WJEC
CBAC

GCE EXAMINERS' REPORTS

GEOLOGY
AS/Advanced

SUMMER 2011

Statistical Information

This booklet contains summary details for each unit: number entered; maximum mark available; mean mark achieved; grade ranges. *N.B. These refer to 'raw marks' used in the initial assessment, rather than to the uniform marks reported when results are issued.*

Annual Statistical Report

The annual *Statistical Report* (issued in the second half of the Autumn Term) gives overall outcomes of all examinations administered by WJEC.

GEOLOGY

General Certificate of Education

Summer 2011

Advanced Subsidiary/Advanced

Principal Examiner: Mr. David Evans

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
GL1	1521	60	38.6

Grade Ranges

A	47
B	41
C	35
D	30
E	25

N.B. The marks given above are raw marks and not uniform marks.

The GL1 examination was designed to test a wide range of skills including the interpretation of maps, diagrams, photographs, thin-sections and a geological map. As usual the paper covered a broad selection of the specification content and included both straightforward and more complex ideas, making it appropriate for a wide ability range. Students generally performed quite well on this paper with many gaining high marks on the more open-ended latter parts of each question.

Q.1 (a) Most candidates were able to draw the relative direction of the plate movement correctly although surprisingly, fewer correctly identified the 3 types of plate boundary using the terms provided.

(b) Most students were able to explain the formation of earthquakes on the San Andreas fault. Many candidates recognised that the processes involved in subduction lead to an increase in focal depth from X to Y. However there were a range of answers to this question, with weaker candidates merely attempting an explanation in terms of the relative thickness of oceanic and continental crust.

(c) The best candidates noted that beneath locality A, magma of basaltic composition would originate and explained this in terms of partial melting of mantle material. Good candidates also commented on the role of decompression melting. The weaker answers simply commented on eruption of basaltic lava which showed a clear mis-interpretation of the question.

(d) The increase in width of the Gulf of California was well noted with reasons linked to processes at the oceanic spreading centre or related to the movement of the San Andreas Fault.

(e) The best answers stated a reduction in size of the Juan de Fuca plate and explained this in terms of the relative rates of spreading and subduction. Many answers simply explained that the plate would become smaller "due to subduction" for which full credit could not be given.

Q.2 (a) The histogram was generally well drawn although a few candidates made errors in the use of the scale on the axis showing the frequency. Few candidates achieved full marks for drawing the texture of the rock. The most common mistakes were to draw grains rather than interlocking crystals, or to draw both phenocrysts and groundmass as euhedral, or both as anhedral. Most students correctly explained the texture in terms of a two-stage cooling process with slower and faster rates related to a change of depth of crystallisation.

(b) Most candidates correctly identified mineral Q as biotite mica. In addition most students recognised the silicic nature of the rock and so noted that mineral R would need to be one found in such conditions. The most common correct responses were plagioclase feldspar and muscovite mica. In section (iii) the best students correctly identified the rock as granite based on the coarse crystal size and the presence of quartz and orthoclase feldspar.

(c) This question was designed for students to come up with their own interpretation of the available evidence. Consequently a wide variety of plausible answers were acceptable. The most common correct responses related to contact metamorphism adjacent to rock E, xenoliths and two adjacent igneous intrusions. Weaker answers commented on sedimentary processes.

Q.3 (a) The best answers noted the rounded grains, reasonably good sorting, and made use of the scale to comment on grain size. The weaker answers commented on features of igneous rocks.

(b) Most students correctly recognised the relative hardness of the two minerals and the presence of cleavage in feldspar rather than quartz, and used this information to comment on the relative resistance of the two minerals to erosion. The best answers also developed the role of hydrolysis in the conversion of feldspar to clay minerals.

(c) Many students correctly identified G as orthoquartzite and H as arkose. Weaker candidates confused metaquartzite with a sedimentary rock. Another common error was to note the angular nature of the grains in sandstone H and interpret the rock as breccia despite the sand sized grains within the sedimentary rock.

(d) This was a well answered question with many students noting the umbo of two bivalves and a set of ripple marks.

(e) Many students were able to gain the 4 marks available by piecing together the evidence from three photographs. The best answers noted the fragmented bivalves, ripple marks and rounded quartz grains as evidence for a high-energy aquatic (commonly shallow marine or beach) environment with a current.

Q.4 (a) The definition of a half-life was undertaken with varying competence. Some students recognised the implication of "half the time" without understanding the concept properly, producing incorrect answers such as "half the time for a radioactive isotope to decay". However the majority of students did answer the question correctly.

(b) Many students gained the mark for noting the 50:50 values after one half-life, but fewer handled the 25:75 idea for the second half-life.

(c) A surprising number of candidates were unable to calculate that a proportion of parent isotope of 6.25% occurs after 4 half-lives. A wide variety of answers which displayed no understanding of the concept were seen.

(d) The best students identified igneous body J as a dyke because of the linear nature of the body and its discordant relationship with the surrounding country rock. Most candidates noted the impact of contact metamorphism on igneous body J and its consequent effect on the radiometric age. Weaker answers suggested that the body had intruded from north-west to south-east. Section (iii) was answered with variable success, with the better candidates noting the relative ages of body J and body K, and of body K and the conglomerate. Consequently the relative ages of body J and the conglomerate could be determined and the map completed accordingly, showing the conglomerate overlying body J.

Geology

General Certificate of Education

Summer 2011

Advanced Subsidiary/Advanced

Principal Moderator: Mr Craig Wall

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
GL2a	1440	60	34.7

Grade Ranges

A	43
B	38
C	33
D	28
E	24

N.B. The marks given above are raw marks and not uniform marks.

The paper tested the range of skills and techniques introduced in Unit GL1 of the specification. The demands made by the paper on candidates were designed to be broadly comparable with papers from previous years. It had to be, like GL2b, centre marked with moderation by the WJEC team. A meeting, whose personnel included the moderators, took place 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 to be downloaded by centres from the WJEC website. Guidance in its application was available, as in the previous year, via e-mail from the Principal Moderator. There was also a marked example available from the website. The scheme suggested expected, acceptable and unacceptable responses. It stated that alternative acceptable answers could be credited where appropriate. The e-mails 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 broadly successful. There were a very small number who failed to apply the mechanics of marking stated on the cover of the mark scheme, and these issues are discussed in their Centre Reports, which are issued alongside publication of results.

The total entry was 1440 students, with 504 scripts moderated. Of the 87 centres which entered candidates for this paper, 78 were not scaled with the original centre mark remaining unchanged. 3 centres were judged to be too harsh and 6 too generous; their marks were scaled accordingly.

The average mark rose slightly this year, but overall, the statistics for the 2011 paper are broadly comparable with those of 2010, and it is concluded that this year's paper performed at a similar level to previous ones.

Q.1 Candidates who used the mineral data sheet hardness column usually stated the expected result in part (a)(i). It must be stressed that the question was about a "dark mineral" – some students seemed to test Specimen A as a whole rather than just concentrating on the indicated mineral. Description and explanation of the texture was usually correct in (ii), but the nature of the contact proved to be more demanding with the expected answer of a large, discordant intrusion cross-cutting the country rock, not always clearly stated. Some candidates referred to a contact metamorphic aureole, but as one wasn't shown on Map 1, no credit was given. In common with previous years, Map 1 didn't contain all the information about the geology of the area and so candidates are strongly advised to base their answers only on what is published! The better candidates had little trouble in understanding the prompts given in the question stems, Specimen A, Map 1 and Figure 1 and recognised that an igneous rock was overlain unconformably by a sedimentary one. Weaker candidates lost marks by simple guesswork, including contact metamorphism.

Q.2 Specimen C was an oolitic limestone, which was fairly consistent in its texture. This year a photograph sheet was published as a guide and centre specialists are reminded to check the specimens on arrival; they should contact the subject officer if a variation in any one specimen is obvious. There was evidence that many candidates used the hand lens effectively in (a)(i). The result of an acid test was commonly seen as the answer to part (ii) allowing candidates to be credited with "limestone" (oolitic wasn't necessary). Some candidates were credited with the observation of "ooliths". Hardness was sometimes cited as a test, but again any suggestion of testing the rock as a whole was not credited. Given the scale of the ooliths, it would have been difficult to determine this property and so it was not a wise test to choose. Part (b)(i) produced a range of drawing quality, with some again being rather stylised – candidates simply have to draw what they see. Some centres were very generous in crediting the drawings despite the examples contained in the mark scheme. Any hard part applicable to a colonial rugose coral gained credit in part (ii). The last part of the question proved to be a good discriminator with some excellent explanations of either a replacement process or mould and casting, but many candidates mixed up some of the detail of possible processes of preservation.

Q.3 The skills tested in part (a) were utilised much better than when a similar question was set several years ago, but some candidates still lost marks by careless reading and application of the data. Part (b) saw a wide range of features suggested, but where candidates lost marks in the naming of the photographs, they could still be credited for their formation, provided there was correct reference to Figure 4. Similarly, credit was not given for the name when no reference was made to the data on the figure. Part (c) had a mixed response, not helped by fact that the relative age arrow can be interpreted in two quite opposite ways – the words "older" or "younger" would have prevented this confusion. Hindsight is a wonderful thing! In the event, the thought processes were in fact similar for both interpretations, with the younger rock having to be downthrown in part (i) and the older rock having to outcrop along an anticline's axis in part (ii). The published mark scheme allowed for the various interpretations of relative age.

Q.4 This produced the usual range of answers when testing metamorphism with better candidates scoring full marks and the weaker none – not all due to them simply opting out. Part (a) needed evidence only from Map 1 and it was hoped that the foliation shown in Rock Unit E would concentrate candidates' minds, especially when attempting to give other diagnostic features in part (b). Crystals could be clearly seen on Photograph 3, which showed garnets (use of data sheet). Specimen E was a slate showing slaty cleavage. Photograph 3 indicates schistosity.

Q.5 The very flexible mark scheme traditionally used in questions of this type continues to allow credit to be given for any good interpretation of the information given on Map 1. The instruction again said "complete the sketch" and so the mark scheme allowed for some variation in e.g. dips; many of the stronger candidates are "constructing" and are producing sections of the highest standard. There are still centres where considerable time and effort is spent on mapwork and their candidates score very well on this question. It is pleasing to note that there are now very few candidates who fail to score on this question.

Q.6 The chosen topic this year was how fossils provide evidence of sedimentary environments. Answers could have been entirely from a candidate's own fieldwork where similar problems have had to be solved, but it also could have been answered using Specimen M and/or Photograph 4. Some good responses were seen, but far too many candidates interpreted this question as being solely theoretical and consequently they ignored the rubric and produced mini-essays (or in one case, a 4 page answer!). The total of 6 marks is a good indicator of the time to be allocated to this question. Future papers will contain questions which will be much more tightly phrased with the key word "must" replacing "should".

A reserved credit was given for "uniformitarianism" – not often awarded and resulting in very few candidates gaining full marks on this question. In fact most candidates gained half marks or less. More students failed to score in this question than in any other on the paper, usually by just ignoring it. This has been the pattern since this style of question was transferred from paper GL1.

A wide range of credit was awarded provided candidates attempted to interpret fossils (preferably named) and environment. Any valid statement gained marks even where the interpretations differed between candidates e.g. is Photograph 4 a life assemblage indicating low energy conditions (many of the fossils are whole) or high energy (strongly ribbed shells) or has it characteristics of a death assemblage (some broken fossils)? The photograph shows a marine environment (uniformitarianism – brachiopods) where water was shallow (benthonic fossils). Specimen M (a coral) lived (uniformitarianism) on a marine reef, where the water was shallow, warm, turbulent but clear and of normal salinity – better candidates commented on why this was so.

Some candidates wrote about zoning fossils and gained no credit.

GEOLOGY

General Certificate of Education

Summer 2011

Advanced Subsidiary/Advanced

Principal Moderator: Dr Alan Seago

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
GL2b	222	60	41.2

Grade Ranges

A	48
B	42
C	36
D	30
E	24

N.B. The marks given above are raw marks and not uniform marks.

23 centres submitted field investigations for moderation including some centres operating as a consortium It is pleasing to report that centres are taking note of comments made in individual centre reports in previous years so that there is a continuing improvement in the suitability of tasks being undertaken and the quality of candidates' work. Few centres now require scaling. There are two main reasons why scaling has to be applied:

- reliable rank order but marks generous or severe;
- failure to show how criteria have been achieved by annotation of candidates' work.

Centres should be aware of the required context of the investigation at all times as described in the specifications.

Centres are to be congratulated on;

- the standard of work produced by the candidates;
- the opportunities given to the candidates to study geology in such suitable areas;
- and in most cases the accuracy of the assessment.

The enthusiasm for geology and expertise of the teaching staff in centres is obvious from the quality and effort put into coursework submissions.

There were one or two examples of errors in administration such as using the incorrect forms, not doubling the marks to a mark out of 60, errors in addition of marks, discrepancies between marks on the work and on the forms and not authenticating the work of candidates.

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 can be 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.

In some cases there was no risk assessment although the number of instances is decreasing. It was pleasing to see the extensive use of the Planning Tracking sheet. **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. 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. **Evaluation still remains the weakest skill.**

Some field notes consisted entirely of tables of data and it would be an improvement to see a variety of data collection including field sketches and rock descriptions etc. In a number of cases, opportunities for the collection of basic field data have been missed. **Observations such as rock identification, grain size, sorting, direction of cross-bedding, clast roundness/orientation, field sketches, dip and strike measurements should normally be part of every investigation where appropriate.** There is no need for candidates to repeat observations made in the field notebook within a report unless it contributes significantly to the analysis. It is more advantageous for candidates to concentrate their efforts on the analysis and evaluation. 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 moderators. Candidates are making good use of their IT skills.

A range of tasks were 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;

joint orientation related to faulting (rose diagrams and stereonets);

structural analysis (faulting and folding styles related to compression or tension or to specific orogenies);

textures of Quaternary coarse grained sediment;

nature and relative age of igneous intrusions;

evidence for contact metamorphism around a granite intrusion;

interpreting past plate boundaries through analysis of volcanic rocks.

Centres are to be congratulated on the variety of opportunities given to candidates in areas of outstanding geology such as Cardigan Bay, Isle of Arran, Pembrokeshire, Ogmore, Styal Mill, Tenerife, Gower Peninsula, Dorset, Black Mountain, Lake District, Staffordshire, Devon and Cornwall. Other centres made good use of suitable local geological locations.

Centres should be aware that there is help available from WJEC. Published exemplars of coursework investigations can be obtained from WJEC and CPD events are provided. Moderators' reports on the current moderation process are sent out to centres. Centres are urged to act on any recommendations in the moderators' 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 the centre could discuss suitable investigations with the Principal Moderator through email/ telephone as several centres do. This can include advice on the suitability of coursework investigations prior to carrying them out and examination of candidate's draft field investigations. 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 moderators' report or assistance with future presentations please contact the Principal Moderator at the following e-mail address: a.seago@open.ac.uk

GEOLOGY

General Certificate of Education

Summer 2011

Advanced Subsidiary/Advanced

Principal Examiner: Mr Pete Loader

Unit Statistics

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Unit	Entry	Max Mark	Mean Mark
GL3	1275	50	29.3

Grade Ranges

A	35
B	31
C	27
D	23
E	19

N.B. The marks given above are raw marks and not uniform marks.

Section A

Section A was generally less accessible for the weaker candidates than previous years. Question 1 was generally very well done though Question 2 proved to be more demanding with many very vague answers which did not answer the question set. A number of illegible scripts made the task of marking difficult in some cases and candidates run the risk of gaining few marks if this occurs.

Q.1 (a) (i) The vast majority were able to correctly measure the distance on the map within tolerance.

(ii) Only a few were unable to make a valid statement about the proximity of the fault to the nuclear power station though often candidates answered by inference with many responses being far too vague e.g. "*it might affect the reactor*", without qualification.

(b) (i) This proved to be a good discriminator and candidates who used the evidence from Figure 1b were given full credit. In a number of cases the evidence for normal movement was given for the fault identified as reverse or even strike slip. The terms "hanging wall" and "footwall" were generally not used. A not uncommon response was "*the fault dips towards the sandstone / shale*."

(ii) Another good discriminator. Some candidates were clearly not at ease with the concept of maximum and minimum ages and only where it was clearly stated that the fault did not affect (cut) the Quaternary raised beach deposit were full marks awarded.

(c) (i) This was generally answered correctly even if candidates had previously lost marks on (b)(ii).

(d) This was generally well done for those who answered the question directly using the data. A common correct response referred to the possibility of landslip, coastal erosion or tsunamis and cited evidence from the data given or knowledge of the plate setting of California. Poor grammar was one of the main obstacles to candidates obtaining full marks.

Q.2 This question was more of a challenge to some, though generally because candidates failed to answer the question set or interpret the data given; overall a very disappointing response.

(a) A significant number of students interpreted the question as "explain HOW" rather than "explain WHY". Rather than explain the geological factors associated with dipping beds, the hydrological setting and variation in rock type, they concentrated on a discussion of the monitoring techniques – which were then repeated in part (b)

(b) This question was set in response to previous poor attempts at an essay on slope monitoring and was equally poorly answered in very vague terms that often gained little credit. Ground levelling was rarely related to changes in height, surface strain was seldom linked to the monitoring of cracks (despite Figure 2), and many who chose micro seismic monitoring suggested that this was somehow linked to the vibrations of distant earthquakes that ultimately brought about the destruction of the face. The monitoring techniques Q and R were also poorly outlined though the EMD (P) was better understood. A very large number of candidates suggested that "any" change was indicative of sudden failure and only on rare occasions were the rates of change in the data collected by the monitoring instruments used.

(c) This was generally well done with reference to Rock Bolts. Candidates who chose retaining walls often gave vague answers about "holding back" the slope and few referred to supporting the toe of the potential slide. The reason for the suitability of the rock step to lower the overall angle of the slope was only mentioned by the more able candidates. Weaker candidates simply repeated the stem of the question by stating that the method was suitable as it "helped stabilise the slope".

(d) References to pore pressure, reduction in friction and increasing the driving force of the slope were only mentioned by the more able candidate and again weaker candidates simply restated the question without explaining "how". For example, "*Prolonged rainfall will reduce the stability of the slope because of changes in the water table*" was an all too common response.

Section B

Question 4 was by far the most common question chosen and marks awarded covered the whole range. The few that did question 3 either wrote essays that were excellent or very poor with few in the middle perhaps reflecting the level of interest or an inability to do one of the others. Question 5 was generally done poorly.

Q.3 (a) Clearly many candidates who did this were often unaware of the number of marks (15) available for part (a). Weaker candidates gave superficial responses that vaguely referred to permeability and porosity (often confused) and were often short, whilst the more able candidates discussed texture (size, shape and sorting of the grains), packing etc. and its effect on the ability of leachate (or gas) to pass through the beds. Faults and joints were often mentioned but those who gained higher marks the discussed the effect of structure (bedding, joints, faults and folds).

(b) Whist this part was better answered, few gave really convincing explanations and even fewer referred to real case study material.

Q.4 (a) This was by far the most popular choice and was generally well done.

(i) The potential benefits of living in a region of active basaltic volcanoes posed little difficulty to most and many candidates scored good marks for descriptions of tourism, fertile soils and geothermal energy. However, some bizarre interpretations of the question resulted in suggested benefits that included "*gentle, non-explosive eruptions*", "*jobs for volcanologists*", a cheap "*waste disposal method*" and a "*quiet life*" (as no none wants to live there!). A significant number of candidates ignored the reference to **"basaltic"** eruptions. This was particularly evident with regards the examples. Although Icelandic and Hawaiian studies were the most common, Mt Saint Helens, Vesuvius and Pinatubo were freely quoted.

(ii) This was generally well done although many accounts were far too vague. Lavas and ash were the most common acceptable choices followed by lahars and gases (particularly lake overturn). However, pyroclastic flows were also very popular but are not related to **"basaltic"** eruptions. Details were usually lacking when lavas were discussed and most accounts amounted to "*lavas are hot and destroy crops and buildings*". Ash was discussed much more comprehensively often with reference to breathing difficulties, roof collapse and air travel. The term "viscosity" is still not well explained and a significant number of candidates claim for example, "*basaltic lavas have a high viscosity and flow quickly*".

(b) This area of the subject is well understood and was done well by all apart from those candidates who ignored the word "effectiveness" and just wrote all they knew about preventative measures. Radon is commonly quoted as the gas most commonly monitored in volcanic areas. There were some candidates who discussed two or more case studies (as required) but repeated much, especially monitoring techniques. There were some very good discussions where candidates compared two case studies such as Iceland (range of effective measures) with such as Montserrat (limited effectiveness). Occasionally the discussion drifted into earthquake studies.

Q.5 (a) This was not a popular choice and generally poorly answered.

(i) Most accounts amounted to "*take the rock out and roof caves in as there is no support and there will be subsidence at the surface.*" Very few candidates discussed the rock types, structure (dip, jointing, cleavage etc) in any great detail.

(ii) This was covered more comprehensively as porosity and pore pressure are well understood.

(b) Acid mine drainage was rarely covered in any great detail. Most candidates just suggested that when a mine floods the water dissolves or picks up minerals and toxins. Overpumping at wells was well covered and the concept of cones of depression was well understood. Salt water incursion is also well understood in principle but the general standard of diagrams and explanations was poor.

Two good websites related to this subject that might be of useful to teachers are at:

http://www.slideshare.net/sankarsulimella/slopestability

http://www.slideshare.net/sankarsulimella/subsidence-in-coal-mines

GEOLOGY

General Certificate of Education

Summer 2011

Advanced

Team Leader: Ms Jo Conway

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
GL4	880	100	60.7

Grade Ranges

A	73
B	65
C	57
D	49
E	41

N.B. The marks given above are raw marks and not uniform marks.

Questions certainly discriminated between candidates, and a wide range of marks were seen, with some reaching near perfection. The mean mark was almost 4 marks higher than last year, with the standard deviation showing a big spread. Data suggests that the candidature is similar to previous year, and the exam team felt the paper was more accessible to candidates. There was a small decrease in the number of candidates sitting the paper from last year, with a slight increase in the proportion of females in the candidature.

Section A

This section assessed areas which candidates usually find very challenging – in depth knowledge on igneous processes in Q1 and metamorphic rocks in Q2, three-dimensional rock deformation concepts in Q3, and climate change over geological time in Q4.

Item level data revealed the metamorphism based Q2 (usually most challenging topic to students) was the most accessible question to students this year, and Q5 (the introduction to the mapwork) the least accessible.

Section B

As in previous years the candidates showed they are getting familiar with the style of questioning and reasoning and a good range of answers were seen. Q5 was a "traditional" question designed to give some familiarity with the main features of the map. Sedimentary rock characteristics linked to the map in Q6, also brought in the fossil aspect of the specification in the later stages of the question. Q7 and Q8 were similar to previous years in testing deformation and culminating in an overview of all factors linked to extending the AS level concepts in synoptic testing.

The paper must be taken as a whole in its coverage, and examiners make use of relevant links wherever possible to point to the specification, aiming to assess the skills-based approach of responding to data. The maps used are "real data", which means that they can include with a wealth of information which cannot be touched on in an approximately 1 hour segment of the exam. The questions set by the examiners are an attempt to help focus the students onto specifically relevant data. This may draw out particular topics in Section B and the examiners attempt to balance the specification across the paper. It is a challenge to the examiners to find maps which are "simple enough" for the number of questions available yet "complex enough" to stretch and challenge the candidates.

Section A

Q.1 The question focused on data for an unnamed dolerite sill, with a wealth of information for the candidates to use.

Candidates scored well on this question, demonstrating good levels of response to the range of data given and showing very good knowledge and understanding.

(a) The majority of candidates got this correct.

(b) The majority of candidates got all three parts of (i) correct by reading off the graph. The best answers in part (ii) explained the change from Ca-rich to Na-rich linked to temperature change and Bowen's Reaction Series.

(c) The majority of candidates were able to draw a line for olivine corresponding to the lowest point of both augite and plagioclase. In part (ii) credit was given for upper or lower chilled margin and an explanation linking to faster cooling.

(d) A wide range of responses were seen here. Low level answers failed to link mineralogy to formation temperature for stability. Excellent answers were also seen using a wide range of specialist terminology.

Q.2 The question focused on metamorphism.

Candidates scored well on this question, demonstrating very good levels of knowledge and understanding of a topic which they often find the most challenging.

(a) The majority of candidates got this correct.

(b) (i) Incorrect responses here showed candidates were unfamiliar with calculating geothermal gradients. Candidates were instructed to show their working, though some seemed to conjure up random figures as an answer. In (ii) the majority of candidates drew a correct line which aimed from the origin towards 12 on the pressure axis. Candidates were stretched by (iii) – both high temperature and low pressure were required for 1 credit, contact metamorphism and gradient B gave the other 2 marks.

(c) A surprising number of candidates struggled with labelling a porphyroblast on Figure 2b, and in part (ii) despite metamorphism being stated in the question stem, many candidates confused metamorphic and igneous processes here. Little credit could be given to candidates who described igneous processes involving two stage cooling from a melt. The best answers talked of large garnet crystals disrupting the finer foliated groundmass of mica.

(d) Generally candidates drew a line to show the most recent foliation. Weaker candidates struggled with this, often leaving it blank or picking out the original foliation of the garnet. This proved to be a good differentiator – especially the answers for part (ii), where the evidence of change was required rather than just stating that it had changed. The best answers talked of the maximum principle stresses being E-W for the original foliation to be aligned N-S and changing to N-S most recently for the E-W foliation.

Q.3 This question examined the rock deformation and structural element of the specification. As in previous years candidates found this a challenging question. This has been examined by means of block diagrams and 2D cliff faces in the past, and this year the first part of the question was assessed in a similar manner to that seen in 2008, via a map. Candidates accessed the whole mark range.

(a) Candidates coped well using the skills of geological time to order the events and show correct cross cutting relationships. They found the fault offset of the fold the most challenging part of the question and though some exposures were drawn in already many failed to use these data points, and simply mimicked the Tertiary fault on the figure and drew a strike slip displacement instead of a wider outcrop of the Silurian Shale. The key chosen for the rock units was simple and did not require candidates to spend much time shading in.

(b) The majority of candidates correctly stated reverse.

(c) The formation of slickensides was correctly given by the majority of candidates. There were some excellent additions to Figure 3b and extra diagrams drawn below the answer to illustrate the movement directions.

(d) Candidates did not seem unduly perturbed about flicking back to the previous page for the evidence for part (d), although it would have been aesthetically pleasing to have the question on one single double page spread this would have cramped the data and limited space for candidate answers. As last year, examiners were looking to credit evaluative statements which explained the evidence rather than candidates simply rephrasing the question stem or stating yes or no. The majority of candidates correctly talked of the dyke cross cutting the Triassic, Fault A being downthrown to the SW as the youngest rock (Triassic) was to the SW, and as the vertical dyke was offset Fault A must show strike slip movement. Only the better candidates saw the tension for the dyke being NW-SE as the dyke is orientated NE-SW and only the highest level/best candidates saw that the last movement of the fault was vertical according to the slickensides.

Q.4 The question focused on climate change over the last 150,000 years of geological time.

Candidates responded well to the data and the whole mark range was seen, with candidates demonstrating good levels of knowledge gained from their studies.

(a) Candidates on the whole responded well to the data response question, although a small number regurgitated learned data and did not use Figure 4a to work out the cycle length. A variety of spellings of 'obliquity' were seen!

(b) The majority of candidates got part (i) correct and some candidates showed "thought process workings out" on the graph (eg. Present = high CO_2 = interglacial). Part (ii) was a good discriminator. Candidates needed the link that ^{18}O was heavier than ^{16}O and this meant more ^{16}O would be evaporated from the sea during colder times. The oceans then being richer in ^{18}O during the cold glacial period, and the ratio of ^{18}O:^{16}O (being richer in ^{18}O) being recorded in the shells of forams of that period.

(c) The majority of candidates got this correct.

(d) The positive correlation in part (i) was identified by the majority of candidates with the better candidates pointing out the strength of the correlation for the second credit. Part (ii) tested the high-level critical evaluation skill. The majority of candidates noted that the cause and effect were not established and then gave very good examples of other contributory factors which could cause the change instead.

Section B

The 1:25,000 solid and drift map extract of Clitheroe and Gisburn was clearly reproduced, accompanied by a cross section. 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, hence some extraneous information was removed from the Generalised Geological Column by the examiners in an attempt to help focus the students onto specifically relevant data. The X-Y line of section was also partially embolded to aid students.

Q.5 This question intends to get candidates familiar with the map and was generally well done.

(a) This was well answered.

(b) The majority of candidates gained full credit here. Candidates were asked to show their working, allowing the examiners to track how the candidate has arrived at an answer and possibly award marks if the answer (or initial measuring) is incorrect but the correct method has been used. Parts (iii) and (iv) were more challenging to candidates.

Q.6 This question based on the sedimentary rocks also linked into fossil content and used the map as a starting point, making the candidates think about the "real" situation and the relevance of geological learning. The question differentiated well showing a full spectrum of marks.

(a) It was pleasing to see that the majority of candidates had little difficulty with reading off or plotting data on the triangular diagram.

(b) In describing the environments of deposition, the key to describing and explaining was the use of evidence, and many candidates simply gave lists of environments without any link to the evidence from the table. Rational answers with evidence were given full credit. The majority of good answers focused on the fine-grained laminated shale indicating low energy conditions with a marine fossil content for the UBS, while the PG indicated higher energy with erosion surfaces, and fast moving currents to create the flute casts. High calibre candidates gave good explanations of turbidites or meandering river channels with the land plants being washed in.

(c) Students found the explanation of the spring locality more challenging. Examiners were looking for a link to the map as a grid reference was given, pointing candidates to the juxtaposition of rock types: Bowland Shale and Pendle Grit, from which they could look at the table for the grain sizes and talk about permeability characteristics and the water being forced to the surface.

(d) Part (i) was very well answered. Part (ii) caused some candidates more of a challenge, as it was looking to assess the use of just the fossil shown in the figure. Good answers did not include lists of modes of life or environments, but did focus on the assessment. The majority of candidates recognised that only the pygidium was shown and this would have very limited use in determining mode of life. Better candidates were able to talk about the issue of using an extinct organism in environmental reconstruction with no links to uniformitarianism.

Q.7 A standard question testing the structural elements of the map. Candidates performed well on this question and examiners saw the whole mark range being used.

(a) The majority of candidates were able to name the type of fold as an anticline and state the direction of plunge to the southwest, with students showing the same issues as in previous years in determining plunge direction. Although teachers of the subject will recognise a monocline in the cross section, the term is not in the A level specification and 'anticline' or 'antiform' were the most commonly seen correct answers. Only a handful of candidates left the answer blank, as they did for the entire question 7, showing that this did not limit them.

(b) The majority of candidates were able to correctly draw in the axial plane trace and plunge direction. Disappointingly there were quite a number of the candidates who contradicted their answers for the plunge direction for (a) and (b).

(c) Better candidates recognised that the "wavelength" was only half the true value, requiring a further axial plane trace to get the true measurement.

Q.8 Candidates performed very well on this question and examiners saw the whole mark range being used. Only a very small minority left this question completely unanswered. Candidates should be reminded that the last question in Section B is a significant proportion of the section marks and they should endeavour to answer it.

(a) The majority of candidates were able to suggest geological explanations for the reservoir siting. The most common answer was the impermeable shale allowing less leakage.

(b) Examiners saw a very wide range of answers here. A list approach with no links to the map will never score very highly and the best answers showed evaluative skills and made specific reference to the map. A number of candidates incorrectly explained that the rock dip was very steep and this would lead to landslides, when it was the steep slope (exceeding the critical angle) which was the factor more responsible than the shallow dip of the rocks (of 8 or 9°). Very good answers showed candidates building on their GL3 knowledge with discussions of pore water pressure and lubrication of rocks.

GEOLOGY

General Certificate of Education

Summer 2011

Advanced

Principal Examiner: Mr Elliott Hughes

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	**Max Mark**
GL5 (all options)	80

Grade Ranges

Option	**01**	**02**	**03**	**04**	**05**	**06**
A	56	54	53	56	55	53
B	49	47	46	49	48	46
C	42	40	39	42	41	39
D	36	34	33	36	35	33
E	30	28	27	30	29	27
Entry	224	130	125	132	189	75
Mean	47.9	43.0	46.9	47.8	44.2	46.2

N.B. The marks given above are raw marks and not uniform marks.

Geology GL5

General comment: All section As proved to be very accessible and no major problems were reported. The essays were very discriminatory with the usual problems of candidates not adhering to the rubric. When totalling marks the added weight of Section B was very noticeable. Some candidates scored lowly on Section A but highly on the essay which resulted in a high overall mark. The converse was also true. Some scored very highly on Question 1 but ended up with a low final score because of a poor attempt at the essay. It is again pleasing to report that spelling is not a major issue. However, there continues to be a problem with the legibility of some scripts. It often proves very difficult to ensure that candidates are given full credit for their responses.

Many candidates are still not making adequate use of diagrams in Section B and their use of English is often not good enough to merit high marks.

Candidates' ability to evaluate continues to please. The aim is to set questions which are accessible enough to allow the average candidate to score reasonably well with descriptions of geological features. The ability to produce adequate explanations takes candidates to a higher grade. To identify, and extend the very best candidates an evaluation is now required and, where possible, the type of evaluation expected has been shown in the published mark schemes. Although weaker candidates inevitably find evaluation difficult, it has been very pleasing to see that even some of these can now often provide rudimentary evaluation, resulting in an improved grade.

Breadth versus depth was employed by candidates and credited by examiners in many essays. However, care has to be taken with some essays. ALL components of the essays must be addressed at some level if the candidate is to obtain the highest marks.

The use of field locations continues to be an issue. Candidates should be aware that this is a convenient way to improve their marks. However, although a grid reference is not expected, "Yorkshire" is not considered to be sufficiently precise. On the other hand, in most cases, "Ribblesdale" is acceptable, although "south Ribblesdale" would be better.

The use of numerical data in answers is readily credited.

Candidates should be encouraged to quote field locations, make quantitative descriptions, and use labelled diagrams whenever possible.

Unit 1 - Quaternary

1. (a) (i) Generally well answered, with a wide variety of acceptable answers, 'hill and vale' being one of the more common. Very few candidates used the term 'cuesta'.

(ii) Again, generally a well answered question. Most candidates identified that the limestones were more resistant to erosion than the shale, with some noting that the conglomerate was also resistant to erosion.

(iii) Reasonably well answered. Most candidates identified the boundary between the limestone and the shale as being key, but very few mentioned the level of the water table.

(b) (i) Very well-answered, with a wide variety of descriptive terms employed to describe the shape. "Diamond-shaped" was common. Some candidates did not provide any dimensions of the body. Any reasonably accurate dimension (height, width, sides) in metres was acceptable.

(ii) Relatively few candidates correctly identified this structure as a reef, (some suggested that it was a glacial erratic) with many only talking about broken fossils being transported to this site and deposited. Most used the corals as the key feature in determining the environment.

(iii) Poorly answered. A major problem was candidates reluctance to adhere to the rubric which asked for "processes." Only a small number of candidates suggested that this was a reef growing in situ and that coral growth continued as the limestone was deposited. The most acceptable answers described the accumulation of fossil remains which were cemented by calcite that was precipitated from warm waters or supplied by algae.

(c) Candidates employed two acceptable ways to gain full marks here. The first route was to just use Figure 1a and conclude that the interpretation was incorrect as the depth fluctuated. The second was to rely more on Figure 1b to claim that the interpretation was correct. Most candidates correlated limestone with shallow water and shale with deep water. Hardly any candidates questioned this. A very small minority combined the information from all three figures to produce a very competent evaluation that deserved more marks than were on offer.

Q.2 This question was not well answered. Generally the glacial part of the question was covered much better than the interglacial part with very few candidates mentioning, for example, the formation of peat and the increased fossil content of deposits during interglacial periods. The description of glacial landforms and deposits was the area in which most candidates scored their marks. A few candidates talked at length about periglacial features which were only really tangential to the question. Many candidates correctly identified that erosion can leave an incomplete record, but generally, evaluation was quite poor, with few mentioning that sediments from marine deposits can potentially provide a more continuous record.

Q.3 (a) Well-answered, with some excellent diagrams, although few candidates actually noted that the amount of uplift etc. could actually be easily quantified. By far the most common choices were raised beaches, submerged forests, rias and fjords. A few made excellent use of river terraces, knick points and entrenched meanders. A number of the better candidates discussed the evidence from oxygen isotopes, relating to global ocean volumes etc. although some omitted to state where the isotopes are recovered from. There was good use of pertinent examples in this question, from Scotland and S England.

(b) The second part of the question was reasonably well-answered, with most candidates being able to describe eustatic and isostatic changes in sea level, giving examples. However, evaluation was generally poor with few candidates discussing the fact that both causes of sea level change had to be considered together. Hardly any candidates mentioned that tectonic activity or global warming can cause sea level change that is unrelated to continental ice sheets, and similarly that the melting of sea ice has no effect on sea level.

Q.4 This was the most popular question, which was generally answered reasonably well.

(a) The first part of the question was answered more fully than the second part, with some good descriptions of the process of sediment accumulation, collapse, transport and deposition. Weaker candidates tended to ignore density, speed and erosive characteristics. Many candidates noted the Grand Banks as an example.

(b) The characteristics and features caused by turbidites was usually clear. However, evaluation was generally quite weak with few candidates addressing adequately the use of the structures in assessing the nature of the physical processes. Although some candidates drew diagrams that hinted at a cyclic nature of turbidite sequences, very few actually discussed this. Many cited flame structures and load casts without realising that they were the result of post depositional processes and not the processes of formation.

Unit 2 - Natural Resources

A common assumption in Question 1 was that the ore was native copper, however this did not disadvantage candidates.

Q.1 (a) (i) A surprising number of candidates did not read this question properly and commented on the distribution of copper over the area. Those that read the question correctly did well. Most gave the spacing as 1km but a significant number claimed that the points were in a $10km^2$ grid.

(ii) The two 50ppm lines proved more of a problem than the 200ppm area.

(iii) Generally well answered with a wide range of suggestions. By far the most popular was that the analyses are time-consuming and expensive.

(b) (i) Relatively poorly answered, with many candidates drawing the ore body unfeasibly big (i.e. too far down river). Pleasingly though, few candidates extended the ore body as far west as the 200 ppm point.

(ii) A well answered question. The most common answer was (along the lines of) that due to its high density any copper (ore) will be deposited when the energy of the streams falls. Thus, further downstream the ore will be progressively removed and its concentration will fall as a result. A significant number ignored the rubric and stated that the copper was in solution and would be diluted as more water flows into the streams.

(iii) A wide variety of answers that were mostly sound and scored good marks. However, a lack of evaluation meant that many candidates did not secure 4 marks for the question. It was clear from many answers that candidates thought that the ore body was composed of native copper. Some candidates commented that the only way to confirm the presence of the ore body was by the use of bore holes and invariably were awarded full marks. A few claimed that a magnetic survey would locate a copper ore, as the latter is a metal and therefore magnetic.

Q.2 This was a well-answered question. Diagrams were generally well used and this was encouraging to see. Although evaluation was better than in the other questions, it was still relatively poor, which prevented some candidates with otherwise good answers from scoring higher marks. In terms of good evaluation in this question, candidates should have talked about the importance of other processes, such as the source of elements, tectonic setting, rock structure, geological history etc. – but few did this.

Q.3 This question was the most popular choice of essay and was reasonably well-answered. Many candidates scored good, yet not exceptional marks – simply because there was in most cases little attempt made to evaluate the effects of geological processes. The best candidates described the major factors and explained why they were all essential to the accumulation of economic deposits of hydrocarbons. Diagrams, particularly of traps were the most noticeable positive feature of this question.

Q.4 The vast majority of candidates chose coal as the named resource. A few chose oil, which was not the best choice as these candidates, then struggled to find much to write about in part (b). Where coal or a metalliferous deposit was chosen in (a) most candidates discussed all the usual suspects and mitigations (noise – baffle banks, dust – wetting wheels etc.) Evaluation was, as in the past, the weakest part of this type of question, which prevented the vast majority of candidates from securing high-level marks. Candidates should be made aware that because it is assumed this will be a case study, very specific details are expected for high marks. Examples are "explosives are used to break up the rock", "machines are used to break up the coal" or "to stop the noise they plant trees." Examiners expect some discussion of how, and perhaps what explosives are used and what the specific results are. What types of machines are used? Why? Also, what types of trees were planted in their case study. Why? Were they effective?

Unit 3 – Evolution of Britain

Most candidates found Section A much easier than Section B. Section A was very accessible but, candidates struggled with the evaluation part of the essays.

Q.1. (a) Generally well-answered, although some candidates found it difficult to put into words.

(b) Very well answered with most candidates scoring 2 marks.

(c) (i) Generally well answered although some candidates did not read the question properly and discussed **multiple** lines of evidence for this conclusion. Corals were the most popular choice and many were able to produce convincing arguments invoking the Law of Uniformitarianism. Some just stated that corals mean "shallow marine", ignoring the fact that this had been given in the stem.

(ii) Generally slightly better answered than (i) with turbidites being the most popular choice. The significance of black shales is well understood and many were able to put forward a convincing argument for pillow lavas, even adding a reservation that they can be produced in shallow water or even on land, under ice. Such arguments are readily credited.

(d) (i) Very well answered, although there were considerable variations in the angle that the boundary was drawn across Britain.

(ii) Quite a few candidates completely missed the point of this question, and failed to discuss evidence for N and S Britain being on separate continents during the early Palaeozoic and merely described the fossils, environment etc on one of the two fragments. The best answers discussed fully palaeomagnetism, palaeontology and igneous processes in relation to separate continental masses. Some ignored the rubric, and the evidence provided, to write from their knowledge a mini essay on plate tectonics in the early Palaeozoic.

Q.2 A popular question that was generally well- but not spectacularly-answered. There was a considerable amount of confusion as to what actually constituted Variscan events (e.g. Snowdon volcanism and the Exeter volcanics). A surprising number of candidates did not mention the Lizard ophiolite, or the preservation of the South Wales coalfield in synclinal basins. Evaluation was very poor, to non-existent on this question which prevented many candidates securing the best possible marks. Having said that, there was a very small minority of very able candidates who put forward the case for a destructive plate boundary and orogenesis but then questioned this interpretation, namely in view of the low-grade metamorphism, lack of volcanics, metamorphism of the Lizard ophiolites and one candidate posed the question "where have all the mountains gone?"

Q.3 This question was answered by relatively few but was generally answered reasonably well, although some candidates failed to highlight the fundamental differences between fluvial and deltaic sequences. Very often the full range of features in each setting was not discussed e.g. braided river systems, plant fossils and fresh water fossils in fluvial systems and coal deposits, swamps and amphibians in deltaic systems. Again, however, evaluation was quite poor. Many candidates failed to convince, with much repetition. Their essays made it quite clear that they would not be able to distinguish fluvial from deltaic sequences. The most popular discriminators were fining up sequences for rivers and fining down sequences for deltas. A few made the point that a large 3D view of the deposits was often needed to fully define the environment of deposition.

Q.4 This was quite a popular question and responses were very varied. The range of igneous features in the BTIP was generally well outlined, with some good examples, particularly from Arran. Some claimed that pillow lavas and ophiolites are common. Some of these candidates went on to invoke a destructive plate boundary. A few of the better candidates discussed the possible interplay of North Atlantic rifting and mantle plume at some length. Virtually no one mentioned the presence of hotspot trails on either side of the Atlantic to Iceland , in the form of the Iceland-Greenland ridge and the Iceland-Faeroes ridge, or the large volume of basalt which erupted at this time ($>1 \times 10^6$ km^3). An alarming number of candidates claimed that the Whin Sill is part of the BTIP – it is Carboniferous, and the dyke swarms trend NE-SW. The latter was regularly used as evidence for tension parallel to the Mid-Atlantic Ridge. A very small number of candidates pointed out the problem with the NW-SE trend in their evaluations.

Unit 4 – Lithosphere

Q.1. (a) (i) Very well answered.

(ii) Generally quite poorly answered. Although most candidates recognised that the deformation in (a) was folding and was compressional, very few recognised that the deformation in (b) was tensional and even fewer could describe boudinage. Credit was given to those candidates who stated that the deformation at **A** was plastic while that at **B** was brittle. Many claimed that the deformation was greater at **A** than **B**. Some claimed that the quartzite at **B** had not been affected.

(b) Very poorly answered. Most candidates appear unable to interpret correctly stress-strain curves such as these. A few recognised the elastic and plastic behaviour, and connected this with the folding, but very few linked the failure point to the tension and the boudinage structure. A few labelled curve **L** to show the elastic zone, elastic limit and plastic zone.

(c) (i) The geothermal gradient was generally well answered and most candidates correctly identified that the geothermal gradient of '10' was the only one that intersected the temperature range within the given pressure range.

(ii) Generally this question was well answered.

(iii) This question was not particularly well answered. Relatively few candidates identified that this was a subduction zone (low geothermal gradient), however, credit was given for continental collision with some qualification / justification for this choice.

Q.2 This was a very popular question and was generally reasonably well answered. Some candidates did not read, or understand, the question well enough and for (i) described a constructive plate boundary and gained no credit. Most candidates identified that the primary difference between, ocean-ocean and ocean-continent related to the presence of continental crust in the latter and the melting and incorporation of this crust into the arc magma, thus making it more andesitic. Relatively few identified that another reason for the more andesitic nature of continental arcs was related to the greater thickness of crust that the magmas had to traverse through, thus making it more likely that they would get trapped (and so fractionated) in large magma chambers. Some candidates are still under the misapprehension that it is the slab which melts in subduction zones, whereas in reality for all but the youngest (and so hottest) slabs (<10Ma) it is the water being driven off the slab and lowering the solidus of the asthenospheric mantle wedge that generates the melt. Overall descriptions tended to be very good and excellent use was made of diagrams. In general, candidates skirted around the question as to how the slab is absorbed into the mantle. Many candidates stated that magma rising through continental crust would become more silicic while some claimed that it would become more silicate-rich.

Q.3 This was not a particularly popular question. The oceanic part was generally answered much better than the continental part. Most candidates had a very clear idea of the structure of oceanic lithosphere and a few provided impressive details. The structure of the continental lithosphere proved to be more of a challenge. The most common attempt was to give a broad overview of the structure more or less in line with their description of the oceanic crust. This consisted of a layer of sedimentary rocks over a layer of metamorphic rocks over a layer of igneous rocks. Evaluation was generally very poor to non-existent. The most common plus point was the suggestion that sediments are relatively insignificant in oceanic crust although they thicken away from the ridge. Evaluation in continental crust was either non-existent or amounted to "due to weathering and erosion there is much more sediment in continental crust than oceanic". Hardly any candidates referred to the layering within the rocks themselves e.g. bedding, schistosity, plateau lavas, layered intrusions etc.

Q.4 This was a reasonably popular question, with some candidates giving excellent detailed accounts of the age distribution of material in the continents. Most did this on a horizontal basis (i.e. older rocks in the centre) but some talked about the vertical distribution of ages within certain crustal sections. Relatively few candidates dwelt at length on the way in which the continental crust grew (either through the accretion of arcs, or accretion of thickened areas of oceanic floor that is unable to be completely subducted). Some candidates discussed the Wilson Cycle in far too much detail. A few candidates discussed how continents through break up and re-amalgamation can effectively turn themselves inside out and leave the oldest cratons on the outside – this was excellent and these candidates scored highly. Some exhibited an impressive knowledge and understanding of the age distribution of rocks within the British Isles and its relationship to plate tectonic history.

GEOLOGY

General Certificate of Education

Summer 2011

Advanced

Principal Moderator: Mr Ian G. Kenyon

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
GL6	868	60	43.3

Grade Ranges

A	48
B	42
C	36
D	30
E	24

N.B. The marks given above are raw marks and not uniform marks.

Coursework Module GL6

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 ringbinders 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 individuals. 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%. Please state clearly on the GLF1 form whether Lab (L) or Field (F) is being assessed. It is not appropriate to write F/L.

Electronic Sample Selection

This was the first year that the new system was introduced and it clearly took a number of centres by surprise. There are no longer any pink computerised C forms to complete. Instead centres need to log onto the WJEC Secure Website and enter their GL6 marks (just the total out of 60) in the appropriate boxes under their centre number candidate list. Having entered all marks, the sample will be automatically generated and will not necessarily equate with the old system of every other, third, fourth, fifth candidate etc.

GLF1 Forms

A completed F1 form should be included with the coursework sample. This is used by the moderator to make any recommendations for mark adjustments. The F1 form should list **all** candidates and their marks from the centre, not just those selected as a sample for moderation. It is helpful to mark with an asterisk on the left hand side those which are included in the sample.

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 light of this. A significant 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. A digital copy is available for download from the WJEC website along with F1 and F3 forms.
http://www.wjec.co.uk/index.php?subject=61&level=21&list=docs&docCatID=84

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.

Please ensure that the centre has the updated F3 form which has the candidate declaration on the reverse. This must be signed by the candidate and teacher to confirm the authenticity of the work being submitted.

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 was 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.

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.

It is strongly recommended that candidates practise field sketching from photographs or slides prior to fieldwork being carried out. 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 they may be 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. Less than half the candidates included photographs this year and 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 could the work 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 just 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.

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 not been as reliable as in previous years but comparable with 2010. With the introduction of the A* grade at A2 it seems that a number of centres have erred on the side of generosity when awarding marks for coursework, particularly in the planning and evaluation components. In 2011 ten centres were adjusted downwards and one was adjusted upwards.

Help and advice is available from the Principal Moderator at any time. Contact email address iangkenyon@aol.com

Coursework for 2012 can be submitted any time after 1 April 2012.
The deadline for submission of on-line marks and the coursework sample is 15 May 2012.
This date will be remain the same in forthcoming years.

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