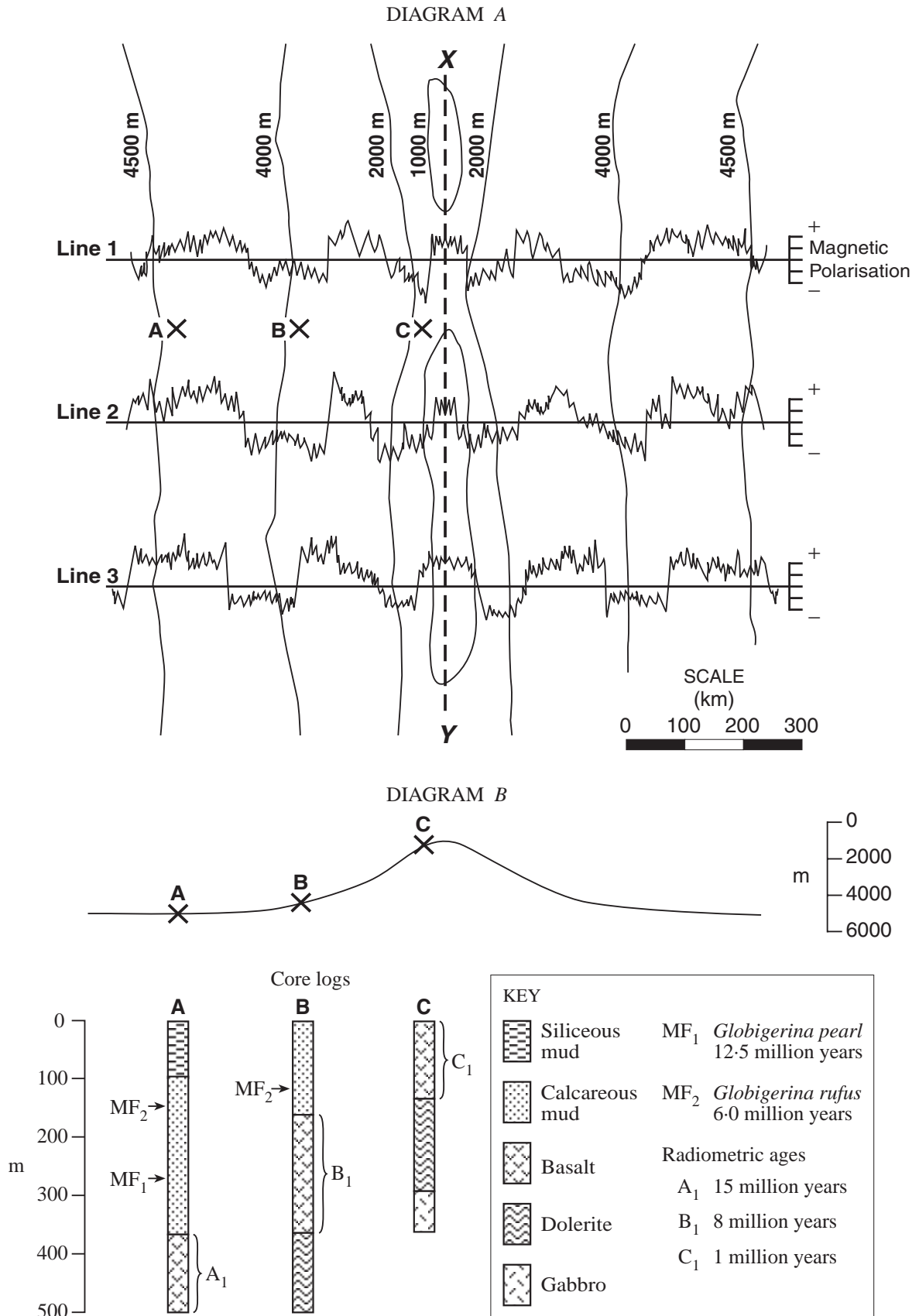
- State the composition of the volcanic material erupted from these volcanic vents.
- Sketch and label a diagram to show the internal structure of this type of volcano.
- Describe and explain the difference between the distributions and thicknesses of the ash layers OK2 and OK3.

- 27 The diagram shows a faulted, shallow, copper ore body dipping at 20° to the east and being mined by open cut methods. The present cut-off grade of the ore body is 3% copper. Maximum mining depth by open cut methods is 200 m. The mine is located 300 km from the nearest town.



- Define the term *grade*.
- Explain what is likely to happen to future mining operations if the price of copper increases.
- The existing open cut mine has caused a number of environmental problems. State TWO possible problems.
- The deeper part of the ore body will be mined as an underground operation. Describe ONE new environmental factor that has to be considered.

28 Diagram A is a map that shows three magnetic anomaly profiles and contour lines on an ocean floor. Diagram B is a cross-section through A, B and C. Beneath Diagram B are the core logs for drill holes A, B and C.

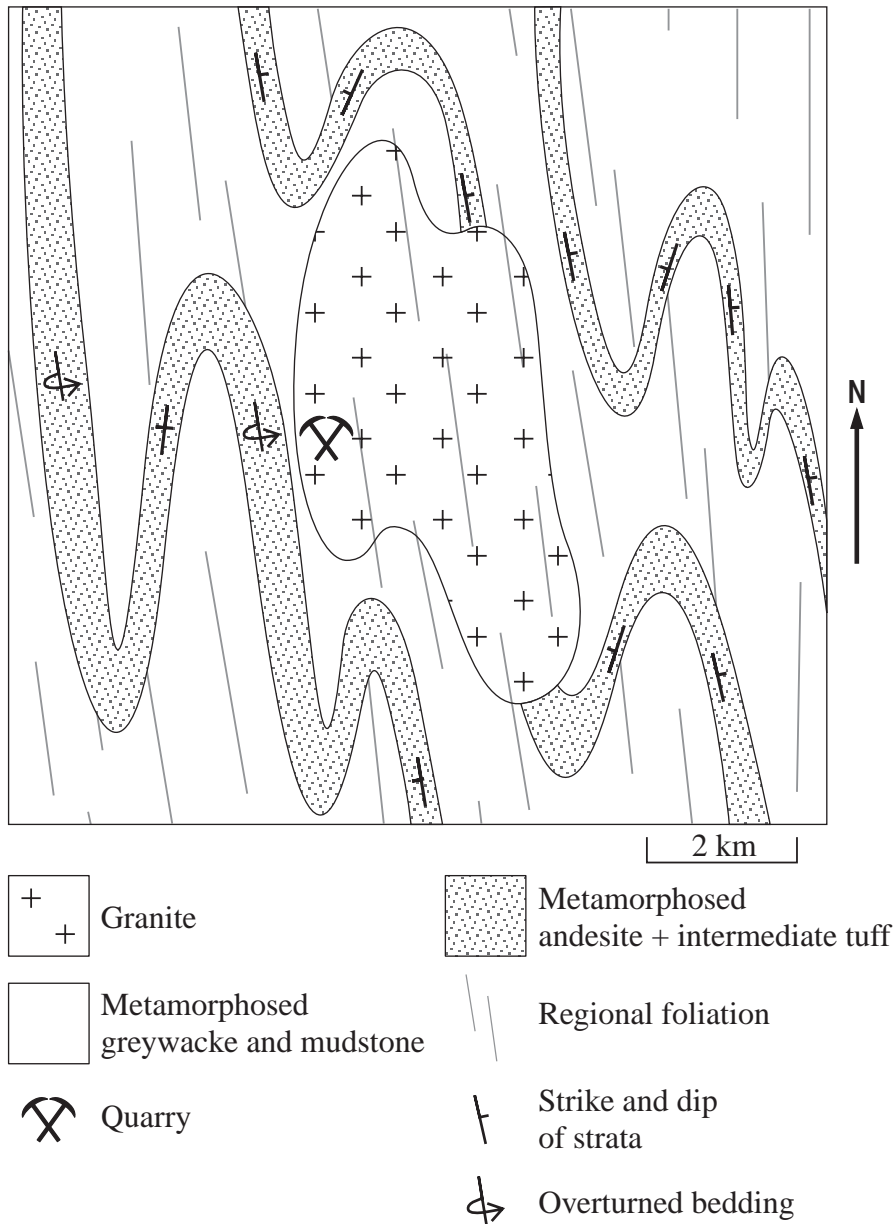


QUESTION 28 (Continued)

- (a) Name the large-scale geological feature present in the region depicted in the diagrams.
- (b) Calculate the average rate of motion, in kilometres per million years, experienced by the rocks and sediment located at site A.
- (c) What is the average rate of sediment accumulation, in metres per million years, at site B?
- (d) Explain why the magnetic signatures on Lines 1, 2, and 3 are approximately symmetrical about the line *XY*.

Please turn over

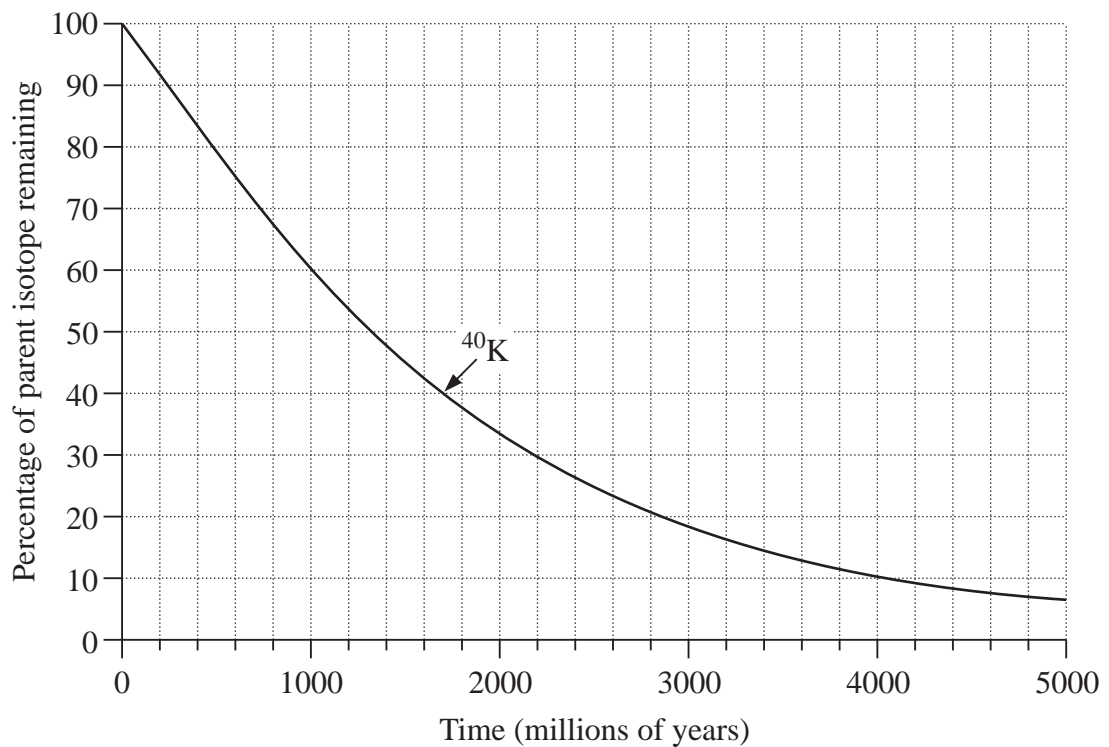
- 29 The map shows a granite body that intruded a sequence of regionally metamorphosed mudstone, greywacke and intermediate volcanic rocks. Both the granite and the metamorphic rocks have a distinct foliation that strikes approximately north-south.



Question 29 continues on page 21

QUESTION 29 (Continued)

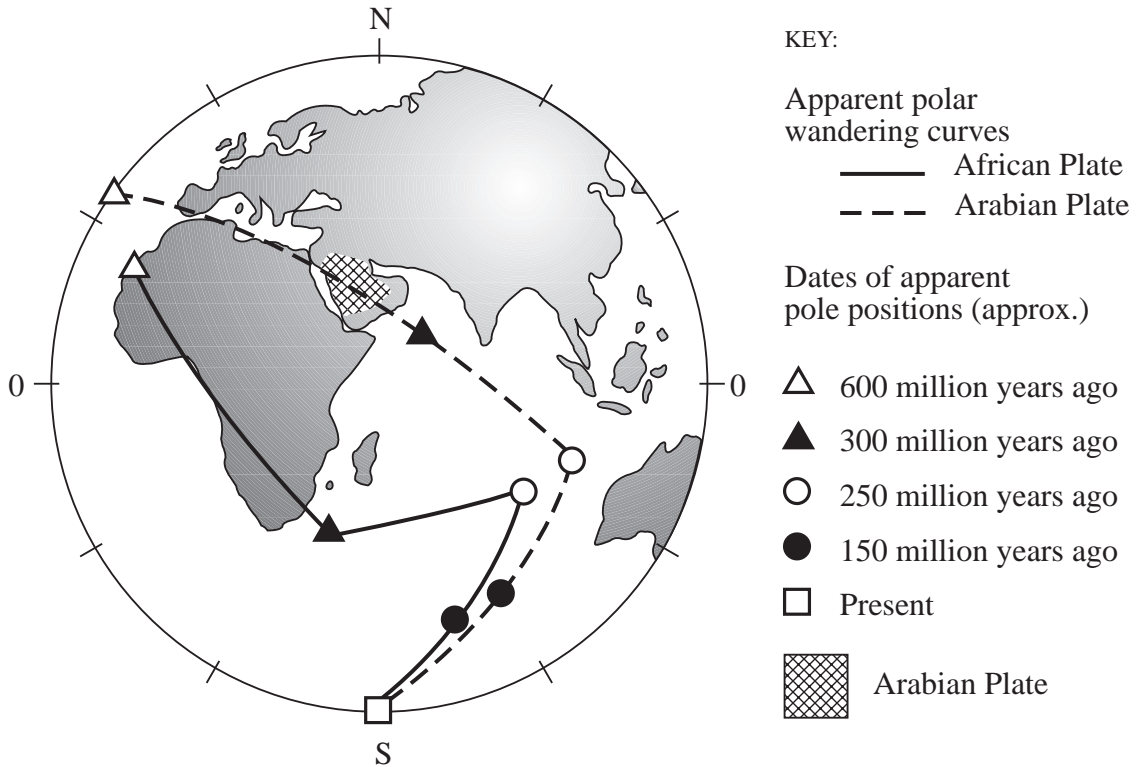
- (a) Name a plate tectonic setting in which these rocks and structures could have developed.
- (b) Describe how foliation develops in rocks in such a setting.
- (c) List the following events in order from oldest to youngest:
- the formation of the foliation
 - the emplacement of the granite
 - the formation of the mudstone/greywacke/volcanic sequence.
- (d) Analysis of the granite revealed that it retains 70% of its original ^{40}K . Use the radioactive decay curve to determine the age of the granite.



- 30 Fold mountains are composed of rocks representing all the major rock groups—volcanic, plutonic, regional metamorphic, contact metamorphic, and sedimentary.

Name ONE rock type from each of the five groups above that you would expect to find in a fold mountain range. For EACH of these rock types, briefly explain how it becomes part of a fold mountain range.

- 31 The diagram shows the apparent polar wandering curves for the African Plate (solid line) and Arabian Plate (dashed line).



Montgomery, C W, Fundamentals of Geology, Wm C Brown, Dubuque, Iowa, 3rd ed 1997, p 144.
Reproduced with the permission of The McGraw-Hill Companies.

- (a) What is an *apparent polar wandering curve*?
- (b) Using the apparent polar wandering curves, describe the motion of the African Plate and Arabian Plate relative to each other over the past 600 million years.
- (c) Describe the data that you would need if you were required to construct a polar wandering curve for the Australian Plate for the past 200 million years.

SECTION II—ELECTIVES

(25 Marks)

Attempt ONE question.

Answer the question in a SEPARATE Elective Answer Book.

	Pages
QUESTION 32 Contemporary Sedimentary Processes	24–27
QUESTION 33 Igneous Rocks	28–31
QUESTION 34 Economic Geology	32–33
QUESTION 35 Regional Geology	34–35
QUESTION 36 Palaeontology	36–41

QUESTION 32 Contemporary Sedimentary Processes**Marks**

In this elective you have studied the sedimentary processes that are occurring in a present-day depositional environment. You will have undertaken some field work and laboratory investigations in order to study the environment and produce a report.

- (a) Name the depositional environment you studied, and state its location.
- (b) Draw and label a full-page sketch map of the area you studied. The map should include: **3**
- (i) sampling locations;
 - (ii) direction(s) of sediment transport;
 - (iii) locations of features of particular interest, such as sedimentary structures, sediment sources, and locations of human influence on sedimentary processes.
- (c) Describe, in detail, the methods that were used to: **5**
- (i) determine the composition, grain size, distribution and shape of the sediment grains;
 - (ii) measure the velocity of the transporting medium;
 - (iii) determine the source of the sediment.
- (d) (i) Use labelled diagrams to illustrate TWO sedimentary structures that were characteristic of the environment. **3**
- (ii) Describe the composition and average grain size of the sediment found in one of these structures.

Question 32 continues on page 25

QUESTION 32 (Continued)	Marks
(e) List THREE organisms, excluding humans, found in the environment. Discuss how these organisms interacted with the environment, and how they affected the sedimentary processes you observed.	3
(f) Describe, in detail, ONE significant effect that human activity has had on the sedimentary processes that you observed in your study area. Assess its influence in changing the natural processes.	2
(g) You are on a field trip to another region and you find an exposure of sedimentary rocks in a cliff face. This exposure contains some, but not all, of the structures you observed in the present-day depositional environment you studied. (i) Briefly describe the field and laboratory methods you would use to interpret the environment in which the sedimentary rocks in the cliff face formed. (ii) Explain how you would support an hypothesis that the rocks in the cliff face might have formed in a different depositional environment from the one you studied.	4

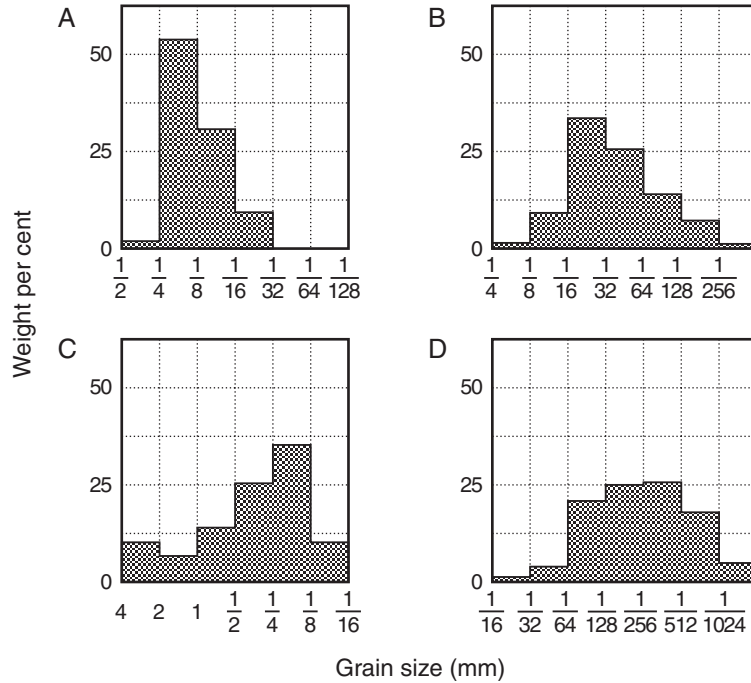
Question 32 continues on page 26

QUESTION 32 (Continued)

Marks

- (h) Diagram A shows four frequency histograms, A, B, C, and D that show the grain size distributions of four different sediments. 5

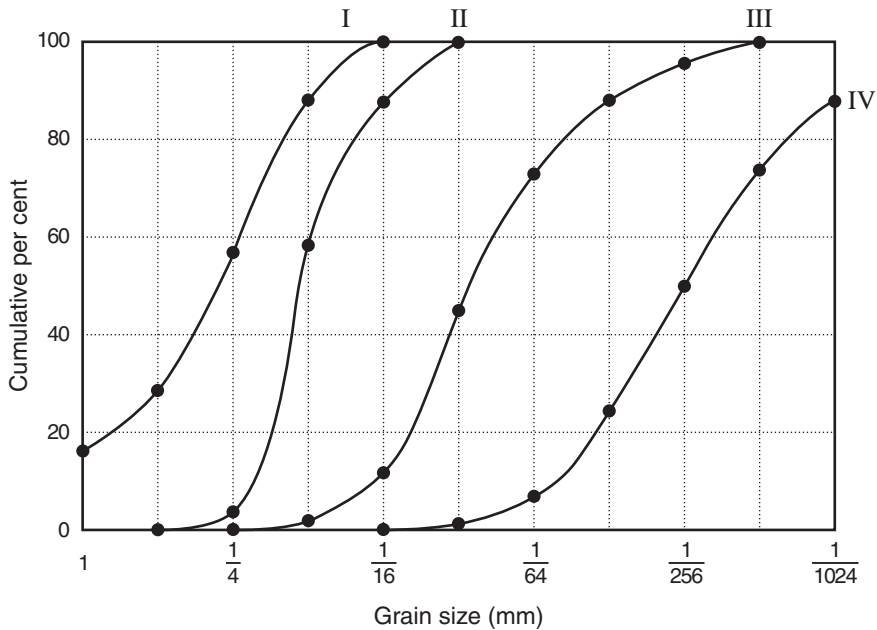
DIAGRAM A



Blatt, H, Middleton G, and Murray, R, Origin of Sedimentary Rocks, Prentice-Hall, Englewood Cliffs, NJ, 1972, p 35.

Diagram B shows cumulative frequency curves labelled I, II, III and IV, for the SAME four sediment samples shown in Diagram A. They are in no particular order.

DIAGRAM B



Question 32 continues on page 27

QUESTION 32 (Continued)

Marks

- (i) Match each frequency histogram (A, B, C and D) with the correct cumulative frequency curve (I, II, III or IV).
- (ii) From the cumulative frequency curve, give:
- 1 the MEDIAN (50%) grain size of the finest sediment sample;
 - 2 the sediment sample that displays the best sorting.
- (iii) The four sediment samples were obtained from a river, a desert sand dune, a deposit of wind-blown silt, and a deep marine clay.

Match each of the histograms with its correct source, giving reasons for your choices.

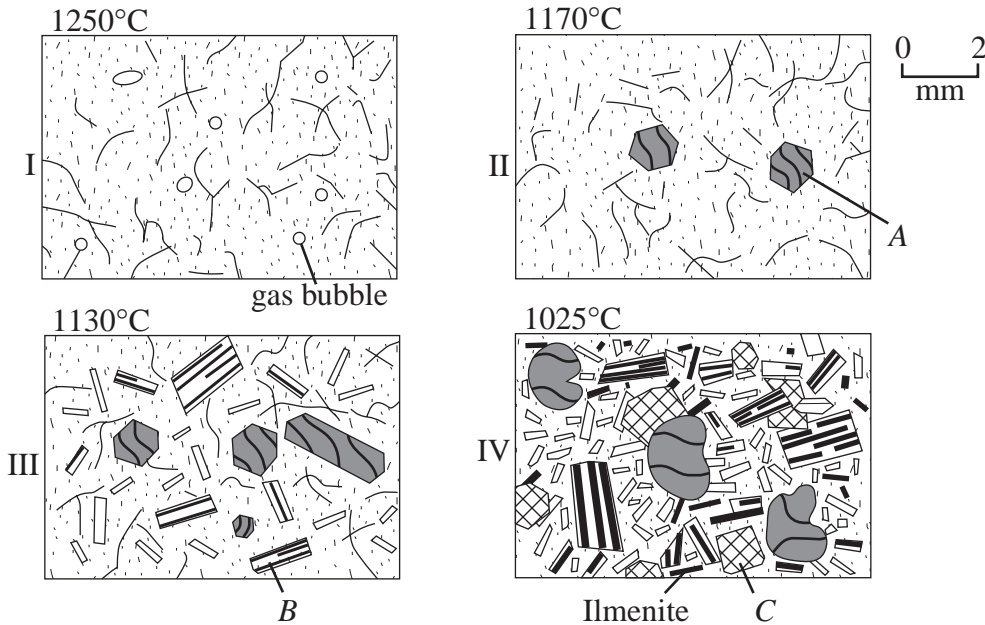
End of question

QUESTION 33 Igneous Rocks**Marks**

(a) This question relates to the diagrams and table shown.

11

The four photomicrographs (I, II, III, and IV) show a sequence of four consecutive stages in the cooling of a 30 m thick lava flow. The samples were taken from the centre of the flow at five-year intervals. The temperature of each sample is given at the top left-hand corner of the photomicrograph. The samples were instantly cooled to room temperature.



The table shows the major element composition of the lava, as weight per cent of oxides.

<i>Oxide</i>	<i>Weight per cent</i>
SiO ₂	47.52
TiO ₂	3.29
Al ₂ O ₃	15.95
Fe ₂ O ₃	3.16
FeO	8.91
MnO	0.19
MgO	5.18
CaO	8.96
Na ₂ O	3.96
K ₂ O	1.09
P ₂ O ₅	0.64
H ₂ O	1.36
Total	99.85

Question 33 continues on page 29

QUESTION 33 (Continued)

Marks

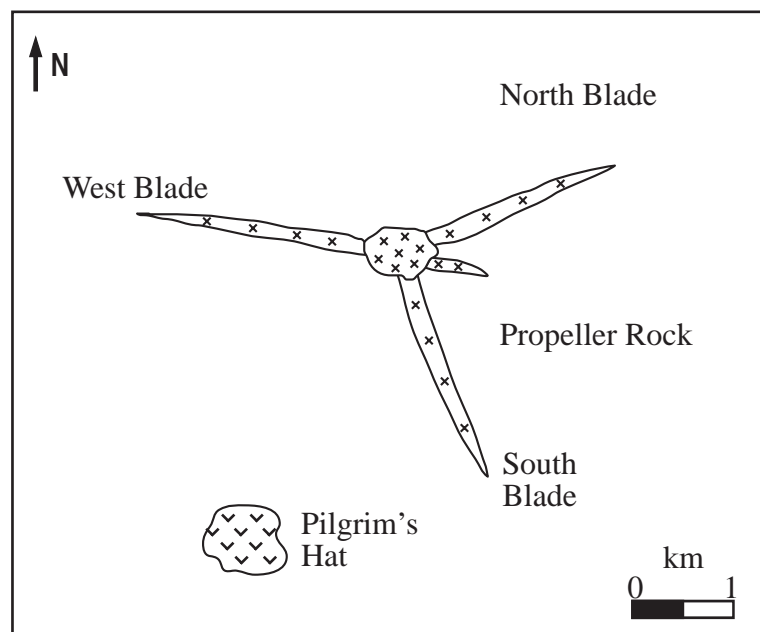
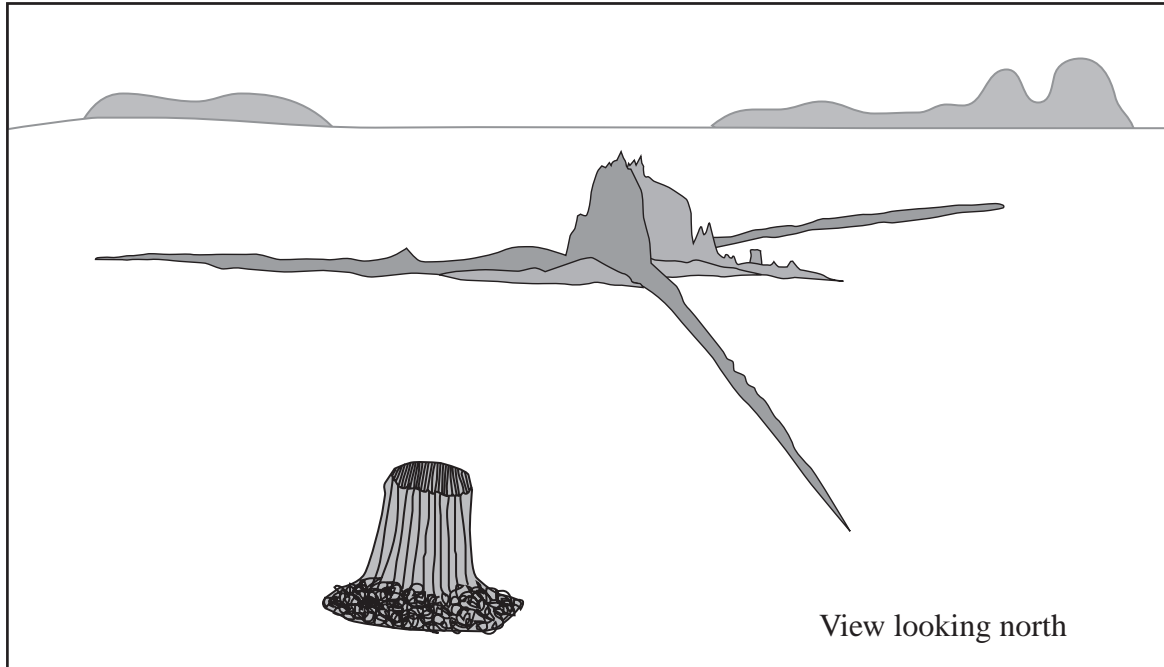
- (i) Determine a name for the lava, using its major element composition.
- (ii) Name the minerals labelled *A*, *B*, and *C*.
- (iii) Describe the cooling history of the lava flow, and give an order of crystallisation for the minerals present.
- (iv)
 - 1 Name the texture shown in photomicrograph I.
 - 2 Explain why samples taken from the base of the lava flow have the same texture as that shown in photomicrograph I.
- (v) Name the texture shown in photomicrograph II.
- (vi)
 - 1 Name the rock type that is the plutonic equivalent of this lava.
 - 2 Draw and label a sketch that shows the texture of the rock type you named in part (vi) 1.
- (vii) The rock type shown in photomicrograph IV is composed mostly of crystals. Compare the texture shown in photomicrograph IV with the texture shown in the sketch you drew for part (vi) 2. Explain any differences.
- (viii) Name the type of volcano that would be entirely composed of this lava type, and indicate a typical plate tectonic setting for this volcano.

Question 33 continues on page 30




QUESTION 33 (Continued)

Marks

- (b) This question relates to the sketch and the geological map that show the igneous landforms called Pilgrim's Hat and Propeller Rock. 9



KEY

-  Microgranite, age 15.5 ± 0.3 million years
-  Microdiorite, age 15.6 ± 0.3 million years
-  Mudstone, age 155 million years

Question 33 continues on page 31

QUESTION 33 (Continued)

Marks

- (i) What type of igneous structure is Pilgrim's Hat?
 - (ii) What type of igneous structure is North Blade?
 - (iii) The land surface around Propeller Rock and Pilgrim's Hat formed about 5 million years ago. Use a series of labelled diagrams to show how Pilgrim's Hat, Propeller Rock, and the Blades formed.
 - (iv) Chemical analysis of the microdiorite and the microgranite that form Propeller Rock and Pilgrim's Hat indicates that these two rock types formed from the same parent magma.
 - 1 Name a possible parent magma.
 - 2 Explain, in detail, how the microdiorite and the microgranite formed from the parent magma.
- (c) (i) Name TWO types of economic deposits, other than hydrothermal vein deposits, commonly associated with intrusive igneous rocks. **5**
- (ii) Briefly describe how EACH type of economic deposit you named in part (c) (i) forms.

End of question

QUESTION 34 Economic Geology**Marks**

In this elective, you studied TWO of the following:

- an economic deposit formed by igneous and/or metamorphic processes;
- an economic deposit formed or concentrated by weathering or sedimentary processes;
- an engineering project.

(a) For an economic deposit you studied, answer the following questions. **10**

- (i) Name the economic deposit.
- (ii) Describe the resource, the final product or products, and its/their eventual use or uses.
- (iii) Draw and label a cross-section of the deposit. Show both the economic deposit and the surrounding geology.
- (iv) Describe in detail the geological processes that were responsible for forming and concentrating the deposit.

(b) For EITHER a second economic deposit, OR an engineering project you studied: **10**

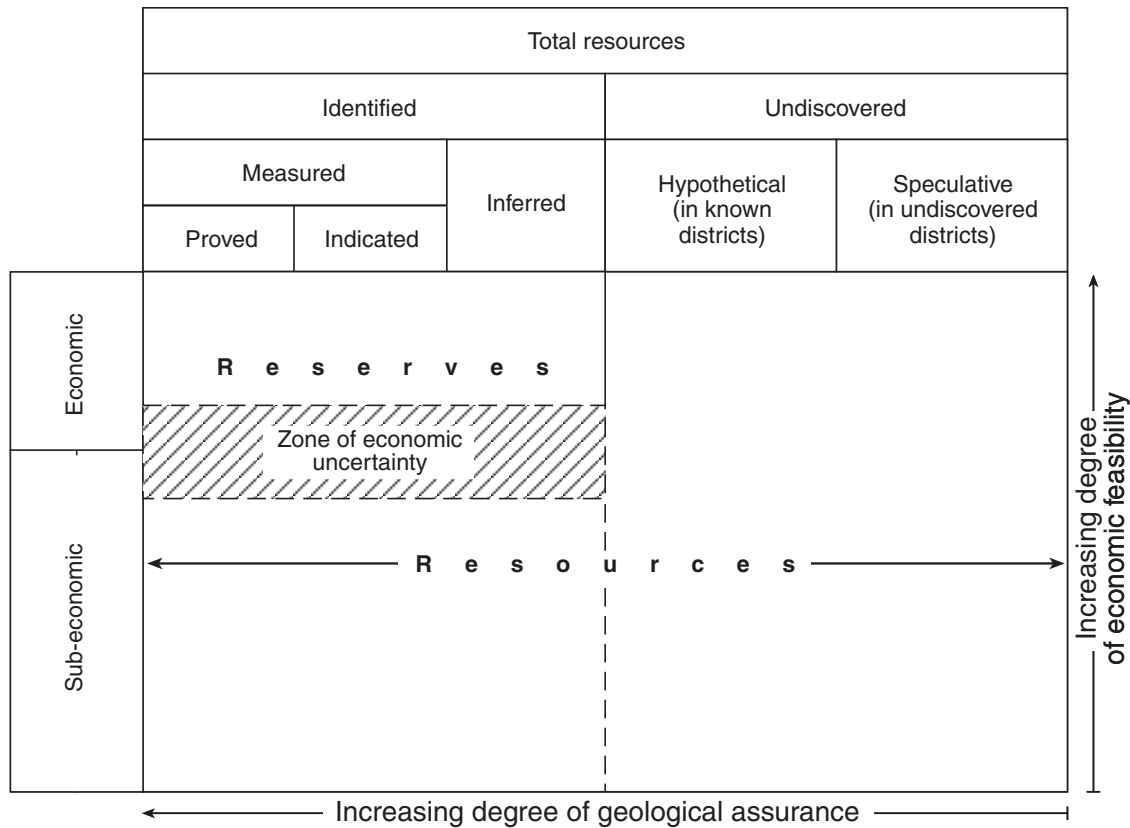
- (i) Name the deposit or project.
- (ii) Name one exploration or testing method used in this deposit or project. For this method, describe:
 - 1 why it was used;
 - 2 the procedures used;
 - 3 the results obtained.
- (iii)
 - 1 Describe TWO environmental factors that influenced the development or operation of the deposit or project.
 - 2 Choose ONE environmental factor described in part (b) (iii) 1. Explain the effect it had on the operation or maintenance of the deposit or project.
- (iv) Explain how the geology of the site influenced EITHER the design and construction of the project, OR the extraction method used in the project.

Question 34 continues on page 33

QUESTION 34 (Continued)

Marks

- (c) The diagram shows one scheme that can be used to categorise reserves and resources to indicate areas of immediate economic interest. 5



Evans A M, Ore Geology & Industrial Minerals: An Introduction, Blackwell Scientific Publications, Boston, 1993, p 24.

- (i) With reference to the diagram, state the difference between the terms *indicated*, *inferred*, and *proved* reserves.
- (ii) Name and briefly describe TWO factors that could move an ore body into or out of the 'Zone of economic uncertainty'.
- (iii) With reference to the diagram, distinguish between Reserves and Resources.

End of question

QUESTION 35 Regional Geology**Marks**

In this elective, you studied one of the following regions:

- North-western Fold Belt
- Central and Southern Fold Belt (northern areas)
- Central and Southern Fold Belt (southern areas)
- New England Fold Belt
- Sydney Basin.

Name the region you studied.

- | | | |
|-----|--|----------|
| (a) | <ul style="list-style-type: none"> (i) Draw a stratigraphic column for the region you studied. On the column, show the major lithological units and unconformities, using appropriate symbols. Do NOT include intrusive igneous rocks. (ii) Label each unit on the right-hand side of the column. Include the name of the unit and the names of the major rock types. (iii) Explain why a stratigraphic column is a useful tool for understanding the geological evolution of the region. | 4 |
| (b) | The geomorphology, land use, and vegetation of an area are controlled by the underlying lithology. Choose TWO of the major lithological units from your region, and describe how these units have influenced the geomorphology and EITHER land use OR vegetation. | 4 |
| (c) | <ul style="list-style-type: none"> (i) Name and draw a diagram of a major structural feature in the region you studied. Label the lithological unit(s) in which the feature occurs. (ii) Describe the significance of this structural feature in terms of the geological development of the region. | 3 |
| (d) | <p>The region includes an economic deposit or mine.</p> <ul style="list-style-type: none"> (i) Name the deposit or mine. (ii) Name the economic commodity in this deposit. (iii) Describe the formation of the deposit. | 3 |

Question 35 continues on page 35

QUESTION 35 (Continued)

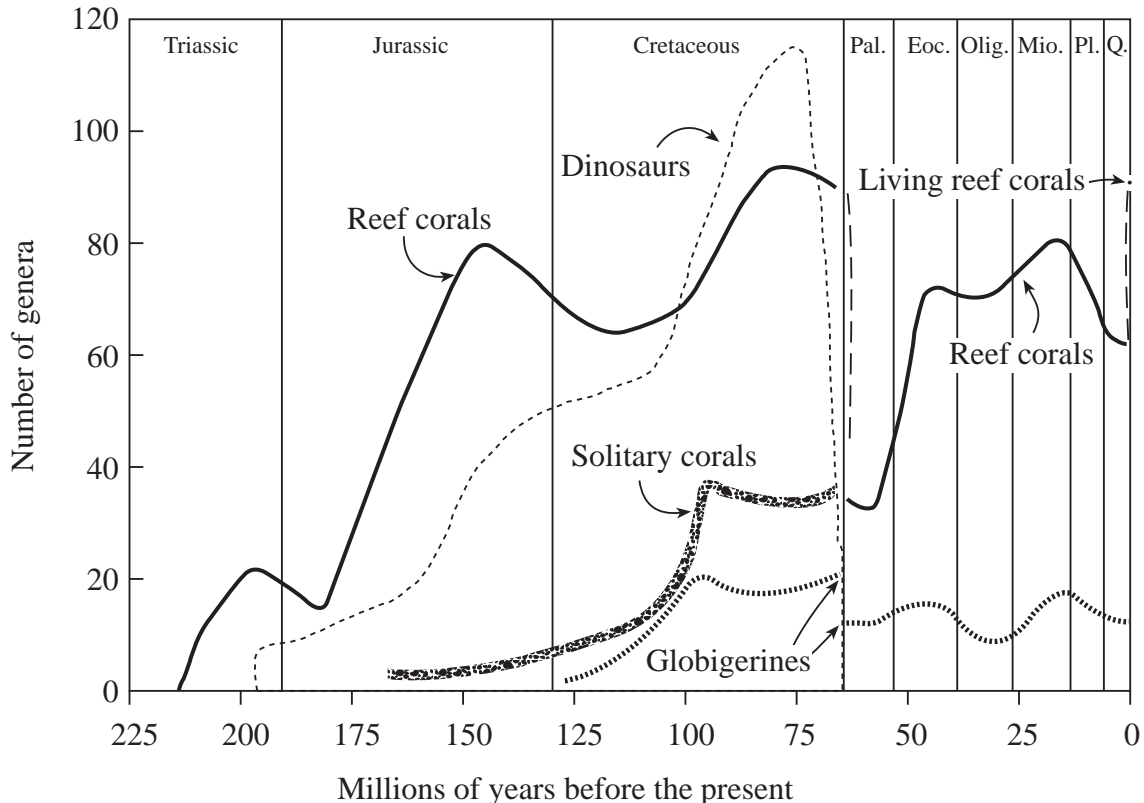
Marks

- (e) The region contains a feature of special geological interest. **3**
- (i) Name the feature.
 - (ii) Describe, in detail, the formation, construction or development of this feature.
- (f) (i) Name the types of boundaries between the region you studied and TWO adjacent regions. **3**
- (ii) Describe the significance of each of the boundaries named in part (f) (i), in terms of the geological development of the region.
- (g) You will have used a number of methods to investigate the region you chose. **5**
- (i) Maps and air photos are sources of information. For each, describe the type of geological information you can obtain.
 - (ii) Explain the meaning of a scale of 1 : 100 000 when given on a map or air photo.
 - (iii) Name TWO other sources of information you used during your investigation of the region you chose. Evaluate these sources in terms of their usefulness.

End of question

QUESTION 36 Palaeontology**Marks**

(a) The diagram shows the number of genera of animal groups since the Triassic.

5

Berggren, W A & Van Couvering, J A (eds), *Catastrophes and Earth History: The New Uniformitarianism*, Princeton NJ, Princeton University Press, 1984.

- (i) What was the maximum number of dinosaur genera?
 - (ii) When did the first reef corals evolve?
 - (iii) Suggest ONE reason why the number of dinosaur genera increased during the Jurassic.
 - (iv) State the maximum number of reef coral genera, and when this number was achieved.
 - (v) Compare the trend in the number of dinosaur genera with the trend in the number of solitary coral genera and Globigerines during the Cretaceous.
- (b) Discuss, in detail, ONE probable cause for the changes in the number of genera across the Cretaceous–Palaeocene boundary. **3**
- (c) (i) What is a *missing link*? **2**
- (ii) Explain why many animal groups have *missing links* in their fossil record.

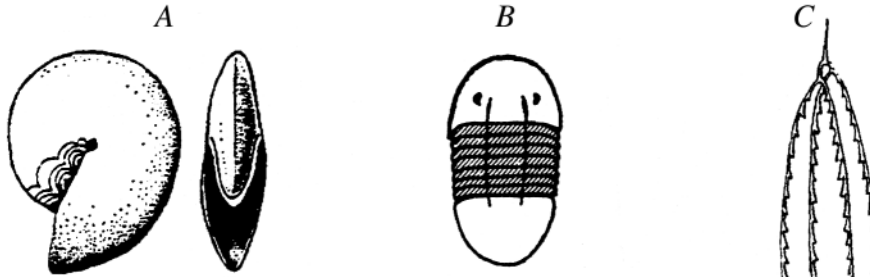
Question 36 continues on page 37

QUESTION 36 (Continued)

Marks

(d) The diagrams show three fossils *A*, *B*, and *C*.

7



McDonnell, Massey et al, Enquiring into the Earth,
 Longmans 1968, pp 136-137.
 Reprinted with permission of Pearson
 Education Australia, www.longman.com.au.

Branagan D, Beneath the Scenery:
 Geology for senior students,
 Science Press, Marrickville, NSW, 1971, p53.

- (i) To which group does each of the fossils *A*, *B*, and *C* belong?
- (ii) Select ONE of these groups.
 - 1 Name the group.
 - 2 When did this group first appear?
 - 3 When did this group become extinct?
 - 4 Describe the environment in which this group lived.
 - 5 Describe the major morphological changes that occurred in this group as it evolved.
- (iii) For ONE of the above groups, OTHER than the one you selected in part (ii), discuss why it is difficult to classify members of this group to species level.

(e) (i) What is *evolution*?

3

- (ii) How is the fossil record useful for demonstrating evolution? In your answer, use examples from ONE fossil group, but not the same group selected in part (d) (ii).

Question 36 continues on page 38

QUESTION 36 (Continued)

Marks

(f) Answer EITHER (i) OR (ii) OR (iii).

5

EITHER

- (i) Select TWO fossil assemblages from different palaeo-environments.
- 1 Discuss how the fossils in each assemblage might be used to interpret the palaeo-ecology of the assemblages.
 - 2 Discuss evidence, other than fossils, that you might use to interpret the palaeo-ecology of each assemblage you selected.

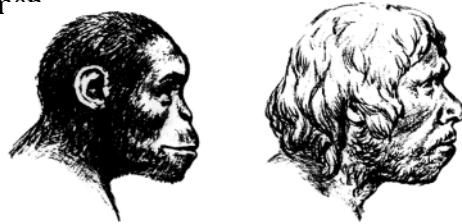
OR

Question 36 continues on page 39

QUESTION 36 (Continued)

Marks

(ii) The diagrams show an artist's impression of *Australopithecus* and Neanderthal man



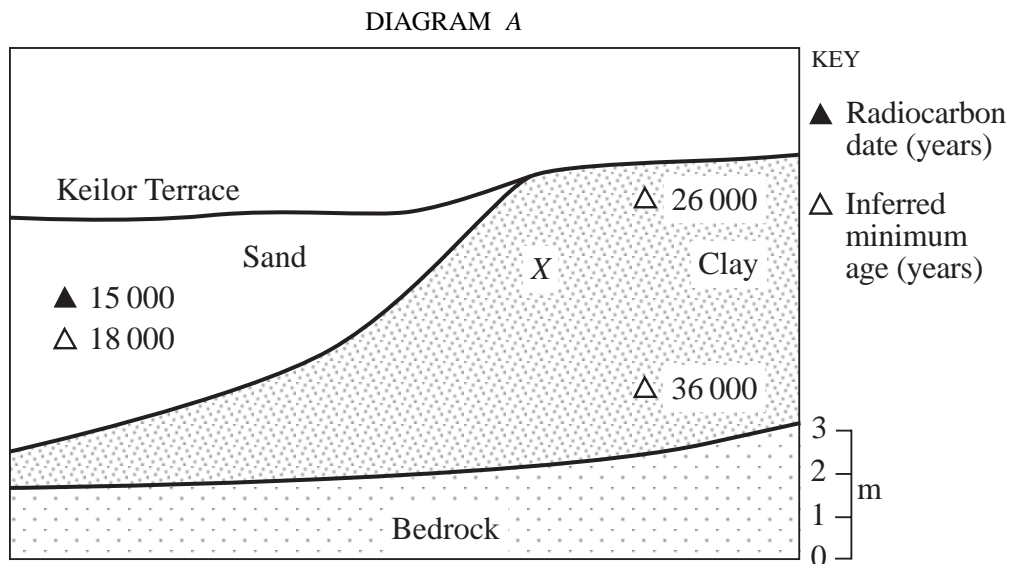
Simpson, Pittendrigh & Tiffany, Life: An Introduction to Biology, Routledge & Kegan Paul, 1958, fig 32.16

Australopithecus

Neanderthal man

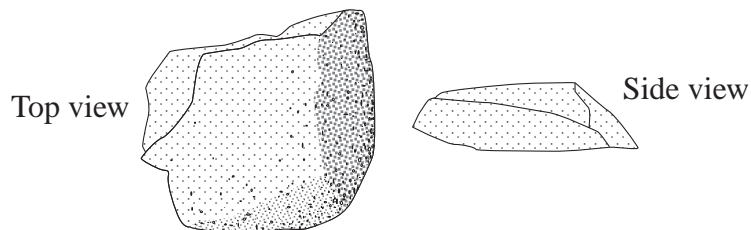
1 Which of the two is more closely related to modern people? Justify your answer.

Diagram A shows a cross-section through the Keilor Terrace, Maribyrnong River, Victoria. Diagram B shows an Aborigine's tool found at the level marked by X.



Continent of Hunter-gatherers: new perspectives in Australian prehistory, Cambridge Uni Press, Melbourne, Vic, 1997. Reprinted with the permission of Cambridge Uni Press

DIAGRAM B



- 2 What is the age of the Aborigine's tool?
- 3 How might you verify the age of the tool?
- 4 What evidence would you look for to determine the lifestyle of the owner of the tool?

OR

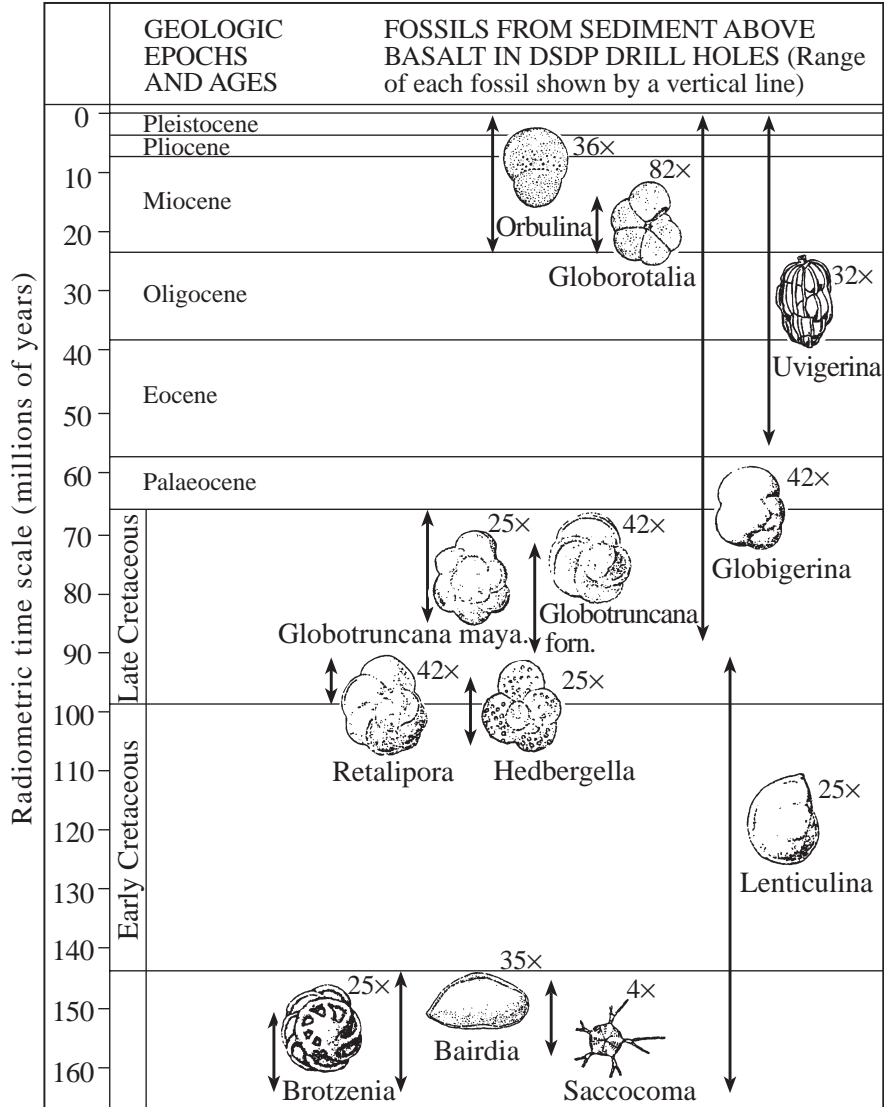
Question 36 continues on page 40

QUESTION 36 (Continued)

Marks

(iii) Diagram C shows the age range of micro-fossils recovered from Deep Sea Drilling Project (DSDP) drill holes.

DIAGRAM C



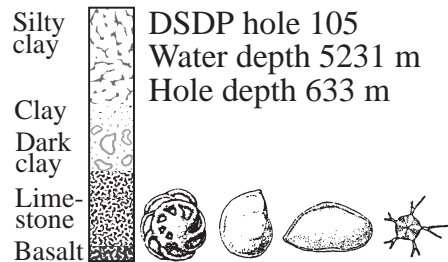
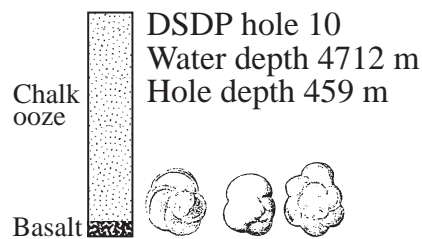
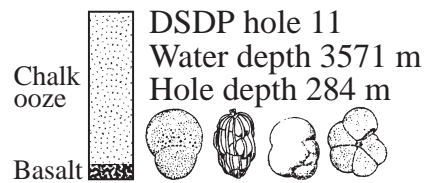
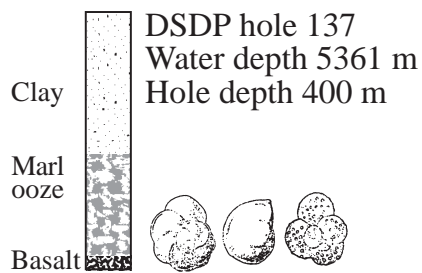
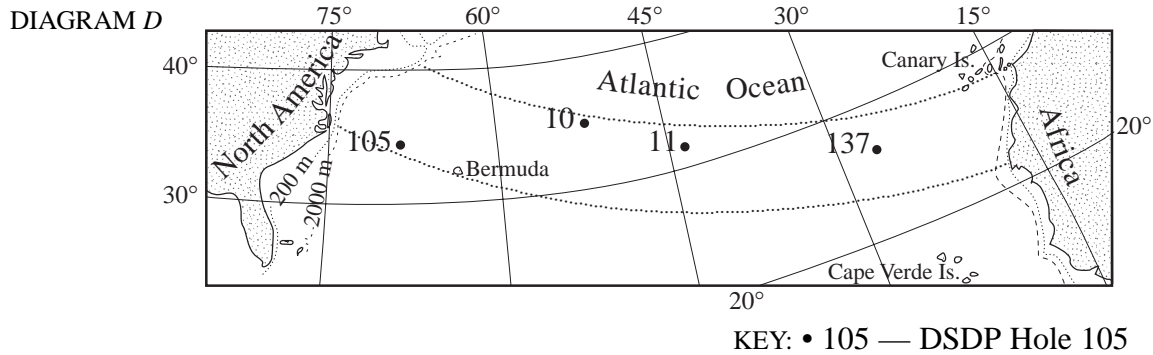
Brice, J, Levin, H & Smith, M, Laboratory Studies in Earth History, 6th ed 1997, Wm C Brown Publishers, Dubuque, Iowa, pp51-53.

Question 36 continues on page 41

QUESTION 36 (Continued)

Marks

Diagram D shows the location of four DSDP drill holes and the micro-fossils recognised in each hole.



- From the data given in Diagram C, name ONE micro-fossil that could be a good index fossil. What other characteristic must the fossil have to be a good index fossil?
- What is the radiometric age range of the fossil assemblage in DSDP hole 11?
- What is the minimum age of the basalt in DSDP hole 105?
- Discuss how micro-fossils are used as stratigraphic tools in the petroleum industry.

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2000

GEOLOGY

2 UNIT

PART B ANSWER BOOK

DIRECTIONS TO CANDIDATES

- Write your Student Number and Centre Number at the top right-hand corner of this page.
- You should receive this Answer Book with a Part A Answer Sheet, a Part C Answer Book, and an Elective Answer Book.
- Answer Questions 16 to 25 in this Answer Book.
- Each question is worth 3 marks.

MARKER'S USE ONLY

PART	Mark	Marker	Check
B			

PART B

MARKER'S
USE ONLY

Each question is worth 3 marks.
Answer the questions in the spaces provided.

- 16** (a)
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- (b)
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- (c)
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- 17** (a)
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- (b)
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MARKER'S
USE ONLY

18 (a) (i)

(ii)

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(b)

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19 (a)

(b)

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MARKER'S
USE ONLY

20 1st Evidence

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2nd Evidence

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3rd Evidence

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21 (a)

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(b)

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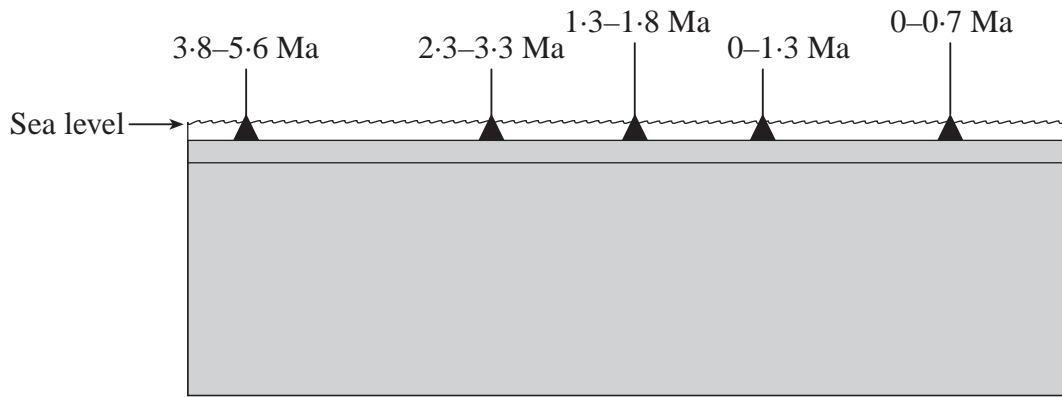
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22 (a)



(b) (i)

(ii)

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MARKER'S
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23 Problem 1

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Problem 2

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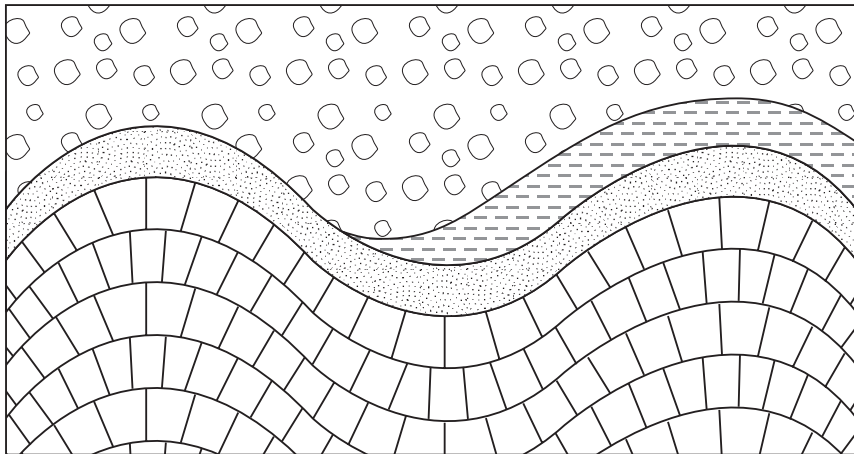
Problem 3

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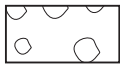


24 (a) W E

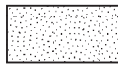


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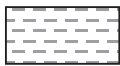
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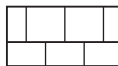
Conglomerate



Sandstone



Shale



Limestone

(b) Reason 1

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Reason 2

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Please turn over



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PART C ANSWER BOOK

DIRECTIONS TO CANDIDATES

- Write your Student Number and Centre Number at the top right-hand corner of this page.
- You should receive this Answer Book with a Part A Answer Sheet, a Part B Answer Book, and an Elective Answer Book.
- Answer Questions 26 to 31 in this Answer Book.
- Each question is worth 5 marks.

MARKER'S USE ONLY

PART	Mark	Marker	Check
C			

MARKER'S
USE ONLY

- 27** (a)
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- (b)
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- (c) Problem 1
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- Problem 2
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- (d)
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MARKER'S
USE ONLY

- 28** (a)
- (b)
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- (c)
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MARKER'S
USE ONLY

29 (a)

(b)

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(c) Oldest

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Youngest

(d)

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MARKER'S
USE ONLY

31 (a)
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(b)
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(c)
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