Qualification Accredited

Oxford Cambridge and RSA

A LEVEL

Examiners' report

GEOLOGY

H414
For first teaching in 2017

H414/03 Summer 2019 series

Version 1

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

Paper 3 series overview

This is the first examined unit for the new style geology A Level. Paper 3; Practical skills in Geology is worth 60 marks and assesses content across all the teaching modules 1 to 7 but with a greater emphasis on module 1 than the other two written papers. There is also a focus on skills and experiences candidates will have gained while undertaking their 4 days fieldwork. Candidates are expected to answer all the questions. The paper includes short answer questions, 6 mark level of response extended response questions related to practical applications and skills based questions where candidates are expected to carry out recognised geological techniques.

Key point call out

Candidates need to plan their allocation of time in the examination as some candidates had not left enough time to complete Question 5 properly. There were also a few candidates who had constructed very high quality cross-sections and graphic logs to a standard beyond that expected under examination conditions. Paper 3 will always contain a map skills question, based on an extract from a real geological map and candidates should allow approximately 15 minutes for this question.

Previously candidates' practical skills were assessed using coursework tasks, where the time available was open ended within reason. Candidates are advised to develop and practice practical skills (including map work and geological problems that require the application of mathematics) throughout the two years of the course. The extension activities associated with the OCR exemplar PAG activities provide one opportunity for candidates to develop their practical skills. There is also a selection of legacy coursework tasks accessible from the qualification webpage to teachers with OCR Interchange access.

The most successful candidates	***Less successful candidates***
• had a broad knowledge spanning the all seven modules • used practical skills effectively such as photo interpretation, mapwork and knowledge from fieldwork • had strong skills in planning and visualisation of geological concepts • had strong mathematical skills • could write coherent prose	• had gaps in their knowledge as some aspects of the specification were not as well understood as others • were not familiar with drawing standard geological graphs and diagrams such as cumulative frequency curves • had poor mapwork skills in general • had difficulty interpreting photographs and diagrams of geological features

Note

From this series students have been provided with a fixed number of answer lines and an additional answer space. The additional answer space will be clearly labelled as additional, and is only to be used when required. Teachers are encouraged to keep reminding students about the importance of conciseness in their answers. Please follow this link to our SIU (https://www.ocr.org.uk/administration/support-and-tools/siu/alevel-science-538595/)

Question 1 (a) (i)

1 Four sediment samples have been collected from different environments.

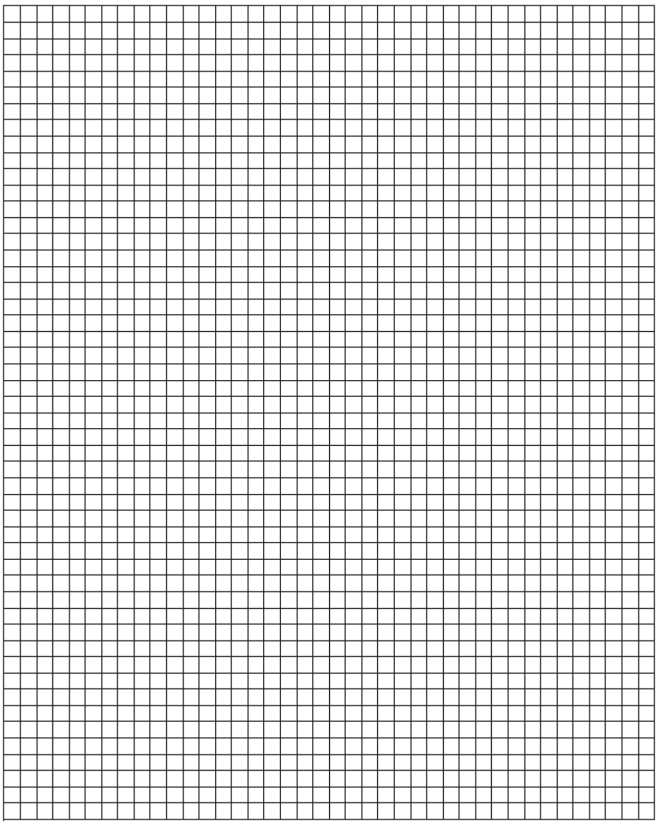
A student has analysed the sediment samples by using a sieve bank, a stack of sieves arranged with the biggest mesh (4 mm or –2 Φ) at the top and the smallest (0.0625 mm or 4 Φ) at the bottom.

The student's results are shown in Table 1.1 below.

Phi Φ	Sample A (%)	Sample B (%)	Sample C (%)	Sample D (%)
–2	11	2	0	0
–1	18	6	0	2
0	14	39	2	19
1	9	38	4	69
2	15	12	78	8
3	16	2	14	2
4	17	1	2	0

Table 1.1

(a) (i) Using the graph paper below, plot the results in Table 1.1 for samples **A**, **B**, **C** and **D** as cumulative frequency curves.



[3]

Many candidates produced clear labelled curves with well annotated axes filling all of the provided graph paper. A small number drew much smaller graphs not utilising the available space and generating more difficult scales to plot their points. A significant number of candidates drew line graphs. The Mathematical Skills Handbook and the Practical Skills Handbook (Appendix 6) both contain guidance for candidates on drawing graphs.

	AfL	Many text books show how to complete cumulative frequency graphs. The Sediment Sieving PAG on Interchange has a section where candidates are encouraged to plot cumulative frequency curves. The graph paper has ready labelled axes showing candidates how to set up their own curves.

Question 1 (a) (ii)

The coefficient of sorting (p) can be measured from cumulative frequency curves using the following equation:

Coefficient of sorting (p) = $\frac{\Phi_{84} - \Phi_{16}}{2}$

where Φ_{84} is the phi value of the cumulative mass of 84% of the sample and Φ_{16} is the phi value of the cumulative mass of 16% of the sample.

Table 1.2 shows how the coefficient of sorting can be converted into the degree of sorting.

Coefficient of sorting	Degree of sorting
<0.50	well sorted
0.5–1.00	moderately sorted
>1.00	poorly sorted

Table 1.2

(ii) Using your cumulative frequency curves in **(a)(i)**, calculate the coefficient of sorting for each sample. Use these values and Table 1.2 to describe the degree of sorting to complete the table. Sample **A** has been completed for you.

	Sample A	Sample B	Sample C	Sample D
Coefficient of sorting (p)	2.65			
Degree of sorting	poorly sorted			

[3]

Candidates who had successfully completed Question 1(a)(i) usually had no difficulty in completing this Question. Many candidates who had did not complete the graphs correctly still manged to calculate the sorting values. However several candidates did not attempt this straight forward mathematical skills question.

Question 1 (a) (iii)

(iii) Which of the sediment samples, **A** to **D**, is most likely to be wind-blown dune sand?

Suggest reasons for your answer.

....

....

....

....

.... **[2]**

Most candidates successfully identified the correct sediment with a valid reason. Not many opted for the most obvious response of it being the **best** sorted sediment of the four samples. The values for the coefficient of sorting for C and D were very similar (i.e. 0.40±0.2) and depending on individual plotting and scaling either could be the best sorted. Most candidates provided explanations linking the theory of Aeolian sedimentation to the very good sorting coefficient of their selected sample.

Question 2 (a)

2 A student is trying out several exploration methods to locate a copper deposit.

(a) Describe **one** geophysical exploration technique and explain how it could be used at the surface to help locate a copper deposit.

....

....

....

.... **[2]**

There were three viable answers for this question: EM survey, gravity survey and resistivity survey. ; A half of all candidates showed good understanding of geophysical prospecting with gravity surveys being the most popular method described. The most common misconception was candidates who wrote about stream sampling or taking rock samples from boreholes. A small number of candidates wrote about placer deposits.

	AfL	Most of the major mineral resources around Norilsk in Siberia were identified using EM survey techniques. The vast orefields are associated with the Siberian Traps and so gravity techniques are not suitable, and resistivity surveys require land based techniques. In Soviet times the USSR developed airborne EM surveying as a geophysical prospecting technique that has spread worldwide since the 1990s.

Question 2 (b) (i)

(b) Soil samples have been collected from two transect lines, **A** and **B**, down a hill and set 1 km apart. A student has analysed the soil samples in a laboratory and has tested for the presence of copper. Their results can be seen in the table below.

Distance from top of hill in metres (m)	Copper parts per million (ppm)	
	Transect A	Transect B
0	57	55
10	61	57
20	61	58
30	61	59
40	63	61
50	65	62
60	67	62
70	69	63
80	76	64
90	820	70
100	963	76
110	1020	85
120	1180	88
130	1207	92
140	1346	94
150	1578	97
160	1610	99
Mean	606.12	
Mode		
Median		

(b) **(i)** Complete the table by calculating the mean, mode and median for both data sets. **[2]**

The majority of candidates answered this question competently and three quarters of all candidates got both marks. In the new Geology assessments Level 2 mathematical skills (at GCSE higher tier or equivalent) form at least 10% of the marks. However there will still be additional mathematical skills questions that are of specification content (M2.6), but are at a lower level of demand.

Question 2 (b) (ii)

(ii) The student also performed a Mann-Whitney U-test on the data. The result clearly showed a difference between the two data sets with 99.9% significance.

Evaluate the usefulness of the mean, mode, median and Mann-Whitney U-test as statistical analyses with these two data sets.

....

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....

.... **[3]**

Although the majority of candidates gained some credit for this question, only a third of candidates were awarded more than one mark for their response. Higher ability candidates respond to the command work 'evaluate' and linked their answer to part (b)(i) to each of the statistical techniques required. The best candidate responses identified that the mean was a useful indicator because the values for the two transects differed greatly which suggested an underlying difference in the geology. However most candidates misinterpreting the requirements of the question and rather than evaluate the usefulness of the different statistics they explained what a mean was.

Question 2 (c)

(c)* Native copper is sometimes found as placer deposits.

Design an experiment which you could do in a school laboratory which simulates the process involved in the formation of placer deposits.

....

.... **[6]**

This is a level of response question which is a new style of question for A Level Geology. Many candidates were highly inventive coming up with a variety of ways in which this could be modelled in a classroom. Good responses referred to the use of tubes/pipes or trays inclined and filled with sediment, with copper particles mixed in. A flow of water was then generated to pass through the area to move the sediment. Reference was made to the creation of obstacles in the 'river channel' and meanders developing where the copper would be deposited on the upstream side of obstacle or the inside of meanders. Some candidates made reference to the properties of placer deposits but few clearly linked these properties to the aim of the experiment which is what was required for the top level of response. A small number of candidates referred to sources of error, controls and repeat measurements for good experimental techniques to qualitative and quantitative data.

i	**OCR support**	Level of response and practical skills questions can be very challenging, and we have provided centres with a range of support materials to help prepare candidates. The blog Science - how much should I write in a science exam? Offers advice based on the latest research, and the experience of the 2018 AS Geology series. The course material for Understanding the Assessment: Webinar: OCR AS and A Level Geology (H104/H414): Reviewing the 2018 AS Level exam series has more targeted advice on both practical skills questions (slide 36) and level of response (slides 42–45).

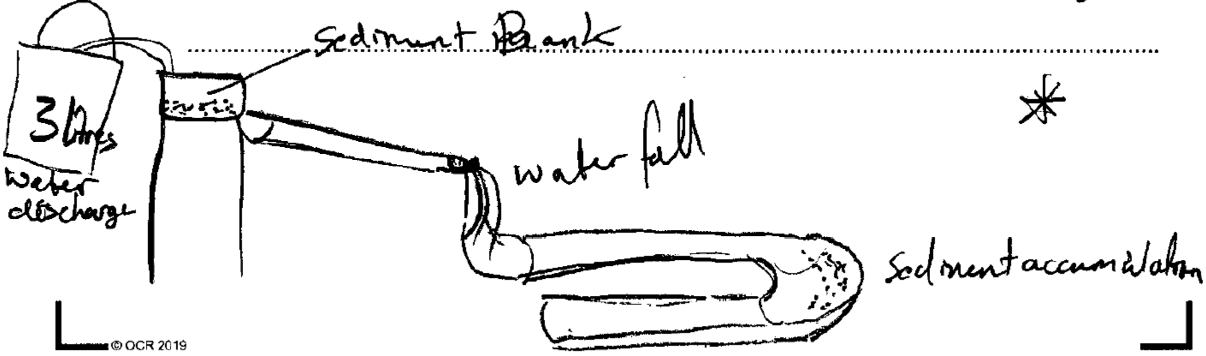
Exemplar 1

Placer deposit form in sediment that has been deposited by water discharge fluxes or deposit prone areas such as a waterfall base. Small particles of metals are carried along the river and deposited in these specified areas.

My Experiment would be a model river with different feature such as a water fall and bank. Have a one size sediment + smaller heavy beads which simulate copper. You could run water down the model ~~start~~, starting the sediment on a bank at the top. The independant variables would be: Change in water discharge (cummecs) or something smaller) I would keep the same: 1.) The time for water **[6]**

Additional answer space if required.

flow. 2) The quantity of sediment (weight) 3.) the amount of times each size of water discharge is used. A weight of placer deposit would be taken each time for various discharges



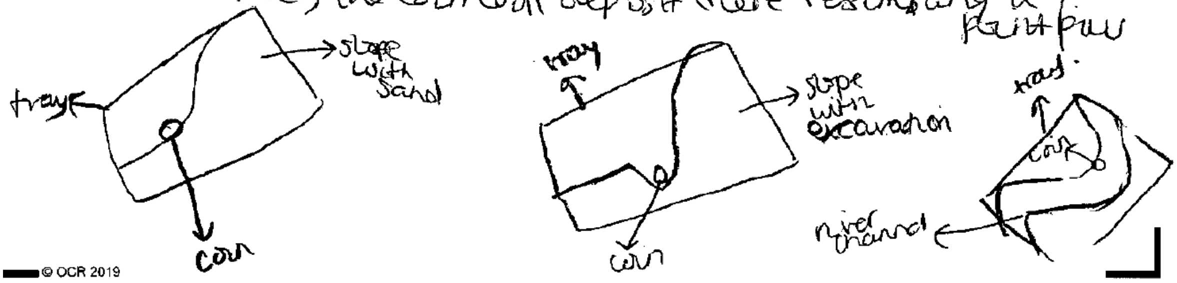
This is an example of a Level 3 candidate response that was credited with 5 marks. This candidate shows good awareness of experimental technique, an area that was missed by many other candidates.

Exemplar 2

Set up a tray of sand, build up the sand into a mound at one end of the tray and make a slope with decreasing gradient, resembling a wadi channel or a river running down a mountain. get a measured volume of water with a copper coin inside ~~[illegible]~~ a jug and pour at a constant velocity onto the top of the slope. As the coin has high density it will ~~drop~~ deposite at the bottom of the slope as the gradient decreases, resembl-ing a placer deposit.
Arrange the ~~sand~~ slope in the sand to have a dip at the bottom of the slope, to resemble a pond at the bottom of a water fall. Observe the copper coin as it is likely to deposit into the pond at the **[6]**

Additional answer space if required.

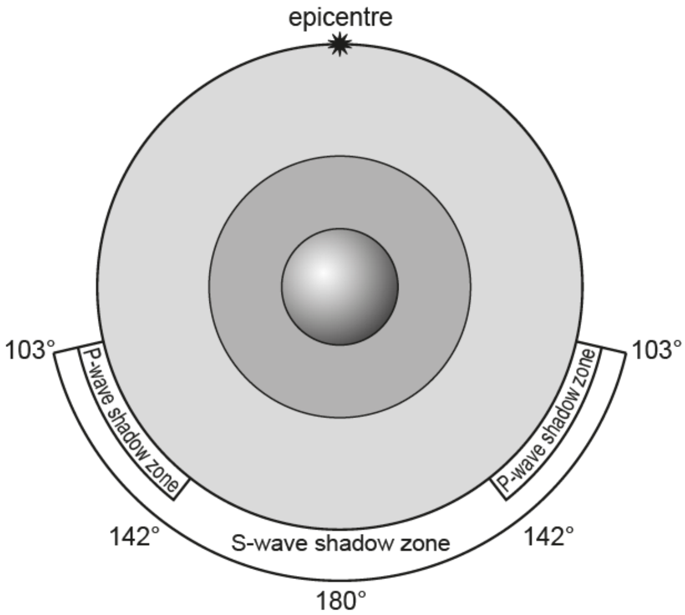
bottom as energy decreases and it is more dense. you can also on a flat gradient create a river through the sand, a meandering one. then run the water through at a constant velocity. As the velocity and energy is less at the inside of the river, the coin will deposit there resembling a point bar



This is an example of a Level 2 which was awarded 4 marks. The candidate has used diagrams effectively to describe clearly how their experiment is set up. To move up to Level 3 the candidate needed to focus more on data collection, repeat measurements and sources or error. A characteristic of the Level 3 responses seen was that they had a stronger focus on explaining placer deposits and then linking them to the experiment. This candidate has mentioned density but they need to link density more clearly with their experimental method.

Question 3 (a) (i)

3 The diagram of the Earth below shows the shadow zones of both P and S waves after a hypothetical earthquake at the North Pole.



(a) (i) Label the following on the diagram:

- inner core
- Gutenberg discontinuity
- crust
- mantle
- outer core
- Lehmann discontinuity. **[2]**

Almost all candidates recalled the structure of the earth theory effectively. The most common misconception was to confuse the Gutenberg discontinuity (mantle–core) with the Lehmann discontinuities (outer core–inner core).

	AfL	Inge Lehmann was one of the leading seismologists of the Twentieth Century and through detailed analysis of seismic records she showed that the inner core must be solid in 1936. Her work established the modern science of seismology and in the 1950s she moved to the USA to work on the VELA UNIFORM seismic monitoring network. Linking her discoveries in the core to interpreting seismograms can help candidates to clearly associate her with understanding the structure of the Earth's core. Beno Gutenberg was a German seismologist with a Jewish background who immigrated to the USA in the 1930. He worked with Charles Richter on understanding the relationship between seismic magnitude and the energy released in an earthquake. He also studied the base of the mantle.

Question 3 (a) (ii)

(ii) On the diagram, draw and label a path of a P wave **and** a path of an S wave propagated from the epicentre. **[1]**

Half of all candidates were aware that S waves are not transmitted through the liquid outer core, while P waves are transmitted through the outer and inner core. The most common misconception was to draw the ray path for P wave but to forget to show them refracting when moving across a discontinuity for example from the mantle to the outer core (Gutenberg discontinuity) or from the outer core to the mantle.

Question 3 (a) (iii)

(iii) Explain why both P and S waves arrive at the Earth's surface up to 103° from the epicentre but S waves cannot be detected beyond 103° from the epicentre.

....

....

....

....

.... **[2]**

Most candidates were aware that S waves would not travel though the liquid outer core and many referred to both types of waves being able to move through the mantle. Only a third of candidates referred to the refraction of P waves at discontinuities to create the shadow zones.

Question 3 (b)

(b) In the space below, draw an annotated diagram to show how P and S waves could be demonstrated in a laboratory using a spring.

[2]

Only a fifth of candidates got both marks for this question, and half of the candidates got no marks. Many candidates drew the correct shapes but did not provide sufficient detail in their annotation to gain the marks. Two points were required for each type of wave. A small but significant number of candidates got their diagrams the wrong way around and some produced perfectly annotated correct diagrams but did not differentiate which was the P wave and which the S wave.

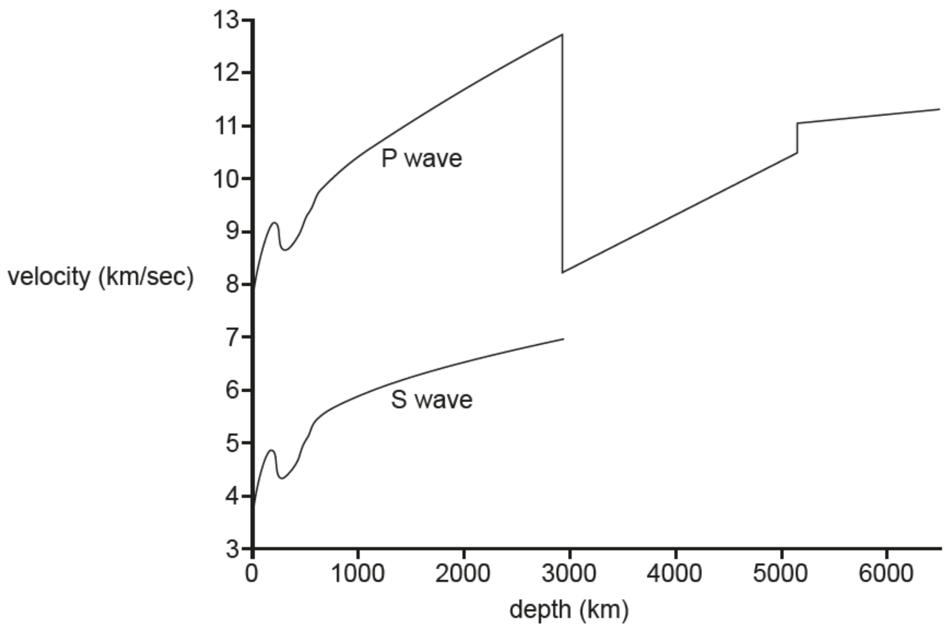
	AfL	In class when carrying out past question work teachers should encourage candidates to always provide at least two annotations for this style of question. Annotation requires more detail than a label. Candidates often have problems accurately labelling a diagram and the annotation line must touch the intended feature. If current questions for the specification on the OCR website (or even past questions from the legacy specification) are projected this can generate ideas to show candidates the expectation for this type of question.

	OCR support	The Past paper resource contains 400 pages of questions and associated marks schemes from the legacy H087/H487 geology qualifications. There is also a H087/H487 extended response question resource with 78 extended response questions and mark schemes mapped to the H414 specification

Question 3 (c)

(c) The graph shows the velocity of P and S waves as they travel through the Earth, which allows us to infer the composition and state of the different layers of the Earth.

Label and annotate the graph to show your understanding of this statement.



[3]

The majority of candidates gained some marks for their response to this question although few got all three marks. Good responses identified all of the different zones within the earth, outlined their states and explained how these properties affected the speed of P and S waves. Many candidates focused only on parts of the graph such as the core or on just the waves and not the layers of the earth. Many candidates struggled to accurately locate the Asthenosphere as the site where velocity rapidly falls and misidentified the crust.

?	**Misconception**	When asked to ‘annotate’ many candidates only add labels. Annotations imply that they will supply some explanation of the graph or diagram. An effective way for candidates to improve marks here would be to provide more detail, Including some explanation.

Question 4 (a) (i)

4 The map in Fig. 4.1, **on the insert**, shows the simplified geology typical of an island in the Inner Hebrides in Scotland.

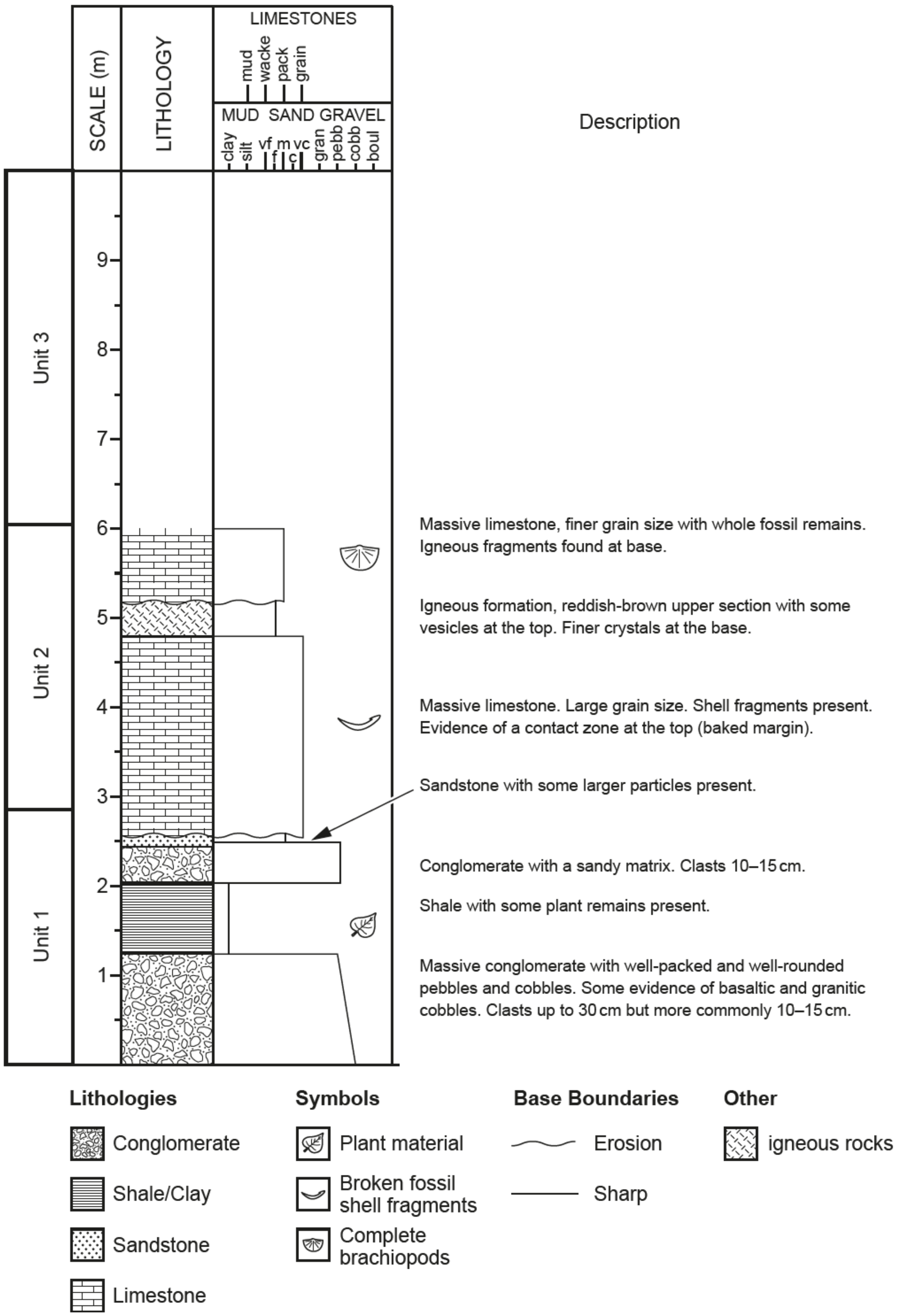
A field excursion has been undertaken at several locations on the island. The three areas of study have been labelled on the map as points **A**, **B** and **C**.

(a) Table 4.1 shows the field data recorded at location **A**. Bed 1 is found 6 m from the base of the cliff, whilst the base of bed 4 is 8.5 m from the base of the cliff.

Bed	Thickness (m)	Rock description	Features visible
1	1.50	Massive conglomerate, densely packed imbricated clasts of arkose up to 30 cm in diameter; irregular silty sandstone wedges towards the top.	Uneven base (erosional). Slight fining towards top.
2	0.20	Fine grained sandstone with sharply defined laminated base.	Parallel bedding.
3	0.80	Massive conglomerate, densely packed imbricated clasts of arkose up to 30 cm in diameter.	Slight fining towards top.
4	0.50	Highly amygdaloidal basaltic lava forming the top of the cliff.	Amygdales present towards the top.

Table 4.1

(i) Using the data in Table 4.1, complete the graphic log on page 11, including summary rock descriptions. **[3]**


SCALE (m)
LITHOLOGY
LIMESTONES
mud wacke pack grain
MUD SAND GRAVEL
clay silt vf f m c vc gran pebb cobb boul
Description
Unit 1
Unit 2
Unit 3
1
2
3
4
5
6
7
8
9
Massive limestone, finer grain size with whole fossil remains. Igneous fragments found at base.
Igneous formation, reddish-brown upper section with some vesicles at the top. Finer crystals at the base.
Massive limestone. Large grain size. Shell fragments present. Evidence of a contact zone at the top (baked margin).
Sandstone with some larger particles present.
Conglomerate with a sandy matrix. Clasts 10–15 cm.
Shale with some plant remains present.
Massive conglomerate with well-packed and well-rounded pebbles and cobbles. Some evidence of basaltic and granitic cobbles. Clasts up to 30 cm but more commonly 10–15 cm.
Lithologies
Conglomerate
Shale/Clay
Sandstone
Limestone
Symbols
Plant material
Broken fossil shell fragments
Complete brachiopods
Base Boundaries
Erosion
Sharp
Other
igneous rocks

This question was generally done well with most candidates gaining 2 or more marks. Most candidates effectively used the information shown in the log to help them successfully complete the rock description part of the task. A small number of candidates did not plot the basalt at all. A few candidates plotted the log upside down and had did not pick up the clues in the question stem about the sequence it should be plotted in.

?	**Misconception**	The most common misconceptions were to not show the two conglomerates fining upwards or plotted the basalt with the wrong crystal/grain size. As basalts are defined as having crystals less than 1 mm in diameter this meant that a grain size of coarse sand or below was acceptable.

Question 4 (a) (ii)

(ii) Use the space below to draw and label an imbricate structure which could be found in Unit 3 of the graphic log.

[1]

Most candidates answered this question correctly and clearly understood imbrication. The most common misconceptions were not to indicate the current direction or drawing clasts that were not in contact with each other.

Question 4 (a) (iii)

(iii) Explain how it is possible to calculate the direction of water movement using the imbricate structure.

....

....

....

....

....

.... **[2]**

Most candidates dealt well with the first part of the question. However, very few could relate their practical experience of fieldwork to the second part of the question in order to gain full marks. Candidates will have experience of measuring 2D geological data with a compass clinometer and also handling directional data so are expected to be able to apply these skills to suggest how to measure imbrication with a compass clinometer.

	AfL	This is a classic question where fieldwork experience is used to inform the answer. However not all fieldwork sites effectivity show imbrication. This can be modelled in the classroom. Specimens can be piled up on classroom tables to mimic imbrication or A3 laminated sheets can be produced with clasts drawn on them. Candidates can them be shown with the aid of a compass clinometer how to measure imbrication. Yorkstone paving are common in most British town centres and will show very good examples of directional features (current ripples and crossbedding).

Question 4 (b) (i)

(b) The diagrams in Fig. 4.2 show field sketches of the fossil assemblages found at location **B** on the map in Fig. 4.1.

Assemblage **X** – Coarse grained limestone   Assemblage **Y** – Fine grained limestone

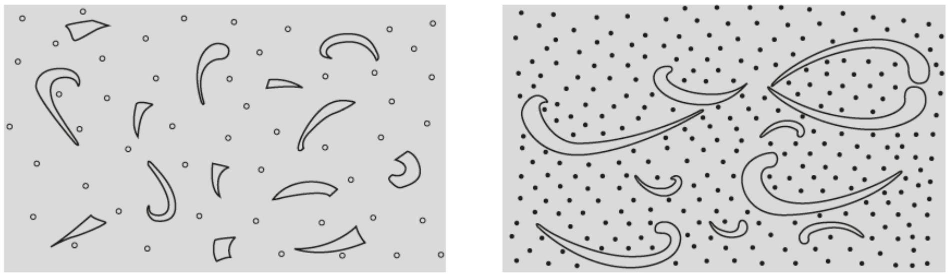


Fig. 4.2

(i) Which of the diagrams, **X** or **Y**, indicates a death assemblage?

.... **[1]**

Almost all candidates correctly identified X as the death assemblage.

Question 4 (b) (ii)

(ii) Describe the factors that can affect the quality of fossil preservation and how this can help to determine the palaeoenvironment.

....

....

....

....

.... **[2]**

Many candidates provided good responses showing a high level of understanding of fossil preservation. However, a significant number provided the reverse argument for their second point and so could not achieve both marks.

	Misconception	Candidates need to make sure that they give two different points **with detail** to show how their chosen factor leads to quality of fossil preservation as many named a factor but did not provide clarification.

Question 4 (c) (i)

(c) **(i)** Identify the igneous feature described within Unit 2 of the graphic log.

.... **[1]**

Two thirds of candidates correctly identified this as lava flow. The most common misconception was misidentifying the unit as a sill.

	AfL	The emphasis in all reformed science A Levels, including Geology, is on applying knowledge and understanding, of in interpreting or analysing data. Displaying a diagram like the graphic log to a class and then getting them to interpret features will give less able candidates the confidence to move beyond expecting simplistic 'what is the difference between a lava flow and a sill' questions.

Question 4 (c) (ii)

(ii) Describe **two** features you would look for in the field which would allow you to identify this igneous structure.

....

....

....

....

.... **[2]**

A half of all candidates provided two good responses to this question. The most common misconception was over chilled and baked margins and how many there should be. Many candidates decided there would only be one of each at the base of the bed, whereas there would be only one baked margin (below the lava flow) but two chilled margins at the top and at the base of the lava flow.

Question 4 (d)

(d) Location **C** on the map in Fig. 4.1 shows an area of metamorphic rocks. Units of both shale and limestone have been metamorphosed following the emplacement of the igneous intrusion.

Outline the changes that take place in the metamorphosed shale and limestone.

....

....

....

....

....
[2]

This question proved challenging with around a third of candidates getting some credit, but only a few being awarded both marks. The majority of candidates knew that limestone changes to marble but most of them did not link this to the metamorphic process of recrystallisation that was needed to get this mark. The concept of shale changing to spotted rock, andalusite slate or hornfels was more poorly understood.

?	**Misconception**	The metamorphic geology content is now spread over both years to allow candidates time to develop a more general geological understanding before introducing more complex concepts in module 5. However some candidates had a very poor understanding of metamorphic processes including the idea that metamorphism involves melting or just stating that 'the rock changed'. Where centres decide to teach all the metamorphic content together it may be better to do this in the second year of the course to move candidates beyond a simplistic KS2 science understanding of the rock cycle and metamorphism.

Question 4 (e)

(e)* The photograph in Fig. 4.3 shows some different rocks found on a nearby island.

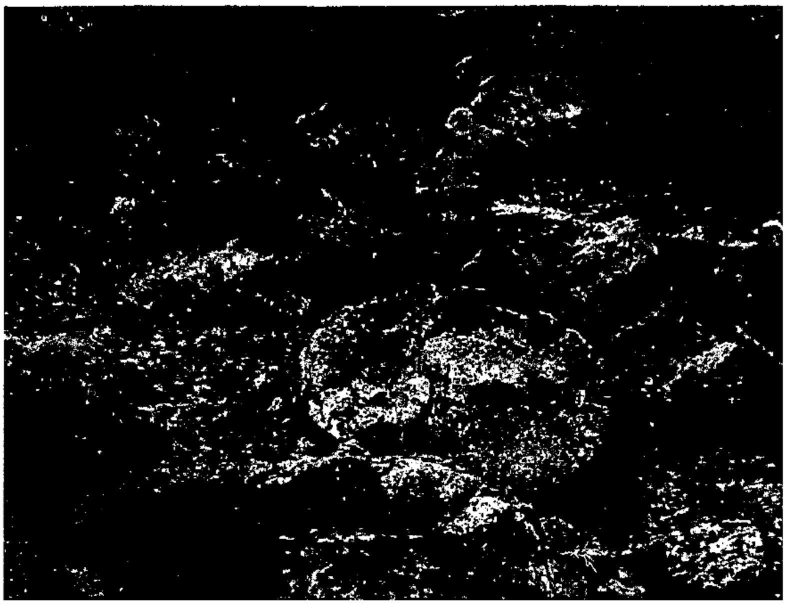
Using the information shown in the photograph, identify the rock type and explain how the rock formed. **[6]**

0 0.5 1
m

Fig. 4.3

This was the second level of response question and required candidates to apply their understanding of mid-ocean ridge volcanic processes to the specific detail in the photograph. Two fifths of the candidates correctly identified the rocks as pillow lavas and provided a sound explanation about their formation undersea at mid-ocean ridges. Many of these candidates provided a sufficient detail to access the Level 2, although not many clear links to the observable features in the photograph needed to meet the criteria for Level 3. The most common error made by the other candidates to identify the features as a sedimentary rock or as volcanic bombs from the explosive eruption of silicic magma.

Exemplar 3



Pillow lava Basalt

2.4m

0 0.5 1
m

Fig. 4.3

In the photograph we can see basaltic pillow lavas. These are quite big with one pillow lava being 2.4 m length and 1.4m width. These form through volcanic activity underwater. When a fissure or guyot erupts lava underwater it cools quickly, these pillow lavas can be found there. When the magma is extruded out into the ocean the cool sea rapidly cools it. This leads to fine grained rock on the out side. But it doesn't completly cool the inside, this leaves time for the crystals to ~~cool~~ grow leaving medium grained crystals on the inside. When it gets extruded it comes out quite rounded but large in a blocky shape.

Additional answer space if required

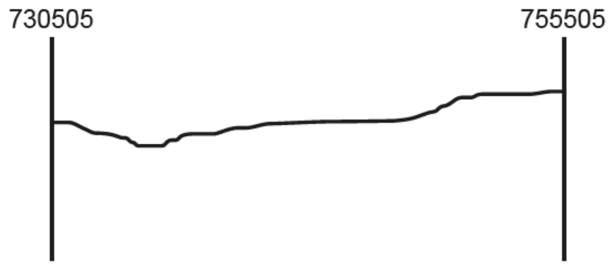
They have mafic minerals and are mainly composed of basalts so are dark / grey in colour.

This is an example of a Level 3 response that was awarded 5 marks. Here the candidate uses their knowledge to explain the formation of pillow lavas but also back up their points with information from the photograph.

Question 5 (a)

5 The 1 : 50 000 geological map excerpt (Worcester), **on the insert**, should be used for this question.

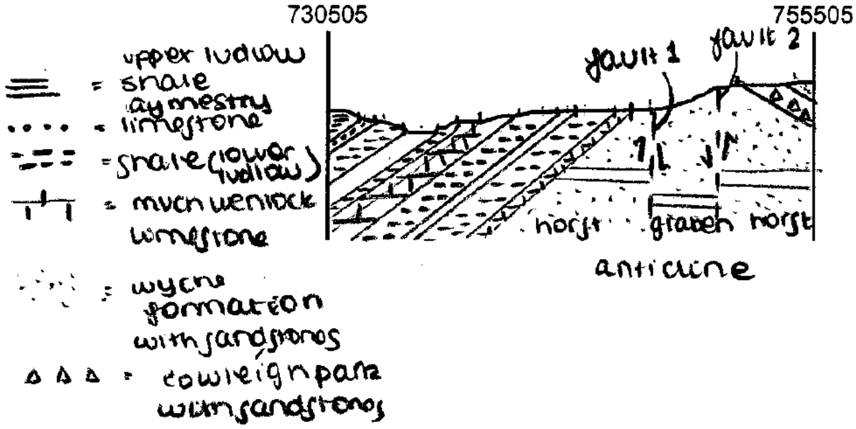
(a) On the topographic sketch profile below draw and label a cross-section of the solid geology from grid reference 730505 in the West to 755505 in the East.



[4]

Many candidates struggled to complete this and fifth of the candidates did not attempt the cross section. Those attempting it mostly struggled to recognise the three faults on the map and the two downthrows marked to identify a graben. Many candidates gained one mark for drawing the dipping beds although a significant number of candidates did not identify that most of the beds west of the axis if the graben were dipping down to the west at more or less the same angle. These candidates drew different beds dipping by different amounts and not always in the same direction.

Exemplar 4



[4]

This is a very good example of a cross section. There is a clear way to identify the rocks from the map, dips are correctly plotted and the graben structure is clearly shown between two faults. Because this cross section does not shown the western boundary fault of the graben it was awarded three out if four marks.

Question 5 (b) (i)

(b) **(i)** Evaluate the fault types and directions that occur within the Coalbrookdale Formation and Much Wenlock Limestones in grid square 730510.

....

....

....

....

....

.... **[2]**

Most candidate responses were very brief and only a quarter of candidates gained any marks. High achieving candidates picked out the main trend NW–SE and that some faults were downthrown to the south. A smaller number identified the graben. Other candidates correctly identified a strike slip fault.

?	**Misconception**	It was clear that many candidates had either allocated insufficient time to complete the map skills question or were not secure in their map skills. Most candidates attempted the question but did not respond to the 'evaluate' command word or the request for directions of the faults.

Question 5 (b) (ii)

(ii) A quarry company have applied for planning permission to site a quarry in the Wenlock Limestone, at grid reference 732512. The overall size of the quarry would cover around 1 km^2.

Analyse the potential geohazards that may occur around the area of extraction.

[3]

The majority of candidates were awarded at least one mark for this answer to this question, and were clearly more comfortable with this style of map question. There were many good responses which linked the steep land surfaces and/or steeply dipping strata as likely cause a risk of potential landslides. A number of candidates mentioned faults but did not link reactivation of the faults due to the quarrying as a geohazard.

?	**Misconception**	Many candidates assume that faults must be currently active and as a cause of earthquakes. Reservoir-induced seismicity (6.2.2b) is an obvious topic in the specification that provides an opportunity to get students to draw together their knowledge and apply it to a problem. For example the link between the human role and the reactivation of historical faults. Similarly studying seismicity in the British Isles and linking that to historical events (6.1.2b) such as tsunami (6.1.3d).

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