

NATIONAL EXAMINATIONS – December 2010

09-Mmp-A1 General Geology and Exploration

3 hours duration

NOTES:

- A. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
- B. This is a CLOSED BOOK EXAM. Candidates may use one of two calculators, the Casio or Sharp approved models.
- C. FIVE (5) questions constitute a complete exam paper. YOU MUST ANSWER QUESTIONS 1 TO 4. Candidates must choose one more question from any of the remaining questions. Where stated in the examination, please hand in any additional pages with your exam booklet.
- D. The first of any of Questions 5 to 7 as it appears in the answer book will be marked, unless the candidate clearly indicates that another question should be substituted for a specified question that was answered previously.
- E. Each question is of equal value. The marks assigned to the subdivisions of each question are shown for information. The total marks for the exam is 100.

***** IMPORTANT: YOU MUST ANSWER QUESTIONS 1, 2, 3, and 4 *****

1. Consider the following 5 ore minerals:

- | | |
|----------------|----------------|
| (i) barite | (iv) hematite |
| (ii) bornite | (v) pyrolusite |
| (iii) cinnabar | |

- a) For each ore mineral listed above, state the element of the Periodic Table for which it is a major ore mineral. {5 marks}
- b) For each ore mineral listed above, state one diagnostic physical property which may be unambiguously used to identify the mineral in a hand specimen. {5 marks}
- c) For each ore mineral listed above, state a typical kind of ore deposit in which the mineral is typically found. {5 marks}
- d) Name one ore mineral that belongs to each of the following groups: {5 marks}
- (i) oxide
 - (ii) sulfate
 - (iii) sulfide
 - (iv) hydroxide
 - (v) phosphate

2.

a) Ore deposits can be hosted in a variety of rock types. Define the following rock types and state one kind of ore or ore deposit that can be typically found in each. {15 marks}

(i) shale

(ii) sandstone

(iii) kimberlite

(iv) pegmatite

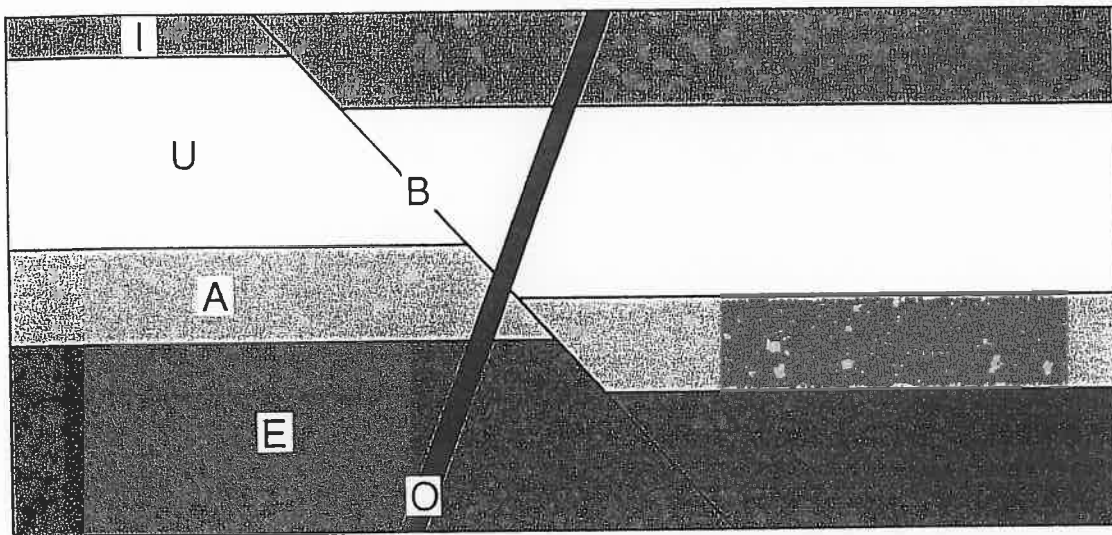
(v) norite

b) Placers are another source of ore. Define what a placer deposit is, how it forms, and list 5 ore minerals that are commonly found in placer settings. {5 marks}

3. Structural geology plays an important role in controlling the formation of ore deposits.

a) With the aid of sketches, define an anticline and a syncline. {4 marks}

b) Consider the schematic geological cross-section in the diagram below. The rock units are labelled A, E, I, O and U and there is a geologic structure labelled B.



(i) Name the geologic structure B. {2 marks}

(ii) Name the geologic feature represented by the rock unit O. {2 marks}

(iii) Briefly describe the geologic history recorded in the cross-section, clearly indicating the sequence of events from oldest to youngest. {6 marks}

c) Define what a joint is in a geological context, and explain how joints can play a major role in controlling the formation of ore deposits. {6 marks}

4.

(a) In terms of magmatic ore deposits, there are three main ways of concentrating ore minerals. Describe each of these ways and give an example of an ore deposit that can be formed in this way. {10 marks}

(b) Ore deposits can be hosted in a variety of rock types. For each type of deposit listed below, state whether it is considered to be plutonic-related, volcanic-related, sedimentary-hosted, metamorphic-host, or vein-hosted. {10 marks}

- (i) banded iron formation
- (ii) iron-oxide-copper-gold (IOCG)
- (iii) kimberlites
- (iv) Kuroko ore deposits
- (v) copper red beds

- (vi) lode gold deposits
- (vii) porphyry copper deposits
- (viii) Mississippi Valley Type deposits
- (ix) skarns
- (x) layered mafic intrusions

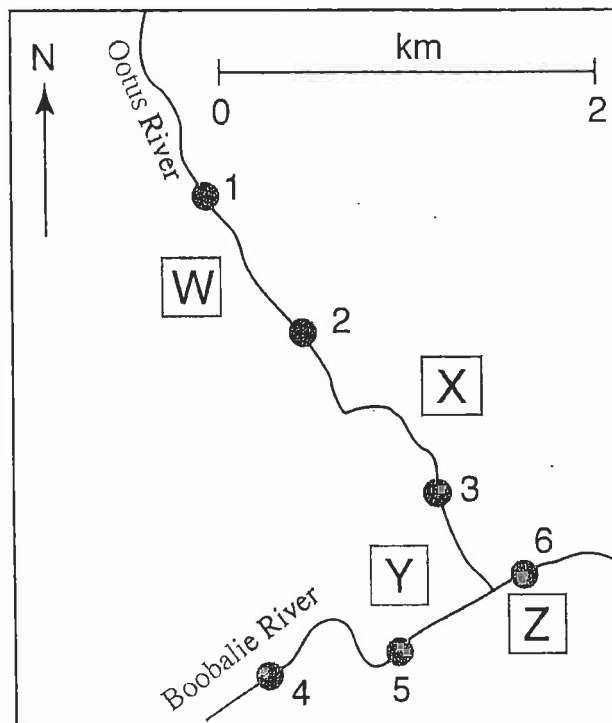
***** IMPORTANT: COMPLETE ONLY ONE MORE QUESTION ***
FROM QUESTIONS 5, 6, OR 7**

5. Many different geophysical techniques can be used to find and delineate ore bodies. Consider the use of magnetic methods.
- a) List three elements which can acquire a magnetic signature and explain how magnetism occurs in minerals. {5 marks}
 - b) Define magnetic susceptibility and state two properties which determine a rock's magnetic susceptibility. {6 marks}
 - c) Place the following list of minerals in order of lowest to highest magnetic susceptibility: pyrrhotite, pyrite, magnetite, salt {4 marks}
 - d) Explain how exploration surveys can use magnetism to detect some types of ore deposits. Give an example of a rock that would typically produce a magnetic "high" and another rock which would typically produce a magnetic "low". {5 marks}

- 6.
- List three kinds of materials which are typically sampled in a geochemical survey. What is the main purpose of geochemical sampling, and explain how this is achieved in a geochemical survey. {5 marks}
 - Explain what a dispersion halo is and describe the various factors which can control its extent. {7 marks}

- c) Consider the following map, showing two rivers – the Ootus and Boobalie Rivers, and six geochemical sampling stations (grey circles labelled 1 to 6).

The Ootus River flows towards the southeast and the Boobalie River flows towards the northeast.



- If a gold deposit was located at X, indicate for each of the 6 stations whether the gold content of a stream-sediment sample would be zero, low, moderate or high, and briefly give reasons. {6 marks}
- What should the optimum spacing be for a geochemical stream survey? Are the geochemical stations shown on the map at the optimum spacing? {2 marks}

7.

- a) Explain when drilling is usually employed in the life of a mineral-exploration program, and outline 3 main reasons for drilling. {7 marks}

- b) Describe the two main types of drilling employed in mineral exploration and outline the major differences. {7 marks}

- c) Briefly explain how drill data are typically interpreted. {6 marks}