



EXAMINERS' REPORT ON 2001 TERTIARY ENTRANCE EXAMINATION

SUBJECT: GEOLOGY

STATISTICS

Year	Number Who Sat	Non-Examination Candidates	Did Not Sit
2001	40	2	4
2000	68	6	9
1999	56	5	7

The Examiners' Report is written by the Chief Examiner (or another Examiner on their behalf) to comment on matters relating to the Tertiary Entrance Examination in their subject. The opinions and recommendations expressed in this report are those of the Chief Examiner and not necessarily representative of or endorsed by the Curriculum Council.

The Marking Guide provided at the end of this report was prepared for markers and may have been substantially amplified by discussions held in the pre-marking meeting. It is not intended as a set of model answers, and is not exhaustive as regards alternative answers. Some of the answers are less than perfect, but represent a standard of response that the examiners deemed sufficient to earn full marks. Teachers who use this guide should do so with its original purpose in mind.

SUMMARY/ABSTRACT

The 2001 TEE Geology paper was designed to assess candidates' understanding of important geological processes and how these processes operate and interact to produce common Earth materials, and 3D rock relationships. As usual, the Examining Panel aimed to set questions which provided a broad and balanced coverage of the syllabus as well as using a style which requires an appropriate level of integration of various aspects of the main sections of the syllabus. The 3-part format and level of difficulty of the paper was the same as previous years, with Part 2 (short answer) and Part 3 (extended answer) questions requiring candidates to demonstrate application of geological knowledge and understanding. Part 1 (multiple-choice questions) aimed, as much as possible, to test understanding of basic geological processes, materials and principles.

The notable feature of the performance of this year's candidates is that on average they achieved good marks across the entire paper. Previously, performance has been markedly inconsistent across all three parts of the paper and there has been a noticeable group of poorly performing candidates. The smaller number of candidates sitting coupled with the stronger performance across the entire paper has resulted in a much higher overall mean mark for the 2001 examination, although the performance of the top candidates is comparable to previous years. Overall the paper was considered to be fair and comparable to previous years' examination papers by the Examining Panel, reviewers and teachers.

Areas in which candidates generally performed well include geological histories and overprinting relationships, sedimentary processes and environments, application of fossils, map interpretation, plate tectonics, exploration and mining issues and the construction of geological cross-sections. Candidates also showed reasonably good understanding of ore-forming processes and contact metamorphism. Weaker areas identified in this year's examination include igneous processes, structural geology and discussion of a field locality. Demonstration of graph- and map-reading skills was also good, although some difficulty in the recognition of unconformities was noted in this year's examination.

GENERAL COMMENTS

The multiple-choice questions (Part 1) were set by all three members of the examining panel, whereas each examiner took responsibility for designing the topic-based short-answer questions (Part 2) and extended answer questions (Part 3). Evaluation of proposed questions and overall balance of the paper was carried out at panel meetings in the first part of the year and subsequently in response to comments on drafts of the paper. We thank the Independent Reviewer, Final Checker and the Curriculum Council staff for their contribution to preparation of the examination paper. The Examining Panel was very disappointed with the reproduction quality of all the photographs in this year's paper because a great deal of time and care goes into selection and submission of material which the panel considers will reproduce well.

The Examining Panel aims to provide a variety of question styles with a broad mix of topics to test knowledge and understanding of key geological processes. In general questions require candidates to apply their knowledge and understanding and show some ability to integrate information across the range of themes in the syllabus. A variety of resource diagrams are provided (e.g. maps, graphs, photomicrographs and block diagrams) which require demonstration of geological skills in map-reading, interpretation and 3D thinking. Questions requiring use of the Minerals Properties Sheet were also included as usual. We have continued to receive positive feedback from TEE teachers that is both pleasing and appreciated by the panel.

There was a marked decrease in the number of candidates who sat the exam this year compared to last year. Summary statistical data provided by the Curriculum Council shows that the mean mark for this year's exam (65%) is higher than in the last two years (55%). The Examining Panel and checkers, and subsequently the teachers, did not consider this paper to be any easier than last year's paper. However, the panel did notice that the overall performance of the group of candidates was better than in recent years *across the entire paper* as seen in the higher means for Parts 1, 2 and 3 compared to recent years. The more typical inconsistent performance has been noted in previous Examiners' Reports for this subject. Although the marks obtained by the top-performing candidates are comparable to 2000, there is a noticeable absence of a very poorly performing group of candidates and that has increased the minimum marks for individual questions and thus appears to have had a marked effect on the overall mean mark for the examination (together with the overall low number of sitting candidates).

It is also commendable in this year's paper that all but one candidate made good attempts to answer *both* extended answer questions in Part 3. In previous years there has been a tendency for candidates to answer only one question in Part 3 and that makes it very hard to achieve a pass mark for Part 3. Overall, the panel considered many of the candidates' essays for Part 3 to be very good.

COMMENTS ON SPECIFIC QUESTIONS

Part One: Multiple-choice questions

As in previous years, the multiple-choice questions were designed to test candidates' understanding of a range of important geological processes with inclusion of map-reading skills. The questions were considered by the Examining Panel to be comparable to the previous year's paper in terms of level of difficulty, however, the mean mark of 74% was a little higher than last year (70%).

Three questions (out of 20) drew a significant number of incorrect responses (= 50%), namely Questions 3, 6 and 18. Question 3 focused on recognition of major geological regions of Western Australia, Question 6 on the definition of limestone (which was a surprising result) and Question 18 on a map view of a tectonic structure that is arguably the hardest question of the three. The response to Q3 was surprising, whereas the response to Q6 is perhaps understandable if the Tamala Limestone is used as the sole example of this broad rock group given the wide variety of rock types within the Tamala Limestone, notably the quartz-rich units. However, the classification of the latter as 'limestone' is erroneous, and terms such as 'calcareous sandstone' or 'calcite-cemented sandstone' are better.

Part Two: Short answer questions, mapping and interpretation

Questions 21-27 in Part 2 were designed to cover the broad range of key topics in the syllabus although the questions typically required some integration across the topics. For example, Q25 sought to examine candidates' understanding of weathering, igneous and ore-forming processes, as well ability to use the Minerals Properties Sheet. Q21 focused on igneous and tectonic processes at a specific type of plate margin. As usual, the questions used a variety of resource information such as maps, photomicrographs and cross-sections.

The cross-section question (Q28) was based on a simpler map than in previous years (although the presence of two unconformities meant it was not straightforward). Candidates had to draw schematic cross-sections for Q24(a) which included folds and faults. It was noted that a significant number of candidates did not recognise both unconformities (a few did not even recognise the younger unconformity), however, construction of cross-sections and recognition of the geological patterns was good resulting in good overall performances in this question.

Question 21

This question focused on the key features and processes at divergent plate boundaries and the formation of oceanic crust. In general, candidates recognised that the crustal structure depicted in the diagram was a spreading centre (a), with opposing plate motions (b) and could identify a modern example (c). Answers to (d), in which identification of specific features was required, were very mixed with a noticeable number of candidates incorrectly referring to continental crustal rocks and features, and few candidates recognising normal faults. Mixed responses were provided for part (e) on magma generation, with some good answers, however, few candidates obtained full marks. Part (f) answers were mixed, but in general candidates could correctly name and justify one rock type out of two.

Question 22

This question focused on candidates' understanding of sedimentary processes applied to a schematic profile, from a high-relief source area to the coast, with a number of related sedimentary environments identified. In general candidates provided some excellent answers for this question, with parts (a), (b) and (d) well done. Overall candidates showed a reasonably good understanding of what happens to sediment transported down the profile, although changes in sediment composition (as a result of physical breakdown) were mixed. Part (c) tested the candidates' application of this knowledge to consider the *controls* on the changes in sediment as it is transported down the profile. This question therefore required some thought and answers to this part were understandably mixed, however, most candidates were at least able to discuss the changes in terms of decreasing energy levels downslope. Better answers included comments on the decreasing gradient and the physical weathering and destruction of grains, and hence potential changes in sediment composition with transportation distances.

Question 23

The question was designed to test candidates' understanding of the processes involved in the formation of an iron ore resource, which included recognition of the precursor rock (banded iron formation), the weathering processes involved and mining considerations. Candidate's ability to use the Mineral Properties Sheet was also tested. In general, candidates performed well in all parts except (a) with very few candidates recognising the rock type as BIF, although some candidates classified the rock as sedimentary. Answers to (c) were mixed but generally candidates obtained at least some marks for this part; a noticeable number of candidates suggested density for both, however, it is not diagnostic for separating hematite and magnetite. Answers to (d) were also mixed, with some very good answers and some very poor ones, whereas responses to (e), (f) and (g) were generally good and answers were well justified.

Question 24

The geological map showed some interesting geological relationships and tectonic structures from which candidates were required to draw two schematic cross-sections. In general the cross-section A-A' was well done (approximate dips, layers and asymmetry) but typically lacked an axial surface to completely show the fold and its interpretation. Attempts at cross-section B-B' were more variable, with some very good drawings showing the fold, fault and unconformity. Weaker attempts tended to neglect one or more of these features. Answers to parts (b) and (c) were similarly mixed. Candidates were able to obtain a satisfactory overall mark for this question by presenting a reasonable geological history from the map (d). There is still a tendency for candidates to neglect identifying the unconformity as representing a period of uplift and erosion, with candidates still identifying this event as "weathering".

Question 25

This question asked candidates to identify and succinctly describe some major geological processes in relation to weathering which required understanding of rock and mineral composition, and to a less extent, rock relationships at depth. In general candidates could identify the most resistant rock on the cross-section (a), however answers to parts (b) and (c) were mixed. Candidates' responses to (b) generally included comments relevant to Bowen's Reaction Series but not always related to the question. Similarly, responses to (c) did not typically demonstrate a connection between colour and composition. Candidates could have referred to the Mineral Properties Sheet to help them think about this question. Responses to part (d) were generally satisfactory although candidates tended to identify only one source whereas two are depicted (granite and quartz veins). Parts (e) and (f) were generally reasonably well done.

Question 26

In previous years there has been a noticeable difficulty in answering metamorphic questions, so this question integrated metamorphic and igneous processes and recognition of overprinting relationships based on the map. In general the question was attempted well by the candidates, with most doing well in part (a). Somewhat surprisingly the rock types depicted in part (b) were poorly identified, including the mica schist (Rock Y), and thus location of the rocks on the map (part c) was very mixed. The reason for the metamorphic zonation developed adjacent to the granite was generally well explained, with candidates making a reasonable attempt to identify the correct position of the index minerals in the metamorphic aureole (c).

Question 27

This question tested understanding of processes in the formation of igneous, metamorphic and sedimentary rocks, via the rock cycle. Overall candidates made a good attempt to answer this question, however, it was noticed in some cases that the actual process was not described. For example, "heat" is not sufficient for partial melting, or "weathering" for the production of sediments from metamorphic rocks where uplift and erosion are clearly required. Typically candidates received part marks for some answers.

Question 28

The cross-section question provided a map with three packages of sedimentary rocks separated by two unconformities. The older two packages have the same attitude (as shown by strike and dip symbols), whereas the youngest package has a shallower attitude. Two igneous rocks (a dolerite dyke and a felsic dyke) were also included to help show the presence of the unconformities by their truncation against different layers. Almost all candidates recognised the age relationship between the two igneous dykes (a) which was good. Overall the cross-sections were well constructed with very few weak answers showing problems in either construction or map interpretation. Most candidates used the correct vertical scale, which was also commendable. Candidates lost marks where the older unconformity was ignored and the dolerite dyke was not projected onto the section line, and/or depth units were not stated. Candidates gave their cross-section a heading (which is good), however, most called it a 'Geological Map' which clearly it is not. The Examining Panel was lenient with this in marking this year.

Part Three: Extended answer questions

The relatively low number of candidates sitting the examination this year was probably a factor in the less even spread of essay attempts than typically seen, however, candidates showed clear preferences for the topics in 29(b) plate tectonics, 30(a) resource geology and 30(c) application of fossils, as expected from recent years. Regardless, the Examining Panel felt that the essay questions provided a great deal of scope for the candidates, by including these popular topics, a field geology question, and two other questions which covered important geoscience areas. The latter two questions on earthquakes, impact craters and the hydrologic cycle are also very topical subjects in Western Australia (the latter covers a range of aspects presented in the 'optional study' part of the syllabus), and the panel felt that these types of questions would provide more scope for candidates, particularly where they may have developed interests during the year.

A notable feature of this year's examination performance is the reasonably good performance of candidates in **both** questions, compared to recent years, which has produced an improved mean mark for Part Three. The approach of candidates to tend to focus only on answering one essay question well has been discussed among the examiners and teachers for a number of years so it is good that candidates are heeding the advice and making good attempts to answer both questions and therefore increase their marks. Question 29(a) achieved the highest mean score (70.0%) but was only attempted by three candidates. Surprisingly the mean mark for the field question (Q.30b) was markedly lower than for the other questions (46.3%).

Question 29(a) (Attempted by 7.5% of candidates)

The candidates who answered this question wrote very good essays describing the important features related to earthquakes and impact craters which included well-labeled diagrams to show the internal structure of the Earth as deduced by earthquake studies. In general understanding of seismic activity was well demonstrated. More variable answers were provided for the part of the question focusing on impact craters, however, the best responses included discussion of the importance of meteorites in understanding the internal composition of the Earth and the age of the Earth.

Question 29(b) (Attempted by 92.5% of candidates)

Overall, candidates provided some very well organised, knowledgeable and well considered answers to this question which was based on the theory of plate tectonics, thus responses ranged from excellent to poor. It was very pleasing to see that candidates could divide the question into sections based on plate margin types by themselves (almost all did this), and logically address the key features associated with each plate margin. The best answers also included intraplate topographic features such as the Hawaiian volcanic chain. The weaker answers tended to neglect the overall focus of the question that was on explaining the generation of topography. Candidates, who also included topographic features other than those listed in the question (e.g. subduction zones, trenches, transform faults at spreading ridges), tended to gain more marks, as did candidates who provided a good introduction to the theory of plate tectonics at the start. It is very worrisome that some candidates are still using the term 'geosyncline' which is a pre-plate tectonic term and should not be used in discussion of Earth surface processes.

Question 29(c) Not attempted by any candidates

Question 30(a) (Attempted by 47.5% of candidates)

Candidates provided mixed responses to this essay question although candidates generally made a good attempt to address each part of the question. The most commonly chosen resources were bauxite and coal with several other resources also chosen. As noted in previous years, parts (i) and (ii) drew mixed responses, with weaker candidates less able to discuss clearly the importance of the tectonic/geological setting, or particular structures or rock types, in relation to their chosen resource. In contrast, parts (iii) and (iv) were typically well answered. Relevance of the answers in these parts to the chosen resource was generally good.

Question 30(b) (Attempted by 10% of candidates)

Overall, candidates who attempted this question fared poorly in comparison to the other extended essay questions. This was largely due to inconsistent performance across all parts of the question, including aspects such as age of the rocks in the chosen area and other key aspects of the area. Candidates tended to overlook describing the geographic location of the area clearly and the associated landforms.

Question 30(c) (Attempted by 40% of candidates)

Answers provided by candidates to this question ranged from excellent to very poor. Candidates who performed better provided considered responses to each part of the question on the application of fossils, whereas weaker answers tended to discuss one area but not the other two. It was pleasing to see inclusion of some good examples to illustrate key points as well as labeled sketches where appropriate. In particular, some candidates undertook very good discussions on the dating and correlation of strata.

POINTS FOR THE SYLLABUS COMMITTEE TO CONSIDER

The 2001 TEE Geology examination has provided no new insights into the syllabus but does reinforce observations from previous years. The small number of candidates who sat the examination and the lack of a 'poorly performing tail' means that higher means have been achieved although the top marks are consistent with previous years. No recommendations are forthcoming from the 2001 TEE Geology examination. Given that candidates and teachers are happy with the format of the examination there is no reason to make any changes to the three-part style of the paper.

Annette George
December 2001

2001 Examining Panel

Chief Examiner: Dr Annette George
Deputy: Mr Peter Spitalny
Third Member: Dr Steven Reddy

Chief Marker: Mr Peter Spitalny

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APPENDIX: 2001 TEE GEOLOGY MARKING GUIDE

The following is taken from the set of answers used as a marking guide for markers in the 2001 examination.

Part 1

- | | | | |
|-------|-------|-------|-------|
| 1. a | 2. c | 3. d | 4. a |
| 5. c | 6. b | 7. c | 8. b |
| 9. d | 10. b | 11. a | 12. b |
| 13. b | 14. a | 15. b | 16. d |
| 17. c | 18. d | 19. c | 20. a |

Part 2

Question 21

- (a) mid-ocean (spreading) ridge.
- (b) arrows oriented perpendicular to the spreading centre indicating opposing motion.
- (c) Mid-Atlantic Ridge etc.
- (d) A: normal faults. B: plutons of mafic igneous material (gabbro). C: oceanic crust.
- (e) Partial melting of mantle source (peridotite/ultramafic composition) and convective upwelling of magma which will have a mafic composition.
- (f) Any intermediate or felsic igneous rocks that are typically associated with eruptions at/near convergent margin settings, e.g. andesite, rhyolite, tuff, pumice.

Question 22

- (a) **Typical rock types:**
Alluvial fan: breccia, conglomerate, very coarse/pebbly sandstone
Braided river: conglomerate, pebbly sandstone, medium-coarse sandstone
Meandering river: coarse to fine sandstone, siltstone, shale
- (b) **Changes down the profile:**
Grain size: generally decreasing.
Sorting: generally improving (very poorly–poorly to moderately–well sorted).
Grain shape: expect larger grains to show improved rounding with distance (as a function of amount of abrasion).
Grain composition: may not change, however, rock fragments and physically weak grains might be expected closer to source.
- (c) **Factors controlling any changes:** *decreasing gradient* from source area to coast and therefore *decreasing energy levels* so that coarser grains are deposited upstream and finer material still able to be carried downstream. *Longer transportation* affects degree of rounding and potential loss of physically weak grains.
- (d) (i) *average grain size: ~1 mm; sorting: poor; rock name: coarse sandstone.*
(ii) technically anywhere on the profile depending on justification, however, typical sites would be in braided river given coarse grain size and poor sorting.

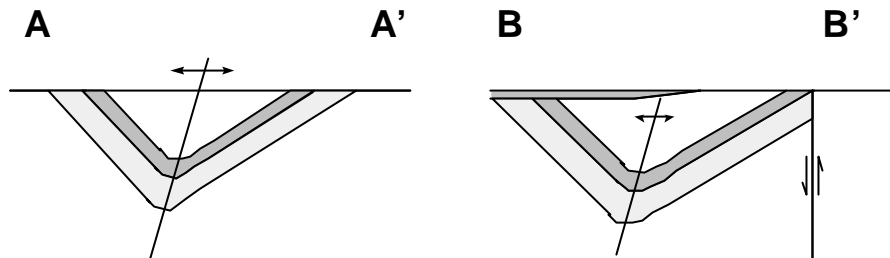
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Question 23

- (a) Banded Iron Formation.
- (b) Hematite.
- (c) **not** magnetite: magnetism, streak
not cassiterite: density, streak, lustre
- (d) The rocks at the ridge top are of similar composition and represent the surface/near surface weathered equivalents of the banded iron formation.
- (e) Iron.
- (f) Manufacture of steel and alloys for construction etc.
- (g) Open pit mining method would be used because ore is at/close to the surface.

Question 24

(a)



- (b) Cross-section A-A' shows asymmetric syncline.
- (c) Cross-section B-B' shows asymmetric syncline, faulted southern limb, and an unconformity overlain by the shallow dipping limestone layer.
- (d) Order of geological events from oldest to youngest:
Deposition of mudstone, fine sandstone, coarse sandstone and mudstone
Folding
Faulting
Uplift and erosion (producing unconformity)
Submergence and deposition of limestone
Gentle tilting and erosion to present day surface

Question 25

- (a) The granite.
- (b) The minerals which make up granite (quartz and potassium feldspar) crystallise at lower temperatures according to Bowen's Reaction Series and are the least susceptible to weathering.
- (c) The granite contains abundant feldspars which weather to pale coloured clays such as kaolinite, whereas the ultramafic rocks contain abundant iron which produces iron-rich (red-brown coloured) clays.
- (d) Coarse sand produced by weathering of the granite and/or quartz veins to release coarse quartz sand.
- (e) Olivine would be present in the unweathered ultramafic rock.
- (f) (i) mineral is gold; (ii) probably weathered out of quartz veins; (iii) gold is *chemically resistant* and *heavy*, so once weathered out it is not transported away.

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Question 26

- (a) Oldest to youngest: gabbro, dolerite, diorite, FAULT, granite.
- (b) Rock X: diorite; Rock Y: mica schist.
- (c) (i): Zone I: sillimanite; Zone II: staurolite; Zone III: biotite; Zone IV: chlorite.
(ii) Mineral zonation shows the distribution of metamorphic index minerals which grow in response to increasing temperature towards the granite margin.

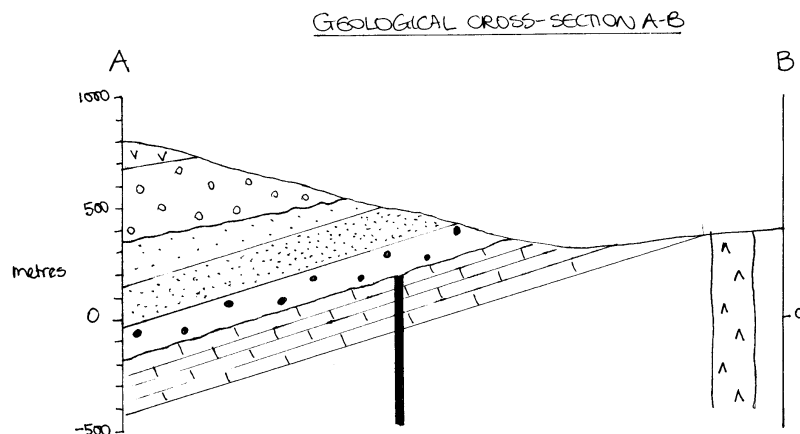
Question 27

1. rise of magma and solidification
2. uplift and erosion.
3. burial and lithification.
4. deep burial and metamorphism.
5. uplift and erosion.
6. deep burial and metamorphism.
7. partial melting.

NB: Erosion is not enough to explain how metamorphic and sedimentary rocks (formed at depth) are able to be eroded at the Earth's surface; therefore uplift is also required.

Question 28

- (a) Felsic intrusive rock is younger than the dolerite dyke.
- (b)



Part 3

Question 29(a)

Earthquakes and impact craters provide important information about the internal structure of the Earth.

- **Earthquakes:** originate through the release of stress along a fault plane which generates seismic waves. Energy release is sudden and results in movements along the fault plane. Two types of seismic waves are generated, P and S waves. [Characteristics of P and S waves can be outlined]. Refraction of waves show discontinuities and low velocity zone in the Earth's interior indicating that it is layered and that the outer core is molten.
- **Impact craters:** are formed by collision of a meteorite and Earth's surface producing a cratered impact site. Crater walls expose subsurface geology and can produce ejecta which blankets the surrounding area, sometimes over great distances. Massive collisions at times in Earth history have been linked to major extinctions. Meteorites associated with impact craters provide significant information about the Earth's internal composition (particularly the core) and the age of the Earth. Some researchers suggest early life may be related to meteorites, however, this is highly speculative.

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Question 29(b)

The theory of plate tectonics provides a framework for understanding the types and distribution of features on the Earth's surface. Plate tectonics is based on the observation that the crust is broken into a number of large plates which are moving relative to each other.

Plate margins are the sites where many of the Earth's major features are formed. Hot spots are anomalous in that they form volcanoes in intraplate settings, e.g. Hawaii. Types of plate motion are convergent (destructive), divergent (constructive) and strike-slip (conservative).

- **Convergent margins:** Variety of types depending on the types of crust colliding. At subduction zones where oceanic crust is being subducted, volcanic chains and oceanic trenches (which are seismically active zones) are formed. Modern examples include New Zealand, Japan and the Andes. Convergence of two continental plates results in major collisional zones and suturing, e.g. the best known modern example is the Himalayas (collision of India and Eurasia).
- **Divergent margins:** Zones of plate divergence are associated with magma upwelling and development of mid-ocean ridges. Subsea volcanoes are associated with these ridges. Commonly the ridges show offsets by transform faults along their length. Modern examples include the Atlantic MOR and the MOR between Australia and Antarctica.
- **Transform margins** are major zones dominated by strike-slip movement. Modern examples such as San Andreas and Alpine Fault in NZ appear as major linear features on the Earth's surface. They are not typically associated with volcanism but are major earthquake zones.

Question 29(c)

The hydrological cycle neatly summarises the cycling of water through the various Earth systems. Water exists in three phases (liquid, vapour and ice). The Earth is special in having liquid water on its surface.

- **Water resides** in a number of reservoirs such as the oceans, ice, atmosphere and land surface (where it involves rocks and organisms). The cycle is driven by the sun's energy. Transfer of water from one reservoir to the next involves fundamental processes such as evaporation (ocean to atmosphere), condensation and precipitation (atmosphere to surface), and run off and groundwater flow (surface to ocean). Freezing and melting and freezing are key processes in the formation/loss of ice.
- **Shaping of the land surface** is heavily influenced by the activity of water and ice through the movement of ice sheets, glaciers and rivers. Erosion by these processes produces recognisable landforms (glacial and fluvial features such as U- and V-shaped valleys) and deposition of recognisable sedimentary units (e.g. moraines, tills/tillite, varves, channels and floodplains).
- **Water quality** is very important for people and livestock for continued survival. Key aspects include: location and management of (subsurface) groundwater reservoirs; problems with salinity (measures to remedy salinisation of agricultural land); management of fertilisers (too many nutrients in runoff); pollution of groundwater, lakes, rivers and nearshore areas from industrial and domestic sites; minimisation of oil spills from tankers and offshore platforms in oceans.

Question 30(a)

- (i) Answers will vary depending on resource chosen. Resource must be clearly stated and general discussion of key aspects of resource formation as appropriate, including tectonic setting, host rocks, important geological processes
- (ii) Geological controls on the location of resource might include: the type, composition and age of the host rocks; location and types of tectonic structures (e.g. faults, folds, veins); response to climatic conditions; pressure and temperature; primary geological processes and environments (depositional, crystallisation etc).
- (iii) Exploration methods need to be clearly linked to chosen resource, but may include geophysical imaging of the subsurface (seismic, gravity, magnetics), drilling and coring, mapping, satellite image–aerial photographic interpretation, rock and/or sediment sampling, geochemical analysis, etc. Need to consider features such as the size and shape of deposit/s, depth below the surface etc.
- (iv) Environmental concerns in exploration include access (distance to roads/coast for transportation), vegetation and topography, land use, land rights, and cultural significance. Concerns during extraction include impact on flora and fauna, local communities, effects of pollution (noise, water and air), cost of rehabilitation etc.

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Question 30(b)

- (i) Answers will vary depending on field locality chosen. Location and major landforms in the area need to be clearly stated.
- (ii) Description of the geology should describe the tectonic setting, major geological features (e.g. sedimentary basin, craton etc.) and the main rock types (composition, relationships). Ages (particularly any fossils) and evidence for ages of the main rocks is important as well as depositional environments if appropriate. Tectonic structures and any other geological features should be included.
- (iii) the significance of the area generally relates to economic significance, e.g. hosting mines, oilfields and/or an important tourism site, but may also include cultural significance, heritage listing, or geological reserve.

Question 30(c)

The fossil record is important for:

- **reconstruction of ancient environments** - able to distinguish marine vs terrestrial environments based on fossil types and their distribution, and shallow marine from deep marine, using body fossils and trace fossils of known environments/water depths. Fossils also provide information about depositional environments since the Precambrian and how they compare to modern day environments, including evidence for climatic changes (e.g. ice ages).
- **dating and correlation** - certain fossils lived for relatively short periods of time and underwent rapid evolutionary changes, making them useful index fossils for particular geological periods (for example trilobites and graptolites). Recognition of similar aged strata enables correlation of packages of sedimentary rocks in different areas.
- **understanding evolution of life forms** – the fossil record is extremely important for tracing the evolution of modern life forms through time, including humans, interpreting controls on evolutionary trends, and examining reasons for extinction of particular ancient life forms at various times in the Earth's history.