Surname	Centre Number	Candidate Number
First name(s)		2

GCE A LEVEL

A480U10-1

O20-A480U10-1

TUESDAY, 6 OCTOBER 2020 – AFTERNOON

GEOLOGY – A level component 1
Geological Investigations

2 hours 15 minutes

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- the Resource Sheet
- **Specimens B**, **C**, **G**, **H** and **J**
- geological equipment for testing specimens
- the Mineral Data Sheet
- a calculator
- a ruler
- a protractor

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

	For Examiner's use only		
	Question	Maximum Mark	Mark Awarded
Section A	1.	19	
	2.	11	
Section B	3.	8	
	4.	8	
	5.	9	
	6.	6	
	7.	8	
	8.	17	
	9.	14	
	10.	5	
	Total	105	

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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** and **Photograph 1** are provided on separate resource sheets.

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

Five specimens, **B**, **C**, **G**, **H** and **J**, 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 **5** and **8***(e)*.

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SECTION A

Answer **all** *questions.*

1. **Figure 1a** and **Figure 1b** show skulls of dinosaurs **A** and **B** found on the Isle of Wight, in southern England.

dinosaur **A**

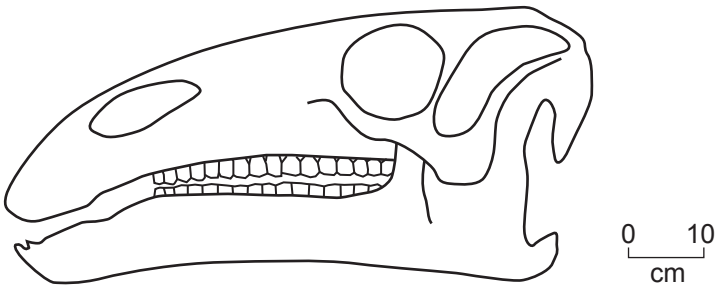

Figure 1a

dinosaur **B**

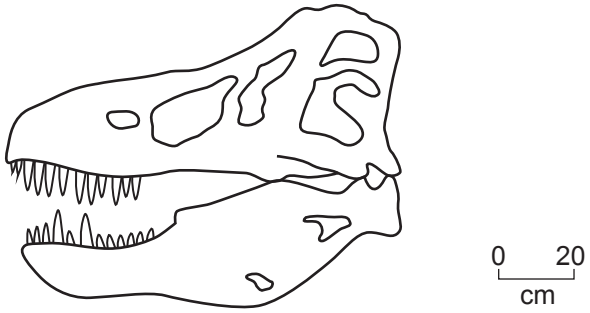

Figure 1b

(a) Refer to **Figure 1a** and **Figure 1b**.

(i) Describe **two** differences between the skulls of dinosaur **A** and dinosaur **B**. [2]

1. .....

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2. .....

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(ii) Suggest, with reasons, why there are differences between the skulls of dinosaur **A** and dinosaur **B**. [2]

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Figure 1c shows a footprint produced by dinosaur **A**.

Figure 1c

(b) The area of the footprint is 132 cm^2.

Describe **one** method by which the area of the footprint could have been determined. [2]

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(c) A student planned to measure the depth of the footprint using the ruler in **Figure 1d**.

Figure 1d

(i) State **one** possible error that could occur using the equipment in **Figure 1d**. [1]

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(ii) Suggest how this error could be reduced. [1]

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(d) (i) The mean depth of the footprint was found to be 3.4 cm. Use the equation below to calculate the mass of dinosaur **A**. Show your working. [3]

$$v = \frac{m}{0.15}$$

v = volume of footprint (cm^3)
m = mass of dinosaur (kg)

Mass of dinosaur **A** = ... kg

(ii) Suggest **two** reasons why this value calculated in *(d)*(i) may not represent the actual mass of the dinosaur. [2]

1. .....

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2. .....

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(e) The Alvarez Hypothesis proposes that the dinosaurs became extinct at the Cretaceous-Palaeogene boundary as a result of an asteroid impact.

(i) Describe, from your knowledge, **three** pieces of evidence that indicate an asteroid impact. [3]

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(ii) Explain how an asteroid impact could have caused the global extinction of dinosaurs. [3]

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2. **Table 1** contains information about two sedimentary processes associated with the formation of geological resources.

(a) Complete **Table 1** by;

- describing the process of china clay formation
- stating a resource formed in precipitated deposits. [3]

Type	Brief description of process	Typical resource
Residual deposit	•	China Clay
Precipitated deposits	Evaporation of sea water in hot, arid climates increases the concentration of soluble salts resulting in them precipitating out of solution.	•

Table 1

(b) **Figure 2a** shows a **cross-section** within an area where a gold deposit is found.

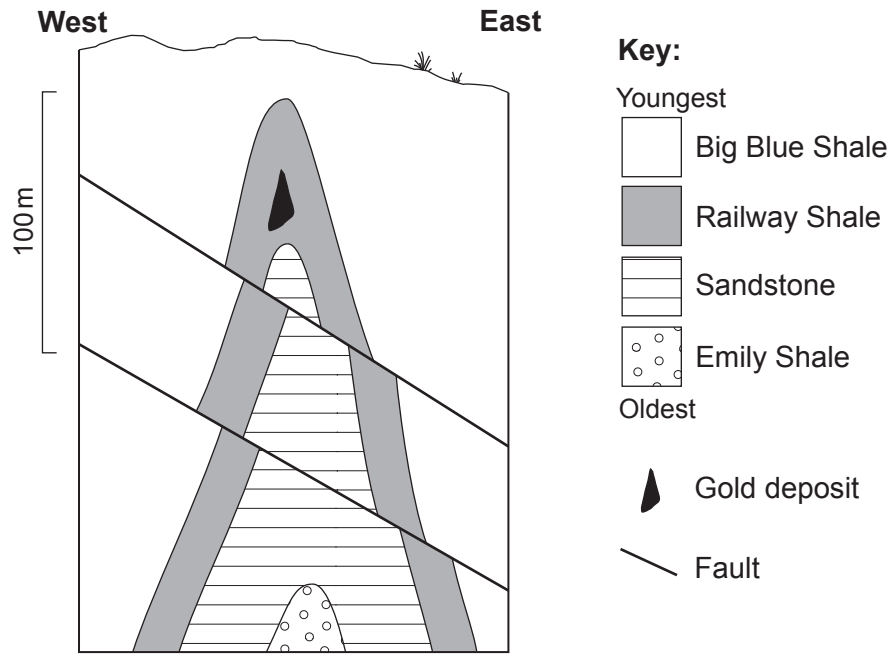

Figure 2a

(i) Draw and label the fold axial plane trace on **Figure 2a**. [2]

(ii) Identify the type of fold shown in **Figure 2a**. Tick (✓) **one** box only. [1]

Synformal syncline	Antiformal syncline	Antiformal anticline	Synformal anticline
☐	☐	☐	☐

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(c) **Figure 2b** shows a polar stereonet of the dip directions and dip angles measured on a **different** structure from that shown in **Figure 2a** within the same area.

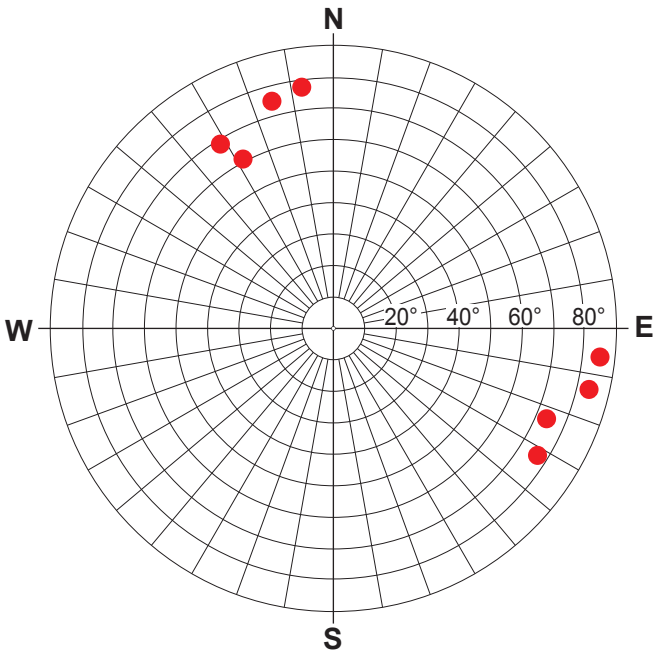

Figure 2b

Table 2 contains readings from two additional bedding planes.

	Dip angle	Dip direction
Bedding plane 1	80°	110°
Bedding plane 2	70°	340°

Table 2

(i) Plot the data points contained in **Table 2** onto **Figure 2b**. [2]

(ii) A student stated that the data shown in **Figure 2b** indicates a plunging, open synform. Evaluate this statement with reference to the data in **Figure 2b**. [3]

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SECTION B

Answer **all** *questions.*

Study **Map 1** *on the Resource Sheet before answering questions 3 to 10.*

3. *(a)* **Specimen J** was collected from within the area of **Map 1**.

(i) Complete **Table 3** by:

- describing **two** diagnostic tests or observations of the named physical properties on **Specimen J**. You may use any of the equipment provided for use in the examination.
- recording the results of your tests or observations on **Specimen J**. [4]

Physical Property	Description of test/observation	Record of results of test/observation
Hardness	•	•
Cleavage	•	No Cleavage
Colour	Observe the colour of reflected light	•

Table 3

(ii) With reference to **Table 3** and the Mineral Data Sheet, state the name of the mineral forming **Specimen J**. [1]

Name of **Specimen J** .....

(b) **Figure 3** shows mineral **T**.

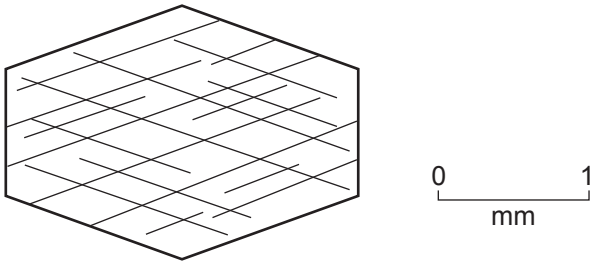

Figure 3

(i) Refer to the Mineral Data Sheet. Identify mineral **T** in **Figure 3**. [1]

Name of mineral **T** .....

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(ii) **Table 4** shows a range of silicate structures. Indicate with **one** tick (✓) in **each** of the blank columns the silicate structures represented by **Specimen J** and mineral **T**. [2]

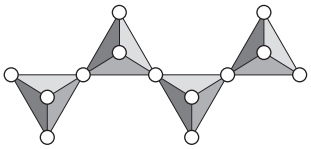
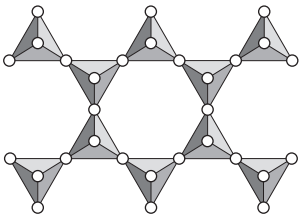
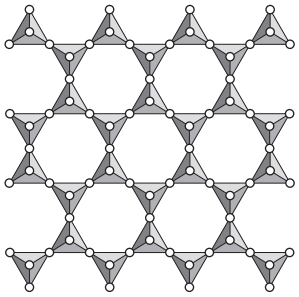
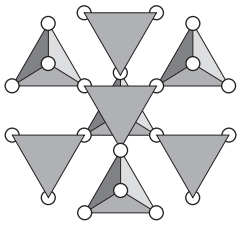
Internal Structure	**Specimen J**	Mineral **T**
Single Chain 		
Double Chain 		
Sheet 		
Framework 		

Table 4

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4. **Specimen C** is representative of **Rock Unit C** on **Map 1**.

(a) Suggest, with reference to the texture of **Specimen C**, the probable transport conditions of **Rock Unit C**. [4]

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(b) Refer to **Map 1** only. State the type of boundary forming the base of **Rock Unit C**. Give a reason for your answer. [2]

Type of boundary .....

Reason .....

.....

(c) Explain **two** additional pieces of field evidence which would confirm the type of boundary at the base of **Rock Unit C**. [2]

1. .....

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2. .....

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5. **Photograph 1** on the resource sheet shows an outcrop of **Rock Unit D** taken within the area shown on **Map 1**.

State and give reasons for;

- the observations you would make in the field
- the techniques you would use

to determine the variety of environmental conditions when **Rock Unit D** was deposited.

[9 QER]

Examiner only

Examiner only

6. **Specimen G** was collected from **Rock Unit G**.

(a) Complete **Figure 6a** below by drawing a fossil from **Specimen G**. Add a scale to your drawing. [3]

Figure 6a

(b) Label **two** morphological features on **Figure 6a**. [1]

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(c) **Figure 6b** shows fossil **M** which was collected from outside the area of **Map 1**.

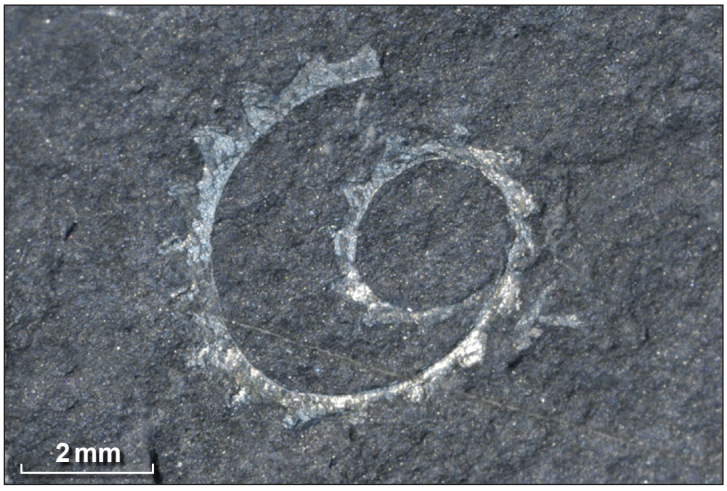

Figure 6b

State the relative age of the fossils within **Specimen G** and fossil **M**. Tick (✓) only **one** box.

Fossils within **Specimen G** are the same age as fossil **M** ☐

Fossils within **Specimen G** are younger than fossil **M** ☐

Fossils within **Specimen G** are older than fossil **M** ☐

Give **one** reason for your answer. [2]

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7. *(a)* The following is a description of fault **F1** on **Map 1**, taken from a student's field notebook.

"The fault plane was examined in several exposures. It had a mean dip of 70° towards 270°. There were a number of vertical parallel grooves found on the fault plane."

(i) State the name of the structure represented by the *"vertical parallel grooves on the fault plane"*. [1]

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(ii) Name and explain **one** further piece of field evidence that you would look for to confirm the presence of fault **F1**. [2]

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(iii) Refer to the evidence on **Map 1** and in the student's description. State the type of fault formed by **F1**. Explain the evidence for your answer. [3]

Type of fault (normal, reverse, strike-slip) .....

Explanation .....

.....

.....

(b) State the orientation of the principal stress direction σ_{max} for faults **F1** and **F2** on **Map 1**. [2]

F1 = ...

F2 = ...

8

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8. **Rock Unit B** and **Rock Unit H** on **Map 1** have differing compositions.

Specimen B is representative of **Rock Unit B** on **Map 1**.

(a) State the name of the rock forming **Specimen B**. Give **two** reasons, from **Specimen B** alone, for your answer. [3]

Name of **Specimen B** .....

Reason 1 .....

.....

Reason 2 .....

.....

(b) State the type of igneous body represented by **Rock Unit B** on **Map 1**. Give **two** reasons for your answer. [3]

Type of igneous body .....

Reason 1 .....

.....

Reason 2 .....

.....

(c) **Specimen H** is representative of **Rock Unit H** on **Map 1**.

State the name of the rock forming **Specimen H**. Give **two** reasons, from **Specimen H** alone, for your answer. [3]

Name of **Specimen H** .....

Reason 1 .....

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Reason 2 .....

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(d) Using evidence from **Map 1** state the relative ages of **Rock Units B** and **H**. Give a reason for your answer. [2]

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Examiner only

(e) Explain why the potential volcanic hazards produced by the type of magma associated with **Rock Unit B** differ from those associated with **Rock Unit H**. [6 QER]

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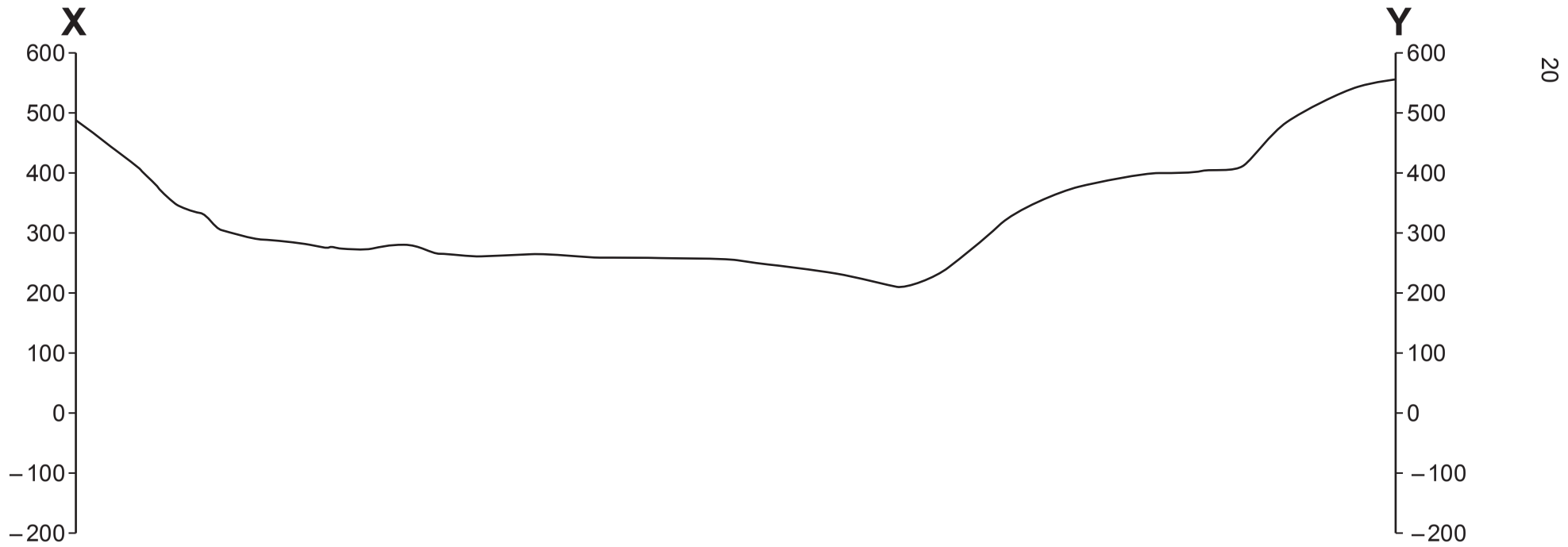
9. The topographic profile below was taken along the line **X–Y** on **Map 1**.

Construct the geological cross-section along this line using **Map 1**.

- The contacts of **Rock Unit B** along the line of section dip at 60° towards the west.
- **Rock Unit A** has a true thickness of 220 m.
- **Rock Unit D** has a true thickness of 100 m.
- Draw the rock units. Use similar ornament, or letters, for those as on **Map 1**.
- Draw and label any **fold axes**, with the correct symbol.
- Draw **arrows** to show the movement of any faults.
- **Project** the rock units and structures **above** the ground surface to illustrate any cross-cutting relationships. [14]



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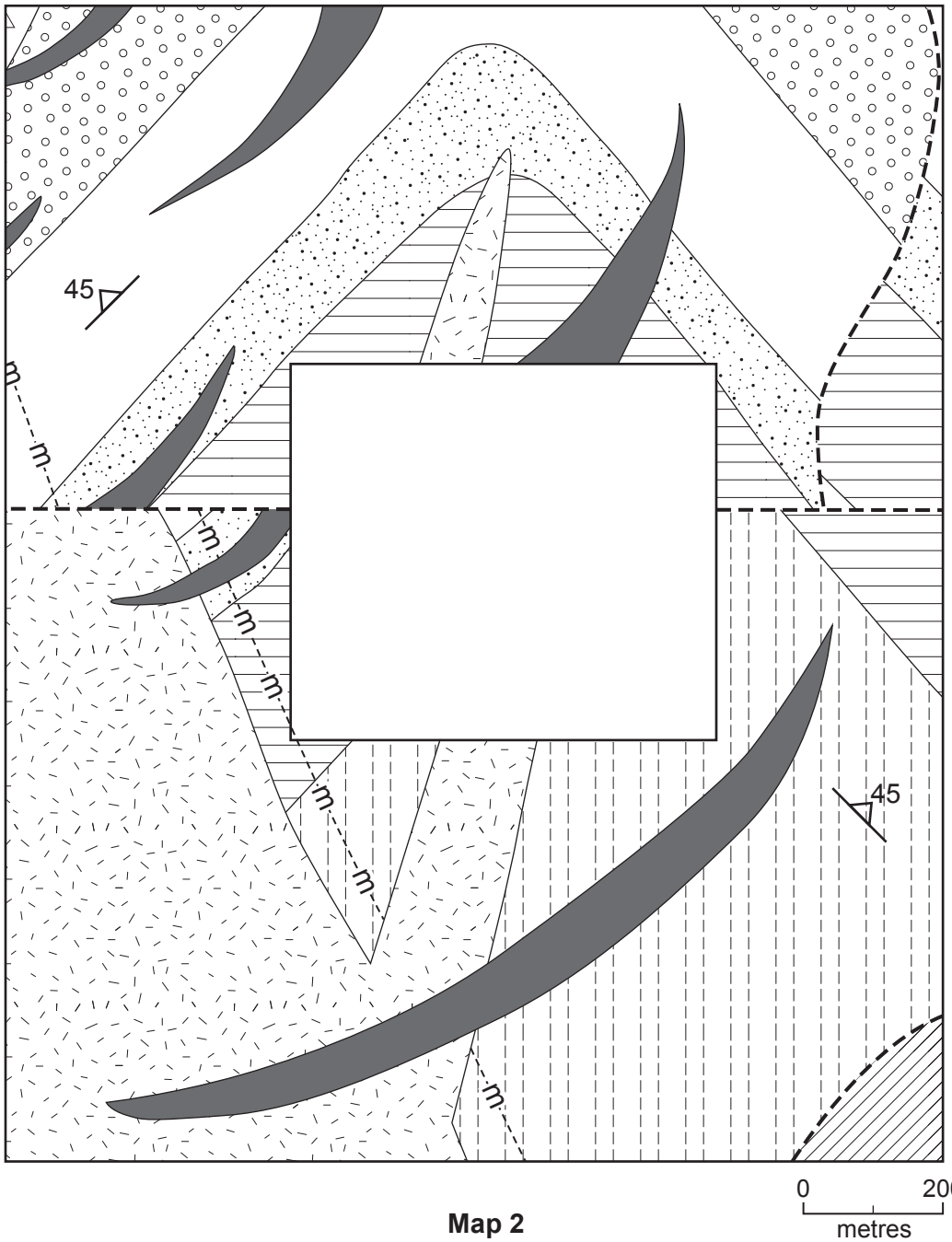
10. **Map 2** below is a reproduction of an area within **Map 1**. Complete **Map 2** to show the expected surface outcrop that would be seen in the blank area. [5]



Map 2

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END OF PAPER

Acknowledgements

Figure 1a	http://what-when-how.com/dinosaurs/new-light-on-
Figures 1b	http://lrrpublic.cli.det.nsw.edu.au/lrrSecure/Sites/Web/gondwana/Animal_Fossils_of_Gondwana/lo/fossils_05/fossils_05_01.htm
Figure 1c	https://www.pinterest.co.uk/pin/152981718575453805/?lp=true
Figure 6b	http://britgeoheritage.blogspot.com/2013/06/charles-lapworth-

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