Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

C480U20-1

S24-C480U20-1

WEDNESDAY, 22 MAY 2024 – AFTERNOON

GEOLOGY – Component 2

Investigative Geology

1 hour 30 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**9**	
2.	**14**	
3.	**7**	
4.	**14**	
5.	**9**	
6.	**17**	
7.	**6**	
8.	**4**	
Total	**80**	

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ADDITIONAL MATERIALS

In addition to this examination paper you will need:

- the Map Extract
- the Data Sheet
- a calculator
- a protractor
- a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

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. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

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

Plain paper may be obtained from the supervisor on request.

The assessment of the quality of extended response (QER) will take place in question **7**.

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Answer **all** questions.

1. **Figure 1** is a photograph of sedimentary rocks taken at **Locality 1** on **Map 1**, facing north-west.

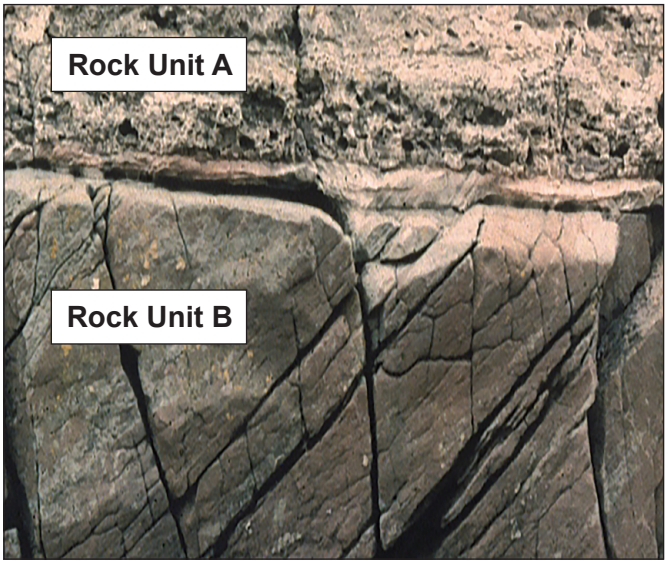

Figure 1

(a) Describe **two** methods that were used to decide the position of **Locality 1** on **Map 1**. [2]

1. .....

.....

2. .....

.....

(b) A dip and strike measurement was taken on **Rock Unit B** at **Locality 1**. Using **Map 1** and **Figure 1**, complete **Table 1** to record the dip and strike data for **Rock Unit B** at **Locality 1**. [3]

dip angle	•
dip direction	•
strike direction	•

Table 1

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(c) State the name of the geological feature forming the boundary between **Rock Unit A** and **Rock Unit B** in **Figure 1**. [1]

.....

(d) Refer to **Figure 1**. Explain how the geological feature forming the boundary between **Rock Unit A** and **Rock Unit B** formed. [3]

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2. **Figure 2a** is a student's key used to classify sedimentary rocks. **Figure 2b** shows a microscope view of **Rock Unit B**.

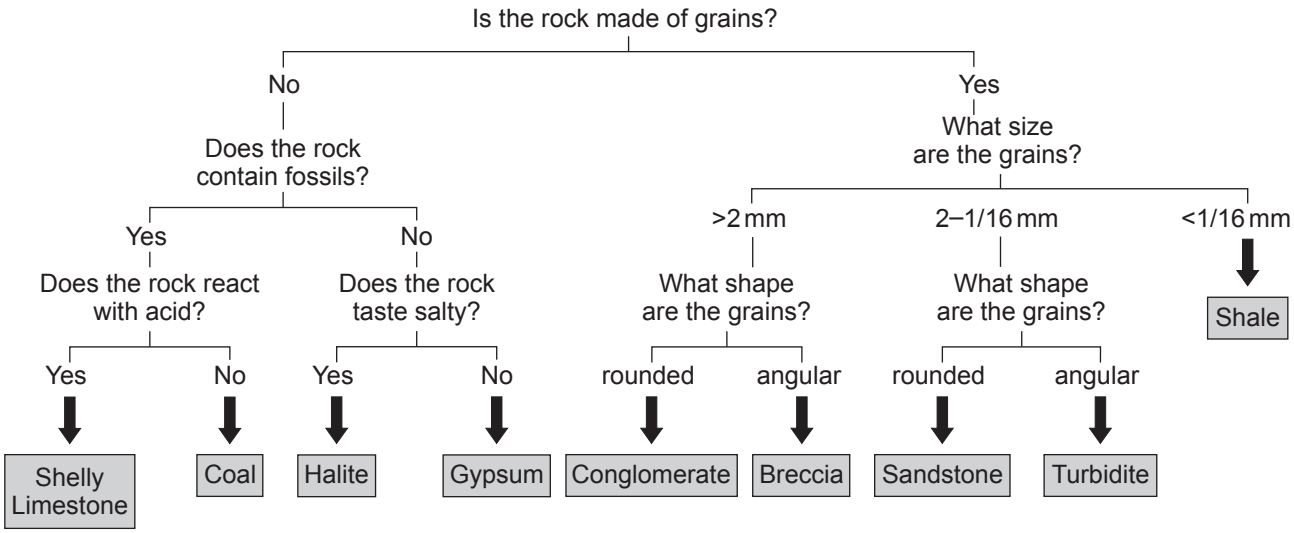

Figure 2a

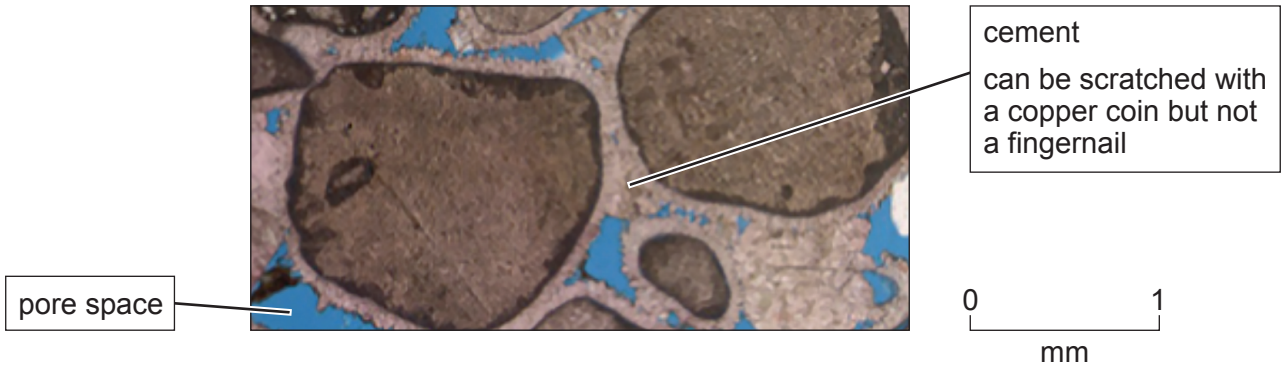

Figure 2b

(a) Using **Figure 2a** state the name of the rock making up **Rock Unit B** shown in **Figure 2b**. Give **two** reasons for your answer. [3]

Name of **Rock Unit B** .....

.....

Reason 1 .....

.....

Reason 2 .....

.....

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(b) (i) Using **Figure 2b** and the Data Sheet, state the name of the mineral forming the cement in **Rock Unit B**. [1]

.....

(ii) Complete **Table 2** which refers to tests on the features of **Rock Unit B** shown in **Figure 2b**. [3]

Feature of rock	Description of test	Result
permeability	•	•
composition of cement	dropping hydrochloric acid on the rock	•

Table 2

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(c) **Figure 2c** is a photograph of a fossil found in **Rock Unit B** at **Locality 1** on **Map 1**.

scale × 1

Figure 2c

(i) Complete **Figure 2d** by drawing the fossil shown in **Figure 2c**. Measure and draw the fossil using the scale provided. [3]

scale × 2

Figure 2d

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(ii) Refer to **Figure 2b** and **Figure 2c**. Evaluate the statement '**Rock Unit B** was formed in a high energy, marine environment'. [4]

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3. **Figure 3a** is a photograph of mineral **G** found within **Rock Unit C**.

Figure 3a

(a) Using **Figure 3a** and the Data Sheet, state the name of mineral **G**. [1]

.....

Figure 3b shows a sedimentary structure found on the upper surface of **Rock Unit C**.

Figure 3b

(b) State the name of the sedimentary structure in **Figure 3b**. Explain how it forms. [3]

Name .....

Explanation .....

.....

.....

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(c) Using evidence from **Figure 3a** and **Figure 3b**, describe the most likely environment in which **Rock Unit C** formed. [3]

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4. **Table 3** shows the mineralogy of **Rock Unit D** collected from **Locality 2** on **Map 1**. The rock is equicrystalline and has a mean crystal size of 0.5 mm.

Mineral	Percentage of minerals in **Rock Unit D**
augite	60
feldspar	30
olivine	10

Table 3

(a) (i) Using the information in **Table 3** and the mineral key below, complete **Figure 4a** to show the texture and mineralogy of **Rock Unit D**. [5]

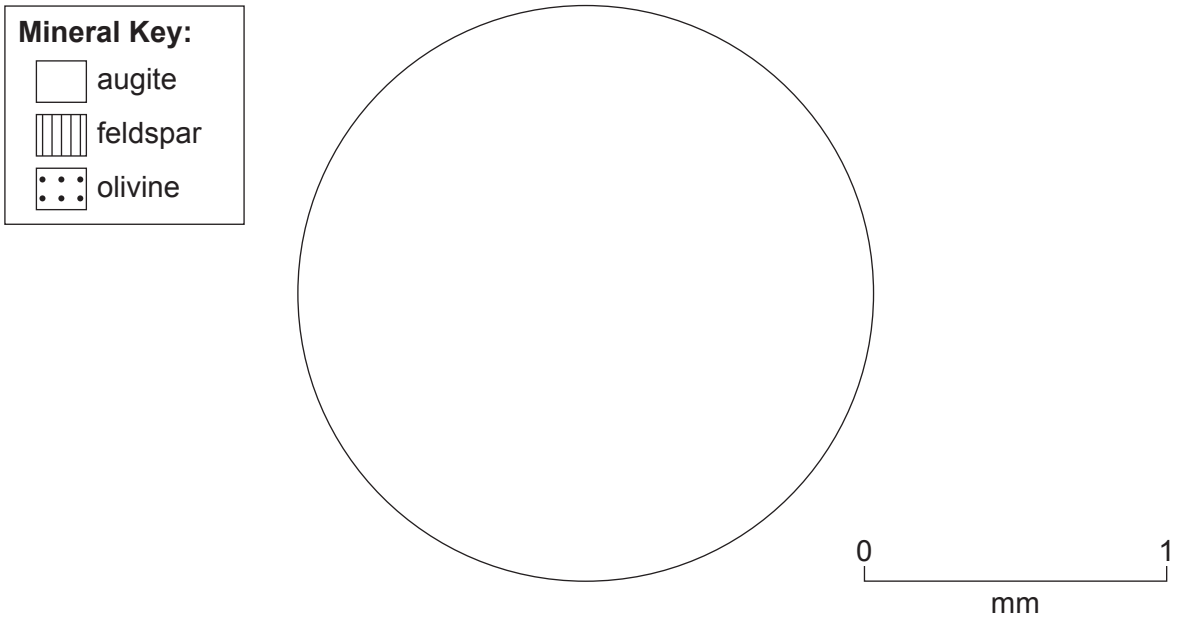

Figure 4a

(ii) State the name of the rock forming **Rock Unit D**. [1]

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(b) **Figure 4b** is a photograph of **Rock Unit D**, an igneous body, taken from above at **Locality 2** on **Map 1**.

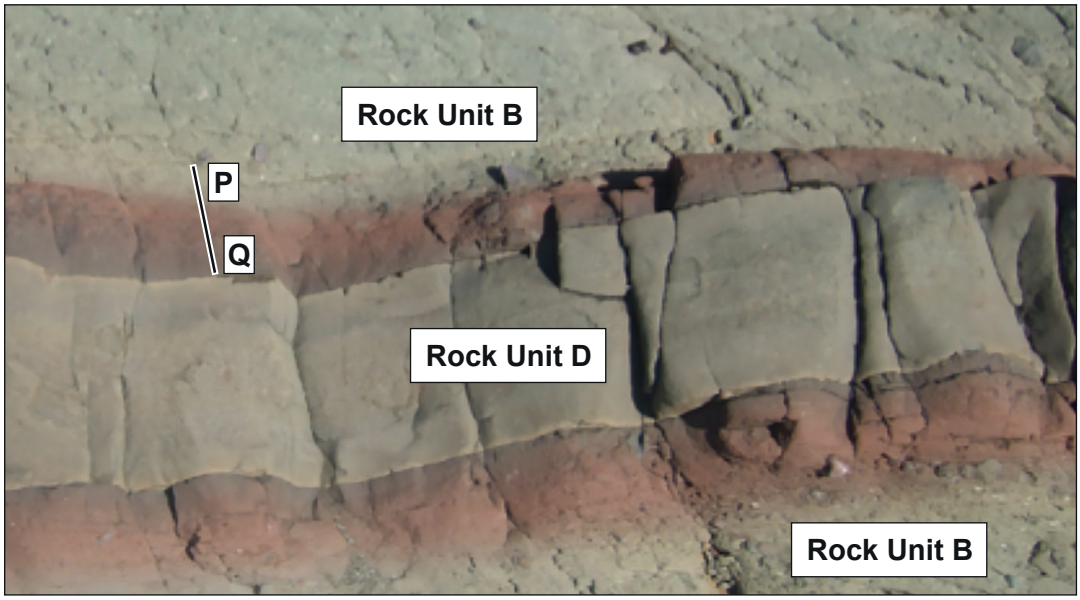

Figure 4b

Refer to **Figure 4b**.

(i) In **Figure 4c**, draw to scale the main geological features shown in **Figure 4b**. [3]

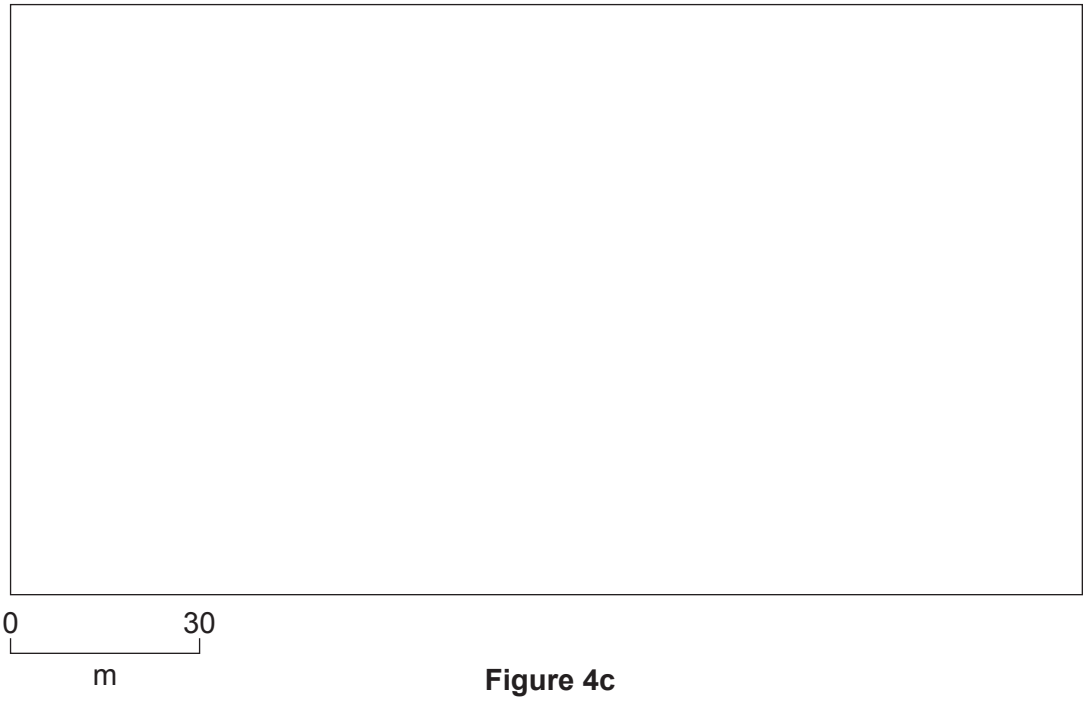

Figure 4c

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(ii) Describe **three** differences between **Rock Unit B** at point **P** and point **Q** on **Figure 4b**. [3]

Difference 1 .....

.....

Difference 2 .....

.....

Difference 3 .....

.....

(iii) Explain why the changes have occurred between point **P** and point **Q** on **Figure 4b**. [2]

.....

.....

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5. **Table 4** shows the orientations of 12 dykes found outside the area of **Map 1**.

(a) (i) Complete **Table 4** by recording the orientations of the 4 dykes of **Rock Unit D** on **Map 1**. [2]

NW–SE		N–S		NE–SW		E–W	
		𝍸		//			
total	0	total	•	total	•	total	0

Key:
/ = 1 dyke
𝍸 = 5 dykes

Table 4

(ii) Using the data provided in **Table 4**, complete the rose diagram in **Figure 5**. [2]

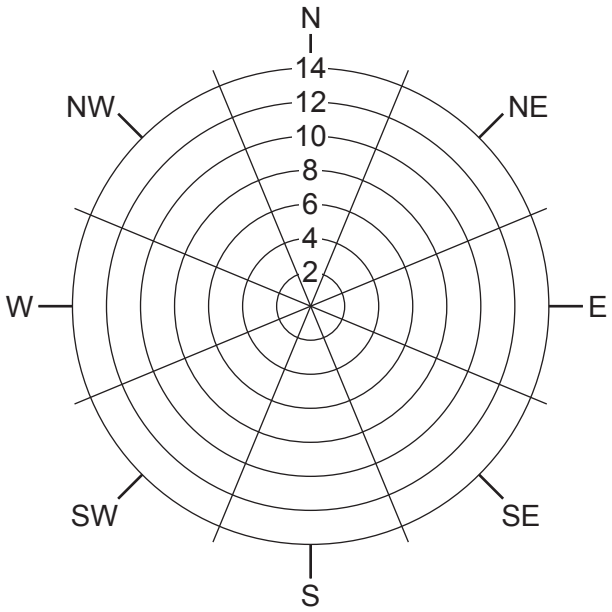

Figure 5

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(b) A 3 km transect line was taken across the 10 parallel N–S dykes outside the area of the map.

length of transect (km)	3
number of dykes	10
mean width of dykes (m)	15

Table 5

The intrusion of these 10 dykes resulted in crustal extension. Using the information in **Table 5** and the following formula, calculate the percentage of crustal extension. [3]

$$\text{Percentage of crustal extension} = \frac{\text{total dyke thickness}}{\text{length of transect} - \text{total dyke thickness}} \times 100$$

Percentage of crustal extension ..... %

(c) Explain why every dyke along the 3 km transect line was recorded rather than sampling the rocks every 50 m. [2]

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6. **Figure 6** is a cross-section along line **X–Y** on **Map 1**.

(a) Complete the cross-section **Figure 6** along the line **X–Y** by drawing the boundaries between the different rock units. Use the same ornament or letters as on **Map 1**. [5]

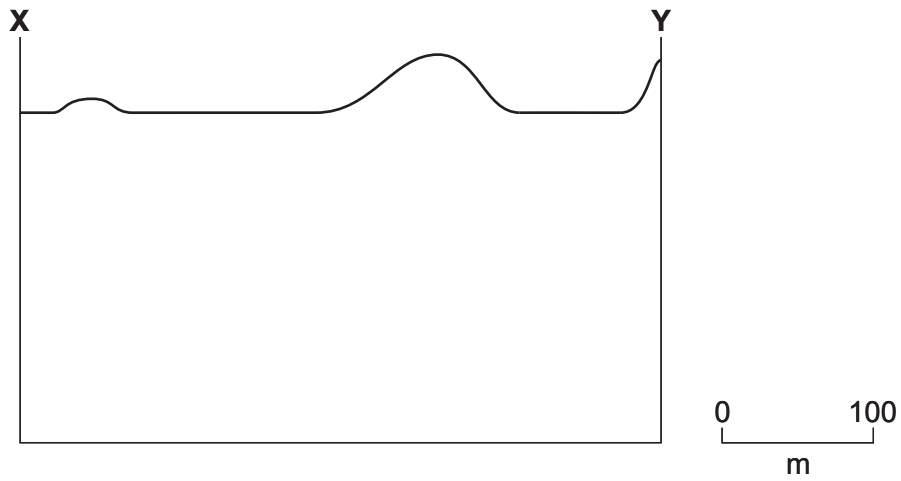

Figure 6

(b) Use evidence from **Map 1** only. Evaluate the statement 'the fold has limbs with different dip angles'. [2]

.....

.....

.....

(c) (i) Measure the amount of displacement along **Fault F1** on **Map 1**. [1]

..... m

(ii) State the type of fault represented by **Fault F1**. Give **two** reasons for your answer. [3]

Type of fault .....

Reason 1 .....

.....

Reason 2 .....

.....

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(d) (i) For each of the pairs of rock units given below:

- state which is older
- give a reason for your answer. [4]

Rock Unit D and **Rock Unit E**

Older Rock Unit .....

Reason .....

.....

Rock Unit B and **Rock Unit C**

Older Rock Unit .....

Reason .....

.....

(ii) Evaluate the statement '**Rock Unit D** is older than **Rock Unit A**'. [2]

.....

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.....

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7. Evaluate the statements:

- **Map 1** provides evidence for compressional, shear and tensional stresses.
- The type of stress changed over time. [6 QER]

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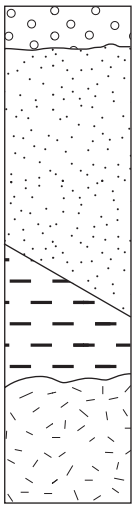
8. Two sites, **S1** and **S2**, have been identified on **Map 1** as potential sites for the long-term, underground storage of hazardous waste. **Figure 8** shows two boreholes (not to scale) drilled at **Site S1** and **Site S2**. Using **Figure 8**, **Map 1** and your geological knowledge, evaluate the suitability of each site. [4]

Borehole drilled at **Site S1**



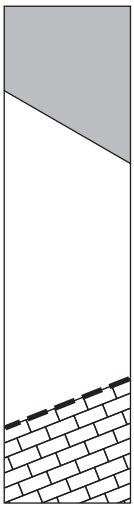
Rock Unit A (conglomerate)

Rock Unit B

Rock Unit C

Granite pluton
(not shown in **Map 1**)

Borehole drilled at **Site S2**



Rock Unit E (breccia)

Rock Unit F (desert sandstone)

Fault (not shown in **Map 1**)

Limestone
(not shown in **Map 1**)

Figure 8

Site S1 .....

.....

.....

.....

.....

.....

Site S2 .....

.....

.....

.....

.....

.....

END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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Acknowledgements:

Figure 1 http://earthwise.bgs.ac.uk/index.php/

Figure 2b https://www.sciencedirect.com/science/article/abs/pii/S0264817216300770

Figure 2c https://www.ukge.com/en-ie/

Figure 3a https://www.geol.umd.edu/~jmerck/geol342/lectures/08.html

Figure 3b http://www.pitt.edu/~cejones/GeoImages/5SedimentaryRocks/SedStructures/

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