OCR
Oxford Cambridge and RSA

GCE

Geology

Advanced GCE **A2 H487**

Advanced Subsidiary GCE **AS H087**

OCR Report to Centres June 2016

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This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

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F791 Global Tectonics

General Comments:

This paper was generally more accessible than that of last summer. On every question at least some candidates scored full marks. There were a number of straightforward question types, using tables, maps and diagrams, where candidates often gained high marks. The quality of the candidates' extended prose question was generally high with many candidates gaining full marks.

The specification for this unit requires the use of technical terminology which can be tested in a number of ways. In general, candidates have shown that they have a solid grasp of technical terms and they used them correctly in the extended prose question. Candidates were also good at defining technical terms or linking them with definitions.

There was no evidence of candidates running out of time and there were few "No Response" questions. As is often the case, some candidates missed a question in error usually because they require a label on a diagram so there are no lines to write the answer immediately below the question. As always candidates should read and take note of every word in the exam paper. A number of candidates had used the spare pages at the back of the answer booklet to continue answers or to replace crossed out answers. When candidates do this, it is very helpful if they clearly indicate where to find additional parts of answers.

Comments on Individual Questions:

Question 1:
Many candidates started the paper confidently showing sound knowledge of meteorites and tectonic landforms.

1ai Most candidates had a clear understanding of what a meteorite is. Students should be encouraged to mention that it should go through the atmosphere and land on Earth.

1aii The majority of candidates knew that meteorites originate in the Asteroid Belt although the spelling of Asteroid was variable. Some indicated the location of the Asteroid Belt between Jupiter and Mars.

1bi Nickel was well known as the main metal other than iron in iron meteorites although the spelling did vary.

1bii The composition of stony meteorites was quite well known with most either indicating they are made of silicates or indeed giving examples of the silicate minerals. Others mentioned the peridotite/ultramafic composition. A common error was to say they were silicic rather than made of silicates.

1biii The vast majority knew that iron meteorites represent the core and the stony meteorites the mantle. The most common error was to suggest that stony meteorites represent the composition of the crust.

1c This question offered a chance for the candidates to give a wide range of answers, however, to get 2 marks, the answer needed to focus on identifying the impact crater rather than general evidence for meteorite impacts. Therefore the evidence needed to link to the impact crater. Many candidates knew of the inverted strata, shocked quartz and tektites in and around the impact crater. Less common answers linked to tsunami deposits and meteorite fragments focussed on the impact crater.

1d Matching tectonic feature terms with definitions was generally well done with many candidates gaining full marks. The most common error was mistaking the continental shelf for the correct answer of continental shield. Candidates should be encouraged to be clear about the properties of all ocean and land based tectonic features.

Question 2:
Candidates showed a good understanding of earthquakes and the use of seismology when inferring the structure of the Earth.

2ai Candidates were very successful in plotting the graph with only a small number either miss-plotting more than one data point or not realising that they were asked to add a curve.

2aii This proved to be a straightforward question with candidates spotting the simple positive correlation or even the exponential nature of the curve.

2aiii Candidates struggled with coming up with a reason why a magnitude 10 earthquake is unlikely. Some had an idea that it was to do with the amount of energy involved but did not link it to the energy stored in the rocks and the strength of the rock.

2aiv The great majority of candidates knew the Richter scale with very few offering the incorrect Mercalli.

2b Candidates needed to think carefully about the seismic wave shadow zones and many linked all 4 statements correctly. Some candidates helped themselves visualise the shadow zones by drawing a small section of the Earth showing the shadow zones.

2ci Candidates were able to plot the P, S and L waves in the appropriate part of the seismogram. This was the first question on the paper with evidence of candidates missing out the question, presumably because they did not read the question. It is vital that candidates read every word of every question so that they do not miss this type of question.

2cii Most candidates knew that body waves travelled through the body of the Earth. Some candidates were a bit vague, mentioning movement in the crust or through the crust. The best answers mentioned travelling through the body of the Earth including the crust, mantle and core.

2ciii Candidates found it difficult to give a clear explanation of how P and S waves are used to show the size of the outer core. It is the size of the shadow zone that has the clearest link to the size of the outer core. The larger the outer core the larger the shadow zones. Measuring the time taken for P waves to travel though the outer core also helps. Many candidates did know that S waves stopped at the outer core and therefore the outer core must be liquid. A number of candidates mentioned that S waves cannot pass through liquids but did not then state that the outer core is liquid. Others mentioned that S waves stop at the outer core but did not then link it to the outer core being liquid.

Question 3:
There was a more varied range of responses for this question with candidates knowing about the shape of the heat flow at a subduction zone and the cause of the Benioff zone but they were less clear on the process of mantle convection and the evidence for convection currents.

3ai In general, candidates knew where the island arc and ocean trench were on the map. Those that chose to circle the feature, especially the island arc, sometimes had an area that was far too large and so did not gain the mark. If circling features then it must be precise and care taken.
3aii Most candidates recognised from the map that it is a convergent plate margin and subsequently drew convergent arrows. Candidates do need to be careful when following instructions as they were asked to place the arrows on the map, some candidates drew the arrows above or below the map.

3aiii As with 3aii the majority of candidates recognised a convergent/destructive plate margin; the best answers also mentioned that it involved oceanic plates.

3bi Approximately half the candidates were able to draw an accurate heat flow curve. Weaker answers had the heat flow as too high or low, away from the trench or island arc. Some candidates drew a heat flow curve as if it were a Mid Ocean Ridge.

3bii Whether or not the candidate drew the heat flow curve correctly, most still linked the high heat flow with rising magma or volcanic activity. Only the best answers gained the second mark for linking the low heat flow to either sinking/subducting of the cold oceanic plate or due to the cold sinking convection currents. The most common misconception was that the deep trench full of water is responsible for the low heat flow.

3ci Candidates did struggle to show accurately the location of the subducting Pacific plate in relation to the Fiji plate. Many drew the Pacific plate in the vicinity of the Benioff Zone but they struggled to draw the Fiji plate in its correct position. Candidates should be aware that oceanic plates should not normally be deeper than 100 km below the surface: some answers had the Fiji plate at greater than 200 km which is too deep.

3cii The most common answer was that the pattern shows the Benioff zone which is due to the friction caused by the subducting plate. Better answers indicated that with distance from the trench, the foci became deeper, and they also linked the earthquakes to friction at the top of the subducting plate.

3ciii Most candidates were aware that at 700 km the plate has melted or is ductile but did not link this to an inability of the rock to fracture or store and release strain energy.

3di Many candidates understood that the asthenosphere is able to flow. Weaker answers discussed the crust floating on the asthenosphere or the asthenosphere lubricating the movement.

3dii Candidates found it difficult to give specific evidence for convection currents driving plate tectonics. Many candidates talked vaguely about continental drift or sea floor spreading but did not link it to heat flow at plate boundaries or specific processes. Many also mentioned mantle plumes/hot spots which in themselves are not evidence for convection currents. Marks could have been awarded had they then discussed the islands created by the convection currents moving the volcanic islands off the plume and being progressively older away from them.

Question 4:
Candidates showed that they were confident with some aspects of fold cross sections but found folds and faults on a geological map more difficult.

4ai Candidates coped well with inserting the correct terms into the paragraph relating to the cross section of a reverse fault. It seemed that if the candidate could not recognise the hanging wall then they would get the downthrown side wrong as well.

4aii Approximately half the candidates accurately measured the amount of vertical displacement (the throw) with many others measuring the displacement along the fault itself. Candidates should practice taking various measurements on faults and folds.

4bi Candidates were excellent at drawing and labelling both of the fold axes. Candidates should be encouraged to draw the fold axis line through the whole fold: some just drew it in the sandstone bed which did not gain the mark.

4bii The majority of candidates recognised that the fold was an antiform and that it was asymmetrical. The main extra detail related to the dip angles and direction of the limbs or the closed interlimb angle. Candidates should practise measuring dip angles and directions on fold cross sections.

4biii Candidates did find it difficult to state a direction, often giving a one word answer such as East or West, which is ambiguous. Candidates should be encouraged to be clearer such as (in this case) “from the West” or “to the East”.

4ci Many candidates spotted the symmetrical patterns in the rocks on the geological map and placed the axial trace on one of those lines of symmetry. This was a difficult question and required the candidates to recognise that the youngest rocks should be in the core of the syncline and this in turn required use of the rock key.

4cii If the candidate marked the correct axial trace then they generally drew the dip arrows in the correct place too. Candidates should make sure that the dip arrows they draw are at 90° to the bed boundaries.

4ciii This proved a difficult question, requiring candidates to realise that the line of the unconformity must be in a different direction to the older beds. In order for the unconformable rocks to be the youngest rocks on the map, the unconformity needed to cut across the fault and the sandstone bed (and be within the western half of the map).

4civ Recognising upthrown and downthrown sides on a map with folded rocks is difficult and it proved to be true in this case. Candidates need to learn or be able to visualise that a downthrown syncline will show a wider outcrop of youngest rock in the centre (sandstone in this case) and vice versa.

4d Candidates did well in realising that a dextral fault required all the beds were shifted to the right by the same amount. A common mistake was to match up the wrong sides of the beds, so that the left side was matched with the right side.

Question 5: Candidates showed that they had a sound knowledge of joints with many gaining full marks. It is clear that candidates had the fullest understanding of cooling joints. Their detailed written explanations were often backed up with well labelled and drawn diagrams showing hexagons with cooling centres and arrows showing contracting magma/igneous rock.

Less well understood were tectonic joints. Many candidates knew where they are located on a fold but few clearly linked the location to tensional forces acting on the outside of a bed at the hinge of a fold. There were some detailed diagrams showing the location of the joints on a fold. Candidates should make sure that they label arrows to show the tension at the hinges and the compressive forces either side that create the fold.

Candidates understood how pressure release joints formed, knowing details such as the typical rocks affected (granite) and linking it to erosion and release of pressure. The key point that was often missing is that the subsequent expansion of the rock causes fractures parallel to the erosion surface. Diagrams also tended to miss out labelling these joints parallel to the land surface.

F792 Rocks – Processes and Products

General Comments:

This paper covered wide areas of the F792 specification and had a number of very accessible questions using tick lists, tables and diagrams for which candidates often gained high marks. Although there were a significant number of 'no responses' to some part questions, there was no evidence that time was an issue. Most candidates attempted both of the two 10 mark extended answer questions at the end of the paper.

The quality of candidates' diagrams varied from very detailed, accurate, fully labelled diagrams that gained maximum marks with ease, to those that had no labels, were difficult to decipher and did not gain any credit. Candidates should be encouraged to practise drawing labelled diagrams as this is a key skill in Geology.

Some candidates were able to show a sound understanding of geological terminology, especially with regard to rock classification and identification. However, a number of common misconceptions were apparent. Confusion between mineral names and rock names continues to be a problem, as does mixing up igneous, sedimentary and metamorphic terminology. Other errors were using rock names for sediment or vice versa and describing rocks rather than magma erupting or crystallising.

A number of candidates underlined command words on the examination paper which is good practice as it helps them to focus on what is required in the answer. On occasion, some answers appeared to be to a different question on the same topic.

If candidates need additional space to write their answers it is very helpful if they clearly indicate where to find the additional parts of their answers. It is preferable that the additional answer space at the end of the question paper booklet is used rather than separate answer pages. A number of candidates didn't appear to have access to an electronic calculator and most of these were unable to correctly calculate the average for Q6(a)(ii).

Comments on Individual Questions:

Question 1
The quality of responses to this question on sedimentary rocks and classification were variable and it proved to be a good discriminator. Candidates with a good grasp of sedimentary classification scored highly.

a) i) Most candidates knew clastic meant broken and fragmental and the best answers made it clear that the fragments were in a rock.
ii) The two types of non-clastic rocks were less well known. Candidates who took note of the word 'the' scored better as they realised that the answer required rock groups rather than specific rocks.

b) i) Many candidates attained the maximum 4 marks but those who failed to take account of the grain size or composition information did less well. Some candidates gave the names of igneous and metamorphic rocks suggesting inadequate understanding of rock classification.
ii) The range of grain sizes used to define medium grains in sedimentary rocks was not well known. Many candidates gave the range for medium crystal size of igneous and metamorphic rocks (1 to 5 mm) while a significant number who did give the correct size range (2 to $^{1}/_{16}$ mm) forgot to include units.

iii) The majority of candidates knew clay is the main mineral found in fine-grained clastic rocks but it is advisable to state clay minerals rather than just clay.
iv) The difference between angular and rounded grains was well known and most diagrams were accurate but a notable number of candidates ignored the command word 'label' and thus lost the mark.

c) i) The characteristics of desert sandstone were well known and both microscopic and macroscopic features were accepted. Some answers could be improved by ensuring full descriptors are given, e.g. well rounded, mostly quartz. Red colour was not a marking point – a specific description of iron oxide / haematite coating or cement was required.
ii) The characteristics of a sandstone formed in a fluvio-glacial environment were less known and a number of candidates appeared to give a description of boulder clay but could still get marks for some descriptors. Texture was better known than composition, but precise statements of grain shape and sorting were required to get marks.

d) The composition of chalk and the cement of bioclastic limestone were least known and some transposed oolite and concentric layers.

Question 2
Volcanoes is a well-known topic but some candidates were unable to describe correctly how the volcanic rocks ignimbrite and agglomerate form.

a) i) There were many good answers to this tick box question on volcanic eruption types. The most common correct response was that the eruption of shield volcano **H** produces only lava. Common mistakes were either ticking ignimbrite for the eruption of volcano **F** or not ticking ignimbrite for the eruption of volcano **G**, suggesting the processes that form ignimbrite are not well understood.
ii) Most candidates also scored well on this question about the VEI scale of volcanoes **F**, **G** and **H**. However, a significant number of candidates ignored the prompt to use each letter only once. Multiple use of each letter was given credit provided all were correct. Candidates should ensure they read questions carefully so they know what to do before starting their answers.

b) i) The formation of an ignimbrite was poorly understood and there were a significant number of no responses to this part question. The most common correct answer for one mark was that ignimbrite results from a pyroclastic flow, but few went on to describe the formation of the rock as the pyroclastic material welds or fuses together.
ii) Likewise the formation of agglomerate was not known well. The most common correct answer for one mark was the material that makes up the agglomerate – coarse-grained volcanic blocks and bombs. Some candidates could have improved their answers by describing how the blocks and bombs are then lithified to form the rock agglomerate.

c) The stages of caldera formation were well known and there were many excellent descriptions accompanied with accurate, fully labelled diagrams. Some lost marks due to poor diagrams or no labelling. There was some confusion between the formation of craters and calderas.

Question 3
Although there were good answers to this question on igneous rocks and textures, many were weak and igneous classification continues to be a poorly learned area of the specification.

a) i) Those who knew igneous classification had no problem with this plotting question. Dolerite was plotted correctly more often than andesite.
ii) Again, those who knew the minerals used to classify gabbro and granite were in the minority. Granite was better known, with quartz and K feldspar being the two most common correct minerals stated. For gabbro, many candidates knew augite / pyroxene but often did not include calcium plagioclase and a notable number only wrote olivine. A common error was not stating the feldspar type and a significant number of candidates listed biotite mica for gabbro.

iii) A number of candidates ignored the word mineral and merely described how silica content determines colour thus losing marks.
iv) Many candidates knew silica composition can only be determined by chemical testing in a laboratory but could have improved their answers by using more precise terminology.

b) The features of lava flows and sills were well known and many answers to this tick box question achieved maximum marks. There was some confusion about crystal size and rate of cooling and some candidates ticked both options for these.

c) i) A variety of diagrams were produced in response to this question. Some candidates could have improved their answer by ensuring they label diagrams and add a scale particularly when prompted to do so in the question.
ii) The formation of porphyritic texture in granite was not well known. Many candidates knew the process involved two stages of cooling but needed to use precise descriptions of the formation of coarser phenocrysts, first by slow cooling at depth and then the finer groundmass by more rapid cooling at a higher, but still plutonic, level to attain both marks. Some candidates did not appear to have read the question and just followed on from part (i) and described how a vesicular or amygdaloidal texture forms.

Question 4
Sedimentary structures are a well-known area of the specification and there were many excellent responses to this question. The formation of turbidites on the deep sea floor was understood less well.

a) i) The majority of candidates correctly identified the cross-section diagram of desiccation cracks, although those who spelled the word desiccation correctly were in the minority. There were many good descriptions of how desiccation cracks form but a number of candidates appeared to be confused with the formation of cooling joints and described the sediment contracting during cooling. Some candidates used the term rock when they should have been referring to sediment – the cracks form in <u>mud</u> (sediment) as it dries out, which only becomes <u>mudstone</u> (rock) after lithification.
ii) Most candidates gave a correct description of how graded bedding forms but some did not refer to deposition in still water or due to loss of energy.

b) There were many excellent, accurate and fully labelled diagrams showing imbricate structure with an arrow showing the correct current direction. A number of candidates incorrectly labelled the pebbles as rocks thus losing a mark.

c) i) The most common incorrect answer was asymmetrical ripple marks – the cross-section diagram and prompt that they were formed by turbidity currents should have helped in this respect.
ii) There were many good descriptions of how flute cast form by turbidity currents scouring hollows in the underlying sediment which are then infilled and preserved. However, some candidates referred to scouring of rock rather than sediment thus losing a mark.
iii) Candidates who had learnt the rocks formed in turbidite sequences had no problem naming rock **L** as greywacke and rock **M** as shale, mudstone or clay. Some candidates gave sediment names instead of rock names compounding the issue of rock versus sediment terminology.

d) Most candidates were able to gain some credit for explaining how the alternating rock sequence of **L** and **M** forms by deposition of fine-grained sediment (interturbidites) in low energy conditions when turbidity currents are not operating and then coarser sediment in higher energy conditions when they are. Fewer appreciated that deposition of shale is the normal situation and that repeated turbidity currents produce the alternating sequence.

e) The formation of oozes on the deep sea floor was well understood. Some candidates could improve their answers by referring to microscopic marine organisms rather than 'tiny sea creatures' or fish. A few thought that the organisms had to fall through the CCD before being deposited.

Question 5

Responses to this question on metamorphism and metamorphic textures were variable and it proved to be a good discriminator. Most candidates coped well with the graph in part (b) but the identification, description and formation of the textures in part (d) were not done well.

a) Those who were able to correctly define the term polymorph were in the minority. Some gave the correct mineralogy definition but failed to include the differing forms. Confusion between the terms rock and mineral was a problem.

b) i) Most candidates understood how to plot the kyanite / sillimanite boundary on the phase diagram and this question was done well.
ii) Sillimanite as the high grade regional metamorphic mineral was well known.
iii) The majority of candidates did correctly calculate a temperature of 450°C and were able to read kyanite from the graph.

c) There were some excellent answers to this question on paired metamorphic belts. However, these were in the minority and many candidates gave vague location descriptions such as 'further down in the subduction zone'.

d) i) This question was not well answered. Some candidates did not take note of the word texture and wrote schist for texture identification. Descriptions were done better and there were some good descriptions of the garnet porphyroblasts disrupting or distorting the micas. Explanations of the formation of schistosity often failed to include an explanation of micas / muscovite / flat minerals / platy minerals and their alignment at right angles to the maximum pressure. Explanations of the formation of the porphyroblastic texture were often confused with the igneous porphyritic texture, with statements such as 'the garnet grew first', or 'formed by slow cooling'.
ii) Gneissose banding was better known than schistosity and there were many good descriptions of the bands of light and dark coloured minerals. Explanations were weaker with many repeating their description and failing to relate the segregation of minerals to high pressures and temperatures during high grade regional metamorphism or due to alignment at right angles to maximum pressure. There was confusion with the igneous processes of fractional crystallisation, gravity settling and flow banding.

Question 6

Many candidates found aspects of this question on the geological column, principles of dating and the eruptions of Hekla volcano difficult.

a) i) The division of the geological column into Eras and Systems was not well known.
ii) Knowledge of the two principles of dating used to construct the geological column was patchy. Of those who knew radiometric dating is used, some chose carbon-14 dating and could not be awarded the mark as carbon-14 has too short a half-life to be used extensively for dating geological materials.

b) i) Most candidates recognised the relationship shown in the table: that the shorter the time since the last eruption, the lower the silica content. They realised that after a time interval of 9 years the silica content would be lower than the percentage given in the table for an eruption interval of 21 years. Thus, values between 53 and 45% silica were accepted as correct. However, a number gave a value below 45%, clearly not appreciating that Hekla is a mafic volcano at a divergent plate margin.

ii) The majority of candidates were able to calculate the average silica % correctly but there was evidence that some candidates did not have access to a calculator.
iii) Understanding of the reasons why the eruptions of Hekla vary in silica % was variable. Candidates that merely described the relationship between the silica % of the lava and the time since the last eruption with no explanation could not gain full marks.

Question 7
There were some excellent responses to this question which gave full definitions of the various rock cycle processes operating at and just below the surface. These answers included sound definitions of the various processes, along with good descriptions of the effects of the processes in terms of the products formed. To their detriment, some candidates did not take account of or did not understand the prompt ‘at and just below the surface to a maximum depth of 500 m’ and wasted time including inappropriate processes such as recrystallisation, metamorphism, and partial melting that occur at depths below 500 m. Other candidates did not include any of the processes that occur at the surface, thus limiting themselves to a maximum of three marks if they described burial and diagenetic processes only.

Question 8
The standard of responses to this question on the effects of contact metamorphism on beds of shale and limestone were variable. The rocks produced were well known, as were their distribution around a granite batholith, so a score of half marks was gained quite easily. Many candidates used a labelled cross-section or map diagram to summarise information to good effect. A minority of candidates did not describe the effects on limestone thus losing marks for marble and its characteristics.

F793 Practical Skills in Geology 1

General Comments:

The overall standard of work submitted continues to improve. Candidates demonstrated excellent subject knowledge and were able to express themselves clearly and concisely using a sound range of geological terminology. The new tasks proved popular with many centres and allowed candidates to score well, demonstrating good knowledge and skills.

Whilst administration was completed to a high standard by most centres, clerical errors remain an issue that can hold up the moderation process. This resulted in delays in the moderation of some centres whilst these were sorted out. This applies particularly where a candidate's marks have been changed, to check that the right mark is clearly shown and is recognisable on the script, and that the correct total is shown. Clerical errors can also lead to an invalid order of merit which also causes delay to the moderation process.

The marking by many centres was sometimes on the generous side. In part this is often linked to failing to spot errors in marking onto, labelling or annotating graphs, maps or diagrams. But of great significance is the failure by centres to take note of relevant additional guidance in the mark schemes. In a small number of centres it was worrying to see the closeness of candidate answers to mark schemes. To aid the marking of graphs, graphic logs, sketches etc., centres might find it useful to use acetate overlays taken from the relevant sections of task mark schemes

Moderators are still finding centres introducing new additional marking points which they have chosen to accept. Centres are reminded that they need to contact OCR if they wish to query any element of the mark scheme and to check Interchange to ensure they are using the most up to date version of the relevant mark scheme as amendments may be made during the year.
In all mark schemes the additional guidance about what precisely is required in candidate answers is provided to help centres make judgements and award marks correctly.

It is now very rare to find a centre which has not supplied trial data with the Centre Based Tasks. Centre comments where a student's results differ from trial data and marks are awarded greatly assist the moderator, however a small number of centres still give marks for results which clearly conflict with the trial data, but in these cases, as the student results were consistent with each other's, moderators were able to accept the awarded marks on the basis of teachers' comments.

The Moderating team found that of the Centre Based tasks, CBT1 and 2 were equally popular with CBT 3 less so. The Centre Based tasks remain more popular than the alternative Fieldwork Task.

Where fieldwork was submitted centres are largely using the new approved tasks downloaded from Interchange. As a result, centres are now submitting a range of photos, sketches and other data with fieldwork in the same way that trial data is provided for Centre Based tasks. This is greatly assisting the moderation of fieldwork with much greater clarity on how marks are being awarded. Moderators saw some very good examples of high standard work, with supporting annotation and thorough marking clearly linked to mark schemes.

The Evaluative tasks were clearly and accurately marked with close adherence to the mark schemes by the vast majority of centres. Evaluative Task 1 had amendments made during the year which were on Interchange. It is essential that centres check on Interchange before setting and marking any task. During moderation it was noted that not all centres had used these updates to the mark scheme.

Comments on Individual Tasks:

CBT 1- This new task proved popular with many centres. Sediment analysis and sieving is a straightforward practical that most candidates performed well. When referring to inaccuracies candidates need to ensure that 2 clearly distinct reasons are given. It was noticeable in many responses that descriptions of their sand sample were often rather general and did not always identify clearly its source from a beach. Candidates are getting better at identifying features in sketches and drawing and labelling them.

CBT 2 –The practical element of this task proved to be fairly straightforward. The mark scheme and additional guidance clearly stated that for rock textures and formation both were required for the award of a mark. With sketches some centres are still too generous with marks for labels, measurement, annotation and description. Candidates need to provide a full range of labels for the features and a set of measurements to get full marks.

CBT 3- In this practical there were a few problems with consistency of weight and density data. However, following the additional marking guidance, if results were applied to the average density values of the different layers of the Earth, candidates could still earn maximum marks. Again, some centres were too generous with marks as candidates must provide a full range of labels for the features and a set of measurements to get full marks.

ET1- This proved a popular task with many centres, being an update of a previous task. Candidates scored well on the data processing and graphical element. The elements requiring calculation and interpretation also proved to be good in stretching the more able candidates. Where identification of features from photographs was required most candidates performed well however this was not always backed up by detail in their explanations.

ET2 - This task was generally done well by most candidates. In some question components there was over generous marking where the mark scheme required either two features described and explained or two pieces of detail for the award of one mark.

ET3- This task was popular and generally done well. When a question asks for use of evidence provided, it is important that candidates include this in their answers. This also applies to questions asking for both description and explanation in a response. Some centres tended to credit responses with maximum marks when explanation was not really evident. Where description and explanation of a trend on a graph is asked for, it is important that candidates cover **all** the changes that are evident. For a couple of the question components, the mark scheme stressed reference to terms or the full range of data in the additional guidance but this had not been noticed by some centres and lead to over marking.

Fieldwork Tasks -. Whilst fieldwork was rare, the quality and clarity of marking continues to improve, causing the moderators fewer problems. There is now much greater consistency in the work being produced and marks awarded. This applies particularly to rock descriptions and graphic logs, and increasingly to annotation of sketches and measured datasets.

Most logs now follow the same marking principles as centre based and evaluative tasks which include a log element. However a few centres submitted logs which were not really appropriate either due to their lack of bed variation or having too greater thickness and height to be realistically logged accurately by candidates in the field.

It was noticeable that the number of centres which submit fieldwork continues to decline, which is a worrying trend. It should be noted that fieldwork **must** have been OCR approved. An approved task will have a “T” number clearly labelled at the top of the information sheet. A very small number of centres still had their candidates doing work that had not been finally approved or was still awaiting changes; a few still had fieldwork that had not been submitted for any feedback at all.

F794 Environmental Geology

General Comments:

The standard of responses to this paper was generally good and many candidates were able to demonstrate sound knowledge and understanding of the key ideas and concepts of the Environmental Geology unit. Although there were some 'no responses', the majority of candidates completed the question paper in the allotted time.

In common with previous years, candidates with good synoptic knowledge scored highly, as did those who read the questions carefully, took note of the command words used and ensured their responses were concise and relevant to the specific questions asked. Those candidates who had a good appreciation of the properties of rocks gained from their AS level studies were most successful in tackling the applied questions about rock characteristics in water supply and suitable rock types for roadstone and nuclear waste disposal.

Some candidates wrote far too much for questions only worth one or two marks and, in some cases, used more than double the space provided for their answers, leaving themselves less time to give well-considered answers to questions further on in the paper.

In common with previous years, some scripts were very difficult to read due to poor handwriting and, in some cases, it was impossible to decipher whether the answer was correct or not. Responses to the questions requiring mathematical calculations were variable in quality.

Comments on Individual Questions:

Question 1
Once again, water supply proved to be a well-known area of the specification. Some candidates found the calculations challenging and many struggled to correctly name rocks with a suitable porosity or permeability for parts (b)(ii) and (d)(ii).

a) i) Most candidates were able to use their synoptic knowledge to suggest a suitable structure for the aquifer. The most common incorrect answers were anticline or confined aquifer.

ii) The quality of responses to this question was variable. Candidates could improve their answers by taking the time to draw their diagrams accurately and labelling all the features asked for in the question. The most common errors were drawing the water table through impermeable rocks or drawing it following the shape of the syncline within the aquifer rock. Others did not label aquicludes / impermeable rocks both above and below the aquifer. A minority labelled the confining rock above the aquifer as granite.

iii) Candidates who calculated the percentage porosity correctly were in the minority. The most common incorrect answers were 11.4% (arrived at by dividing by 487.1 instead of 431.4) and 88.6% (arrived at by dividing 431.4 by 487.1). If candidates had thought about it – an answer of 88.6% porosity is very unlikely to be correct.

b) i) Candidates were more successful at calculating the volume of pore space correctly, but a notable number divided 18.3 by 160 and multiplied by 100 to give an incorrect answer of 11.4 cm^3, while others divided 160 by 18.3 to arrive at an incorrect answer of 8.7 cm^3. Others forgot to divide by 100 or forgot the decimal point.

ii) About half the candidates were able to correctly suggest what rock type the sample from the aquifer could be, but not all of these were able to give a creditable reason. Some candidates did not have an appreciation that 18.3% is a relatively high porosity even though the question stated the rock was from an aquifer.

c) Most candidates knew an aquiclude is an impermeable rock that does not transmit water. There was a common misconception that it has to be above an aquifer which is not the case. In addition, a number stated that an aquiclude is not porous – this is not correct but candidates were not penalised provide they had stated the rock is impermeable.

d) i) The relationship between grain diameter and permeability shown on the graph was described correctly by most candidates. However, a significant number were unable to give a correct accompanying explanation. Some candidates stated incorrectly that rocks with coarse grains have more pore space. The most successful answers clearly linked increased water flow through coarser grained rocks to less resistance to flow or better interconnections between the pore spaces. Less successful answers gave explanations referring to sorting rather than grain size.
ii) Few candidates were able to suggest a correct rock that can be permeable but not porous, suggesting a lack of awareness of rock properties. Jointed granite was the most popular correct answer. Some reversed the question and suggested a rock such as clay or pumice that can be porous but not permeable.

e) The best answers to this question applied knowledge of porosity and permeability to the requirements of a good aquifer rather than merely stating the meaning of the two terms.

f) i) The geological locations where springs could form on the cross-section diagram were well known. A small number incorrectly labelled a spring at lower contact of the igneous rock, while others labelled the boundary between the top of the limestone and the base of the shale. Candidates could improve their answers by ensuring their arrows accurately touch the point they are labelling.
ii) The geological reasons why springs would form in these positions were also well known. The best answers referred to the specific geological conditions and rocks shown on the cross-section rather than the general requirements for the formation of springs. A minority thought they had to write a geological history.

Question 2
This engineering geology question on slope stability and road construction was answered well. Candidates with good synoptic knowledge scored highly on the part of the question requiring assessment of the characteristics of rocks for use as roadstone.

a) i) A number of candidates ignored the question and wrote about problems within the tunnel or within the limestone, some distance away from the tunnel portal. Candidates should take care to distinguish between the slope of the ground surface which is not a geological factor and the dip of the beds which is. In addition, when describing dip, the angle and direction should always be given. The incompetent nature of clay and the problem of water saturation were well known.

ii) Those who knew suitable ground improvement strategies applicable to slope stability in clay were in the minority. Many suggested using rock bolts to secure the clay to the limestone, not appreciating that rock bolts are only suitable for competent rocks. Others ignored the question and suggested strategies to stabilise or prevent flooding of the tunnel, with grouting being another common incorrect suggestion. To improve their answers, candidates should be encouraged to focus on the specific geological situation given in the question as this will allow them to provide appropriate answers.

iii) The majority of candidates correctly identified the fault or dolerite dyke as a geological problem in the eastern half of the area which could affect the road if it was built along the proposed route. Most gave a correct explanation. However, few achieved the describe mark as descriptors such as strike-slip for the fault or dyke for the dolerite rock were required.

b) i) Aggregate was well known as the technical term for unconsolidated construction materials of sand size and above. The correct spelling was known by most candidates but writing needed to be neat and legible to avoid any ambiguity. A few candidates ignored 'sand size' and gave gravel as their answer.
ii) This question proved to be accessible and most candidates were familiar with the characteristics required for rocks to be used for roadstone. The best answers addressed each of the three rock types given in the question separately and gave clear assessments of the suitability of each of them. Some candidates stated a long list of characteristics for each rock type and in some cases contradicted themselves, thus losing marks. There was also an issue with some candidates listing characteristics required for roadstone that were not applicable to the rocks given in the question. It is important that candidates can correctly distinguish between hardness and strength of rocks. Limestone is a strong, competent rock, but it is not hard. Another common error was the use of the terms weathering and erosion as if they are synonymous – some stated that as limestone is chemically reactive it will erode, while others stated that as limestone is soft it will weather. Some candidates stated limestone and sandstone would be unsuitable as they suffer weathering, but did not distinguish between chemical weathering, which is only a problem for limestone, and mechanical weathering, which could be a problem for both. Others assessed macroscopic rock features such as jointing which are not relevant to aggregate used for roadstone, while some suggested large-scale problems such as flooding of the road due to permeability. In this type of question, less is more – picking out one or two key properties for each rock with concise explanations as to how they would affect the suitability of the rock for roadstone, is the most successful approach.

Question 3
The quality of responses to this question on fossil fuels was variable. Those who had learned 'facts and figures' performed well on the recall parts of the question and most candidates were able to gain some credit for the graph plotting part of the question. The best approach to compare and contrast questions is to include point by point comparisons.

a) i) Most candidates knew the organic matter required for the formation of coal is terrestrial plant material and for oil is marine plankton, but some named macroscopic marine organisms for oil. Others wasted time comparing the environments of deposition of the organic matter which was best reserved for part (ii).
ii) The environments of deposition were well known too, but not all descriptions were precise enough to gain credit. The best responses compared the two environments point by point. A number of candidates gave a description of the climate rather than the environment of deposition for coal formation.

b) i) Many candidates had learnt the facts and figures for the different ranks of coal and thus gained credit for their answers. However, a large number did not take note of the command word **two** and only gave one physical and one chemical difference between bituminous coal and anthracite, limiting their mark to a maximum of one. Others failed to give direct comparisons of one property, e.g. 'anthracite is shiny and bituminous coal is layered'. A common misconception was that bituminous coal is brown whereas anthracite is black or that anthracite is darker in colour. There was confusion between physical and chemical properties and some stated anthracite is 'rich in coal'.
ii) The process that causes the physical and chemical changes as the rank increases was well known, but not all managed to attain the second mark for their description which required two points for one mark.

c) i) Answers needed to include both the texture and composition of the rock to achieve the mark. A significant number gave a description of an oil shale that had already undergone maturation rather than a source rock containing plankton.
ii) The technical term maturation was well known and usually spelled correctly. A small minority gave the term migration instead.
iii) Most candidates were able to plot a correct line graph but a small number attempted to add a straight line of best fit.
iv) The majority of candidates stated the correct value of 3200 metres for the peak of hydrocarbon formation, but a notable number lost the mark because they forgot to include units.
v) Calculation of the temperature for the peak of hydrocarbon formation was done correctly by many candidates, but some lost the mark because they were unsure what to do about the surface temperature of 15°C.

d) Explanations as to why oil is usually found in rocks closer to the surface than the source rock were sound and most candidates gained some credit for their answers. Some answers could be improved by making it clear that oil is prevented from migrating upwards when it encounters an impermeable cap rock rather than a trap. The trap concentrates the oil in one place, but it's the cap rock that prevents upwards migration of oil.

e) The origin of the natural gas in the southern basin of the North Sea was not well understood. Many candidates gave the oil source rock Kimmeridge Clay as their answer rather than the Coal Measures. Stating the gas was trapped was insufficient as a marking point – candidates needed to show an understanding of what a trap is.

Question 4
This question on alternative energy sources to fossil fuels proved to be a good discriminator. The environmental and social consequences of using dams and reservoirs for hydroelectric power generation were well known, but candidates found the evaluative questions about geothermal energy and nuclear waste more challenging.

a) Candidates who focused on the specific question asked were more successful than those who gave a 'model' answer about the environmental and social consequences of dam and reservoir construction. Descriptions of damage to habitats needed specific detail to obtain the mark. A significant number gave descriptions of impacts on marine ecosystems which were not credited unless they were clearly linked to changes in the river downstream of the dam. There was confusion between environmental and social consequences. For example, flooding of agricultural land is an environmental consequence, whereas a farmer losing their livelihood is a social consequence.

b) There were some excellent answers to this question highlighting the lack of volcanic sources along with good, detailed discussion of the feasibility of using either hot, dry rock sources or geothermal aquifers in named parts of Britain. Less successful answers stated that there are 'not many volcanoes in the British Isles', rather than none. Some candidates lacked geographical knowledge of possible sites in the British Isles, while others discussed the advantages and disadvantages of geothermal energy or described how it is extracted, which did not answer the question.

c) i) The standard of responses to this question on the formation of uranium ore deposits in sandstone was good. Candidates could improve their answers by ensuring they link each description to a correct explanation. A significant number of candidates used the term deposition (laying down of sediment) incorrectly as an alternative to precipitation (minerals coming out of solution).

ii) This question on the geological factors that should be considered when evaluating an area for the long-term safe storage of nuclear waste in an underground repository in rocks was not answered particularly well. Many answers could have been for landfill waste disposal with very few considering the specific requirements for nuclear waste – few answers mentioned the word radioactive or radiation. To attain marks, each marking point needed to describe a correct geological factor linked to a matching explanation as to how this related to safe storage of nuclear waste. An evaluation was required in each marking point.

Question 5

There were many good responses to this extended question on how metallic mineral deposits can form as a result of igneous processes in mafic (gabbro) intrusions and in and around intrusions of silicic (granite) composition. Labelled cross-section diagrams were used to good effect by some. Only a few candidates described the wrong types of ore deposits for these geological situations. However, a number of candidates forgot to state which igneous intrusion they were describing the ore deposit for, while others only described one ore deposit type thus limiting themselves to a maximum of 4 marks. As the question stipulated mafic intrusions, descriptions of hydrothermal ore deposits associated with black smokers and mafic volcanoes could not be accepted.

The term ‘gravity filtering’ was used by a number of candidates in relation to the formation of ore deposits in mafic intrusions – this is not a recognised geological term and appears to be the result of confusion between the terms gravity settling and filter pressing. Incorrect spelling of cumulate continues to be a problem.

In common with question 4(c)(i), there was confusion between correct use of the terms crystallisation and precipitation, and between the melting point and solubility of minerals. In the case of magnetite forming by gravity settling, early crystallisation from magma due to its high melting point is the correct description. In the case of hydrothermal minerals such as cassiterite, galena and sphalerite, precipitation from solution during cooling of the hydrothermal fluid is the correct description. The zonation of hydrothermal minerals around silicic intrusions is due to differences in solubility rather than melting points of the minerals.

F795 Evolution of Life, Earth and Climate

General Comments:

In general this paper was very similar to the standard of last summer's paper. There were a number of questions where candidates showed clear and detailed understanding and so gained high marks. Some candidates used the additional answer space at the end of the examination booklet for both the long answers and also for part questions.

The quality of diagrams did vary, especially the graptolites which could be detailed and accurate or very vague and poorly labelled.

Interpretation and plotting of graphs was generally well done. Candidates do though need to take care when labelling axes using the labels given in the data table. It was noticeable where synoptic knowledge of sedimentary textures was tested that many had apparently forgotten this aspect of the AS F792 module and could not link textures to processes.

There were many lengthy answers in Q7 and Q8 which suggested that few candidates ran out of time. In Q7, candidates were told to cover three aspects of Ordovician graptolites and most candidates did structure their responses in this way leading to many gaining full marks. In Q8 candidates struggled to find sufficient detail when linking large scale volcanism to the Permian extinction event. Many candidates were also vague about what animals or plants became extinct and which had reduced numbers.

Comments on Individual Questions:

Question No. 1
Most candidates were confident in answering this question involving identifying fossil groups, coral morphology and brachiopod modes of life. These can often prove difficult areas for candidates.

1ai The main source of error was identifying the gastropod as a graptolite. Most candidates recognised belemnites as having a phragmocone with some also offering other appropriate cephalopods such as ammonites.

1aii Most candidates were aware of the role of the tabula in offering structural support and rigidity to the coral. Many also knew of the phragmocone having a role in controlling buoyancy.

1b There were many impressive coral diagrams full of appropriate labels. Candidates do need to take care with the labelling and that the structures they draw are accurate especially with the dissepiments. The best diagrams had both internal and external features drawn and labelled. Even though only one diagram was required some candidates drew top and side sections which proved beneficial.

1c Almost all candidates did well in this question, recognising that ammonites are evolute and then knowing how they moved, often writing in detail. Answers were less secure regarding how ammonites fed with many discussing filter feeders.

1di The majority of candidates recognised and labelled the brachial valve although some were unsure and labelled the boundary between the two valves which was not credited. When labelling valves it is always best for the labels to be in the centre of the valve.

1dii Candidates knew the mode of life of A (terrabratulid type) better than B (productid type). Candidates need to get into the habit of using the more technical terms such as benthonic, epifaunal, infaunal, vagrant, sessile, attached and free lying. This question did require the candidates to provide the evidence for these modes of life. For A, many candidates linked the pedicle foramen to the exit of the pedicle. In B, the most common correct answer was linked to the support offered by the spines. Few candidates talked about the heavy brachial valve offering a lower centre of gravity.

Question No. 2
Candidates showed a general understanding of trace fossils and exceptional preservation but often lacked the detailed understanding to gain high marks.

2ai Most candidates linked trace fossils to evidence of the activity of organisms, but better answers also offered examples such as tracks.

2aii Many candidates could think of one appropriate organism that could produce a vertical burrow, with the best answers noting a specific bivalve or irregular echinoids. Not all burrowers produce a vertical burrow especially if they are shallow burrowers.

2aiii Although many candidates knew an appropriate condition that can be inferred by burrows, relatively few explained why the condition helped burrows to be formed or preserved.

2aiv Knowledge of sedimentary features such as grain size, grain shape, sorting and sedimentary structures was good, but relatively few candidates could link the feature to a correct aspect of the environment. The most successful link was between grain size and energy. Grain shape should be linked to amount of transport and sorting links to rate of deposition/energy change. This is a synoptic element of the module and it is clear that some candidates were not able to recall and use their sedimentary rock knowledge from F792.

2av It was impressive how many candidates recognised the trilobite resting trace. Better answers named it as Rusophycous and knew that infilling with fine sediment could preserve the trace.

2b Archaeopteryx was the animal most candidates linked to this exceptional site. There were other animals that could be named but candidates needed to explain what was exceptional about their preservation. A common misconception is that the animals were rapidly buried: this was not the case and was not necessary.

2c The majority of candidates knew of an animal that could be preserved in amber. The best answers mentioned the liquid resin covering and trapping the animal and then hardening/undergoing chemical changes which then allowed the animal to be preserved in fine detail.

Question No. 3
Candidates had an excellent understanding of echinoid morphology and mode of life.

3ai An impressive number of candidates were able to locate and label the three morphological features. Some candidates did try and locate the anus on the irregular echinoid even though it was not visible on the diagrams.

3aii Some candidates recognised the interambulacral area but proceeded to label all the interambulacral plates in the area rather than just one.

3aiii Most candidates recognised the regular and irregular echinoids.

3aiv There was a mixed response to this question about morphology and the mode of life of echinoids. Many knew that the large tubercles in fossil C were to hold large spines and many went on to link this to movement or defence. Many also knew that the anus is on the aboral surface but could not give a good reason. Some also noted the pore pairs and linked this to tube feet. The main weakness was not linking the feature seen on the fossil to a function. Fossil D was less well known with vague answers about shape and lack of tubercles with little explanation. A clear link should be made between the shape and burrowing. In particular, few candidates discussed the pore pairs in the petaloid ambulacra and the role of the tube feet extending up the burrow.

3bi Candidates had little difficulty plotting the data and drawing a best fit line either joining all the points or as a straight line.

3bii Most candidates were able to calculate the two averages to the appropriate precision.

3biii A simple question answered correctly by almost every candidate.

3biv Most candidates were able to describe the relationship between the two features but the explanation is more difficult and linked to more efficient feeding driven by competition or changing food sources and a need to transfer food more quickly to the mouth.

Question No. 4
Candidates are generally confident with trilobites and so it proved with this question.

4a Most candidates could link the free and fixed cheeks to the process of ecdysis. Some of the descriptions were a bit vague and needed to mention either falling away from or remaining attached to the cephalon. Many candidates knew about the pleura being a thoracic segment of having limbs and gills underneath but many were confused by “spine”. A common error was to talk about it being a spine running down the centre of the thorax.

4bi Candidates used brackets accurately to show the pygidium on both trilobites. Some candidates extended the pygidium in fossil F into the thorax which did not gain a mark.

4bii Candidates were confident in their labelling of a genal spine and glabella. The only occasional error was to label the glabella on the cephalon to the left or right side of the glabella. One or two candidates ignored the instructions in the question and tried to label fossil E.

4biii It could be argued that Fossil E had more than one potential mode of life and as long as the candidate justified their suggestion using the morphology then they gained the marks. Again candidates must use the correct mode of life terms as mentioned in 1dii. When discussing the number of legs suggesting walking or swimming, it is not enough to say that they had many pleura, this needs to be linked to the number of legs.

4biv Many candidates knew about the sensory pits and knew detail such as sensing chemical changes, water currents, movement or even possibly for respiration.

4ci An easy question as long as the candidate recognised the compound eye, made a little difficult by the unfamiliar look of an enrolled trilobite.

4cii Most candidates knew that the pleura play a key part in enrolment.

4ciii Some candidates were a bit vague mentioning “moving” using the legs. The ideal answer needed to talking about walking using the jointed legs/appendages or swimming just above the seabed using the jointed legs/appendages.

Question No. 5
Candidates found the style of this question a bit of a challenge, many not being familiar with cladistics charts.

5a Although some candidates were not familiar with cladistics charts many did recognise the 3 dinosaur groups, although the spellings varied wildly. Candidates do need to be secure in their spelling of dinosaur groups and the case study species.

5b The majority did recognise the Tyrannosaurus hip with the pubic bone pointing forwards. When describing the differences between the two hips many candidates were too vague saying "one pubis points to the left and one to the right" without clarifying which of the two diagrams they are referring to. With comparison questions, candidates must get into the habit of being clear which of the two they are describing rather than letting the examiner guess.

5c Candidates knew the similarities between birds and some dinosaurs and so many gained full marks. It is important in this question to state the similarity between birds and dinosaurs rather than just saying hollow bones, feathers, claws without any context or link.

5d Although candidates did know something about Iguanodon mouthparts they were often vague, the question was looking for a description of the significance of the toothless beak, leaf shaped cheek teeth and smaller back teeth.

5e Candidates were more successful describing the adaptations of Diplodocus in particular discussing the very long neck and role of gastroliths. Many mentioned the peg like teeth but they needed to be clear that their location was at the front of the mouth.

Question No. 6
Candidates found aspects of this question difficult, especially the parts relating to correlation, but were stronger on radiometric dating.

6a Candidates were confident in their understanding of parent and daughter isotopes and the link between the two.

6bi Most candidates were able to construct the graph. Candidates should take time and care when plotting graphs. Most candidates labelled the axes correctly with common errors being not putting Ma on the X-axis and mixing up daughter with parent isotope on the Y-axis.

6bii and iii The vast majority of candidates either knew the half-life of the ^{40}K system or read it accurately off the graph. Candidates had little difficulty using the graph to work out the age of the rock at 40% ^{40}K.

6c Many candidates gained the first mark for linking errors to metamorphism, weathering or the opening of the closed system. Some of the best answers discussed the fact the system needs to be closed and weathering and metamorphism could open the system.

6d Many candidates could give an appropriate mineral and rock. Common errors were to think about minerals that could contain uranium rather than potassium, such as zircon, which was not appropriate. The only acceptable sedimentary rock was greensand.

6ei Candidates did struggle to correlate an appropriate tuff layer, perhaps because there was quite a vertical jump from borehole L to M. Candidates need to look for an overall pattern and the pair of tuff layers was the visual clue that they were the best to use for correlation. Candidates should use a ruler to draw neat correlation lines that connect the base and top of each tuff layer.

6eii An impressive number of candidates realised that tuff is a good candidate for chronostratigraphy because it is an instantaneous event and also can cover a large area. Few candidates mentioned that it has the correct minerals and, being igneous, can be radiometrically dated.

6eiii Candidates had little difficulty in describing the distribution of the till, although not many linked this to the relative position of each borehole to the glacier. The best answers realised that L was closest to the melting glacier front and M and N were successively further away. A common error was to think the till was related to volcanic activity (probably due to discussing tuff in the previous question).

6f Many candidates knew that zone fossils could be used, but few extended this to mention why zone fossils are so good and what makes a good zone fossil. Many candidates did know that diachronous beds and lateral variation were a negative aspect of lithostratigraphy although few discussed them in any detail.

6gi Most candidates were able to work out the thickness although a significant number of candidates omitted the last step of converting metres into kilometres.

6gii Almost every candidate knew that rates of sedimentation vary over time and place and so are unreliable; some of the better answers also talked about the role of compaction and erosion affecting the thickness of beds.

Question No. 7

Candidates showed a detailed understanding of graptolites in all three areas tested by the question, morphology, mode of life and preservation. Many candidates gained full marks. Candidates new the basic morphology of graptolites but also knew the features that were peculiar to Ordovician graptolites such as 2 or 4 stipes and their stipe attitude. Diagrams were generally good with at least 2 good labels. Most candidates knew of the planktonic mode of life with filter feeding. Stronger answers mentioned the nema possibly attaching to a float of some sort. Candidates were particularly strong regarding the preservation with most candidates gaining marks for both carbonisation and pyritisation. A common error was to discuss silicification and casts and mould which are not a normal graptolite method of preservation.

Question No. 8

Candidates found a discussion of large-scale volcanism and the Permian extinction more difficult, particularly as it is quite a narrow question and so required detailed knowledge and recall by the candidates. Relatively few knew the extent of the Siberian traps in terms of the area covered and the time span of the eruptions. Candidates did know about what became extinct although sometimes the use of English was poor so they mentioned trilobites being affected rather than they became extinct. Candidates knew about the ash causing global cooling and did link this to glaciation and sea level fall. Candidates also discussed the opposite affect caused by greenhouse gas emissions such as CO_2, however they often become confused over the role of SO_2, linking it to CO_2 as a greenhouse gas when it has the opposite, cooling effect. Candidates mentioned gas hydrates and methane being released but they need to link this to ocean temperatures increasing to gain marks. Some of the best answers gave detail of the percentage of marine organisms and terrestrial tetrapods that became extinct.

F796 Practical Skills in Geology 2

General Comments

For this seventh year of submission there were many very good tasks submitted and a large percentage of candidates demonstrated excellent subject knowledge. Many were able to express themselves clearly and concisely using a sound range of geological terminology. There was no evidence of candidates struggling to complete the centre based and evaluative tasks within the suggested time of an hour.

There was still a small number of centres who sent no MS1. Where centres are unable to submit their marks via Interchange it is important to send the moderator a copy of the MS1 form as well as the top copy to OCR, so the sample can then be selected. If marks are submitted via Interchange a copy of the centre marks is also needed. This can be printed off from Interchange and is the IMS1. One of the most important uses of the MS1 is to allow the moderator to quickly check candidates' marks in case there is an arithmetic error. This can significantly speed up the moderation process. MS1s are especially important when several centres teach Geology as a consortium.

This year there appeared to be a slight increase in the number of centres who offered a single task to all candidates, in this case it was nearly always EV1 and CB1 offered and so centres are reminded that candidates can attempt all of the tasks and that their highest mark will be the one submitted. There was a significant drop in the number of centres submitting fieldwork. This is concerning as fieldwork usually achieves good grades and is an excellent experience for candidates who may be continuing their geology at HE. Fieldwork has also been highlighted as an integral part of the new courses to be offered in 2017. Centres unsure about undertaking fieldwork are encouraged to get in contact with OCR to request tasks which have been approved for their area of interest.

Administration

This year there were a large amount of clerical errors notified by moderators, arising due to addition errors from the papers, then wrong marks being put onto cover sheets and from there the MS1 or equivalent. In a large number of cases marks on the papers or fieldwork were added up wrongly; it was noted that this often occurred where sections were being subtotalled. To aid addition marks should *only* be placed in the right hand margin next to the bracket showing the marks available. Avoid sub-totals and this way the only marks on the paper are for credit in the questions.

Another cause of errors occurred when candidate's marks had been changed due to internal moderation. It is important to check that the right mark is clearly shown and is *recognisable* on the script and that the correct total is given. In a few cases where internal moderation had been carried out, marks had been changed on the script but totals had not been amended. Ideally all of the paperwork should be carefully checked for accuracy before submission.

The internally assessed work cover sheet is not compulsory but can be very useful for summarising the candidate's performance and showing which tasks are being submitted. Some centres not using cover sheets submitted work where marks were not visible and moderators had to add up the marks themselves. A small number of centres are still failing to secure any of their candidates' work and a mass of lose sheets of paper arrived. Please ensure all the work of each candidate is well secured with a name, candidate and centre number plus the mark awarded clearly displayed on the front page.

Some centres are still sending more than just the two assessed tasks to the moderator. Please only send **2 tasks** per candidate; if they achieve the same mark on more than one task it is up to the centre to decide which task to submit.

Marking

In general marking was of a good standard; where marks were on the generous side it was usually a result of issues over the generous interpretation of the mark schemes. Most centres appear to have read and used the additional guidance column about specific requirements for marks to be given but a significant number are ignoring this If a list of acceptable terms or answers are provided in the mark scheme, then these are the answers which must be credited. A small but significant number of centres were giving credit to answers which were not on the mark scheme.

If a centre feels strongly about a correct answer having been left off the mark scheme they should contact OCR. The issue can then be taken up and a response sent back to the centre and, if appropriate, an update made to the task or mark scheme on Interchange. All centres should make sure that they sign up for Interchange updates and that if a change has been made to a task or mark scheme that they use the most up to date version.

It should be noted that if a mark scheme states “AND”, then marking points from before and after the “AND” must be included to gain credit. When a term is underlined then it *must* be used in the candidates answer for the mark to be awarded.

If the tasks are printed and then photocopied, centres are advised to check any scales within the task AND the mark scheme; as photocopying can change the scale and so if the centre marks as per the mark scheme they may find all of their candidates fail to get marks. Teachers are advised to trial the task and to write onto a copy of the task the results they get using the scale from photocopying. Doing this will show the moderator the impact the copying has had and the teachers trial will illustrate the range of marks the candidates should then be expected to achieve. If the task requires maps, graphs or cross sections to be marked to a degree of accuracy, then teachers might find it helpful to create an accurate overlay to speed up the checking of that particular question.

Centres can submit a piece of marked work to OCR for detailed feedback, prior to finishing all of their marking and before mark submission.

Preparation of candidates

Centres should ensure that all candidates have a sound grasp of the main command words, such as describe and explain, as frequently these get confused. Candidates should be guided to carefully read all parts of the questions including the stem which often gives help towards what they will be expected to do.

Where a question asks candidates to describe/explain what can be seen “in this photo/graph/fossil”, candidates must restrict their answer to the image they have been asked about and so they should not write about generalised photos/graphs or text book fossils. Likewise with sketches, candidates should draw what they see not what they have learnt in class. Photos are chosen very carefully with specific features in mind which it is hoped the candidates will identify. By drawing a generic textbook version valuable marks may be lost.

Centres are reminded that although the teacher will have access to the tasks the only material candidates can be shown/told about the task is the information provided in the “grey box” in the Instruction to Teachers document. Ideally candidates should be given this information a short time before the task in order to aid their preparation. There were some real concerns this year that some candidates may have been very carefully and specifically prepared for these tasks.

Centres can teach topics as outlined in the text but candidates should never be shown the task in advance; should not be allowed to see the answers of other candidates, be told specifics about questions or be shown the mark schemes. Finally for CB tasks all practical work needs to be carried out individually. Working in pairs and sharing results is not allowed.

Comments on the Centre Based Tasks

Centre Based tasks must always be accompanied by the trial results obtained by the teacher in their trial run of the practical. In experiments where the samples are destroyed the data should show similar starting amounts so that the rates/trends of break up can be compared. This helps with applying the tolerances quoted within the mark schemes. If a tolerance is stated it must be applied. When an experiment is involved, temperature may have an impact so it is worth the teacher carrying out their trial in the same room/similar conditions to where their candidates carry out the task. On no account should candidates work together or carry out the experiment together. Each candidate needs all the equipment as outlined in the instructions to teachers and technicians.

CB1
The practical part of this task had been used previously and proved very popular with centres.

1ai) Teachers should be aware that temperature differences can play quite a role here and so the trial data should be done in a room with a similar temperature to the one which candidates will carry out the task.
b) It is not possible to credit dropping from different heights, as this is not on the mark scheme. Also for most candidates the water lands on the oil surface and the surface tension needs to be broken by gently pushing the droplet. Consequently drop height is irrelevant.

2aiii) It was possible to work this answer out in different ways which did give slightly different results. E.g. some candidates included leap years in their calculations. Moderators were aware of this and checked answers awarding the mark if the correct result was gained from either 365 or 365.25 days.
b) Care needed to be taken here to make sure the same marking point was not credited twice.

3ai) This proved to be done quite well for what was a more difficult question. Many candidates made reference to the direction of dip of the beds or the land being tilted.
aiii) Many candidates got the geological reason part of the answer. Not many were confidant as to the likely effect.

4ai) Candidates did need to have two correct measurements for one mark. There was also a requirement for two labels as outlined in the mark scheme.
aii) This photograph did not always copy clearly. If at all possible it is worth projecting the image as well as supplying copies, as this allows the calcite crystals between the ooliths to be seen more clearly.

CB2
This was the most popular choice of tasks as centres clearly felt confident with the practical component.

1a) Centres are asked to make sure that they check the percentage calculations as in a few cases these answers were wrong and so the marks could not be allowed (one error was allowed).
c) A small number of centres still have issues in marking safety and some centres still credited answers not on the mark scheme. The Additional Guidance column states that lab coats and tying back hair cannot be credited.

2ai) This produced many good quality sketches. A small number of candidates drew textbook versions of the fossil. Centres must take care with assigning marks: two labels on each diagram were needed for 2 marks and 2 labelled measurements for the third mark.

3) This question produced some really excellent responses and many candidates gained full marks on this section. The mark scheme provided a wide range of marking points. A few centres failed to realise that 2 features were needed for each mark awarded.

4b) Geological histories were generally well done but the expectations of the mark scheme do need to be addressed, so reference to two faults was needed, tilting needed a value of tilt to be suggested.

CB3

This task was the least popular this year, possibly due to a need for more specialist input of solutions and chemicals. On the whole candidates did not appear to have any problems with the practical and the precipitates formed were usually showing the expected colours. A few centres had made comments that they had produced results slightly different to those in the mark scheme, some helpfully included photo evidence which was very valuable and the teacher trial data in these cases proved to be very useful in seeing how marking had been applied. A few centres did mark the first column a bit harshly if candidates had not mentioned the term "interface" in their answer. However the instructions had asked for the interface colour and as such the mark could have been awarded.

1bii) Candidates must refer to both of the metal elements within the mineral to get the mark. Most of the answers to this first section showed a sound understanding of metal deposits and this continued with question 2.

2ai) In geological histories, candidates should give more information that just "tilting": the mark scheme asks for specific degrees.

3ai) The photograph question raised issues where centres credited things that were not on the mark scheme or gave marks for insufficient features. If the scale has been changed due to photocopying, do include the results as part of the teacher trial data.

Comments on Fieldwork Tasks

In the few tasks seen there was a lot of really good fieldwork. It should be noted that fieldwork must have been OCR approved. An approved task will have a "T" number clearly labelled at the top of the information sheet. A very small number of centres had their candidates doing work that had not been finally approved and was still awaiting changes; a few had fieldwork that had not been submitted for any feedback at all.

Centres are asked to send written information of the rock types candidates will be describing as well as photographic evidence and copies of base maps etc. This acts in a similar way to the teacher trial data in centre based tasks and will create a benchmark for comparison.

Most centres had the required 50% of marks awarded for A2 tasks. One of the main weaknesses still being seen was the lack of detail to the fossil work and in rock descriptions. Many centres submitted work with barely any detail to rock/fossil descriptions yet full marks had been awarded. Centres need to encourage candidates to describe their fossils/rocks in a lot more detail and label diagrams more clearly for A2**.** It can be useful to consider the type of detail required for a centre based task and aim for a comparable standard. For rock descriptions; often a mineral name with a reason for identification could be required for 1 mark. If sandstone is described it would be reasonable to expect a comment to explain the presence of quartz in the rock with a reason to show how the quartz was identified e. g. hardness testing. Comment on grain/clast size (numeric for the quantitative component) shape and sorting would be a

reasonable expectation, as would comments on colour, cement and composition of the whole rock. If all is in order this could then fulfil a “detailed” requirement. Many candidates are very familiar with the 3 S’s and 3 C’s, an easy way to train candidates in detailed rock descriptions. Likewise the fossil descriptions need more detail especially for Brachiopods and Bi –Valves: a clear distinction needs to be made to show how each was identified as they can have many similarities when viewed in a rock. Fossil sketches should not be of textbook versions but should show what the candidates actually observed on the fieldwork.

A good way to include A2 marks into fieldwork besides using fossils is to focus on economic uses of rocks. Here candidates should be encouraged to identify properties of the rocks visible or testable in the field and link this to possible economic uses. Alternatively if the site is on the coast, issues to do with coastal erosion could be explored. Field evidence for relative dating, using things such as way up structures and cross cutting relationships, are sound fieldwork tasks.

There were some excellent graphic logs evident. A few though are still drawing them as a simple diagram of 2 or 3 beds, not to scale and without clear grain sizes. It should be remembered that if a sequence only contains Limestone beds that a graphic log is not going to show any variation in the beds and as a result a different technique might be more suitable. A few centres had outlined a good fieldwork plan in their submission. Yet when submitted it appeared that up to 5 marks were being given for marking rather basic points onto a log. Sometimes grain size was being credited in the graphic log and again elsewhere which is not allowed.

In some cases it can be difficult to work out the mark scheme used by centres and apply it to the candidates work as the work may not be in the same order as the mark scheme, making it difficult to ascertain which section was being credited. It is permissible to use task numbers on the mark schemes and on candidate work. In a few cases where teachers wrote nothing onto the candidate work it was sometimes very difficult to work out where the marks fitted and to see how the marks were awarded. A system which works really well is to assign a numbered tick onto the mark scheme and then to write a number next to the tick on the candidates work so the moderator can see how the 2 link up. The official task sheet with the OCR ‘T’ number on it **must** be sent to the moderator to prove that is it an approved task.

A small number of centres had some candidates writing almost word for word the same for every site suggesting that they were taken around en masse and shown the same features. This is a concern as the fieldwork is meant to test independent field skills. However it is perfectly acceptable to go over the general geology of the area to put the site into context. The type of information given prior to the task should be consistent with the “grey box” information for the Centre Based tasks. The only time candidates could work together is if for example two ends of a measuring tape need securing. It should be noted that where locations have information boards on the geology of the area, candidates must *not* be shown these boards as this will give them an unfair advantage and technically means they are not producing their own work.

Comments on Evaluative tasks

It is a good idea to reiterate to candidates the importance of carefully reading the questions especially information in any stem as it was noticed that the marking of EV tasks tended to be more frequently out of tolerance when compared to centre based tasks.

EV1

This task had some questions in it which were familiar from a few years ago, balanced by some new questions. Overall it was popular and candidates were gaining good marks for this paper.

1b) This question needed a clear reference to size as part of the answers as shown by the 4 bullet points; answers making no reference to larger or smaller fossils could not be credited.

c) A lot of centres had marking issues with this question. Some credited some of their candidates who had written about low energy and then credited others who wrote about high. It is not possible to credit two completely opposite responses.

3ai) The additional guidance column helps here to explain how this question should be marked: it requires an answer that outlines how they are made not just a reference to walking.
di) Here there were some changed scales from photocopying. As noted above, the teacher should annotate the measures they obtained and then mark their candidates to this value applying suitable tolerances as outlined in the mark scheme.

EV2
This task produced some really good quality pieces of work where candidates had clearly taken on board the advice from the grey box and had learnt this section of the course to a high standard. The main issues where down to detail from the mark scheme not been applied.

1ai) this question required a reference to depth of the overburden being measured from the graph.
aiii) The mark scheme had clear tolerances stated for the angles of throw of the faults. These tolerances do need to be adhered to.
aiv) Terms in the mark scheme that are underlined mean that the term must be in the candidates answer in order for the mark to be awarded.
bii) A reason for the thinning of the coal was required; it was not enough to say it had thinned as that is obvious from the diagram.
biii) The question told candidates that the roof supports had been removed; therefore this is not an acceptable answer. A reference to the coal having been removed was required.
ciii) This was a graph and so should not have been interpreted as an isoline map; this was a problem several centres had come across although this question was usually very accurately marked.

3b) The terms shown in the diagram had to be used in the candidates answer to be awarded the mark. Many centres credited good detailed responses, which showed understanding but had not followed the guidance in the questions.

EV3
This continues to be the task that candidates find the most difficult. Most often marks are adjusted due to miss-application of the mark scheme.

1aii) Specific reference had to be made in candidates' answers to specific rocks and fossils found in the sequences. General geological knowledge was not tested here but a response to the data presented. Within their answer candidates had to have a comparison of the 2 methods and a judgement had to be stated as to which was better for full marks to be awarded.
dii) Reference needs to be made to the photo suggesting a current due to the presence of coarser material or by the fossil alignment.
diii) Many candidates still struggle to recognise that this requires a reference to both measuring the angle of the fossils and plotting them onto a rose diagram.

2bii) Reference here must be to prove why the coral has to be Rugose. To do this, candidates need to show why it cannot be either of the other 2 groups.
ci) A reference to temperature of the seawater or colder water needs to be made; as the additional guidance column states temperature alone is not enough.

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