WELSH JOINT EDUCATION COMMITTEE
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General Certificate of Education **Tystysgrif Addysg Gyffredinol**
General Certificate of Secondary Education **Tystysgrif Gyffredinol Addysg Uwchradd**

EXAMINERS' REPORTS

SUMMER 2005

GEOLOGY

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WJEC
CBAC

Statistical Information

GCE (AS/Advanced)

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.*

GCSE

The Examiners' Report may refer in general terms to statistical outcomes. Statistical information on candidates' performances in all examination components (whether internally or externally assessed) is provided when results are issued. As well as the marks achieved by individual candidates, the following information can be obtained from these printouts:

For each component: the maximum mark, aggregation factor, mean mark and standard deviation of marks obtained by *all* candidates entered for the examination.

For the subject or option: the total entry and the lowest mark needed for the award of each grade.

Annual Statistical Report

Other information on a centre basis is provided when results are issued. 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 2005

Advanced Subsidiary/Advanced

Chief Examiner: Mr. Peter Loader, St. Bede's College, Manchester

Principal Examiners:

GL1	Mr. Dave Evans, King-George V College, Southport
GL2a	Mr. I.C. Wall, Bolton Sixth Form College
GL3	Mr. Peter Loader, St Bede's College, Manchester
GL4	Miss Jo Conway, Yale College, Wrexham
GL5	Mr Elliott Hughes

Chief Coursework Moderators:

GL2b	Dr. Alan Seago, Open University
GL6	Mr. Ian Kenyon, Truro School

GEOLOGY

General Certificate of Education 2005

Advanced Subsidiary/Advanced

GL1 Foundation Geology

Principal Examiner: David Evans, King George V College, Southport

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an AS award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this paper 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	1426	60	37.0

Grade Ranges

A	46
B	40
C	34
D	28
E	23

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

UNIT GL1 FOUNDATION GEOLOGY

The examination provided a fair test for students, offering them the opportunity to demonstrate a wide variety of skills effectively. It differentiated well, producing a wide range of marks. There were many very good and excellent scripts.

Q.1 (a) (i) Many candidates correctly identified X as the suture line, although the wide range of spelling was disappointing to see. Occasionally X was confused with growth lines.

(ii) Most correctly identified the ammonite as C, based on the Jurassic age or the complexity of the suture line.

(b) (i) The term 'zone fossil' was often well known but not so well phrased. The most common error confused zone fossils with the interpretation of past environments.

(ii) This was generally well answered.

(c) Many students were able to successfully match the fossil and the locality, and earn 3 marks. However, fewer explained how they used the information, to gain further marks. Simply to write "locality 2 is the oldest rock and fossil A is the oldest" gained no further explanation marks. Examiners were looking for statements explaining how candidates knew the relative ages of the fossils (using age order of the periods and complexity of suture lines) and the relative age of the rocks (based on direction of dip of rocks and the presence of the unconformity).

Q.2 (a) Virtually all candidates noted the increase in density with depth, and many specifically quoted depths in km where the density suddenly increased.

(b) The vast majority of candidates correctly drew an arc passing through the point of refraction of the P wave.

(c) (i) This was reasonably well known, although the sudden drop in velocity was sometimes not correlated with the density change in Figure 2a.

(ii) Most students noted that the increase in velocity was due to the P wave entering the inner core and related this to the increase in rigidity of the solid material. More common errors suggested that the liquid nature of the inner core, or the increase in density, brought about the increase in velocity.

(iii) Relatively few students recognised the partially molten atmosphere or low velocity zone at point M. The main error was to call it the Moho.

(d) Many students recognised that this would be a stony meteorite. However, few accurately read the graph and quoted depths outside the range of 400-600 km suggested by the density. The best answers pointed out the mantle origin of such a meteorite, and the higher density of an iron meteorite which would be similar to the rocks of our core. Few candidates noted the link between meteorites and fragments of planets similar to ours.

Q.3 (a) Basalt was well identified and its vesicular texture well explained. It should be noted that vesicles occur when gas has not managed to escape. The most common error was to relate the presence of holes to the weathering out of minerals.

(b) Anticline or antiform was well known.

(c) (i) This was usually correctly identified as a breccia. The term conglomerate was also accepted since the shading on Figure 3a showed some casts as relatively well rounded.

(ii) Many candidates correctly commented on the poor sorting or angular nature of the clasts as evidence of short transport distance. Fewer correctly suggested the large clast size as evidence of fast flow. Virtually all commented on the channel eroded into the greywacke as evidence of river action.

(iii) Most candidates coped well with parts (i) and (ii) using the law of superposition or the cross cutting relationship of the base, and the law of included fragments. Only the best candidates recognised that there is no way of determining the relative age of the greywacke and clast H in part (iii).

(d) This section followed the typical format for the "fieldwork question" although full marks could be scored without reference to a field location. Some candidates earned the full 6 marks, but many omitted key aspects. The most common omissions/errors were:

- Very simplistic drawings of sedimentary structures. E.g. near vertical current bedding.
- No evidence of some idea of scale of a sedimentary structure.
- No specific location for a sedimentary structure. "Yorkshire" is not precise enough for a location, but "Ingleton" is specific enough to gain credit.

The environmental interpretation of sedimentary structures was mostly done well and gained the full 2 marks available.
Surprisingly, a significant number of students offered examples that were not sedimentary structures, such as " a meandering river" or "an alluvial fan".

Q.4 (a) (i) This was commonly known, although a number of candidates confused the answers.

(ii) Most candidates answered this correctly.

(iii) A significant proportion of candidates made errors here.

(b) (i) It was surprising how many candidates did not recognise that a fold with limbs dipping to the North and South would be formed by stresses directed North-South.

(ii) Few students identified the salty cleavage and attributed it correctly to the alignment of crystals under the influence of directed pressure during regional metamorphism.

(c) The mineral was usually correctly identified and the age relationship with the planes noted from the cross cutting nature of the crystals. The random orientation was also correctly noted but fewer candidates could attribute this to formation without the influence of directed pressure.

(d) The correct site for Rock N in the metamorphic aureole in the original slate was often marked. Only the better candidates explained this with reference to the presence of both the original salty cleavage still present in Rock N and the contact metamorphic mineral chiastolite/andalusite.

GEOLOGY

General Certificate of Education 2005

Advanced Subsidiary/Advanced

GL2a Investigative Geology

Principal Examiner: I.C. Wall, Bolton Sixth Form College

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an AS award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this paper 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	1437	60	32.8

Grade Ranges

A	41
B	36
C	31
D	26
E	22

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

UNIT GL2a INVESTIGATIVE GEOLOGY

The demands made by the paper on candidates were broadly comparable with previous years although the mean mark was down compared with 2004, mainly due to candidates inability to evaluate pebble sorting, shape and size in question 3(a), and to correctly allocate fossils to their eras in question 4b(ii). The other questions produced a range of answers which allowed for suitable differentiation.

Q.1 Most candidates correctly used Map 1 in part (a) to cite evidence, although some failed to read the rubric and used Specimen A. There was some variation among centres in the 'porphyritic' nature of the granite used for Specimen A, but the mark scheme clearly accommodated this with credit being given for a crystalline, non-foliate texture with both good and poorly-shaped minerals drawn to a suitable scale for a plutonic rock. Labelling was not asked for, but was often received! The mark allocation for this paper has to mirror that for the GL2b coursework component and part (c) contained both planning and implementation. Candidates often penalized themselves with poor planning, e.g. using hardness to distinguish both pairs of minerals. No credit was given in the implementation where scripts referred to equipment not specified by the examiner – hammers, glass plates and Moh's hardness boxes all featured. Centres are instructed as to what equipment is to be used and they should keep to this list. A wide variety of tests or observations could have been, and were used allowing candidates to gain credit (e.g. hardness, colour, cleavage, twinning).

Q.2 Part (a) usually allowed candidates to demonstrate their knowledge of igneous rock classification. In (b)(i) many described the shapes of all structures on Photograph 1 rather than that labelled S and although pillows were often correctly identified in part (ii), columnar jointing, desiccation cracks and flute casts featured in the answers! The correct response for the depositional environment was usually stated in (iii). Part (iv) caused some difficulty in measurement in that candidates seem to use rulers and then calculate a width – use of the scale bar on Map 1 gave a more reliable figure. It was pleasing to read those answers which argued the change in width in relation to proximity to a vent, or to a hollow on the seafloor, or to partial erosion prior to being covered by Rock Unit J. Weaker candidates referred to "intrusion" and some even linked this to the Pluton (Rock Unit A).

Q.3 The innovation in this question was that it allowed knowledge of superficial deposits to be tested rather than aspects of solid geology. Both fluvial and Aeolian deposits are studied in GL1, which forms the basis of knowledge for this paper. Part (a) saw many candidates simply describing the sorting, shape and size shown on Photograph 2, whilst others only evaluated with reference to one or other of the processes, but not both. This part question was a major contributor to the decline in the 2005 mean mark. There was sufficient information on Photograph 3 for candidates to state both textural and mineralogical reasons for the metamorphic origin of the clast in (b)(i), although a wide range of names was encountered in part (ii), many of them, unfortunately, igneous or sedimentary! Candidates usually understood that some form of physical weathering would have released the clast part (iii), but not all used the data sheet to argue in part (iv), why the garnet crystals (Mineral K) stood proud of the surface.

Q.4 A correctly labelled, east-west trending line within Rock Unit C was credited in most cases in(a)(i), but the evaluation in part (ii) saw all combinations of answers. Where candidates realised that the trend, symmetry and wavelength of the folded units were different, credit was easily allocated in (b)(i), but weaker scripts referred to fossils or rock types. Many recognised the fossil groups in (ii) (although a "range" of alternative spellings gained generous credit); even the better candidates had difficulty in correctly identifying both eras, with many failing to score at all.

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. There are some centres who obviously spend considerable time and effort on map work and here candidates usually score highly with this question being of much higher standard than the others; one centre even produced tabulated geological histories on the continuation page, and although these were invariably correct, no extra credit was allocated! In most centres, however, this type of question differentiates very well.

GEOLOGY

General Certificate of Education 2005

Advanced Subsidiary/Advanced

GL2b Internal Assessment

Principal Examiner: Dr. Alan Seago, Open University

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an AS award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this paper 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	136	60	37.5

Grade Ranges

A	44
B	39
C	34
D	29
E	24

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

UNIT GL2b INTERNAL ASSESSMENT

Sixteen centres submitted field investigations for moderation. 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. There has been a reduction in the number of centres where scaling is required and the amount of scaling that has to be applied. Very few centres are now creating difficulties for themselves and for the moderators by submitting field investigations from outside the context of GL1 skills. Centres should be aware of the required context of the investigation at all times as described in the specifications.

A problem in some cases was a lack of focus for the investigation. If clearly focused, for example, on 'the effects of the American Orogeny at Broad Haven, Pembrokeshire' (analysis mainly of folding, including crystal shortening), candidates can concentrate on collecting appropriate data such as dip and strike of bedding, folding styles, drawing cross sections and analysing the amount of crystal shortening. With a lack of focus and definition of aims, candidates may collect irrelevant data such as sedimentary rock descriptions. On the other hand 'the investigation of the geological history of a coastal area of Pembrokeshire' is much too wide a brief and needs to be focussed down. This sort of investigation, where the candidates are taken from locality to locality collecting observations at the direction of the leader, results in very poor planning and evaluation, although the observations and the analysis may very well be of a high standard. This approach commonly results in every candidate having the same plan, method of recording data and analytical techniques. This makes differentiation between candidates very difficult. It also often results in 'planning' in the past tense. Even if all of the candidates undertake the same field investigation it is important that they have the opportunity to come up with their own ideas for data collection and presentation.

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. In some cases, there was too much text lifted from secondary sources and largely not related to the investigation and much less on field procedures. In contrast, some candidates devoted insufficient time on the retrieval and evaluation of relevant material from different sources.

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.

Some excellent field investigations are now being seen, which are well suited to the assessment framework. The investigations allowed the candidates to demonstrate basic field skills and perform suitable analytical techniques on the data collected. It is good to see geological field skills being demonstrated with a high degree of competence. There were, however, a minority of investigations which would have been more suited to GCSE, lacking any scope for advanced analytical skills and any degree of complexity.

A mixture of tasks were undertaken with investigations into:

- interpretation of sedimentary environments (sedimentary logs and rock description)
- mapping exercises (leading to drawing up of geological sections and history)
- origin of granite plutons (rock textures, jointing and structural analysis)
- joint orientation related to faulting (rose diagrams and stereonets)
- structural analysis (faulting and folding styles related to compression or tension)

Centres are to be congratulated on the variety of opportunities given to candidates in areas of outstanding geology such as, North Wales, Isle of Arran, Pembrokeshire, Ogmore, Yorkshire coast and County Donegal. Other centres made good use of suitable local geological locations.

Centres should be aware that there is help available from the WJEC. Published exemplars of coursework investigations can be obtained from the WJEC offices and INSET activities are provided. Moderators' reports on the current moderation process are sent out to centres. Centres requiring individual advice are advised to contact the Principal Moderator through the offices of the WJEC. This can include advice on the suitability of coursework investigations prior to carrying them out and examination of candidate's draft field investigations. Centres are urged to act on any recommendations in the Moderators Reports. Any centre having a problem with applying the assessment framework should contact the WJEC well in advance of the submission date.

GEOLOGY

General Certificate of Education 2005

Advanced Subsidiary/Advanced

GL3 Geology and the Human Environment

Principal Examiner: Peter Loader, St. Bede's College, Manchester

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an AS award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this paper 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
GL3	1267	50	29.0

Grade Ranges

A	34
B	29
C	25
D	21
E	17

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

GL3 – GEOLOGY AND THE HUMAN ENVIRONMENT

General comment:

The general quality of the data response questions was good and both were accessible to weaker candidates but discriminated well at the upper end of the mark range. Full marks were achieved by some students for both questions. The quality of the essays was similar to previous years with an encouraging number of full marks given, particularly for question 3. Examiners were encouraged by the use of case study material in all questions but particularly for question 3. It was noted that many students had detailed knowledge from outside the specification, which was duly credited.

Section A:

Q.1 A very accessible question where many candidates scored well.

(a) (i) Generally well answered. Considered an easy starter, many misread the question and gave a reason for the location of the reservoir, rather than the dam.

(ii) Many good answers were received, though weaker candidates confused steepness of the valley sides with dip of the strata.

(b) (i) Generally well answered, though it was surprising how many were unable to mark in the maximum height, despite evidence from the graph (over 700 m) and guidance from the outcropping water table. Credit was given to those who drew a curved level for the water level (meniscus ?) provided it linked the water table data.

(ii) The vast majority scored one mark for the relationship but many were unable to qualify this with a quantitative description.

(iii) Some excellent answers were seen, scoring full marks. The vast majority of candidates recognised the importance of the level of the water table and its effect on the different rock types, but only the best candidates referred to the dip of the strata, which was again sometimes confused with steepness of the valley sides.

Q.2 A very accessible question. Those candidates who made full use of the data usually scored well.

(a) (i) This proved to be more difficult than expected. A significant number gave the range as 2 m or 0 m (+2 to -2 accepted) and the time lag as 3.30 hours, rather than the accepted 3hr 30 min.

(ii) This was generally answered well, though few mentioned the effect of rock fractures or porosity in their answers.

(iii) Although most candidates recognised that work in the tunnel would be difficult or impossible at certain times due to flooding, they usually stated that this would be a problem at high tide; this in spite of previously scoring full marks in (i) and (ii) for recognising that there was a time lag between high tide and the highest water table level. Reference to the fact that optimum working conditions could be predicted on a daily basis or that this might be between low and high tide were fully credited (as was reference to the number of hours that effective excavation would be possible without the need for pumps).

(b) (i) Weaker candidates generally ignored the command words “describe “ and “account”. Though given some credit, most candidates preferred to write about the change in rock strength with depth and not along the length of the tunnel, as the question stated. Few referred to the variation at the tunnel entrance or the Pegwell valley. Weaker candidates did not read the data correctly and assumed that grade II Chalk was weaker than the other grades as it was associated more with rising groundwater. Many referred to surface processes without explaining what these were and a small number were unable to distinguish between weathering and erosion.

(ii) Generally well answered, although a significant number ignored the reference to Pegwell valley and referred, for example, to the entrance of the tunnel. Many might have lost marks had examiners not taken a liberal view of what constituted a “hazard”. The hazard and explanation were marked holistically.

Section B:

General comment :

Though all three essays were popular, they ranked in order of their question number. It was obvious that most centres had done detailed case studies, with many of the responses included material well outside that detailed in the specification. Many candidates had also obviously watched television programmes devoted to considering natural hazards. These received full credit where appropriate. A cautionary note here is that sometimes candidates showed that they did not fully understand some of the more technical aspects they outlined.

Q.3 (a) Generally well answered, with some excellent scripts from students who had been very much involved in a study of the Boxing Day 2004 SE Asian Tsunamis and follow up documentaries. Weaker candidates gave graphic descriptions of the human aspects of the disaster rather than the causes. A few wrote exclusively (and in detail) of the economic effects on tourism and fishing industries and were denied access to high marks. The range of responses was thus great, from superficial references to "huge waves" and "sea defences," to in depth discussion of wavelengths, frequencies, amplitudes, channelling of energy into bays, and lack of warning etc.

(b) (i) This was by far the most popular option, despite not being directly on the specification (hence option 2.) and the main differences between responses was in the depth of explanation. Although accepting the usual trade-off between depth and breadth, weaker candidates relied mainly on the latter. For example, trees were often quoted as a first line of defence but without reference to how these would dissipate some of the energy of the tsunami.

(ii) Although not such a popular choice as 1 (despite being directly referred to in the specification), answers were generally of a higher quality with a greater tendency to explain the use of, and often the effectiveness of, different measures. With both responses, it was good to see candidates using diagrams and examples from previous examination questions in their answers.

Q.4 (a) Some excellent responses were received, gaining full marks, although there was a tendency to overlap with (b). Thus, the factor and its management were both discussed in (a), which then led to repetition in part (b). Weaker candidates ignored the question, preferring to write an essay on hazards rather than the factors affecting risk of damage. This question, like most essay questions in GL3 papers, was taken directly from the wording of the specification and thus it is advisable that students are familiar with its content. Some candidates claimed that both P and S-waves cause damage by causing the ground to shake in different directions. A number of candidates quoted solifluction, and the vast majority discussed liqu**i**faction. Hardly any candidates quoted liqu**e**faction.

(b) Few answers fully developed on the idea (the only example quoted in the specification) of stress release along faults (by increasing pore pressure by pumping). Those that did often thought that this was not only viable but quoted spurious examples of where this was fully operational today. Others considered that stress release was achieved along the San Andreas fault system by detonating bombs (nuclear)! Many candidates were fully aware of the technical details of aseismic building design, for example, building shape, cross-bracing and the use of computer controlled counter-weights in building design. Weaker candidates tended to provide superficial statements such as building are made "stronger" or "earthquake proof" without any further discussion of how this might be achieved. Some candidates unsatisfactorily concentrated on earthquake prediction almost to the exclusion of anything else.

Q.5 (a) This was generally well done, though the answers to this question showed the greatest confusion of terminology. The better answers referred to the silica content of differing magmas and the effect of this on their viscosity and gas content. A few candidates successfully discussed the principles, such as increasing viscosity and / or gas content resulting in more explosive activity, but confused the magma types. Thus, they claimed that viscous magmas where the gas could not escape easily led to more violent eruptions characteristic of ***basaltic*** volcanicity.

(b) This resulted in a greater variety of responses though details tended to be very superficial. Ground deformation was the most popular choice and most quoted the use of tiltmeters or lasers but failed to explain the principles on which they worked. An encouragingly large number of responses went outside the specification and quoted the use of satellites and GPS but rarely were there any details of their use. Seismic activity was also a popular choice, although many candidates extended its more common use to include tomography (although this word was not used). The general principles were generally sound and were credited. However, there were some commonly exaggerated claims. The most common were that artificial explosions created on the flank of a volcano would produce P and S-waves and, as S-waves don't pass through liquids, an S-wave shadow zone would be produced. Although the principles are sound, there are a number of factors that need to be clarified if this argument is used. Those candidates who relied on the recognition of the locality and frequency with time of mini-earthquakes beneath the volcano, invariably made more justifiable claims. Only the more able candidates were able to evaluate the success of the prediction methods, though many were able to give appropriate examples. Good answers were seen that used the example of Mt St Helens from the January 2005 exam.

GEOLOGY

General Certificate of Education 2005

Advanced

GL4 Interpreting the Geological Record

Principal Examiner: J. Conway, Yale College, Wrexham

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an AS award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this paper 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	852	96	50.3

Grade Ranges

A	62
B	55
C	48
D	41
E	34

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

GL4 INTERPRETING THE GEOLOGICAL RECORD

This paper worked well this year, discriminating between candidates, and a wide range of marks were seen. Section B showed an improvement on previous years, mainly as a result of questions 6 and 8.

Section A:

Q.1 This question was data response and the examiners were delighted at the ability of candidates to analyse unfamiliar material. Candidates scored well on this question, with very few gaining less than half the available marks.

(a) (i) No real problems and most students coped, though clearly, students were not aware of the detail required by the specification. A notable howler was feature X being labelled as a pygidium tail.

(ii) No problems. Some good knowledge and understanding beyond the specification.

(iii) Fine, though a quadruped does not always indicate a herbivore.

(b) Fine generally.

(c) Students who made use of all the data came to relevant conclusions that were credited, though weaker candidates did not evaluate.

Q.2 The question focussed on metamorphism. A good spread of marks was seen by the examining team, with candidates accessing the whole mark range.

(a) (i) Well answered.

(ii) Most students who got the right direction were capable of correct explanation.

(b) Only the better students were able to gain top marks for a correct illustration of the rock at location X. Euhedral crystal shape was least well understood.

(c) Most placed H near the intrusion, though only the more able correctly identified that contact metamorphism of clay rich rock restricted this to the schist.

(d) Some good analysis of the data was given, though only the better answers gave a range of evidence.

Q.3 The question examined aspects of deformation. A good spread of marks was seen by examiners and candidates accessed the whole of the mark range.

(a) (i) Well answered by most.

(ii) Poorly answered. Examiners were surprised to see so many students suggesting the folds were symmetric. Plunge amount was a good discriminator.

(b) (i) Many students were unclear about where the overturned limb was and locations on the hinge line were not credited.

(ii) Generally well done when related to what the structure would look like if associated with overturned strata.

(c) (i) Usually OK.

(ii) The key term 'describe' was often ignored and vague discussion, which lacked geological terminology, was given little credit.

(iii) Poor use of English hindered accurate discussion in this question. Only those who used correct terminology and referred to the conflicting evidence of fault movement correctly identified a later tensional movement on fault X.

Q.4 Igneous processes were tested through this question, and candidates were able to access the whole of the mark range.

(a) Poorly answered, with little apparent understanding of the process of partial melting of the mantle. A notable howler was andalusitic lava!

(b)(i)&(ii) Generally OK

(iii) The process of pressure release that enables the mantle to become partially melted at shallow depths was poorly understood. Few referred to the effect of fluid pressure, density or buoyancy of the magma.

(c)(i)&(ii) Generally OK, though often, the concept of a rising mantle plume was poorly explained. The common misconception is that a mantle plume is the result of rising magma rather than a plume of hotter rock (above the average temperature) from the lower mantle.

(d) Generally this was well done and raised the mean mark for this question.

Section B:

The map extract of Castleton was clearly reproduced.

Q.5 This question was generally poorly done.

(a) Descriptions were often too vague to generate marks.

(b) Only the better candidates identified the unconformable relationship between the Bee Low Limestone and the Edale Shales. The map evidence for the age of the landslide was often equally vague.

(c) (i) A simple response indicating the "v" shape was required but many candidates tried to explain in terms of of a valley or plunging fold, neither of which was required.

(ii) Those candidates who referred to the relationship of the outcrop and the contours gained credit but few were critical of the statement with reference to the outcrop on the northern side of the ridge. Few obtained evidence from the section, though a number suggested the unnumbered dip arrow.

Q.6 Candidates answered this question well and the majority of candidates scored over half the available marks.

(a) Well answered indicating sound knowledge.

(b) (i) Generally OK. Credit was given to those who measured Figure 5 or referred to the map using the grid reference given.

(ii) A good attempt was made by many candidates, though an explanation was required and many simply described the conflict between horizontal sediment infill and angle of dip.

Q.7 Although the question discriminated well, only the highest level candidates accessed the top marks of the question.

(a) (i) Generally well answered.

(ii) Poorly answered. Few obtained full marks.

(b) (i) Poor measurement made this a poorly answered question. The dextral movement was only mentioned by the better candidates.

(ii) Slickensides were frequently mentioned along with some reference to direction of movement.

(c) The question was designed to allow candidates to respond with knowledge they had learned in module GL3. However, the question was poorly answered, with vague references to instability. Hazards associated with frequent fault reactivation were numerous but not credited. Good answers focussed on the narrow veins making exploitation difficult and heavy metal pollution from the vein minerals.

Q.8 (a) (i) Examiners saw many variable responses. The maximum length of the landslide was often mistaken for the total length of the line A-B.

(ii) Some good answers relating to the fault, spring and nature of the bedrock were seen.

(iii) Accessible, but only the better students were able to outline and justify how the landslide might be monitored. Some good ideas as to how the slide may be stabilised were seen, though the maximum marks were reserved for those who evaluated the proposed solutions.

GEOLOGY

General Certificate of Education 2005

Advanced

GL5 Geological Themes

Principal Examiner: Elliot Hughes

Unit Statistics

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

Unit	**Entry**	**Max Mark**
GL5 (all options)	838	100

Grade Ranges

Option	**01**	**02**	**03**	**04**	**05**	**06**
A	70	67	70	69	72	69
B	63	60	63	62	66	62
C	57	53	56	56	60	55
D	51	46	49	50	54	48
E	45	39	43	44	48	42
Mean Mark	62.1	52.1	60.3	58.5	64.4	62.4

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

GL5 GEOLOGICAL THEMES

General comment:

All **Section A's** proved to be very accessible and there were some excellent responses.

Where a description was asked for and some of the data provided is quantitative, e.g. Unit 1 Q.1.(a), the easiest way for candidates to obtain full marks is to give a qualitative and a quantitative description e.g. well-sorted with most grains between 2 and 1/16 mm. Similar questions are Unit2 Q.2.(a)(ii) and Unit 4 Q.1.(a)(i).

Examiners tend to be more forgiving with responses to the first parts of Section A questions, which are intended to be gentle introductions to get the candidate to focus on the data provided. Thus, for Unit 2 Q.1. (i), there was significant leeway in the values accepted for the length, width or depth of the ore body. So, as with the previous point, "oval and approximately 3 km long" was credited with the 2 marks available. So was "rectangular with the corners rounded and 4 km long".

The essays in **Section B's** proved, as usual, to be effective discriminators.

The mark scheme often had to be extensively widened when candidates showed that they had studied material that was not on the specification. This provides a good example of how examiners are willing to reward relevant discussion of topics which are not on the specification. However, it does make the production of a comprehensive mark scheme for publication a difficult task.

When trying to give field examples, candidates often give very imprecise locations such as Scotland or Yorkshire, neither of which is particularly illuminating.

It is noticeable how some candidates effectively overcome problems they have with expressing themselves clearly in text by drawing well-labelled diagrams. Such candidates, although they may not obtain the highest marks, still manage to score highly. The best candidates use both diagrams and text to best advantage.

This year, there appeared to be a greater number of candidates who either misread or misunderstood an essay question. As a result, they scored very low marks in spite of the fact they may have scored very highly on Section A.

There was no sign of any significant improvement in the standard of spelling.

Unit 1 - Quarternary

Section A:

General comment:

Proved to be very accessible. The use of English was probably the major limiting factor with Q.1. Q.2. proved to be a little more demanding, although it was only part (b)(ii) that was consistently beyond the capabilities of the majority of candidates

Q.1 (a) Generally well answered. There were some imprecise adjectives applied to the sorting, such as "pretty" well-sorted.

(b) (i) Pleasingly well-done.

(ii) Generally well answered

(iii) Not particularly well answered, many candidates missed the point of the question. Mention of "energy" was scarce. Many took the word "Dunes" in the Key to mean that the sediment must be aeolian.

(c) This caused few problems.

(d) It was difficult to obtain three marks here without mentioning Uniformitarianism. A significant number of candidates did not make the explicit link between observed modern processes and comparison with ancient sediments. The better candidates quoted the Law of Uniformitarianism and gave an example of its usage.

Q.2 (a) (i) Generally well answered

(ii) Generally well answered, although some candidates got ^{16}O and ^{18}O mixed up. An exceptional explanation was required for 3 marks if it was not stated that the isotope ^{16}O is lighter than ^{18}O. A significant number of candidates made claims such as "only ^{16}O is evaporated". It was not always clear with others whether or not they knew in what form the isotopes actually were. An example was "more ^{16}O than ^{18}O particles are trapped in the ice".

(b) (i) Generally well answered although a significant number had no idea what "time period" meant and values such as 20 hours or 400 billion years were given. It appeared that some candidates answered from memory and gave ages such as 41,000y. One candidate quoted this figure and then added that "the other two periods of the Milankovitch Cycles are 22,000y and 100,000y". It was of some encouragement that a few candidates gave periods such as 40,265.556y, indicating that they had taken a number of cycles and divided to get the value for one. On the other hand it was worrying that they thought they could provide an answer with that degree of precision.

(ii) A very poorly answered question. Most candidates failed to recognise that increases in tilt result in a lengthening of winter darkness in polar regions and that this increases seasonal differences in higher latitudes. Many candidates erroneously stated that a change in the angle of tilt caused a change in the amount of solar radiation reaching the Earth. Another common error was to claim that a change in tilt "changed the distance from the Sun". No candidate commented on the significance of the positioning of land masses.

(c) Most candidates correctly referred to the effects of weathering and erosion on terrestrial, as opposed to marine, deposits. Fewer candidates were able to give a convincing characteristic of marine sedimentation that rendered this a more reliable environment. Effective use of language was required and this was often lacking.

Section B:

General comment :

Questions 3 and 5 were the more popular. There were some excellent attempts. The most worrying aspect was when candidates misread or misunderstood the question. In Q.3., this usually meant ignoring drainage below ground. Of even more concern in this respect were questions 4 and 5. It had been anticipated that some candidates might have problems with the term "periglacial" in Q.4. and so it was emboldened. Similarly in Q.5., past experience had shown that candidates might not restrict themselves to "deposits", so this was again emboldened.

In Q.5., candidates frequently discussed glacial and interglacial **erosional** features. The most disappointing examples were usually reserved for Q.4., when a number of candidates, and occasionally some who had scored very highly on Section A and / or their other Unit, chose to write exclusively on glacial and / or interglacial topics. It was unfortunate in such cases that very low marks had to be awarded to what was often a very good essay, but did not address the question set and may only have paid passing reference to periglacial topics. The mark scheme had to be extensively widened for Q.5., as candidates collectively exhibited a very wide range of studies. This provides a good example of how examiners are willing to reward relevant discussion which is not on the specification.

Q.3 A popular choice of essay. Although some good answers were marked, most candidates failed to discuss (or only briefly mentioned) the flow of water below the ground. In this regard, the discussion of aquifers was particularly poor. Most candidates were able to discuss different drainage patterns. Some good field examples were quoted, e.g. the Lake District as an example of superimposed drainage; as were some fanciful ones, e.g. Matlock Bath as an example of a dendritic pattern.

Q.4 Not answered by many, but there were some excellent answers. However, most candidates focused too much on glacial and melt water processes, deposits and landforms. This was not what the question asked.

Q.5 A generally well answered question. There was a wealth of material that candidates could discuss and this essay tended to provide a greater percentage of the higher marks and fewer low marks. Some candidates ignored the word “deposits” and just wrote all they knew about glacials and interglacials. Pollen and $^{18}O/^{16}O$ ratio methods were common. Although these were not included in the original mark scheme they were accepted as being relevant. Most candidates made it clear how pollen is deposited, but only the better candidates explained how ^{18}O and ^{16}O can become incorporated within (limestone) deposits. A few candidates also considered ice cores. One candidate exhibited a thorough understanding of their uses in the study of recent climatic change and was rewarded accordingly.

Unit 2 – Natural Resources

Section A:

General comment :

Very accessible.

Q.1 (a) (i) A generally well answered question as most candidates were able to describe part, or all of the shape plus some reasonable measurement of the length, breadth or depth.

(ii) Generally well answered. Although the “correct” answer for the case on which this question was based is taken to be the forcible intrusion of mineralising fluids, any reasonable alternative based on the data provided was accepted. The most common such answers were “forcible intrusion of the magma” or “expansion / contraction due to the heat from the magma."

(iii) Reasonably well answered, although some candidates failed to recognise the jointed and well-bedded nature of the limestone.

(b) (i) Most candidates answered this correctly.

(ii) Most placed the line correctly at 10 m depth. The majority of candidates failed to recognise the importance of the change from oxidising above, to reducing conditions below the water table.

(c) This question did not discriminate well. The vast majority of candidates got 2 or 3 marks. E caused the only significant problem and by far the most common mistake was to put the order BCEFAD, i.e. E in the wrong place.

Q.2 (a) (i) Caused few problems, although some candidates gave acceptable values which did not add up to 100%. In such cases only 1 mark was awarded.

(ii) The easiest way for candidates to obtain the 2 marks was to state the inverse proportionality (in their words) and to give a quantitative statement such as : volatiles go from 0 to 60%, or the calorific value rises to 30 kJ g^{-1} etc. This, clearly showed that they had made significant use of the data provided. Having said that, 2 marks were awarded for "as the volatile content goes down the calorific value goes up, i.e. they are inversely proportional".

(iii) Well answered.

(b) (i) Very few candidates failed to be awarded the mark.

(ii) Most candidates got this correct.

(iii) Not a particularly well-answered question, in spite of the fact that a wide variety of responses were deemed acceptable. Much repetition, and candidates should be aware that if there are three marks available they generally have to make three valid points.

Section B:

General comment :

Q.5 Was by far the most popular, followed by Q.3 and Q.4

Q.3 (a) Generally well-answered, although some candidates provided no, or inadequate descriptions of how oil forms initially. The higher scoring candidates invariably included labelled diagrams of oil traps. It proved very difficult to obtain the highest marks without the use of diagrams.

(b) Generally quite poorly answered, with inadequate, scant descriptions of methods. Some of the methods described were not geophysical. A common example which received no credit was "mapping". It was surprising that so few candidates described the principles of seismic and gravity surveys to obtain high marks. Many who attempted the former found it too difficult to give a convincing account. Many accounts amounted to no more than "explosions create waves that are picked up by geophones and tell you where the oil is". A small minority of candidates think that "the oil stops the S-waves." Others claim that "oil and gas can be distinguished underground by using seismic or gravity techniques."

Q.4 Answered by very few, and most answers (with a few notable exceptions) were poor. Again a lack of diagrams hindered good marks. Some candidates gave reasonable accounts of the different types of deposits but had them confused, thus, discussing gold, as an example of a residual deposit and bauxite as an example of a placer deposit.

Q.5 Invariably, coal featured heavily in this answer, but some candidates did not mention in detail both deep pit and open cast mining methods. Too many candidates are devoting too much time to discussing obsolete mining techniques. This was not an essay about historical methods of coal mining. Long wall mining was not considered as often as had been expected.

Many candidates wrote in very general terms especially when considering the environmental impact of mining. Thus statements such as "another problem may be dust and this has to be sprayed with water" were all that was written about this problem. There was no discussion of where, how or how effective the spraying might be. In some cases candidates did not say whether or not it was water that was sprayed.

Several candidates wrote about the extraction of granites and aggregates. However, the subject matter of such essays did not really allow much scope for the candidates to display any flair, and marks for these essays were invariably lower than the coal essays.

One candidate wrote a very good (chemistry) essay on how copper is extracted from the ore. As the essay asked for the extraction of a "geological raw material" the candidate scored very few marks.

Unit 3 – Geological Evolution of Britain

General comment:

Accessible, although candidates, in general, found Q.1. more difficult than Q.2.

Q.1 (a) (i) Well answered.

(ii) Reasonably well answered, although Variscan and Hercynian were often quoted.

(b) (i) Not well done. Candidates found it difficult to obtain acceptable ages, although were usually able to reason that the faulting is the key to obtaining correct ages. They were credited for this appreciation, even if they ended up with incorrect ages. Many answered by quoting absolute ages which were not credited.

(ii) Quite poorly answered. Candidates rarely showed any evidence that they were aware of how to approach this problem. Very few candidates commented on the thickness and / or lack of faulting in the U.Cretaceous and Tertiary sediments. There was no common response but one statement was "all the rocks come into contact near point Y". This shows that even if a candidate may have had a valid point to make she was often not able to do so effectively.

(c) Most got the correct answer, although some gave suggestions such as "closing of the Iapetus Ocean".

(d) (i) Surprisingly very poorly answered. It was not obvious whether candidates did not know what was meant by "fining upwards" or the more likely reason that they had difficulty interpreting the diagram.

(ii) This question discriminated well. The evidence was usually of a high standard, but many did not recognise this was a deltaic sequence. Many candidates implied that ripples are only found in marine environments. Some gave the environment as "a regression" and this was accepted.

Q.2 (a) Generally well answered

(b) This question discriminated well. Simplistic answers such as for fossils:

(i) 1. "Figure 2b has only graptolites,
2. "Figure 2c has many different sorts"

and for rocks:

(ii) 1. "Figure 2b has turbidites"
2. "whereas Figure 2c has limestones and a quartz conglomerate" were awarded 2 marks in total.

The best candidates had little difficulty making much more use of the data, particularly with the rocks, when lithologies, grain sizes and thicknesses were readily compared.

(c) Some excellent responses, particularly discussions relating to depth of water and locations, as evidenced by the differing fossils and rock lithologies.

(d) This did not discriminate well as most candidates scored two marks and nearly all of the rest one mark.

Section B:

General comment:

Q.4 was not as popular as the other two.

Q.3 This question was quite popular and provided some excellent answers. Few candidates made use of diagrams. There are some centres who are obviously still teaching their students the term 'geosyncline'. This is usually inappropriate in the context of the rest of their essay as the term is linked with pre plate tectonic paradigms. Some candidates made little reference to ages or Periods and discussed Uniformitarianism in broad terms. An example would be along the lines of "limestones are found in Britain and they tell us that Britain must have once experienced warm, shallow, marine conditions". Some of these accounts were detailed and of merit but very rarely scored high marks.
(No candidates mentioned lateritic weathering of Tertiary lavas in the Tertiary Igneous Province – evidence of warmer conditions than present.)

Q.4 This question was answered by relatively few and then mostly not very well. Part a) was particularly poor, part b) was better but there was a lot of waffle in these answers. Having said that there was one exceptional essay that was awarded full marks (and deserved more!).

Q.5 Essays were generally of a poor standard. Magnetic inclination was often well covered but many essays covered the concept in a very superficial manner with little detail. Polar wandering was not well done, with a general lack of understanding of what polar wandering curves are and how they are worked out. Most candidates attempted evaluation in this question but it was usually very poor.

Unit 4 – Geology of the Lithosphere

General comment:

There were some outstanding scripts with much content outside the specification. This exhibited excellent teaching and / or wider reading.

Section A:

General comment:

This Section proved to be very accessible.

Q.1 (a) (i) Generally well-answered.

(ii) Generally well-answered.

(iii) Generally well-answered.

(b) Elastic behaviour from O to A is well understood. Many candidates did not recognise that A-B represented plastic deformation. An encouraging number readily stated that if the stress is removed between O and A the rock returns to its original state but between A and B permanent strain is induced.

(c) Quite poorly answered, the majority of candidates did not recognise that shale would be less competent and would exhibit more strain than the sandstone under similar stress i.e. the curve for shale should be below the sandstone curve, enter the plastic stage earlier and extend more to the right than the sandstone curve before fracture.

Q.2 (a) (i) Generally well answered. Candidates freely quoted changes of rate and actual values.

(ii) Reasons provided were generally poor. The reason examiners were looking for was an indication that candidates were looking for a part of the graph where the gradient of the curve was steepest, or the temperature was increasing at the fastest rate with depth. The arrow had to point to the lower left-hand side of the curve. There were many candidates who obtained one mark. A significant number positioned the arrow at the highest point of the curve or to the region where the curve cut the solidus.

(b) (i) Generally well answered. The vast majority scored 2 or 3 marks. Placing the magma at the correct depth proved to be the most difficult mark to obtain. A diapir was by far the most common correct answer for the shape although other alternatives were accepted, such as a laccolith.

(ii) Reasonably well answered, however, too many candidates described what was happening at the MOR and did not relate it to wider plate tectonics as the question asked.

Section B:

General comment:

There were some excellent essays produced by candidates. The general use of terminology, often way beyond that listed in the specification, was of a high standard.
Even lower scoring essays frequently correctly use terms such as Benioff Zone, ophiolites , asthenosphere, mantle plumes, magnetostratigraphy, etc. etc. etc. The use of terminology is much more evident in this Unit than the other three.

Q.3 This question was generally not answered particularly well. There was often too much emphasis placed on magnetic anomalies and not enough on working out distances and assessing the age of the ocean floor. There were usually reasonable attempts to explain how a distance might be obtained, but a disappointingly low number could explain how an age might be calculated. There was little discussion of radiometric dating. A few excellent candidates noted that K-Ar dating is now regarded as being unreliable in altered volcanic rocks (the modern method of dating basalts is by $^{40}Ar/^{39}Ar$, which is much more reliable). Magnetostratigraphy was more commonly quoted than radiometric dating but in such accounts candidates often did not explain how the distances were obtained.

Few commented knowledgeably on the accuracy of methods.

Candidates frequently state incorrectly that the asthenosphere is liquid and that there are ‘magma plumes’ in the mantle.

Q.4 This was generally a well answered question and several answers were of second year university standard. Few candidates are aware that the subducting lithosphere does not generally melt unless it is quite young (<2-3 Ma and therefore hot). It is the de-watering of the slab, which lowers the solidus of the mantle wedge and causes melting of the asthenosphere. Fewer candidates now incorrectly claim that “the heat produced by friction causes the slab to melt”.

Some credit was given to the idea that the slab may ‘implode’ at depth, even though this is not an accepted mechanism. It is more generally accepted that the slab loses water and converts to denser minerals, principally garnet and clinopyroxene (eclogite). These subducted slabs descend to the 660 km discontinuity or the core mantle boundary where they are heated up and rise to form hotspots and mantle plumes.

There were some excellent accounts, including advanced diagrams, that covered these points though not necessarily in the terms used above. It is obvious that this topic is very attractive to some teachers and candidates and some essays were of credit to both.

Q.5 This was generally a well answered question. Good answers discussed growth of the continental crust, by accretion of arcs and ophiolites, as well as cratons, greenstone belts, etc. There was a tendency to focus a little too much on oceanic crust as opposed to continental but such candidates still often obtained high marks.

GEOLOGY

General Certificate of Education 2005

Advanced

GL6 Geological Investigation

Principle Examiner: Ian Kenyon, Truro School, Cornwall

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an AS award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this paper 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	848	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.

GL6 – GEOLOGICAL INVESTIGATION

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 6th 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.

GLF 1 Forms

A completed GLF 1 form should be included with the coursework sample. This is used by the moderator to make any recommendations for mark adjustments. Please note it is not necessary to write out the details of the investigations undertaken in the space allocated on the right hand side of the form. The GLF1 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.

GLF 2 Forms

A completed GLF 2 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, inappropriate and shoddy. 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 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.

GLF 3 Forms

A completed GLF 3 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 GLF 3 form. Ideally the use of 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.

C Forms

Please note that the C forms (red/pink) for recording candidates' marks should be sent directly to WJEC and not the moderator of coursework.

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 and then describing them as in a 'traditional' practical is not really in the spirit of the new 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.

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 to 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 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?

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 optimum 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 submitted this year represents yet another improvement on last year, as many centres have again clearly acted upon the advice given on moderator feedback forms. Teacher marking is now very close to that of the principal moderator on all four components of the assessment criteria. In 2005, seven centres were adjusted downwards and two were adjusted upwards. Help and advice is available from the Principal Moderator at any time.

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Coursework for 2006 can be submitted any time after 1st April 2006.

Ian G. Kenyon, Principal Moderator, June 2005.

GEOLOGY

General Certificate of Secondary Education 2005

Chief Examiner: Dr Alan Seago, Open University

Principal Examiners:		
	Paper 1 Higher Tier	Dr Alan Seago
	Paper 1 Foundation Tier	Dr Alan Seago
	Paper 2 Foundation Tier	David Lomax
	Paper 2 Higher Tier	David Lomax
	Coursework	Dr Alan Seago

Principle Moderator: Dr Alan Seago

	Entry	**Max Mark**	**Mean Mark**
Paper 1 Foundation	210	100	50.3
Paper 1 Higher	442	100	60.2
Paper 2 Foundation	212	90	47.9
Paper 2 Higher	441	90	50.4
Coursework	659	30	19.0

Paper 1 – Foundation Tier

There was a change in the format of the Higher Paper this year, so that the resource data was included in the question paper, as it has been on the Foundation paper for many years. The opportunity was taken to use similar data for both papers with a greater overlap of questions to increase comparability. This ensures that a Grade C achieved on the Foundation Paper is equivalent to a Grade C on the Higher Paper. It is pleasing to report another successful year for centres with some high quality candidates and all candidates able to gain significant marks on most questions. Questions 5b, 6b and 7c seemed to be the most challenging for candidates. The main weakness for some candidates was a lack of appreciation of the command words in the question. 'Explain' was sometimes misinterpreted as 'describe'.

Q.1 The first part of this question was based upon the San Andreas Fault and general features of a seismogram. The plotting of earthquake foci to define the Benioff zone followed. The extended prose section asked for the description of three problems caused by earthquakes in populated areas. The question was well answered by the majority of candidates.

(a) Most candidates used the data sheet correctly to define the age of the displaced boundary but the direction of movement along the fault was commonly incorrect. Many candidates could estimate the average rate of movement along the fault. There were a variety of answers to the type of fault with transform being the most common.

(b) The seismogram was correctly interpreted by the majority of candidates. Most candidates identified at least two of the correct statements regarding the seismogram. Movement of plates was accepted as a cause of earthquakes, although movement along the faults was a better answer using the data.

(c) Candidates ability to plot the earthquake foci was mixed but most could correctly label the trench and mountain chain.

(d) Well answered by all candidates

Q.2 The initial part of the question involved the identification of rock textures exhibited by polished sections of igneous, metamorphic and sedimentary rocks. The second part of the question went on to the determination of the pressure and temperature conditions of the metamorphic rock using evidence from the polished section and graph of conditions.

(a) Most candidates could correctly measure the crystal and use the scale. The identification of the rock specimens was well done. The foliated texture of the metamorphic rock and fragmental texture of the sedimentary rock proved to be more difficult.

(b) Few candidates tried to relate the textural features of the metamorphic rock to the pressure/temperature conditions and relied on knowledge to partly answer the question. Very few candidates tried to relate mineralogy or crystal size to the conditions.

Q.3 The first task for candidates was to plot grain size data on a bar graph and then sketch an angular and well rounded grain. Candidates were then asked to describe changes in grain shape and size of a sediment as it is transported.

(a) Most candidates were able to plot the data correctly, although some incorrectly identified H as the most well sorted sediment.

(a) The sketches of a well rounded and angular grain were good. Most candidates obtained at least 4 marks for the description of changing shape and size with transport.

Q.4 The table in the first part of the question compared the shape of andesitic and basaltic volcanoes. This led on to the relationship between volcanic eruptions and the viscosity of magma. Candidates were then asked to plot the thickness and particle size of pyroclastic deposits and describe one volcanic hazard.

(a) The table of differences between the two volcanoes was well completed.

(b) As usual, quite a large number of candidates were confused by magma type and viscosity, thinking that basic magma was the most viscous. Most answers discussed how viscous magma would block the vent and lead to an explosive eruption. Whilst this was correct, for full marks candidates were expected to relate viscosity and composition to the escape of gas.

(c) The two different scales on the y axis of the graph did confuse some candidates. Some candidates did not label the lines. There followed a description rather than an explanation of how particle size varied with distance from the vent. Most candidates were able to describe one volcanic hazard caused by an explosive eruption.

Q.5 As in previous years, the 'fossil' question provided quite a challenge to candidates. The first part of the question tested the identification of fossils using the number of body parts and symmetry. Candidates were then asked to interpret the mode of life of two different trilobites. In the last part of the question candidates were asked to describe the process of carbonisation and describe how plant material can be used to interpret the environment of deposition of clay in the sedimentary log.

(a) When given the choice of 1, 2 or many, it was surprising how many candidates put some other answer. The fossils were usually correctly identified. Candidates could correctly relate the morphology of the trilobite to its mode of life when given sufficient prompting but found the task more difficult when given more scope for composing their own answers. The function of the spines was not well known.

(b) This was poorly answered. Candidates had very little idea of how fossils are preserved by carbonisation. Similarly candidates found the interpretation of the environment of the clay using the plant roots very difficult.

Q.6 In the first part of the question, the field sketch illustrated a variety of different concepts from the specifications such as a fold axis, cross bedding, way-up structure, unconformity and relative dating. The second part of the question tested a different aspect of relative dating by cross-cutting relationships.

(a) Most candidates could label the fold axis but were less successful in showing the current direction as shown by cross bedding. The diagram for way-up structures was well drawn but the direction of younging was rarely shown. Most candidates correctly named the unconformity and realised that the sandstone was older than the oolitic limestone. Many candidates used the law of superposition again instead of the law of included fragments.

(b) The box was often left blank. Those candidates who attempted to draw a dyke or fault usually made a correct attempt at the question with a good explanation and labels.

Q.7 The question began by testing basic mineralogical principles and the use of the Data Sheet. The question went on to the geochemical analysis of river water. In the final part of the answer candidates were asked to describe the origin of hydrothermal fluids.

(a) The basic mineralogical principles were well known and the candidates made good use of the Data Sheet

(b) Most identified vein 2 as the copper ore. There were a number of possible reasons for the change in copper values along the stream but many candidates described deposition as a possibility, not realising the copper was in solution.

(c) The origin of hydrothermal veins was poorly understood by most candidates. A minority of candidates made a good attempt at describing the origin of fluids from magma or convecting groundwater.

Q.8 This question tested the causes of landslides due to dipping sandstone and shale beds.

(a) Few could draw in the position of the water table.

(b) Most candidates could explain what impact the permeability of the rocks would have but they often described the overlying shale collapsing because the water would make the sandstone weak or eroded. They failed to recognise the lubrication of the sandstone/shale boundary.

(c) Most answered the southern side but some candidates said the slope was steeper rather than realising the impact of the beds dipping towards the reservoir.

(d) Most correctly described the possibility of flooding downstream but some candidates described tsunami or water contamination. A significant number of candidates did not complete all of the question, suggesting lack of time may have been a factor.

Paper 1 Higher Tier

There was a change in the format of the paper for the first time in many years. The resource data was included in the question paper instead of a separate data booklet. It was difficult to assess any impact of this change as the mean mark for the paper was very similar to 2004 but candidates certainly did not react adversely to the change. It is pleasing to report another successful year for centres with some high quality candidates and all candidates able to gain significant marks on most questions. Questions 5b and 7c seemed to be the most challenging for candidates. The main weakness for some candidates was a lack of appreciation of the command words in the question. 'Explain' was sometimes misinterpreted as 'describe'.

Q.1 The first part of this question was based upon the San Andreas Fault and general features of a seismogram. The plotting of earthquake foci to define the Benioff zone followed. The extended prose section asked for the description of three problems caused by earthquakes in populated areas. The question was well answered by the majority of candidates.

(a) Most candidates used the data sheet correctly to define the age of the displaced boundary but the direction of movement along the fault was commonly incorrect. There were some errors in the calculation of movement along the fault. The fault was rarely correctly named as a transform fault. A common answer was conservative.

(b) The seismogram was correctly interpreted by the majority of candidates. Movement of plates was accepted as a cause of earthquakes although movement along the faults was a better answer using the data. The main errors came when candidates tried to explain the reason why L waves caused the most damage. The large amplitude of L waves was rarely deduced from their appearance on the seismogram.

(c) Candidates ability to plot the earthquake foci was mixed with vague explanations of their origin often repeating 'plate movement' as in part (b).

(d) Well answered by all candidates

Q.2 The initial part of the question involved the identification of rock textures exhibited by polished sections of igneous, metamorphic and sedimentary rocks. The second part of the question went on to the determination of the pressure and temperature conditions of the metamorphic rock using evidence from the polished section.

(a) Most candidates could correctly measure the crystal and use the scale. The identification of the rock specimens was well done. The foliated texture of the metamorphic rock and fragmental texture of the sedimentary rock proved to be more difficult.

(b) Few candidates tried to relate the textural features of the metamorphic rock to the pressure/temperature conditions and relied on knowledge to partly answer the question. Very few candidates tried to relate mineralogy or crystal size to the conditions.

Q.3 The first task for candidates was to plot grain size data on a bar graph and then describe grain size and sorting. Candidates were then asked to describe changes in grain shape and size of a sediment as it is transported.

(a) Most candidates were able to plot the data correctly although some incorrectly identified H as the most well sorted sediment.

(b) The description of changing grain size and shape was good and often illustrated with relevant diagrams. Attrition and corrasion were often mentioned as the causes of grain shape and size.

Q.4 The table in the first part of the question compared the shape of andesitic and basaltic volcanoes. This led on to the relationship between volcanic eruptions and the viscosity of magma. Candidates were then asked to plot the thickness and particle size of pyroclastic deposits and describe the hazard caused by a mudflow. The final part of the question asked for the origin of basaltic magma.

(a) The table of differences between the two volcanoes was well completed although a number of candidates identified the magma as granite.

(b) As usual quite a large number of candidates were confused by magma type and viscosity, thinking that basic magma was the most viscous. Most answers discussed how viscous magma would block the vent and lead to an explosive eruption. Whilst this was correct, for full marks candidates were expected to relate viscosity and composition to the escape of gas.

(c) The two different scales on the y axis of the graph did confuse some candidates. Some candidates did not label the lines. There followed a description rather than an explanation of how particle size and thickness varied with distance from the vent. A number of candidates failed to read the question carefully and described ash weighing down roofs and the effects of pyroclastic falls.

(d) Again many candidates did not read the question carefully enough and described sea floor spreading in detail rather than discuss the origin of basaltic magma by partial melting of the mantle beneath the ridge.

Q.5 As in previous years, the 'fossil' question provided quite a challenge to candidates. The first part of the question tested the identification of fossils using the number of body parts and symmetry. Candidates were then asked to interpret the mode of life of two different trilobites. In the last part of the question candidates were given the choice of either to describe two methods of preservation of plant material or describe how plant material can be used to interpret the environment of deposition of sediments.

(a) When given the choice of 1, 2 or many, it was surprising how many candidates put some other answer. This part of the question was answered better than what followed but many candidates identified the coral as an echinoid. It was hoped that the hard upper surface of the trilobite would prompt the answer that the trilobite was benthonic and needed protection from above but few candidates gave this as an answer.

(b) This was poorly answered. Candidates who attempted the method of preservation had some idea of carbonisation but little idea of cast or mould as shown by the fossil root. Some did not relate the type of preservation to the specimens in the question. Candidates who attempted the other option did little better. Candidates tended to focus on coal as being a swamp environment but there was little reference to the clay or shale.

Q.6 In the first part of the question the field sketch illustrated a variety of different concepts from the specifications such as a fold axis, cross bedding, way-up structure, unconformity and relative dating. The second part of the question tested the decay of radioactive elements and their use in dating.

(a) Most candidates could label the fold axis but were less successful in showing the current direction as shown by cross bedding. The diagram for way-up structures was well drawn but the direction of younging was rarely shown. Most candidates correctly named the unconformity and realised that the sandstone was older than the oolitic limestone. Many candidates used the law of superposition again instead of the law of included fragments.

(b) Well answered in the main. The parent:daughter ratio after one half life proved to be problematical for some.

Q.7 The question began by testing basic mineralogical principles and the use of the Data Sheet. The question went on to the geochemical analysis of river water. In the final part of the answer candidates were given the choice of describing the origin of hydrothermal veins or two methods of mineral exploration.

(a) The basic mineralogical principles were well known and the candidates made good use of the Data Sheet

(b) Most identified vein 2 as the copper ore. There were a number of possible reasons for the change in copper values along the stream but many candidates described deposition as a possibility not realising the copper was in solution.

(c) The origin of hydrothermal veins was very well described with reference to the origin of the fluid by a variety of means, its migration along fractures and precipitation on cooling of the fluid. In contrast, surveying methods were poorly understood. There were a lot of references to sonar, mapping and boreholes rather than geophysical or geochemical methods. When correct methods were identified they were rarely explained in any detail.

Q.8 This question tested the causes of landslides due to dipping sandstone and shale beds.

(a) Few could draw in the position of the water table.

(b) Most candidates could explain what impact the permeability of the rocks would have but they often described the overlying shale collapsing because the water would make the sandstone weak or eroded. They failed to recognise the lubrication of the sandstone/shale boundary.

(c) Most answered the southern side but some candidates said the slope was steeper rather than realising the impact of the beds dipping towards the reservoir.

(d) Most correctly described the possibility of flooding downstream but some candidates described tsunami or water contamination.

Paper 2

The specimens for the Higher and Foundation tiers were different. Centres are reminded of the need to ensure candidates receive the correct set of specimens.

Paper 2 Foundation Tier

The paper included a geological map, photograph and 4 specimens.

The paper achieved the full range of marks with a number of candidates performing very well. In general terms, the performance was better than last year with very few candidates obtaining very low scores. A number of candidates achieved very high marks (over 80) and the examiners believe that these candidates would have achieved greater success on the Higher Paper. Generally, candidates performed well on all questions, with some part questions producing better responses than others. The quality of sketching had improved on previous years. There is no evidence to suggest that any candidate did not finish in the time permitted.

Q.1 Map

As in previous years, a high proportion of the marks available for this paper were allotted to this question (34/90). Generally, all candidates achieved a degree of success on some parts of the question and the quality of map work was higher than in previous years.

(a) Part (ii) was well done but few gained credit for part (i). The rocks were horizontal, as shown by the key on the map, but this was not recognised by most candidates.

(b) All but a few attempted the cross-section, with varying degrees of success. However, the standard was generally impressive and the examiners are pleased with the steady improvement in this aspect of candidates' performance. Candidates of all ability are able to draw horizontal strata, major and minor intrusions. There were very few examples of all vertical strata and no synclines as opposed to anticlines. Centres need to ensure candidates know what happens when a bed hits a fault and a dyke. Some candidates stopped beds at the dyke while others drew beds continuing across the fault. Very few were able to label the unconformity.

(c) Generally answered very well.

(d) There were some excellent answers to this question. More able candidates correctly identified the dyke and gave impressive reasons. A few incorrectly answered 'sill' and weaker candidates generally did not attempt the unconformity.

(e) The use of tick boxes enabled students to show a good understanding of faults. Most candidates were able to recognise the trend and many appreciated from the section that the fault is dipping. Recognising the type of fault proved more difficult.

(f) The performance on this question was better than last year but the comments from last years report still apply. Credit will not be given when candidates give the reason for their selection as "is above" or "below" the other. More specific reasons are needed. The area where candidates have most problems is where they have to note the position in a fold. Cross-cutting relationships are well done but with unconformities, candidates must take some form of reference to the unconformity or what it represents.

Q.2 Specimen – Calcite

The specimens were a rhombic shape and clearly showed the 3 cleavage planes. Despite many incorrectly identifying the mineral, in general the question was well done. Part (a) states that the mineral reacts with dilute hydrochloric acid but some candidates did not appreciate the significance of this fact. Some candidates use the data sheet incorrectly. They decide on the identity of the mineral, sometimes incorrectly, and then every answer is copied straight from the data sheet. The data sheet is there to help in identification, not vice versa.

(a) Very well answered, with candidates of all abilities showing an impressive knowledge and understanding of health and safety.

(b) Answered well by approximately half the candidates.

(c) This style of question has been set many times before and the examiners were disappointed with the response. Candidates undertook the tests but many gave incorrect results. Candidates should be encouraged to take greater care. Use of the data sheet would greatly benefit students answering this question but there is every suggestion that many did not take advantage of this resource.

(d) More candidates answered very well with references to colour, streak, cleavage, lusture and density. A common error was the use of hardness when the question clearly states "other properties."

(e) Many incorrect answers, primarily for the reason given in the introduction to this part of the report.

Q.3 Specimen – Dolerite/Gabbro

The examiners looked carefully at a variety of specimens. The evidence from the map shows that the specimen should be dolerite but some specimens were sufficiently coarse grained to be gabbro. The examiners decided to accept either dolerite or gabbro as identification for the specimen and the mark scheme was adjusted to take account of this in questions (a), (b) and (c). Examiners looked carefully at each script in order to ensure that no candidates were disadvantaged. The performance on this question was quite good for candidates of all abilities.

(a) Candidates of all abilities found the true/false response relatively straightforward and a number of candidates achieved maximum marks.

(b) Candidates found this question more difficult. Very few recognised that, having come from the same magma, the two rocks would have similar mineralogy. Candidates must be encouraged to read the stem of the question before they begin to answer. Many candidates were able to comment on the grain size differences between the two rocks and were able to give a reason.

(c) Although both dolerite and gabbro were accepted as an answer, the responses were generally disappointing.

(d) Candidates of all abilities were able to name a use for the rock but many of these were unable to give a reason for their answer.

Q.4 Specimen – Ammonite

The specimen provided was a good quality plaster cast which clearly showed the suture lines. Candidates performed well on part (a) questions but poorly on the other part questions.

(a) The quality of sketching was impressive, with most candidates able to draw a top and side view of the fossil. A few drew sketches of both sides where one side was flat plaster. Very few only drew one view. A high number drew the fossil without the suture lines. Labelling of the suture was not done well. Answers to other part questions suggested that many candidates had no understanding of the word 'suture.' Generally, candidates achieved the mark for scale. However, while there are a variety of ways showing scale, some candidates are confused by +1, +2 etc and Centres may wish to encourage candidates to use measurement in millimetres on their sketch.

(b) This question required candidates to state two ways in which the specimen and the diagram differed. Candidates did not need to use correct terms as long as their comment was appropriate. For example, the specimen had a keel but candidates could gain credit for describing the keel and lack of it on the diagram without using the word 'keel'. However, this question was answered poorly by all but the most able candidates.

(c) Presumably, because of the reasons given in Q4 part (a) of this report, answers to this question were disappointing. Credit was only given for mention of the suture.

(d) In the specification, the use of ammonites for dating rocks is clearly stated. Centres will highlight this in their teaching. In view of this, responses to this question were disappointing. Very few candidates achieved more than 1 mark out of 3. 'Short ranged' or 'lived for a short time' were often the only answer. Weaker candidates used three morphological features as their answer.

Q.5 Specimen – Hornfels

Each year, that there is a metamorphic question, it represents usually the candidates' worst performing question. However, this year, candidates performed quite well on questions relating to metamorphic rock.

(a) Candidates needed to look at the location on the map in order to correctly answer this question. Clearly most did not do this and centres should encourage candidates to look at the location on the map where each specimen was collected. Often, there is evidence at the location, which will help answer the question.

(b) Sketching was again very good, although candidates were expected to show the random crystals and relic structure on their sketch in order to gain 2 marks. Labelling was very good by candidates of all abilities. The comment with regards to scale in Q4 of this report also applies here.

(c) The use of a passage with missing words enabled candidates of all ability to gain credit concerning this quite difficult concept. The only common error was to assume the rock was formed by regional metamorphism.

(d) Very few correctly named the rock. Examiners were surprised at the number of names given of rocks not on the specification. This lists those rocks which candidates can be asked to name and Centres need to ensure candidates are aware of this list.

Q.6 Photograph

The colour photograph was from a quarry where the rocks are steeply dipping. Although somewhat varied, the quality of sketching was generally good. Many candidates achieved high marks for this question.

(i) Centres should be aware that marks for the photograph sketch are awarded according to the clarity and detail of the sketches. In this case, generally, a few bedding planes drawn steeply dipping would achieve 1 mark, varying thickness of beds would achieve 2 marks and added details of joints and scree would generally take the mark to the maximum. The examiners are not necessarily looking for works of art but sketches which clearly show the geological features.

(ii) Candidates were expected to use a ruler, measure the distance between the bedding planes and use the scale on the photograph to calculate the distance. All but the weakest candidates were able to gain credit for this question.

(iii) Candidates were provided with 4 labels to add to their sketch. Most achieved at least 2 marks but the steepness of the bedding proved confusing and many candidates mixed up joints and bedding planes. There was an assumption that steep features must be joints and vice versa.

Paper 2 Higher Tier

This paper used a map, photograph and 5 specimens.

Generally, candidates performed well on this paper, with the full range of marks being attained. However, there were not as many very high scoring scripts as in previous years. Candidates of all abilities scored quite well on all questions, although the metamorphic question proved the most problematical. The quality of sketching was rather disappointing and some candidates found a rather straightforward map somewhat difficult. There was no evidence of any candidate failing to finish in the time allotted for the paper.

Q.1 Map

It was mentioned in last years report that there has been a decline in quality of map work and this decline has continued. The examiners are of a view that perhaps the type of shading on the map may have led to the map appearing more complicated than it actually was. Centres should ensure that candidates are well aware that examiners are not trying to 'catch out' candidates. Over the years, there has been no change in the type of maps used.

(a) Generally, both parts were answered correctly, with candidates of all ability showing an understanding of strike.

(b) The more able candidates were able to score maximum marks on this section. However, many candidates made rather careless errors which reduced their marks to between 7 and 10. Very few candidates obtained very low scores. Common errors included extending beds across the fault, inaccurate dip measurements and inaccurate location of surface outcrops. Labelling was often impressive.

(c) This question required a further cross-section and this was completed very well by candidates of all abilities. The second part asked for 3 differences between the 2 faults. As there were 5 marks available, candidates should have been aware that more than 3 general statements were needed to gain full credit. 3 marks were given for 3 differences with an additional 2 marks for the detail of 2 differences. For example, different throws would be one mark, measurements of the throws would be 2 marks. Candidates must take note of the marks available for every question and ensure they give themselves a chance of maximum marks.

(d) The geological history followed the same format as in previous years and many candidates performed well. However, there was a tendency for candidates to focus on their cross-section and not the whole map. They did not mention the unconformity or fault F2. The geological history must relate to the area of the map. Full marks could only be awarded where candidates recognised that dating some events is difficult where, for example, cross-cutting relationships do not exist. The timing of the glacial deposits proved difficult for many candidates.

Q.2 Specimen – Calcite

Candidates of all ability scored well with more able candidates performing particularly well. Candidates were told that the mineral reacts with dilute hydrochloric acid. Some candidates clearly misidentified the specimen before completing any tests or observations. They then used the data sheet incorrectly based on their assumption. The data sheet is to be used in conjunction with a candidate's tests and observations.

(a) Sketches were done well, with more candidates gaining 2 marks for a 3 dimensional rhombic shape. A few drew squares and a minority lost a mark by only drawing a 2 dimensional figure. This did not show the form of the mineral. Only the most able gained the full 3 marks for labelling the cleavage. To gain full credit, examiners expected the 3 planes to be clearly labelled. Many achieved just one mark for a label stating "3 planes of cleavage." In terms of scale, candidates who use measurements in millimetres rarely make mistakes whereas x1, x2 or 2:1, 2:3, are often incorrectly applied.

(b) Very well done by candidates of all abilities. Hardness and streak were accurately tested and appropriate observation given. The question clearly stated "three other" and yet some candidates still used cleavage in their answer.

(c) Very well answered by all but a dew.

Q.3 Specimen – Dolerite/Gabbro

On the map, this specimen is from a dyke but having looked at a variety of specimens the examiners decided to accept dolerite or gabbro for the name of the rock. The mark scheme for all aspects of this question was amended accordingly and each script was looked at carefully in order to ensure no candidate was disadvantaged.

(a) This form of question has been used a number of times and candidates performed very well. They are able to systematically go through a range of features, including aspects of texture and mineralogy. The identification of likely minerals was very well done.

(b) Candidates of this ability are able to link specimens to the map. Answers were generally well done, with references to igneous processes and, in particular, cooling rates. A significant number discussed the rock as metamorphic and made references to alteration by heat.

(c) Well answered.

Q.4 Specimen – Ammonite

The ammonite was a plaster cast in which the suture and keel were very clear.

A pleasing response following on from the improved response seen in last year's fossil question. Centres are clearly giving appropriate coverage to this section of the specification.

(a) A very small minority drew the whole specimen. Most achieved 2 marks for a correct sketch of the ammonite suture. A few lost a mark due to the simplistic nature of the suture in their sketch.

(b) Part (i) required candidates to state 3 differences between the specimen and diagram K. Candidates were obviously given credit for using morphological names such as keel but these were not required to get the marks. Candidates could describe the differences. As a result candidates of all abilities scored well. Part (ii) required identification of the 2 different ammonoids and this was well answered as was part (iii).

(c) Well answered, with candidates of all abilities showing a good understanding of zone fossil characteristics.

Q.5 Specimen – Hornfels.

A specimen showing random crystals and relic structure.

Metamorphic specimens generally cause problems for students and there is no obvious reason for this. Many students failed to note the relic structure in the rock and many identified the rock as something which is not on the specification. Candidates need knowledge of the rocks they can be expected to name in the examination.

(a) In order to achieve full credit for their sketch, candidates needed to show both the random crystals and the relic structure on their sketch. Very few achieved this, although most did gain 1 mark. The label had to be evidence for contact metamorphism and many did not do this. The most common correct label related to the random orientation of the crystals.

(b) Virtually all candidates correctly recognised that this rock could not have come from the sandstone. Able candidates also recognised that the rock is not sufficiently altered to exist very close to the intrusion.

(c) Answered correctly by a surprisingly low number of candidates.

Q.6 Photograph

This question used a colour photograph of steeply dipping beds in a quarry. The photograph was twice the size of the sketch expected from candidates. The candidates' performance on this question was generally mixed with most answering some parts well and others not as well.

(a) Candidates are always asked to draw a sketch of a photograph. Centres would be expected to practice this skill. However, candidates have never been asked to draw a sketch half the size of the photograph. This may explain why sketching was generally not of a high standard. However, disappointing sketching was also mentioned in last year's report and this trend is a cause for concern. Of the 4 marks available, 1 was for the correct size of the sketch. Candidates of all abilities generally achieved this mark. Very few achieved the 3 marks for the sketch. Examiners do not expect works of art but they do expect clear detail that shows the geological features. Labelling was generally fine but candidates must ensure that their labels actually go directly to the feature. Examiners cannot be expected to make assumptions regarding where the label is meant to go. Part (iii) was very poorly answered by all but the most able. The most noticeable changes on the photograph relate to thickness of bedding but few mentioned this fact.

(b) Generally very well done, with a good variety of way up structures.

Q.7 Specimen – Conglomerate

This final question was worth 7 marks with a maximum of 4 for the description and 4 for interpretation. The focus of the question was the texture of the rock. Descriptions of the rock were generally impressive, although some candidates referred to crystals as opposed to clasts. Descriptive comments not related to texture gained no credit. Candidates generally achieved less credit for interpretation, although examiners did allow a range of interpretations as long as candidates were able to provide valid reasons.

COURSEWORK

Forty-seven centres submitted field investigations for moderation. There were some excellent field investigations seen, which are being perfected by the centres and well suited to the specification. The best investigations allowed the candidates to demonstrate basic field skills and perform suitable analytical techniques on the data collected. It is good to see geological field skills being demonstrated with a high degree of competence. The work produced by the best candidates would be a credit to students at a higher level and centres are congratulated on the improving quality of work submitted by their candidates. Many centres are also to be congratulated on the accuracy of their assessment, so that the need for scaling is progressively being reduced. A minority of centres are submitting work with inflated marks, which does result in quite severe scaling, and this is disappointing for the moderation team, centres and candidates alike.

A small team of moderators undertake the moderating process and all have considerable experience of teaching geology in schools and of moderating. The Principal Moderator saw the submission from approximately 20 centres and there were some common themes throughout the moderation, which can be addressed by centres prior to next year’s submission.

- The spirit of the specification is now firmly towards fieldwork but making some provision for laboratory work, particularly in difficult circumstances. There are however, a variety of options which can be used to fit the specification. A minority of centres still submit a substantial amount of laboratory work, although centres are beginning to see the benefits of submitting a single piece of fieldwork which covers all of the skill areas. There are sometimes problems with centres which submit mostly laboratory work in terms of fulfilling the requirements of the specification, which specifies the inclusion of 'work based in the field'. Some centres interpret this very loosely. The number of centres restricted to building stone or gravestone studies is also substantially reduced.

- A problem in some cases was a lack of focus for the investigation. If clearly focused, for example, on 'the environment of deposition of the Purbeck beds of Lulworth Cove', candidates can concentrate on collecting data such as grain size, sorting, sedimentary logging and fossil content. With a lack of focus and definition of aims, candidates may collect irrelevant data, such as fold shape and attitude and be distracted from the main investigation. An investigation entitled 'examine the geology of a section of the Pembrokeshire coast' is unlikely to be a success. With slight modification, most of the field investigations submitted were suited to the criteria. In some cases, instructions were included for each locality rather than allowing individuals to plan and develop their own method. The planning by some candidates was very brief, e.g. no indication of sampling, no field procedure (roundness chart, how to measure orientation of clasts, dip and strike, or a pre-designed data collection table). Some candidates had little or no data in the field notes yet were able to produce the same in a report.

- The use of secondary sources at the planning stage needs further development by some centres and candidates need to demonstrate their detailed knowledge of geology to achieve the high mark range for Analysis and Planning.

- 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 and sedimentary logs should normally be part of every investigation where appropriate.

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

- Evaluation continues to be the problem skill for candidates. Very few candidates are able to discuss sources of errors in their measurements or describe detailed further work to provide additional evidence. Few candidates go beyond 'take more measurements and spend more time' at the field locations.

- Where candidates submitted laboratory work, there was sometimes no risk assessment which, taking the criteria literally, could mean that not even 2 marks are awarded for Planning.

A mixture of field tasks were undertaken with investigations into:

interpretation of sedimentary environments
mapping exercises leading to geological sections and history
structural analysis such as assessment of the degree of crustal shortening
weathering of gravestones
fossil studies
clast analysis of pebble beds and interpretation of environment.

Laboratory investigations included the effect of temperature on the speed of 'lava flows', effect of insulation on the rate of cooling, the effect of the size of a cooling body on country rock, effect of temperature on the behaviour of materials and sieving exercises to determine grain size and sorting.

Centres are to be congratulated on the variety of opportunities given to candidates in areas of outstanding geology such as the Dorset Coast, North Devon, Cornwall, Wren's Nest, the coast of Northern Ireland and the Isle of Man. Other centres used a variety of local geological locations.

Virtually all centres provide sufficient information to facilitate the moderation process and the annotation by teachers is much appreciated. Assessment is rarely severe and most often on the generous side, particularly for the skill of Evaluation. This does mean that the scaling procedure is needed for some centres but year upon year the number of cases of large scaling decrease. Where a candidate achieved equal marks for a skill in the field and laboratory investigation, there was sometimes no indication on the Gl2 form from which investigation the final mark was derived. Although there was no choice in some cases, in others it was left to the moderator who could have been moderating work which was not used in the final assessment by the centre. Circling of the marks used in the assessment on the Gl2 form would easily solve the problem.

The WJEC recognises the effort and enthusiasm that geology teachers invest in their candidates, which certainly shines through in the quality of work that they produce. The Moderators are always willing to provide as much support as is requested by the centre.
Centres should be aware that there is help available from the WJEC. Published exemplars of coursework investigations can be obtained from the WJEC offices and INSET activities are provided. Moderators' reports on the current moderation process are sent out to centres. Centres requiring individual advice are encouraged to contact the Principal Moderator on an informal basis through the offices of the WJEC. Any centre having a problem with applying the assessment framework should contact the WJEC well in advance of the submission date.

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