GCE EXAMINERS' REPORTS

GEOLOGY
AS/Advanced

SUMMER 2015

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GEOLOGY

General Certificate of Education

Summer 2015

Advanced Subsidiary/Advanced

GL1

Principal Examiner: Ian G. Kenyon

The GL1 examination was designed to test a wide range of skills including the interpretation of graphs, diagrams, maps, geological cross sections and photographs. The paper covered many areas of the specification content and included both straightforward and more complex ideas, making it accessible to a wide ability range. Questions 1 and 2 proved to be the highest scoring of the four questions. Questions 3 and 4 proved to be quite testing in places.

Question 1

(a)(i) A simple starter question very well answered by the majority of candidates. Only a small number of candidates failed to connect the plots with a curved line. Marks were lost due to best fit line being inserted or the points being joined in angular steps.

(ii) Most candidates were able to explain that large crystals were formed by slow cooling/small crystals were formed by rapid cooling. Weak candidates simply described the variation in crystal size and did not link it to cooling rates.

(b)(i) Using the data sheet, the majority of candidates correctly identified mineral **F** as augite. The most common incorrect answers were hornblende and olivine.

(ii) A significant number of candidates were unable to identify that the igneous rock was crystalline, equigranular and mafic. A number of candidates only ticked one or two boxes instead of the three stated in the question!

(iii) The majority of candidates correctly identified the igneous rock as gabbro. However more than 15 other names were suggested, including gneiss, marble, peridotite, spotted rock, basalt, schist and metaquartzite.

(c)(i) Many candidates scored full marks here by drawing angular interlocking crystals between 1 and 2 mm in diameter. Weak candidates drew the sedimentary texture of the orthoquartzite and failed to score well on this question.

(ii) This question proved to be a good discriminator and only the most able candidates managed to score full marks here. A large proportion of answers failed to include any element of explanation after correctly identifying the similarities or differences in mineralogy and texture. Very few candidates were able to explain why there was no change in mineral content between orthoquartzite and metaquartzite and reference to recrystallisation due to high grade contact metamorphism was omitted from most answers.

Question 2

(a)(i) The majority of candidates correctly identified feature **P** as a stipe and feature **Q** as a theca. A small number of candidates confused **P** with **Q** and labelled them the wrong way round. Over twenty different names were suggested for feature **P**, including leg, spine, fork, shell, foot, fins, arms and septum. More than thirty different names were suggested for feature **Q** including pockets, flutes, teeth, hooks, gills, barbs, socks, leaf parts, septa and columella.

(ii) This question was generally very well answered with most candidates scoring full marks. A small number of candidates lost marks by comparing graptolite **A** with graptolite **B** when it clearly asked for the differences between **A** and **C**.

(b)(i) The vast majority of candidates correctly identified the brass yellow mineral as pyrite.

(ii) Most candidates had a sound knowledge of the process of petrification and correctly explained that the original hard parts were dissolved away by percolating waters then later replaced by pyrite under anaerobic conditions. Some very detailed answers were given here and full marks were awarded in many cases.

(iii) Many candidates clearly understand the reasons why graptolites make excellent zone fossils. A reserved credit was given for rapid evolution.

(c) This question was a good discriminator as only the more able candidates were able to explain why the beds were overturned in Figure 2. Most candidates simply stated cross bedding or graded bedding without referring to coarsening upwards therefore upside-down or concave down on the cross beds so must be inverted. Few candidates referred to the evolutionary stages in graptolites **A**, **B** and **C**. The youngest, most recent graptolite **A** was underneath the older less evolved graptolites **B** and **C**. Even fewer candidates noted that the Carboniferous coral at the base only evolved after the graptolites had become extinct in the Devonian.

Question 3

(a)(i) The majority of candidates correctly named the plate boundary in Figure 3a as divergent. The incorrect answers were evenly split between the other two choices.

(ii) This proved quite difficult for many candidates as they were unable to use Figure 3a to describe the pattern of magnetic reversals. Many candidates failed to notice the symmetrical pattern about the ridge or that they occurred in stripes of varying width that ran parallel to the ridge. Most candidates scored one mark for referring to alternating normal and reversed magnetic stripes.

(iii) This question was well answered by many candidates with some very detailed explanations given by the more able. Many candidates explained the significance of the Curie point for locking in the magnetic field pattern when the basalts cooled below 570°C.

(iv) In contrast to the previous question, this was very poorly answered by many candidates. Most candidates simply ignored the word 'explain' and replaced it with 'describe'. To score marks candidates had to refer to sea floor spreading, new ocean being created at the ridge, then splitting in half and being moved sideways by subsequent activity.

(b)(i) Most candidates correctly estimated the current period of normal polarity as being within the mark scheme range of 0.65-0.85 million years. Some candidates lost marks by stating, for example, 780 million years or 0.78 years.

(ii) What was thought to be a very straightforward question turned out to be very confusing and demanding for many candidates. Five magnetic stripes in 2 million years (0.4 million years each) or four reversals in 2 million years (reversal every 0.5 million years) were both accepted. Many candidates produced long complex calculations with answers way off the mark.

(iii) This proved to be the most demanding question on the whole paper and weak candidates struggled to pick up any marks at all here. Very few candidates referred to the fact that mid-ocean ridges are offset by transform faults and this would account for the discontinuous nature of the stripes. The width of stripes vary because volcanic activity varies along the length of the ridge and over time. Sea floor spreading does not operate at the same rate on each side of the ridge. Many candidates got bogged down in trying to link it to magnetic field variations and scored no marks.

Question 4

A number of candidates mis-interpreted Figure 4 as a cross section rather than a geological map, even though the first sentence of the question in bold states that '**Figure 4 is a geological map** and the land in the area is flat'. In addition, the area of sea in the south east corner was included to ensure that candidates did not see it as a cross section.

(a)(i) What was thought to be a simple starter turned out to be a good discriminator. The majority of candidates recognised the syncline but far fewer were able to work out that the northern limb must be dipping at an angle of less than 60°. A significant number of candidates thought the fold was younger than the faults and that the fold had been overturned.

(ii) A worryingly large number of candidates clearly cannot distinguish east from west even when a north arrow is provided on the map. Many candidates only drew the APT in one section of the map even though there was a 2 mark allocation for the question. A number of candidates did not attempt to insert the APT and a few inserted it at right angles to the correct direction.

(b)(i) This question proved quite challenging for many candidates. It was disappointing to see very few candidates referring to the core of the syncline being much narrower on the upthrown side following erosion (or the core being wider on the downthrown side). Credit was given for referring to the fact that the younger rocks will be at the surface on the downthrown side of the fault. Candidates interpreting Figure 4 as a cross section tied themselves in knots here and failed to score any marks.

(ii) Quite poorly answered by many candidates; only the most able managed to pick up both marks here. Reference to low angle (18° given on Figure 4) was the most common marking credit. Only a small number of candidates correctly identified that the hanging wall had gone up (or the footwall had gone down) due to compressional forces.

(iii) This question elicited better responses than parts (b)(i) and (ii). Many candidates referred to the bed widths of all the beds being the same width on both sides of **F2**. The more able candidates focused on the importance of the width of the core being the same on both sides of the fault.

(c) The majority of candidates accurately measured the displacement along Fault **F2** within the limits given on the mark scheme. Many candidates realised the relative movement was to the right. A number of candidates stated compass orientations instead (for example southwest or northeast) and lost a mark as a result.

(d) This question was also a very good discriminator and forced the candidates to think and interpret. Weak candidates simply agreed with both statements and failed to include any evidence in support of their answer. The most able candidates scored full marks here and they supported their evaluation using map evidence from Figure 4. **F1** and the fold were both formed by the same type of stress – compressional – but couldn't be formed at the same time as the stress to form the fold would be N–S, whilst the stress to form the fault would be E–W. Also couldn't be at the same time as the fault cuts the fold so must have occurred after the folding. It is not possible to tell whether **F2** is younger than **F1** as there is insufficient evidence on the map – there is no cross cutting relationship between **F1** and **F2**.

GEOLOGY

General Certificate of Education

Summer 2015

Advanced Subsidiary/Advanced

GL2a

Principal Moderator: David Evans

The paper tested the range of skills and techniques flagged up in Unit GL1 of the specification. It had to be, like GL2b, centre-marked with moderation by the WJEC team.

A meeting, whose personnel included the Moderators, took place on the day after the paper was timetabled. The mark scheme proposed by the Principal Moderator was reviewed against some students' scripts and a definitive version was then published via the WJEC website. Guidance in its application was available, as in previous years, by e-mail request to the Principal Moderator.

The scheme suggested expected, acceptable and unacceptable responses. It stated that alternative answers could be credited. The e-mails received and the moderation process indicated that this did occur. Feedback from centres and moderation of sample scripts suggested that the application of the mark scheme by teachers was successful. There were a very small number of teachers who failed to follow the marking guidance stated on the cover of the mark scheme, and any issues are discussed in individual Centre Reports.

The demands made by the paper were broadly comparable with papers from previous years, being an integrated test using maps, photographs and specimens.

Question 1

In part (a) most candidates noted the crystalline nature of specimen **G**, and the fact that it showed gneissose banding lead the best candidates to select that it was the product of regional metamorphism formed under the influence of high temperature and pressure. The nature of the specimens was somewhat variable and every effort was taken to ensure that students were not penalised as a result of this. Centres are reminded that students may request to see alternative samples of each specimen during the examination. In addition, rock unit **G** was shown on the map as having a foliation, a clear indication of the regional metamorphic nature of specimen **G**. Candidates should make use of information contained on the map to help form their answers. In part (b) the question referred to differences in texture not composition, so that answers identifying mineral content were not accepted. The best answers noted the schistocity and variation of crystal size in rock unit **F** compared with the gneissose banding and equicrystalline nature of specimen **G**.

Question 2

The majority of students gained all four marks in completing the graphic log in part (a). Similarly the responses in part (b) were mostly correct with candidates noting that the upward fining nature of bed 5 suggested that the current was most likely to have undergone a reduction in velocity over time. In part (c) the best answers considered each of the statements concerning bed 4 and this prompted the drawing of a granular rock with touching grains, showing poor sorting and an angular shape with a mean size of 5 cm. The most common errors were to draw interlocking crystals rather than grains (a response for which a maximum of only one mark could be awarded) or to draw rounded rather than angular grains. Most candidates noted the angular and granular nature of the rock and correctly identified it as breccia in part (c)(ii), although conglomerate was the most common incorrect response.

Question 3

Most students were able to describe a relevant hardness test i.e. scratching the mineral with a steel pin or copper coin. Since most minerals will scratch with a finger nail this was not considered a diagnostic test. The result of the diagnostic test was credited if it correctly stated that it "did not scratch" or "did scratch" with the relevant tool. Marks were not awarded for simply stating the hardness values 5.5-6.5 as indicated on the Mineral Data Sheet for the mineral haematite. The final row of Table 3 was for candidates to choose their own relevant diagnostic test to perform and the best answers referred to streak, colour or density. The vast majority of students correctly identified specimen **J** as haematite although a number decided that the mineral was garnet and made their responses in Table 3 fit this incorrect identification.

Question 4

(a) The best answers noted the dark colour and fine crystal size of specimen **C** in order to correctly name it as basalt. Recording that the rock was simply "crystalline" was not a precise enough observation to enable the specimen to be named and so could not be credited.

(b) Figure 4a clearly showed a concordant igneous body and so the correct answer, achieved by the majority, was to tick both sill and lava flow boxes.

(c) Figure 4b clearly showed the same igneous body cutting a layer of rock above an unconformity in a discordant manner. Consequently the igneous body had to be an intrusion rather than a lava flow, and could be interpreted as a sill in the lower half of the diagram and a dyke in the upper half. The best candidates interpreted all of these aspects in their evaluation in part (c)(ii). The majority of answers correctly located the field sketch Figure 4b on Map 2, explaining the presence of the igneous body cutting an unconformity.

Question 5

The table concerning the two faults **F1** and **F2** was generally well completed with the straight outcrop of **F2** indicating a vertical fault, and the "left" or "sinistral" direction of movement of **F2** commonly noted. Fewer candidates were able to interpret **F1** as a thrust fault and **F2** as a strike-slip fault however, with all four fault type responses seen in both boxes at the base of the table.

Question 6

The geological history took the form of a short response from an extract of Map 1. Most candidates correctly noted that **F1** post-dated **F2**, and that both faults post-dated the four rock units. The most common error was to overlook the fact that rock unit **G**, being a regional metamorphic rock, was most likely to have pre-dated the adjacent sedimentary rocks. Rock units **E**, **B** and **H** were usually correctly sequenced with reference to the fold structures or dip symbols on Map 1.

Question 7

A variety of standards of accuracy were seen in the drawing of the suture line in part (a) with the best noting the difference in shape of the saddles and lobes, and also recording the correct wavelength and amplitude of the saddles and lobes. Students drawing more than one suture line gave themselves more opportunities to draw one correct suture line and so credit was not given to drawings with more than one suture line, as clearly stated in the question. Most students correctly identified specimen **H** as a goniatite, although ceratite and ammonite were commonly seen errors. In part (b) the best answers noted that Photograph 2 showed a ceratite which, being younger than a goniatite, could only have come from a younger sedimentary unit i.e. **D** or **A**. It was pleasing to see a number of well-reasoned answers although this question proved to be an excellent discriminator with many candidates not appreciating the scope of answer required.

Question 8

The cross-section proved to be an excellent discriminator with a wide range in the quality of responses. The most common errors included incorrectly drawing the dyke vertically, despite the clue in the field-sketch Figure 4b, and incorrectly interpreting the borehole data to reveal the limb of a syncline beneath a thrust fault. In most cases the fold structures across the cross-section were correctly drawn and the unconformity drawn appropriately. The best answers correctly interpreted the detail of the cross-cutting relationships of **F1**, **F2** and the unconformity.

Question 9

The best answers to this question explained in detail how a fossil or its preservation can be used to interpret the environment of deposition. Credit was given to responses that explained the principle of uniformitarianism and went on to illustrate how the specific environmental requirements of modern organisms such as corals can be used to interpret the environment of deposition of sedimentary rocks containing fossils with modern counter-parts. Credit was also given to detailed responses linking the environment of deposition to the features of fossil assemblages, such as energy levels and the state of preservation. In addition good answers linked the style of preservation such as oxidation or carbonisation to oxygen-rich or oxygen-poor conditions.

Full marks were seen from responses involving the photograph of the fossil plant and the photograph of the ceratite as well as answers involving the candidates own selected fossil group. The weakest answers simply listed the conditions of an environment of deposition without any explanation as to how the conditions within an environment of deposition might have been determined. Credit in these answers was necessarily limited since they failed to address the main point of the question.

GEOLOGY

General Certificate of Education

Summer 2015

Advanced Subsidiary/Advanced

GL2b

Principal Moderator: Alan Seago

Specific points are made in the Moderator's Report to each centre but some general points can be made.

Administration

There were one or two examples of errors in administration including not filling in the correct forms. Centres are urged to ensure samples of coursework reach the Moderator by 15 May. There continue to be cases where the marks have not been doubled before submission through the EMI system. Mostly the work was well organised and easy to follow thanks to the detailed annotation.

Suitability of tasks

Centres should be aware of the required context of the investigation at all times as described in the specifications. The centre must remember that the skills range exhibited in GL2b should equate with those assessed within the GL2a paper.

Some centres provided worksheets which gave far too much help to the candidates, some of whom only annotated photographs and measured dip and strike. Where annotated photographs of a location are being used, it is expected that original field sketches should be part of the evidence for AS fieldwork. This prescriptive method hinders individuality and thus ranking of candidates based upon ability.

The better investigations include the demonstration of basic field skills such as rock identification and textures, identification of field structures using dip and strike, field sketches, sedimentary logging and fossil identification. The data collected is then manipulated and presented in cartographical or graphical form. Some excellent field investigations are now being seen which are well suited to the assessment framework. It is good to see geological field skills being demonstrated with a high degree of competence.

A number of centres are using Field Study Centres in order to carry out their fieldwork. In the majority of cases this proves to be a successful venture. However, centres should be aware that in some cases the Field Study Centre may not be familiar with the relevant assessment criteria. Teachers should make sure that the Field Study Centre knows exactly what is required for the field investigation in terms of the specification.

A mixture of tasks was undertaken, with a rough break down being investigations into:

- Interpretation of sedimentary environments (sedimentary logs, fossils and rock description)
- Mapping exercises (leading to drawing up of geological sections and history)
- Analysis of fossil assemblages
- Structural analysis (faulting and folding styles related to compression or tension or to specific orogenies)
- Nature and relative age of igneous intrusions
- Geological history of an area involving both sedimentary environments and structural history

Centres are to be congratulated on the variety of opportunities given to candidates in areas of outstanding geology such as Isle of Arran, Amroth, Saundersfoot, Ogmore, Styal Mill, Black Mountain, Barry, Portishead, Bridgnorth, Castleton, Blencathra, Porth Clais, Ludlow, High Force, Alderley Edge and Mell Fell. Other centres made good use of suitable local geological locations.

Planning

Plans tended to be fairly simplistic with no details for example as to how to measure clast roundness, sorting etc. or identify rocks and fossils. Planning is required to be specific and related to the chosen fieldwork site. It is not sufficient to write:
'I will carefully observe and identify the rock types and will describe the rocks in detail'
'I will observe minerals and explain where they come from'
'Locate and identify fossils'

Candidates could also have included background material specific to the area, such as a geological survey map segment and the relevance of this site to the overall geology of the area.

Some thought has to be given at the planning stage as to whether the data being collected is suitable for processing and analysis e.g. by the use of histograms, cross-sections, logs, rose diagrams maps and geological histories.

A number of centres are now making preliminary visits to sites in order to allow some forward planning by candidates, which often results in better Planning marks. Some candidates devoted insufficient time to the retrieval and evaluation of relevant material from different sources.

Field Notes

It is quite frustrating that some candidates persist in not submitting original field notes. Some field notes consisted entirely of tables of data or a very detailed map of a small area. This does not fit particularly well with GL1 and GL2 and it would be an improvement to see a variety of data collection, including field sketches and rock descriptions etc. In other cases, opportunities for the collection of basic field data have been missed.

A minority of field notes were untidy and unclear with poor field sketches. Some field sketches lacked detail and often contained too much shading. Candidates are sketching from afar rather than looking at the rocks in detail then stepping back to make a generalised sketch with the knowledge of what is present.

Centres should ensure that candidates have sufficient time at the investigation site to collect appropriate and sufficient data. Observations such as rock identification, grain size, sorting, direction of cross-bedding, clast roundness/orientation, field sketches, dip and strike measurements should be part of every investigation, where appropriate.

Report (Analysis and Evaluation)

There is no need for candidates to repeat observations made in the field notebook within a report unless it contributes significantly to the analysis. Repeating field notes in locality sequence is not required for the analysis. The conclusions should link up the important evidence from relevant sites rather than describing each site again in sequence. There should be evidence for graphical or numerical techniques e.g. a rose diagram for trends or dip direction and angles. Candidates must process data such as clast orientation, sedimentary logs or dip and strike measurements which have been collected in the field. In a minority of cases it was difficult to distinguish between field data and secondary data or individual work and collective work. Centres and candidates should ensure that the nature of the work is clearly identified for moderation. Candidates are making good use of their IT skills.

Evaluation remains the weakest skill. Evaluation should refer to the data gathering process. Reference to inclement weather and the lack of time gain no credit.

Assessment

Centres are to be congratulated on the standard of work produced by the candidates. It is pleasing to report that in general centres are taking note of comments made in individual centre reports in previous years so that there is a continuing improvement in the quality of candidates' work. However there is quite a turnover of centres with some centres submitting work one year and not the next and other centres submitting work for the first time - so that there is a continuous requirement on the part of Moderators to ensure comparable standards across all centres. Centres are to be congratulated on the accuracy of the assessment in most cases although there were some examples of generous and harsh marking.

There are two main reasons why scaling has to be applied:

- Marks generous or severe; sometimes maximum marks are awarded where candidates have clearly not demonstrated evidence of reaching the highest category
- Unsuitable tasks being undertaken which does not give candidates the opportunity to demonstrate the higher level skills

Help from WJEC

Centres should be aware that there is help available from WJEC. Published exemplars of coursework investigations can be obtained from the WJEC officers Jonathan Owen (jonathan.owen@wjec.co.uk) and Sarah Price (sarah.price@wjec.co.uk). Moderators' reports on the current moderation process are sent out to centres. Centres are urged to act on any recommendations in the Moderator's Reports. The Moderators do not enjoy moderating work which achieves low marks as this is going to be disappointing for the centre and the candidates, especially when there is often so much suitable geology on the centre's doorstep which with a little help and guidance can result in a successful submission. There are guidelines in the specification such as Planning Aid (p62) and suggested investigations (p22). Alternatively centres could discuss suitable investigations with WJEC officers. Any centre having a problem with applying the assessment framework should contact WJEC well in advance of the submission date. If a centre requires further clarification of the Moderator's Report or assistance with future presentations please contact WJEC.

GEOLOGY

General Certificate of Education

Summer 2015

Advanced Subsidiary/Advanced

GL3

Principal Examiner: Pete Loader

SECTION A

General

Question 2 was less well answered than question 1, with both based on data not previously seen and requiring some thought to be given to the answers. Equally the essay section required candidates to do more than rehash previously prepared responses to questions on natural and human-induced hazards.

Question 1

(a) The majority of candidates answered this well. Failure to read the full question meant that some candidates repeated stem.

(b) (i) This was answered well by most candidates with most using the d/t formula.

(ii) Explanations were generally good with many candidates referring to shallow water leading to increasing friction on the wave.

(c) (i) This was answered well but some candidates named the types of plate boundaries instead of the types of fault movement.

(ii) Candidates answered this question well though for 3 marks candidates needed some greater explanation than just outlining that strike slip faults do not generate tsunamis.

Question 2

Candidates should endeavour to read the question carefully, ensure that they respond to all parts of the question and to take time to think through their responses before beginning to write.

(a) (i) Most candidates read the height of the water and the direction of groundwater flow correctly.

(ii) This question was often left blank. Those who attempted to draw the line often gained a mark.

(b) (i) This was often drawn incorrectly. Candidates seemed confused by the term 'isoline' despite it being explained in the diagram. Some candidates did not realise there were two separate plumes and drew a straight line to join up the dots for 10 across the diagram. Many students were inaccurate in their isoline losing marks they should have gained with ease.

(ii) Candidates often missed this out or completed the fault line erroneously. The question asks for 'the fault across the map' yet many drew a cross indicating a point on the map thus missing the second mark.

(iii) This was better answered though some weaker candidates had difficulty in expressing permeability in sandstone along with the less permeable/ impermeable shale. Few students related the plume direction being diverted by the fault.

(c) Many candidates referred to Acid Mine Drainage and explained the concept – these candidates were able to gain full marks easily. Weaker candidates wrote vague, rambling statements but usually managed to gain a mark for naming pyrite or some other contaminant.

SECTION B

General

Questions 3 and 5 were the most popular with question 4 answered by very few candidates.

Question 3

This was generally done well although many candidates took the opportunity to write all about a case study they had learned rather than to actually respond to the question. About 75% of candidates answered this question.

(a) This part was moderately answered with a number of candidates twisting the questionand writing a description of mitigation methods or the causes of earthquakes and volcanoes. Some did not confine themselves to "the **factors** that affect risk" but referred instead to the nature of the hazards themselves, often with detailed case studies for which limited credit could be given. The concept of "risk" is not generally well understood. Proximity to the epicentre and the magnitude of event were rarely considered by candidates. This is similar to findings from the 2014 paper.

(b) Most candidates were able to choose two from the list. Some weaker candidates outlined 'why' the methods should be used thus limiting their marks. Very few candidates evaluated – explained the 'extent'. Some centres had prepared their candidates very well and student knowledge and understanding was greatly evident. Other centres had many candidates who rambled vaguely without really demonstrating any high level responses.

(i) Slope stabilisation methods: Some candidates produced excellent responses. Diagrams are always credited as are examples of where these methods have been used. The standard of the response varied greatly from centre to centre. There is a common misunderstanding that removing the weight on top of a slope will reduce the likelihood of slippage. The importance of drainage was omitted by the majority of candidates. To what extent these methods minimise risk was addressed by only a very few candidates.

(ii) Lava speed and direction: This saw the weakest responses of the three options; all too often rambling and vague. Candidates are credited for examples even if they are not fully accurate – Heimaey is in Iceland, not Italy, Hawaii or Indonesia! Many wrote about pyroclastic flow rather than lava flow. To what extent risk was minimised was rarely considered.

(iii) Engineering of domestic landfill sites: The best responses had diagrams and referred to a specific landfill site that candidates had studied. Some candidates expressed great faith in the engineering practices and did not appreciate that even the best landfill sites will have some leakage.

Question 4

Very few candidates answered this question (less than 4%).

(a) This was generally very poorly answered. Few candidates referred to case studies and responses were vague.

(b) This section usually proved to be very well answered and some excellent responses were seen which scored very good marks. Case studies were mostly applied well. The majority of candidates used Aberfan and/or the landslide at Vaiont and scored highly. Diagrams were used well by some candidates.

Question 5

(a) This was well answered by many yet it is apparent that the concepts of porosity and permeability are still not fully understood. Definitions of porosity (a percentage of space) and permeability (the capacity of fluids to flow through a rock) were given by surprisingly few candidates. Too many candidates were confused (and it is often centre specific) regarding the fact that grain-size has no effect on porosity. A virtual experiment produced by the Earth Science Teachers' Association (ESTA) is recommended to help candidates with this concept. This can be downloaded free of charge.
http://www.esta-uk.net/porosity/

(b) Generally this was well answered with many candidates using the Vaiont Dam disaster as the main basis for their essay. Some had excellent detailed diagrams, which helped them to gain access to higher marks. Some candidates (again this was very centre specific) referred in depth to the structure of the underlying strata dip/folding/cleavage/joints and these candidates had the knowledge and understanding to access full marks with ease. Few candidates referred to pore pressure. Some weaker candidates just wrote all they knew about the Vaiont Dam disaster with little consideration to the question asked. This approach resulted in limited marks being awarded.

GEOLOGY

General Certificate of Education

Summer 2015

Advanced

GL4

Principal Examiner: Jo Conway

General

The mean mark was up 2.5 marks on last year, with this being a slightly more accessible paper than last year for candidates. Candidates at the lower end performed a little better than in previous years.

Section A assesses areas which candidates find very challenging looking to combine depth of knowledge with application to given data. This was generally done better than Section B. Item level data revealed that in Section A Q3 was most accessible and Q2 was the least.

Section B was based on an extract of the solid geological map of the Malmesbury area. As in previous years the candidates showed they are getting familiar with the style of questioning and reasoning required and a good range of answers was seen. Item level data revealed that in Section B Q6 was most accessible and Q7 was the least.

Handwriting legibility was sometimes a problem. Candidates should be reminded that examiners are unable to award credit if they cannot read a response! Many candidates had difficulty expressing themselves clearly and spelling of subject specific terminology was often poor.

SECTION A

Question 1

The question focussed on igneous processes, with a traditional geotherm graph moving into application to plate tectonics, testing graph reading and interpretation skills. The majority of candidates used the data given to good effect. The mean mark was 9.3/15. Candidates scored well on most parts of this question, demonstrating very good levels of response to the range of data given and showing very good knowledge and understanding.

(a) The majority of candidates got parts (i) and (ii) correct, showing good numeracy skills in reading the graph.

(b) Some candidates showed confusion between “wet” and “melt” in terms of igneous processes but in part (i) most were able to relate to Figure 1b. Part (ii) was quite challenging with candidates often struggling to correctly shade an area of continental crust below 600°C. In part (iii) candidates often lost marks by not making clear reference to Figure 1a.

(c) Was generally well done by the majority of candidates with some excellent responses detailing evolution of magma.

Question 2

The question focussed predominantly on the deformation topic, bringing in sedimentary way-up structures. The mean mark was 9.5/15 with this question having the largest standard deviation of all questions, showing the marks were widely spread.

Figure 2a is similar to block diagrams used in previous examinations examining two and three dimensional relationships.

(a) Many candidates gained full marks. Candidates frequently lost marks for drawing the displacement as normal by missing the σ min symbol on the diagram. Often careless drawing of the dyke meant candidates lost the "pre-Jurassic" credit.

(b) Some excellent data was given in the form of a photograph of a loose block of rock showing way-up structures, allowing the majority of candidates to score highly on parts (i) and (ii). In part (iii) many candidates missed the key word of evaluate in the question stem, and simply discussed the way-up of the structures in the boulder without giving an evaluation of the fragmentary nature of the evidence and hence it having little use or value.

(c) The majority of candidates gained high marks for describing the internal folding, thickness and cleavage differences between the sandstones and shales in part (i) and using specific terminology of competent/incompetent in part (ii).

Question 3

This question examined metamorphic processes with links to how water can change the dynamics. Candidates tackled the question well and produced some extremely knowledgeable answers with this question having the highest facility factor on the paper. The mean was 10.2/15.

(a) Many candidates scored highly, though some struggled with their phrasing for the explanation. Better answers were "not enough energy for recrystallisation" or that below 200°C was the realm of sedimentary diagenetic processes.

(b) The majority of candidates scored highly.

(c) Part (i) was generally well done with candidates identifying shale and that hornfels was high grade. Part (ii) was more challenging. Good descriptions were seen comparing the size of the metamorphic aureole in shale and limestone, with explanations leading from this discussing the role of water and the permeability properties of the rocks, the faster transfer of heat away in the limestone and hence the narrower aureole.

(d) Both parts (i) and (ii) were well answered by candidates demonstrating a good range of knowledge and understanding. The most common answer in part (i) was that there was an offshoot of magma giving rise to metamorphism being separated from the pluton. In part (ii) the most common answers were the angle of the intrusion against the country rock and the size of the intrusion.

Question 4

This question examined the climate change topic linking the long-term carbon cycle to plate tectonics and weathering. The mean mark was 10.0/15. Unfortunately many candidates lost credit in their answers on this question by poor phrasing leading to vague and imprecise responses.

(a) Good answers were seen in part (i) following the flow of subduction of ocean carbonates to eruption of carbon dioxide at volcanoes. Part (ii) looked for answers to remove carbon dioxide from the atmosphere (effectively described by candidates as being washed out by precipitation) and then return it to sediment (by rivers into the sea). The majority of candidates linked increased carbon dioxide to increased global temperatures.

(b) Part (i) was similar to last year in having two graphs to be interpreted. Firstly Figure 4b required a description of the relative changes. Often candidates missed the 40Ma cue and described the entire age range. Many candidates got the rates confused. Correct answers noted the steady rise from 40Ma and the reduced rate from 16Ma. In part (ii) a description of the correlation tied Model B as the best fit. Examiners were also looking for higher level responses for the third credit by explicitly linking the elevation to the Sr ratios.

(c) The majority of candidates scored well on parts (i) and (ii) though some candidates missed the word 'cooling' in the stem.

SECTION B

The 1 : 63 360 map extract of Malmesbury was accompanied by a cross section and some enlarged portions of the map. The maps are “real data”, which means that they can be littered with a wealth of information which cannot be touched on in an approximately 1 hour segment of the exam. This really tests the candidates' skills in interpreting the data.

Question 5

This question intends to get candidates familiar with the map and was generally well done with a mean of 4.9/9. This also had one of the lowest standard deviations.

(a) The majority of candidates got part (i) correct, though there were some unusual incorrect answers in the range of thousands of square kilometres! Part (ii) was more challenging. The majority of candidates described the outcrop in Box Z but did not explain the shape as being due to horizontal strata.

(b) Part (i) was testing field skills, similar to last year's question. The majority of candidates correctly detailed the offset of beds, slickensides and fault breccias. Part (ii) was a straightforward question which was generally well answered. The majority of candidates were able to draw a vertical fault, beds dipping towards **Y** and show the bedding displaced.

Question 6

This question brought in fossils to the mapwork section of the paper and showed the synoptic development of fossils to the A2 level of assessment. This question had a mean of 5.5/9. This had the lowest standard deviation of all the questions on the paper.

(a) The majority of candidates were able to explain the function of the eyes of the trilobite. In part (ii) this was developed into explaining a mode of life from this piece of evidence. Candidates did well in linking the eyes on the top of the cephalon to the creature being a bottom dweller and related developments. The eyes did not provide evidence for the trilobite being a swimmer.

(b) Candidates found little difficulty in linking the fossil content to the marine environment in part (ii) but often did not explain how the evidence supported the hypothesis. The best correct answers used uniformitarianism of the corals for this. There was a common misconception amongst candidates that corals are indicators of low energy environments, often despite comments about aerated environments in part (i). As is usual for many of the critical evaluation questions, the range of answers accepted all hinged on how the candidate pieced together their line of argument, so opposing lines could be accepted for different candidates. The most common correct response linked to corals indicating high energy in the lower part of the sequence and the finer mud and articulated valves indicating lower energy. Other acceptable answers were that there was not enough evidence, and that the trilobite being a fragment was broken along with the “flipped” brachiopod indicating an increase in energy conditions.

Question 7

Similar to last year there was the inclusion of an unusual source of data (in this case a Bouguer gravity anomaly map), with the examiners looking to test how candidates respond and apply their knowledge. The mean mark was 4.5/9 – the lowest facility factor of any question.

(a) This was similar to previous questions in asking about the fold characteristics, but it was often poorly done by candidates who confused synform and syncline evidence. As in previous years, candidates found it difficult to explain the evidence for the fold plunge.

(b) It was disappointing that many candidates did not attempt to even draw the profile of the gravity anomaly, showing that the concept of negative numbers is poorly understood. Links to numeracy will be made whenever relevant.

(c) This was a demanding part of the question and the paper, and it was very pleasing to see some candidates rising to the challenge and competently explaining their answers to parts (i) and (ii). Examiners allowed some tolerance for candidates mixing mass and density terms. In part (i) acceptable answers generally commented that the syncline contains more of the less dense material (though candidates often phrased this as the core being less dense), and developing the point to explain about the gravitational attraction for the second credit. Part (ii) was pointing candidates to look for patterns to explain a conclusion of an unmapped fault. A very good number of candidates noticed the sudden rapid change in the gravity values with the contours being close together and then discussed there being more lower density strata (downthrown) on the east.

Question 8

The photograph of the two quarries was well presented using colour and candidates were able to make good links to their GL3 topics. Candidates performed well on this question and examiners saw the whole mark range being used. The mean mark was 7.2/12.

(a) Part (i) was well done. Part (ii) was a surprising challenge to many candidates and poor phrasing let down other candidates who were not able to explain effectively that apparent dip was being seen along the strike of the beds. Part (iii) was more traditional and the majority of candidates gained full credit. Candidates should be reminded that if the question states “show your working” that it is required to gain full credit.

(b) Part (i) proved very straightforward with the majority of candidates drawing in bedding at 36° dipping to the west, then developing good annotations to explain the differences between the western and eastern sides of the quarry. Some excellent links to GL3 slope stabilisation were explained by candidates. In part (ii) it was disappointing that many candidates wrote considerable amounts about roads and farms despite the explicit instruction for geological factors to be explained. Good answers made reference to rock units from the map and whether they would be required units or not (economics). Other good links were made regarding water table issues and the width/depth ratios regarding mining operations.

GEOLOGY

General Certificate of Education

Summer 2015

Advanced

GL5

Principal Examiners: Michael Walsh and Kevin Stephen

Theme 1 – Quaternary Geology

Question 1

(a)(i) A very accessible question that was answered very well, with the majority of candidates demonstrating good use of the correct terminology.

(ii) There was a disappointing response to this question. The best candidates related the texture of the till to the erosive and depositional processes. However, many weaker answers merely asserted that the texture of the till is typical of a glacial environment without explaining why this is the case.

(iii) Most candidates were able to recognise the weathered layer of till as evidence of the break in sedimentation. Fewer candidates were able to explain why this indicated that a break had occurred.

(b)(i) This question was generally not well answered as many candidates did not relate the texture to fluvioglacial processes. Many candidates merely described the texture of the deposit, which gained no credit.

(ii) A well answered question which showed that many candidates could relate the position of this location relative to the ice front.

(c) This question was well answered with many candidates being able to interpret the wide range of evidence of interglacial, periglacial and further glacial episodes.

Question 2

Many candidates were able to explain the both isostatic and eustatic sea level changes though fewer were able to link the two processes, and particularly to explain their relationship over time. Part (b) proved to be challenging for many candidates. The link between sea level and climatic change was generally understood however only the better candidates were able to evaluate the strengths and limitations of the evidence and relate that to the scale of the changes.

Question 3

A generally well answered question with very many good explanations of the formation of a Bouma Sequence linked to the processes that occur in and after a turbidity flow. Part (b) discriminated well with many candidates able to describe some of the sedimentary structures but only the better candidates able to evaluate their utility in interpreting turbidite environments.

Question 4

This was an accessible question where candidates who had prepared carefully for the exam were able to gain good marks. Most candidates were able to explain the link between the underlying geology and the landscape above. However, the evaluation was often not strong with little discussion of areas where the geological structures and bodies have only a limited effect on the landscape. Only the best candidates were able to write the essay in a way that created a logical flow through the ideas being discussed.

Theme 2 – Geology of Natural Resources

Question 1

(a)(i) Many candidates were unable to calculate a percentage correctly with a significant number giving an answer greater than the initial figure to represent 1.18% of that figure, showing a lack of even basic checking techniques being employed.

(ii) Most candidates were able to identify an environmental problem related to the extraction of the Spence Deposit, though few used the answer to part (i) to identify waste as an issue. Most candidates were able to suggest a planning control though not many developed their answer in enough detail to achieve full marks.

(b)(i) A very accessible question that was almost universally answered correctly.

(ii) Many candidates were able recognize and explain the significance of the limit of mineralization and the presence of the fracture zone.

(iii) This question discriminated well with only the best candidates explaining in full detail why the concentration of copper drops so dramatically outside the limit of mineralization. Few candidates considered the permeability of the rocks in this area.

(c) This question was not well answered with many candidates not fully engaging with the rubric of the question. Only a few candidates discussed the application of geophysical techniques to the Spence Deposit and it was very rare for a candidate to recognise that the Spence Deposit has no outcrop. A number of candidates thought that the groundwater containing dissolved copper was the resource to be mined.

Question 2

This was the most popular choice of essay questions with many good answers showing a good understanding of the processes of migration and accumulation of hydrocarbons. Maturation processes were less well explained though the better candidates were able to discuss this in detail with sketch graphs of oil and gas ‘windows’ to support their arguments. Part (b) was less well answered with some reasonable accounts of how seismic surveying works but poor evaluation of their strengths and weaknesses. Many vague statements about cost were used as the only evaluation.

Question 3

A less popular choice, though candidates who attempted this question did produce some very sound answers. The processes of coal maturation were generally explained well, though the sedimentary processes that lead to its deposition were less well understood. Part (b) gave rise to some interesting answers that explained the two prospecting techniques in varying levels of detail. Only the best candidates were able to discuss the relative merits of the two techniques and contrast their different roles in prospecting for resources.

Question 4

The least popular choice but some excellent essays were seen. There were some detailed answers, particularly from candidates who considered the geochemical processes involved in the formation of residual and secondary enrichment deposits. Some candidates relied too heavily on their learning in other units of the course that only had a limited relevance to this theme.

Theme 3 – Geological Evolution of Britain

Question 1

(a) Generally well answered, with most candidates using the data on Figure 1a to justify their relative age determinations. Better candidates used terms like 'cuts' and 'offsets' in their explanations.

(b) This question was not particularly answered well. Many candidates just gave one line of evidence. Some candidates erroneously associated the origin of the cleavage with the contact metamorphism associated with the granite. The radial cleavage and cross cut of the cleavage were often missed.

(c) A wide range of answers were possible here yet many candidates chose not to engage fully with the data. Many did not recognise the significance of the cleavage or of the various rock types highlighted in the key that gave key lines of evidence for orogenic movements.

(d) Although many candidates scored well on this question, there were also many confused answers. The most common problem was that candidates did not use the evidence from both figures to justify their answers. The significance of the included fragments was well understood but the information from the map less so.

(e) Again a number of ways to gain full marks here. The most common issue was that candidates just mentioned the feature and did not discuss how this provided evidence of sedimentary environment. Many candidates erroneously equated 'red beds' with aoelian dunes or did not further elaborate on a desert setting.

Question 2

This was the most popular question.

(a) This question was generally well answered. Most candidates were able draw upon a good bank of sedimentary and palaeontological evidence to explain changing environments during the Devonian to Permian. Field examples and case studies enriched these answers.

(b) Few candidates convincingly evaluated the assumptions that they made in part (a). Especially surprising was the paucity of responses that assessed the validity of the Principle of Uniformitarianism for such old rocks and fossils.

Question 3

(a) Many candidates focussed too much on magnetic inclination to the detriment of the rest of the question. Indeed very few candidates were able to explain the rationale behind apparent polar wandering curves. Better candidates had good supporting diagrams (e.g. the variation of inclination with latitude between the two poles) to support their written responses.

(b) Evaluation was generally better for this question than the other two essays and many candidates were aware of the factors that limit the accuracy of palaeomagnetic data. The possibility of 'true polar wander' was mentioned by a few high achieving students.

Question 4

This was the least popular question and, as might therefore be expected, saw the weakest responses. The principal issue was that many candidates provided very little detail, if any, on the effects of the Alpine Orogeny in Britain. Evaluation was relatively poor, which prevented some candidates with excellent descriptions from scoring the highest marks.

Theme 4 – Geology of the Lithosphere

Question 1

(a) Generally well answered, with most candidates scoring at least two marks. The best answers quantified the depths of the earthquake foci and discussed the orientation of the Wadati-Benioff zone.

(b)(i) Not particularly well answered with few candidates gaining full marks. The accuracy mark for placing the top of the subducted plate coincident with the trench was rarely achieved.

(ii)/(iii) Well answered with many candidates gaining full marks. Most candidates realised that the surface of the plate bends under tension before the trench and the rising magma induces earthquakes above the subducting slab.

(c) Very mixed responses were seen. Many candidates were unaware where modern-day accretionary prisms occur but some better candidates were able to discuss the orientation/situation of the islands with respect to other tectonic lineaments and hence invoke a fore-arc location.

(d) Again very mixed responses were seen showing the full spectrum from 0-6 marks. The key to answering this question was realising that each Pre-Tertiary rock unit formed in a marine setting and had been emplaced above sea-level to form the chain of islands. The realisation that rock unit 1 represents an ophiolite sequence was very centre-specific. Exceptional candidates realised that the andesite/basalts represent accreted island arcs with flanking 'atoll' reefs.

Question 2

This was the most popular question, although all three questions performed remarkably similarly.

(a) This part of the question was generally better answered. Diagrams were generally good and well utilised. The manner in which the rate of spreading is calculated was well understood although many candidates omitted to mention in any detail how the direction of seafloor spreading is determined.

(b) Some candidates convincingly evaluated the relative merits of the two methods but this was not the norm. A discussion of the factors that influence the accuracy of the method was rarely included. Surprisingly few candidates mentioned the possibility that mantle plumes may not be fixed.

Question 3

A reasonably popular question.

(a) This part of the question was generally well answered. Diagrams were used with good effect to describe the structure of the oceanic lithosphere. A very common misconception was to discuss the crust rather than the lithosphere especially in terms of thickness. Better candidates quantified the age differences between oceanic and continental lithosphere.

(b) Many candidates solely addressed the technological issues of drilling deep into the continental crust rather than evaluating the success of methods (e.g. seismic/ experimental) used to probe the deep continental lithosphere.

Question 4

This was far and away the least popular question but conversely perhaps gave the largest scope for evaluation. Many weaker candidates covered the essential aspects of how and why rocks deform in different ways but completely ignored the reference to rock strength. Indeed better candidates rarely mentioned yield and fracture strength (stress). A good knowledge of the role of lithology and (confining) pressure on the style of deformation was evident.

GEOLOGY

General Certificate of Education

Summer 2015

Advanced

GL6

Principal Moderator: Ian G. Kenyon

Administration

The administration and moderation of the coursework samples ran smoothly once again this year. The Principal Moderator is very grateful for the efficient organisation and punctuality of the majority of centres. Only a small number of centres submitted materials after the May 15th deadline.

Packaging Coursework

When packing the coursework samples please try to **reduce bulk** and **weight** as far as possible. A4 hardback ring binders should not be used. It is helpful (and cheaper for centres) to use slim plastic folders that can be packed efficiently. The use of large and heavy field notebooks containing only a few pages of assessed material is to be discouraged. Please consider detaching the relevant pages of field notes and inserting them in the front of the report with a paper clip. Alternatively photocopy the relevant pages and include in the front of the report. All materials for moderation should be included in just **one modest sized package**.

Please note that the coursework samples for GL6 and GL2B should not be sent together in the same package as they are moderated by different examiners. If centres are unsure about the address for despatch, they should contact WJEC for clarification.

Fieldwork and Laboratory based Investigations

Please note that the requirements for GL6 are a minimum of two investigations. The assessment must be a minimum of 50% field based work. Therefore three possible combinations are available. Field 50%, Lab 50%, Field 75%, Lab 25% or Field 100%.

F2 Forms – The Tracking/Planning Sheet

A completed F2 form should be included for each investigation undertaken, i.e. two for each candidate in the sample. This is used primarily to assess the planning of the investigation. The quality of the planning sheets varied from exceptional, exhaustive and comprehensive to inadequate, over-brief and quite vague. The best marks for planning were achieved where students carried out a pilot study to test their planning, then modified the original plan in the light of this. A number of centres were over-generous on awarding marks for planning. It is not possible to score full marks on this section when candidates have failed to make any predictions about possible outcomes and anticipated sources of error.

These sheets can be enlarged to A3 where space is insufficient.

Additional planning information can be included at the beginning of the written report under a clear 'planning (F2) continued' heading. Students should be encouraged to plan in detail and be discouraged from using simplistic bullet point statements on the planning sheet.

F3 Forms

A completed F3 form should be submitted for each candidate in the sample. Please make full use of the opportunity to comment on the work of individual candidates on the F3 form. Ideally 4 'post-it' notes should be used to locate within the work, where and why the marks have been awarded. A few centres still fail to comply with this request each year and possibly disadvantage their candidates as a result.

It is pleasing to see that all centres are now using the updated version of the F3 form with the student and teacher declaration sections completed on the reverse side of the form.

Downloads from WJEC

Copies of the forms can be downloaded directly from the WJEC website www.wjec.co.uk by following the GCE/AS subjects and then Geology links from their home page.

Implementation

In order to provide evidence for implementation, it is vital that the appropriate field and laboratory notes are included with the report. A small number of centres failed to include the laboratory notes again this year.

It should also be noted that laboratory work must yield some raw data that could not be collected in the field. Bringing back rock samples then describing them as in a 'traditional' practical is not really in the spirit of the assessment.

Good examples of lab work included:

- Making thin sections of rock samples followed by microscope analysis
- Sieving sediments and calculating sorting, skewness and kurtosis
- Establishing composition of sediment samples using point counts
- Testing rock samples for resistance to abrasion, impact and polishing
- Modelling rock deformation using plasticine and mars bars
- Simulating mass movements and tsunami generation in a wave tank
- Porosity and permeability of rocks related to their utilization potential
- Testing the resistance of various mollusc shells to abrasion/attrition and linking to preservation potential

The overall quality and quantity of the lab and field notes were a little disappointing again this year and could easily be improved upon. Field sketches were particularly poor.

Ideally each field location should have a six-figure grid reference. If sites are close together, then the same reference should be given with '12 metres west of site 4'. It was pleasing to note some very accurate fieldwork locations were given by a few centres using GPS.

All field sketches should have grid reference, scale, compass orientation and detailed annotations. Simplistic labelling of sketches should be discouraged. It is strongly recommended to practise field sketching from photographs or slides prior to fieldwork being carried out.

Information from secondary sources such as bed ages or detailed palaeogeographies should not appear in the field notes. Photographs are also inappropriate in the field notes. The field notes should be used to interpret the photographs in the report.

Field notes should consist of detailed observations, measurements and records made individually by each candidate. Identical notes obviously dictated in the field are to be strongly discouraged.

The field and lab notes provide the basis for the report and should be considered the most important part of the investigation.

Analysis

This involves some synthesis and interpretation of the primary data collected in the lab or field. There must be some development from the field or lab notes, rather than simply copying out the same information in a neater form.

The use of photographs is to be strongly encouraged but these should be used selectively and integrated within the text. Transparent overlays or outline diagrams adjacent to photographs may be used to highlight important features or annotated digitally. Grid reference, compass orientation and scale should be included as a matter of course.

Please discourage the indiscriminate use of photographs, which lack location and annotations. Only include photographs, which are directly relevant to the investigation. As a general guide no more than 8 to 10 photographs should be included. Many candidates included some excellent photographs this year but the majority were poorly annotated.

Statistical analysis is recommended if it is appropriate to the data collected. Excellent investigations on sedimentary environments included work on sorting, skewness and kurtosis. Particle size and shape was assessed using Zinng's, Krumbein's and Cailleux's indices. Spearman's Rank, Chi Square and Vector analysis were also used by some centres. Point counts were used to assess the mineralogical composition of rock and sediment samples.

Spreadsheets were used by a number of centres, but not always to the best effect. Printouts of cumulative frequency graphs, Zinng diagrams and histograms were rarely annotated to show evidence of thorough analysis and interpretation.

Evaluation

Evaluation must be included as a **separate section** within the report. It is an opportunity for students to reflect objectively on the work they have carried out. The quality of evaluations varied from sophisticated and thorough to simplistic and inappropriate. It may be worthwhile suggesting to students to break up the evaluation into a number of distinct components:

Evaluating the planning sheet they completed. How appropriate were the techniques and methods they selected? This may refer to methods of sampling, sample size and sample number.

What problems or limitations were encountered during implementation? This could involve reference to confusion between true and apparent dip or problems between the base map geology and actual rock outcrops.

An outline of the way in which the investigation could be improved, given more time and/or resources and with the benefit of hindsight.

An overview of the investigation based on the likely reliability/validity of the data collected in the available time frame. Which part(s) of the investigation(s) yielded the most/least reliable data and why? Are the conclusions made concrete, tentative or partial? How do these findings compare with published work on the same area/topic? How do they compare with the results/conclusions of students from last year? How the work could be developed further, with perhaps reference to the outline planning of extension work.

Evaluation is not a list of excuses. Naïve and simplistic statements regarding lack of time, bad weather and lack of familiarity with equipment do not form the basis of a mature evaluation. As a rough guide one side of A4 word-processed text is a probable **minimum** length for evaluation.

The Report

It is now expected that students make use of IT and finish reports to a professional standard. It was encouraging to see so many centres making appropriate use of IT this year and only a few hand-written reports were submitted.

As a rough guide, the optimum length for each report should be between 1250 and 1750 words. This excludes maps, diagrams, photographs, graphic logs and statistics. Quality rather than quantity is to be encouraged. The reports should be concise, relevant and clearly focused.
Please dissuade students from including large amounts of photocopied material from secondary sources. Also avoid long-winded generalised introductions on the classification of igneous, sedimentary and metamorphic rocks.

The report should be based on the primary data collected in the lab or field and there should be some cross-referencing between the two. Safety considerations should be briefly acknowledged and students should be encouraged to be aware of the importance of the need for conservation of geological sites. The report might include the following sections, though they may be subsumed under a smaller number of headings:

- Contents Page
- Location Map
- Introduction
- Aims/Hypotheses

- Safety Aspects
- Methods Of Data Collection
- Data Presentation
- Data Analysis
- Statistical Analysis
- Graphs/Printouts With Annotations
- Photographs With Annotations
- Conclusions
- Evaluation
- Bibliography
- Acknowledgements

Standards

The standard of coursework marking this year has been the most consistent for many years and suggests that the vast majority of teachers have fully engaged with the assessment objectives and are able to award marks appropriately to their students' investigations.

Help and advice is available at any time via the Subject Officer at WJEC.

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Coursework for 2016 can be submitted from mid-April 2016.
The deadline for submission of on-line marks and the coursework sample is 15 May.
This date will be remain the same in forthcoming years.

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