

Surname	Centre Number	Candidate Number
Other Names		2



## GCE AS/A level

1212/01

## GEOLOGY - GL2α INVESTIGATIVE GEOLOGY

A.M. WEDNESDAY, 2 May 2012

1½ hours

		Examiner only
1.	18	
2.	7	
3.	7	
4.	8	
5.	14	
6.	6	
<b>Total</b>	<b>60</b>	

### ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- the Resource Sheet;
- Specimens **B**, **C** and **D**;
- geological equipment for testing specimens;
- the Mineral Data Sheet.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Answer **all** questions. Questions 1-4 may be completed in any order.

Write your name, centre number and candidate number in the spaces at the top of this page.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

The geology is **not** designed to represent any particular area.

The Mineral Data Sheet and **Map 1** and **Photographs 1 to 5** are provided on separate resource sheets.

These are **not** required by the Examiner.

Strips of plain paper may be obtained from the Supervisor on request.

The strips are **not** required by the examiner.

Three specimens, **B**, **C** and **D**, are provided for use.

All, except **D**, may be tested with the equipment specified by the Supervisor.

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

Marking will take into account the quality of communication used in your answers.

Answer **ALL** the questions in the spaces provided.

Study **Map 1** on the Resource Sheet carefully before answering **Questions 1-6**.

**1. Rock Units A and B on Map 1 are igneous bodies.**

(a) **Rock Unit A** formed as a pluton and contains **only** two minerals, **S** and **T**. A student investigated **Rock Unit A** at **Locality I** on **Map 1** and concluded that:

- “**Mineral T** is *Augite*”;
- “**Rock Unit A** is *not granite or peridotite*”.

(i) Describe **one** piece of evidence from **Map 1** which confirms that **Rock Unit A** is a *pluton*. [1]

Evidence .....

.....

.....

(ii) Suggest **one** piece of evidence you might expect to investigate in the field, which would confirm that **Rock Unit A** is a *pluton*. [1]

Evidence .....

.....

.....

(b) (i) Use **Photograph 1**, on page 4 of the Resource Sheet, and the Mineral Data Sheet to name **Mineral S**. [1]

Name .....

(ii) Use **Photograph 1**, on page 4 of the Resource Sheet, and the Mineral Data Sheet to complete **Table 1**, indicating in the evaluation column whether the student’s conclusion about **Mineral T** is true or false. Explain your answer with reference to **one** physical property. [1]

Student’s conclusion	Evaluation (true/false)	Explanation
... that <b>Mineral T</b> is <i>Augite</i>		•

**Table 1**

- (c) (i) Use **Photograph 1**, on page 4 of the Resource Sheet, to estimate the average crystal size of **Mineral S**. [1]

*Average crystal size of Mineral S* ..... mm

- (ii) With reference to the **crystal size** alone, complete **Table 2** by indicating in the evaluation column whether the student's conclusion is true or false. Explain your answer. [1]

Student's conclusion	Evaluation (true/false)	Explanation
... that on the basis of crystal size alone, <b>Rock Unit A</b> is <i>not granite or peridotite</i>		•

**Table 2**

- (d) (i) Use **Photograph 1**, on page 4 of the Resource Sheet, to estimate the percentage of **Mineral S** and **Mineral T** within **Rock Unit A**.

% **Mineral S** ..... % **Mineral T** ..... [1]

- (ii) With reference to the **mineral composition** alone, complete **Table 3** by indicating in the evaluation column whether the student's conclusions are true or false. Explain your answer. [2]

Student's conclusion	Evaluation (true/false)	Explanation
... <b>Rock Unit A</b> is <i>not granite</i>		•
... <b>Rock Unit A</b> is <i>not peridotite</i>		•

**Table 3**

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(e) (i) Study **Specimen B** which was collected from **Rock Unit B** at **Locality II** on **Map 1**.

Using **Specimen B** only, name the rock, giving **two** pieces of evidence. [3]

*Name* .....

*Evidence 1* .....

.....

.....

*Evidence 2* .....

.....

.....

(ii) **Photograph 2**, on page 4 of the Resource Sheet, shows structures found within **Rock Unit B** at **Locality II** on **Map 1**. Name the structures and suggest how they formed. [3]

You may use annotated diagrams.

*Name* .....

*Formation* .....

.....

.....

.....

.....

.....

- (iii) The list below contains statements which may, or may not, apply to **Rock Unit B** at **Locality II** on **Map 1**.

Tick in the boxes, the **three** statements which best apply to this igneous body. [3]

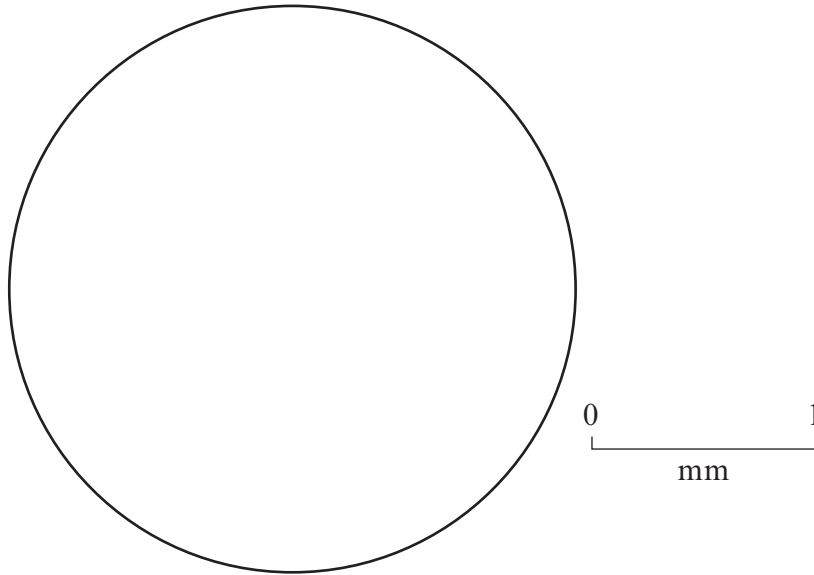
Tick (✓) only  
**three** boxes

- *It is an extrusion*
- *It is younger than the country rock*
- *It is formed by solutions seeping down into the crust*
- *It is concordant with the country rock*
- *It is a lava flow*
- *It is a sill*
- *It is a dyke*
- *It is formed where there is crustal tension*
- *It is only found near to volcanoes*

**[Total 18 marks]**

2. **Rock Unit C** on **Map 1** is an aeolian sandstone. **Specimen C** is representative of this rock unit.

- (a) Study **Specimen C** with a hand lens.  
Draw to scale, in **Figure 1** below, the texture of **Specimen C**. [3]



**Figure 1**

- (b) **Specimen C** is dominated by one mineral, which has a hardness of 7. Using any of the equipment specified by the Supervisor, and the Mineral Data Sheet, name this mineral, recording the result of **one** test/observation, other than hardness, which supports your identification. [2]

*Name of dominant mineral* .....

*Test/observation* .....

.....

.....

- (c) **Photograph 3**, on page 4 of the Resource Sheet, was taken in **Rock Unit C** at **Locality III** on **Map 1**. The rock at this locality is again dominated by the same mineral as **Specimen C**.

Suggest, and explain, the process of the rock cycle which formed the rock in **Photograph 3**. [2]

*Process* .....

*Explanation* .....

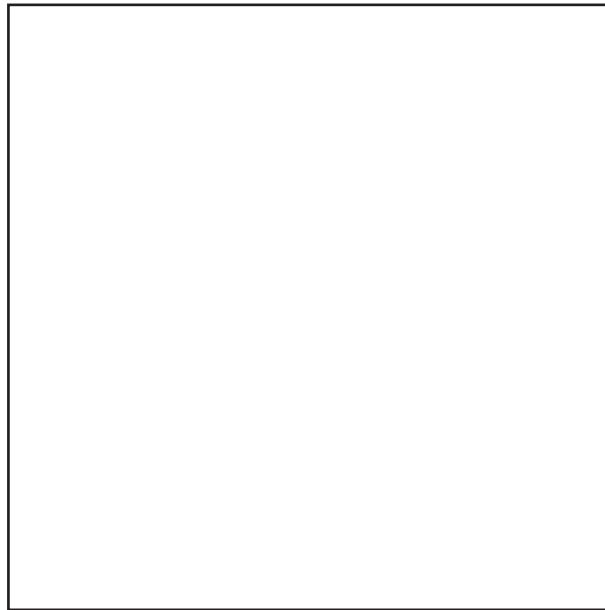
.....

.....

**[Total 7 marks]**

3. Cephalopods are zone fossils and enable geologists to relatively date the rocks in which they are found. **Photograph 4**, on page 4 of the Resource Sheet, shows one type of cephalopod, with details of its suture line. **Specimen D** is a plaster cast of another type of cephalopod collected from **Rock Unit D** on **Map 1**.

(a) Complete **Figure 2** below, by drawing to scale a side view of the fossil **Specimen D**. Draw and label **one** suture line. [4]



**Figure 2**

(b) **Table 4** below contains descriptions of four types of cephalopod suture.

<p><b>1</b> Clearly defined rounded saddles with lobes complicated by minor frilling.</p>	<p><b>2</b> A simple suture line, with barely formed saddles and lobes.</p>
<p><b>3</b> A complex suture line with highly frilled saddles and lobes.</p>	<p><b>4</b> Clearly defined, often angular saddles and lobes, neither of which are frilled.</p>

**Table 4**

Choose the numbers which best describe **Specimen D** and **Photograph 4** and write them in the spaces provided: [1]

**Specimen D** .....

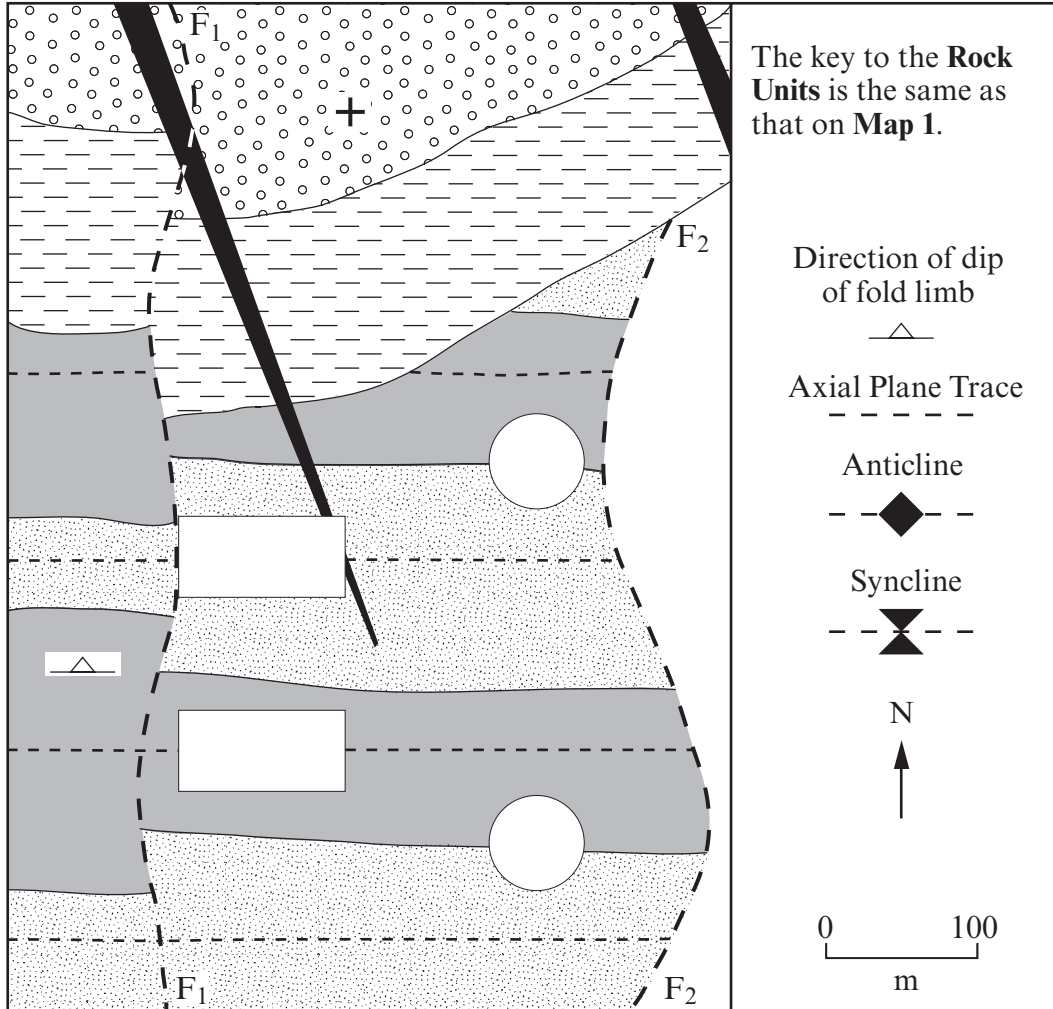
**Photograph 4** .....

(c) Name the type of cephalopod represented by **Specimen D**, stating in which era it is used as a zone fossil. [2]

*Name* ..... *Era* .....

**[Total 7 marks]**

4. (a) **Map 2** below shows that part of **Map 1** which lies to the west of **Fault F2**. **Rock Units C** and **E** have been folded into anticlines and synclines. The axial plane traces of these folds have been drawn.



**Map 2**

- (i) Draw a symbol in each **circle** on **Map 2**, to show the direction of dip of the fold limb. [2]
- (ii) Draw and label the axial plane trace in each **rectangle** on **Map 2** with the appropriate symbol provided in the key. [2]
- (iii) The wavelength of folds is defined as being the distance between the axes of two adjacent folds of the same type and orientation.

The wavelength of the folds on **Map 2** is approximately [1]

<b>125 m</b>	<b>250 m</b>	<b>500 m</b>	<b>625 m</b>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Tick (✓) only **one** box



- (b) **Faults F1** and **F2** on **Maps 1** and **2** show some common features, but also some differences.

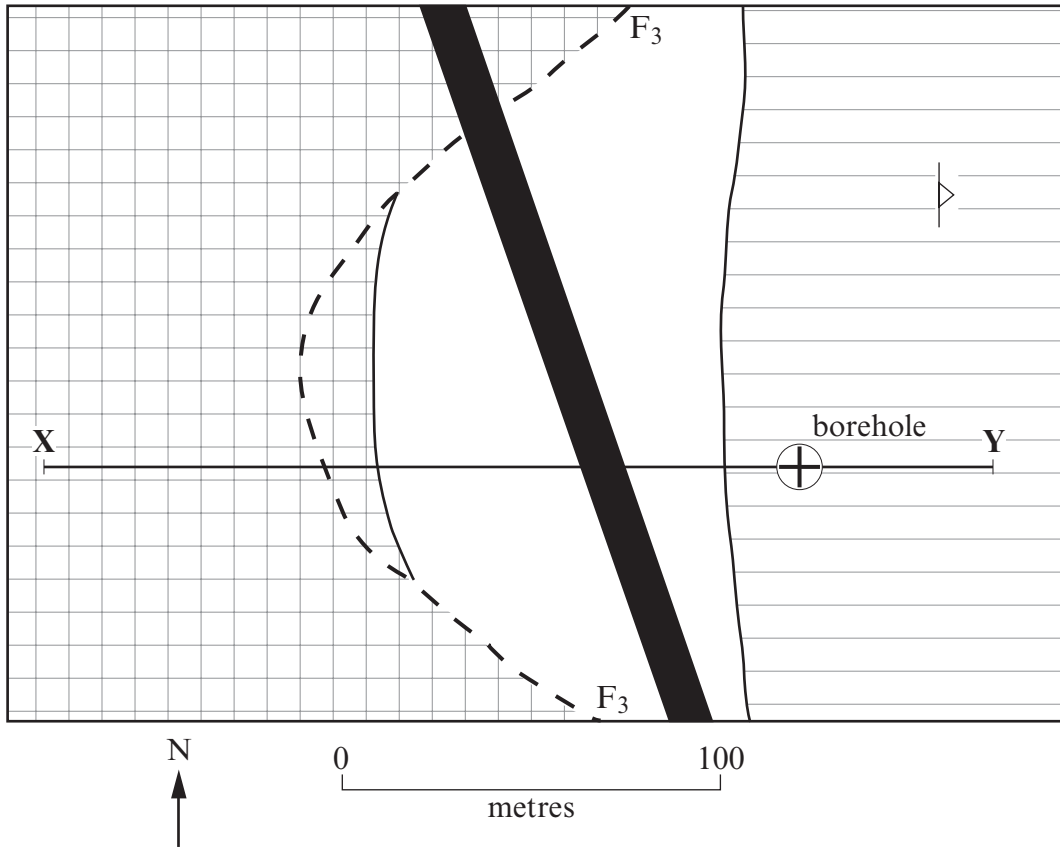
Using the most appropriate value or term for each fault, complete **Table 5** below, to describe the two faults. [3]

	<b>Fault F1</b>	<b>Fault F2</b>
Estimated dip of fault plane (in degrees)	•	• 20
Direction of dip of fault plane	• towards the west	• towards the east
Hanging wall has moved	• upwards	•
Type of fault	•	• thrust

**Table 5**




**[Total 8 marks]**

5. (a) **Map 3** below contains detail of the geology of part of **Map 1**. Individual rock types of **Rock Unit F** are shown, their dips are constant in amount and direction. **Fault F3** dips to the east.




 **Rock Unit B**

Borehole top is 300 metres above sea-level.  
Depth down borehole (in metres) to:

**Rock Unit F** {  Shelly Limestone  
 Shale  
 Oolitic Limestone

20	Base of Shelly Limestone
80	<b>Fault F3</b>
100	Base of Shale

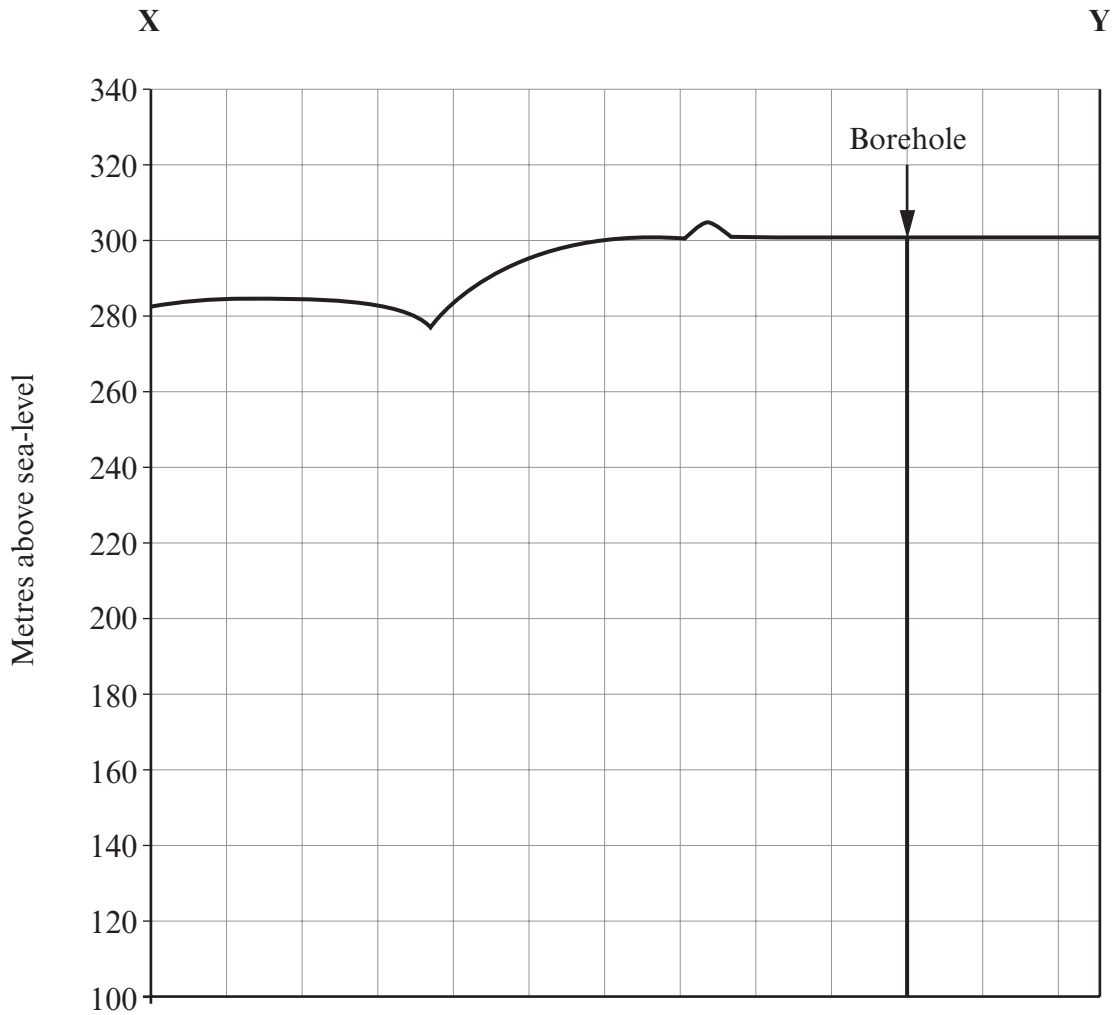
 **F<sub>3</sub>** Fault

 Direction of dip

 Borehole

**Map 3**

**Figure 3** below shows the topographic profile taken along line **X-Y** on **Map 3**. Draw the geological cross-section **X-Y** using the borehole data and the outcrop shown on **Map 3**. Label the rock types of **Rock Unit F** (using similar ornament, or names, as on **Map 3**), **Rock Unit B** and **Fault F3**. Clearly show any cross-cutting relationships. [7]



**Figure 3**

(b) In the spaces below complete the sequence of geological events represented on **Map 1**, in order of age, *oldest at the base*.

Your sequence should list, in the boxes provided, **each** sedimentary **Rock Unit** in *order of deposition*.

Identify each **Rock Unit** by their letters given in the key to **Map 1**.

Clearly mark and label the position of:

- ← an unconformity;
- ← **Fault F2**;
- ← the intrusion of **Rock Unit B**.

[7]

YOUNGEST

← **Fault F1**



← Folding



← Intrusion of **Rock Unit A**

OLDEST

[Total 14 marks]

6. Sedimentary environments can be identified by characteristic sedimentary structures and textures.

Describe how structure(s) and textures can provide evidence of a **fluvial** environment.

Credit will only be awarded to answers which relate to **one, or more**, of the following:

- Your fieldwork observations of one rock outcrop/locality;
- Your fieldwork observations of a modern fluvial environment;
- **Photograph 5** (on page 4 of the Resource Sheet) which is representative of **Rock Unit G** on **Map 1**.

You may use annotated diagrams.

[6]

[Total 6 marks]

A series of horizontal dotted lines for writing, spanning the width of the page.

**Photograph 1** (taken at **Locality I** on **Map 1**)

Scale  $\times 1$

**Mineral S**  
harder than 5  
and shows  
cleavages

**Mineral T**



For use in Question 1



Thin section of  
**Mineral T**

Scale  $\times 50$

Cleavages  
highlighted in red



**GCE AS/A level**

1212/01-B

**GEOLOGY - GL2 $\alpha$**   
**INVESTIGATIVE GEOLOGY**  
**RESOURCE SHEET**

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**Photograph 2** (taken at **Locality II** on **Map 1**)

For use in Question 1



**Photograph 3** (taken at **Locality III** on **Map 1**)

For use in Question 2

Scale  $\times 10$



**Photograph 4**

For use in Question 3

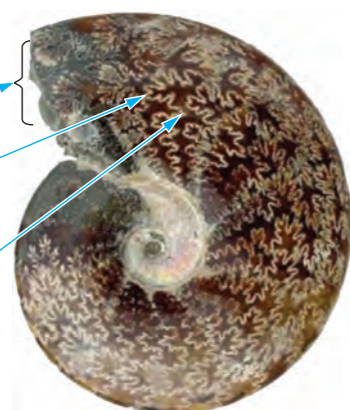
Scale  $\times \frac{1}{2}$

Side view of  
fossil

Aperture

Saddle – projects  
towards the  
aperture

Lobe – projects  
away from the  
aperture



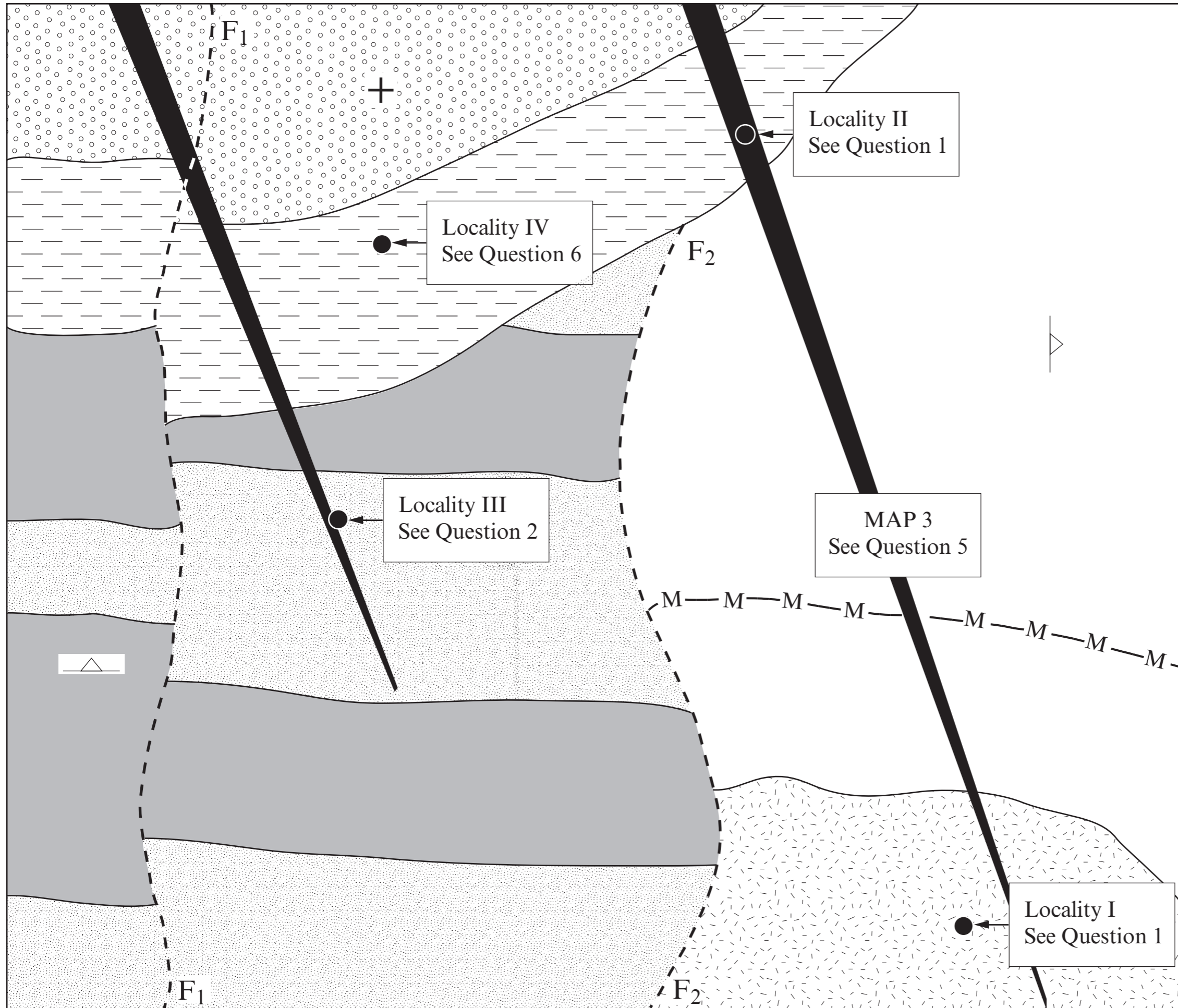
**Photograph 5** (taken at **Locality IV** on **Map 1**)

For use in Question 6

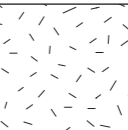

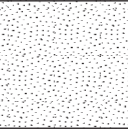
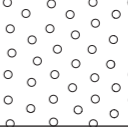
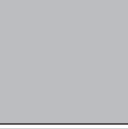

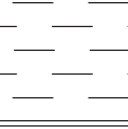
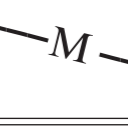
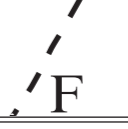
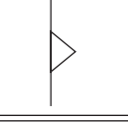

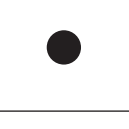


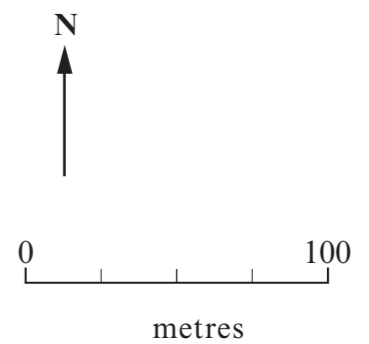
This sheet is **not** required by the examiner.

MAP 1



The rock units are not in order of age. Their ornament is not necessarily representative of rock type.

-  Rock Unit A (Photograph 1)
-  Rock Unit B (Photograph 2, Specimen B)
-  Rock Unit C (Photograph 3, Specimen C)
-  Rock Unit D (Specimen D)
-  Rock Unit E
-  Rock Unit F
-  Rock Unit G
-  M Limit of metamorphism
-  F Fault
-  Direction of dip of bed
-  + Horizontal bed
-  ● Locality numbers



Turn over.