GCE EXAMINERS' REPORTS

GEOLOGY
AS/Advanced

JANUARY 2014

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GEOLOGY

General Certificate of Education

January 2014

Advanced Subsidiary/Advanced

GL1

Principal Examiner: David Evans

General Comments

As usual this GL1 paper involved the interpretation of cross-sections, graphs, photographs, maps and a diagram, offering students the opportunity to access a range of stimulus material.

Q.1 (a) Most students correctly noted the concordant nature of the igneous bodies.

(b) In part (i) most candidates were able to describe the increase in crystal size towards the centre of rock A and used the axes of the graph to state specific crystal sizes. In part (ii) most explained this in terms of more rapid cooling of crystals at the chilled margin due to contact with cold country rock. The third section of this question was often confused, with students describing rather than explaining as the question demanded. The better candidates noted that X is the chilled margin of A against B, and Y represents the former centre of rock B before A was intruded. The weaker candidates simply recorded that X cooled faster than Y.

(c) Most answers correctly noted Orthoclase Feldspar in part (i), but weaker students opted for chiastolite or barite for which the two characteristics stated in Figure 1c matched. However the question was designed such that students then had to understand that only Orthoclase Feldspar would be an essential mineral in an igneous rock. In part (ii) most candidates gained at least 2 of the 3 marks available with the best answers stating accurate sizes of the groundmass and the phenocrysts using the scale.

(d) Few candidates used the colour and crystal size clues given in Figures 1a and 1b to name the rock as Dolerite.

(e) The majority of candidates correctly worked out that A was the youngest and C the oldest and explained this in terms of C, the country rock, needing to be present in order for the intrusions to intrude. The majority noted the significance of the included fragments of rock B in rock A.

Q.2 (a) Few candidates noted that the curves could not represent surface waves since the curves extend to depth in the Earth. Most candidates recognised that since curve Y had higher velocities than curve X, then Y must be the P wave curve rather than the S wave curve.

(b) Surprisingly few candidates accurately located the arrow A in the zone of reduced velocity at approximately 110-250km depth. More students however explained the zone as being a partially melted zone where a reduction in rigidity caused a reduction in velocity.

(c) This section proved to be quite demanding for many.

(i) Surprisingly few candidates recognised that F has thicker crust because of its location on thicker continental crust rather than thinner oceanic crust.

(ii) The recognition of crustal thickening at fold-mountains related to the convergent plate boundary at E was missed by many.

(iii) The increase in age of the crust at H, since it is further from the ridge was explained by many, but not that this caused an increase in time for more sediment to accumulate.

Q.3 (a) Most candidates did not note the question to be about regional metamorphism, hence many arrows were incorrectly linked to the effect of the pluton. The key was to recognise the relative degree of metamorphic change of slate and schist and thereby draw an arrow towards the schist, to the west. Many answers correctly noted that the sandstone had been faulted into place but fewer developed the idea that, being on the downthrow side of the fault, the sandstone must therefore be younger than the schist and younger than the phase of metamorphism.

(b) (i) Some candidates successfully recorded cleavage planes as forming due to low grade regional metamorphism of a shale/clay, with the alignment of clay minerals, micas and chlorite at right angles to directed pressure. A number of candidates gave partial aspects of this "model answer" and so earned 1 or 2 marks. Some candidates gave responses which were not worthy of any credit.

(ii) Surprisingly few candidates correctly selected box B and explained it in terms of the cleavage linking it to a region of slate, and the presence of the contact metamorphic mineral chiastolite/andalusite which indicates subsequent contact metamorphism. All boxes were chosen amongst the answers with a range of unfounded reasons.

(c) Most candidates drew components to the correct mean size of 1.5 mm, so gaining one mark, although the majority incorrectly drew them as grains rather than interlocking crystals.

(d) The testing, final part of the question was designed to allow students to explain the evidence supporting parts of the statement and to recognise aspects for which there is no evidence. Few candidates gained 3 marks, for which it had to be recognised that there is no evidence of lavas. The majority of candidates earned at least one mark for linking the presence of corals to the presence of shallow tropical seas. Other marks were gained for the link between marble and its parent rock limestone which is also typical of shallow tropical seas.

Q.4 (a) (i) It was anticipated that students would simply apply the rule “the younger beds are on the downthrow side” and quote an example from Figure 4a, e.g. the Quaternary is younger than the Cambrian. This was done well by the majority of candidates.

(ii) It was encouraging to see that the fault was correctly recognised as “normal” in the majority of cases with the most common reason being that “the footwall has moved up”.

(b) (i) This was a simple test of understanding which rocks are Cenozoic and how borehole data “works”. The correct answer 602 m was gained by surprisingly few candidates. Many errors involved answers which included adding or subtracting various numbers within the borehole data.

(ii) There were many vague answers to this question but credit was given for any that coherently conveyed the concept that there are no beds which appear on both sides of the fault which can act as “marker beds”. The specific use of the term “marker bed” was not expected.

(c) (i) The majority of students correctly noted that of the two unconformities in Figure 4a, only the upper one at the base of the Quaternary could have formed less than 10 million years ago. The error which some students made was to locate it at boundary R, without reference to Figure 4b which would have shown them that this unconformity is significantly older than 10 million years.

(ii) It was pleasing to see that many candidates used Figure 4b to note the absence of Cretaceous rocks. Other correct responses included the variation in dip angle above and below boundary R, and the fact that boundary R lies on top of, or cross cuts, rocks of varying ages. Few candidates found all three pieces of evidence.

(d) (i) Many students correctly referred to the fact that the fossil has been preserved by pyrite. The better answers developed the idea of replacement of the original shell material atom by atom. Credit was also given to answers which discussed the formation of a mould and subsequent cast. This was a generally well answered question.

(ii) Many candidates noted that the fossil was an ammonite and commented on the highly folded suture lines, which are clearly displayed in the photograph. Some students simply stated that the fossil group was a Cephalopod which was not a precise enough answer. The term “fossil group” has been used over many years in examinations where the correct answer has been goniatite, ceratite or ammonite. Weaker students simply referred to the presence of ribs or of suture lines, without recognition of their complex folding.

(iii) The final section of this question and indeed the paper was intended to be quite demanding, drawing on an appreciation of many aspects of fossils. The key to success was not to understand how ammonites lived, but to recognise when ammonites became extinct. This was a point lost on most candidates, many of whom wrote irrelevantly about the marine nature of ammonites. However those few who recognised that ammonites became extinct before the Quaternary went on to explain that this fossil is merely an included fragment in the deposit and hence, as a derived fossil, is of little use in determining the environment of deposition. The very best answers went on to note that the fact that the fossil forms a large fragment indicates a high energy environment for the Quaternary deposit. The majority of answers gained one or no marks.

GEOLOGY

General Certificate of Education

January 2014

Advanced Subsidiary/Advanced

GL3

Principal Examiner: Pete Loader

SECTION A

General Comments

The entry was restricted to 38 candidates. No clear pattern could be deduced from such a small number but the paper seemed to discriminate.

Q.1 (a) This was answered well by most though the position of the arrow head in some cases did not always make the intended location clear.

(b) The response to the calculation was mixed with only just over half gaining full marks.

(c) (i) Most placed the pathway in the limestone or sandstone but many failed to link the flow from the surface to the spring via the fault.

(ii) This was quite well answered and discriminated well. Rock type was best understood though very few used the previous question to explain how the structure enabled the groundwater to heat up. Some suggested this was a result of friction associated with fault movement.

(d) This was poorly answered with few reviewing and interpreting the evidence. The cavity was rarely referred to or the erosion and weathering of limestone. Many suggested the mudstone was too weak and a significant number ignored the data and related the subsidence to over-pumping and compaction of the aquifer.

Q.2 (a) (i) This was quite well answered although sometimes tilt was confused with earthquake activity and many did not comment on the cyclical nature of the deformation.

(ii) This was well answered by most using the data given.

(b) (i) In some cases candidates tried to explain the pattern rather than describe and a common omission was to link the earthquake changes to ground deformation (tilt). A number also considered that harmonic tremors came just before an eruption despite the data.

(ii) This discriminated well with few mentioning underground magma movement or eruption of lava. Only a small number of candidates realised that the harmonic tremors are the result of movement of gas and magma during an eruption which differed from the short duration earthquakes formed as a result of fracturing of the inflating volcano. Despite this marks could have been gained by referring to the build-up of pressure and its release as stated in Figure 2b.

(c) Most were able to describe and develop upon another monitoring technique. Gas analysis (COSPEC) was often sited although radon gas was sometimes mentioned. Animal behaviour was also popular with weaker candidates.

SECTION B

General Comments

Questions 3 and 5 were the most popular with Question 4 less so.

Q.3 This was generally moderately well answered with few responses gaining high marks.

(a) Despite being stated in the question, some candidates did not use annotated diagrams. Those seen were often very basic and unrealistic with dipping strata running parallel with the topographic slope without “daylighting” which was considered to be unstable. Few compared stability of a slope with strata dipping into and out of a slope. Surprisingly, stable slope angles were rarely mentioned though the effect of different rock types on stability was often included. Only one candidate considered the effect of cleavage, joints or faults in a tunnel and no one mentioned the effect of the density of such disconformities on stability. Fluctuations of the water table was better answered where answers discussed pore pressure rather than simply lubrication of potential slip planes.

(b) This was answered better than part (a) and a few essays, using case studies and annotated diagrams, gained full marks for this section. The Vaiont Dam disaster was often used as a case study of a managed slope and too often the weaker candidates just provided a list of methods to stabilize a slope with little qualification.

Q.4 This was the least popular question.

(a) The process of longshore drift was understood by most of the candidates who answered this question though some did not directly describe how engineering activity might interfere with this process but simply described a range of coastal protection methods. Most drew a diagram to show the movement of beach material interacting with groynes.

(b) The hazardous effects of erosion and deposition were outlined though case studies were mentioned only in the better essays.

Q.5 Although one response gained full marks the majority of essays were modest at best.

(a) This question related to the difference between the geological factors associated with contrasting types of waste. Many candidates wrote about one at the expense of the other, with radioactive waste the least well understood.

(b) This part was better answered with most considering the suitability of a domestic waste disposal site. Worryingly, the 1966 Aberfan disaster was considered by a significant number as the collapse of a landfill tip!

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