



**PROGRAM** : NATIONAL DIPLOMA  
MINING ENGINEERING

**SUBJECT** : GEOLOGY: MINING III

**CODE** : MWG 3211

**DATE** : FINAL EXAMINATION 2016  
30 NOVEMBER 2016

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**WEIGHT** : 40 : 60

**TOTAL MARKS** : 104

**EXAMINER** : MR K S PHOGOLE 150505503

**MODERATOR** : MRS L. MUDIMELI 5052

**NUMBER OF PAGES** : 4 AND 2 ANNEXURES

**INSTRUCTIONS**

1. ALL ANSWERS MUST BE SHOWN IN THE EXAMINATION SCRIPT OR ON THE ANNEXURES PROVIDED AS REQUIRED.
2. STUDENTS MUST ENSURE THAT THEIR STUDENT NUMBER IS ON ALL ANNEXURES.
3. ALL ANNEXURES MUST BE HANDED IN EVEN IF THE STUDENT DID NOT ATTEMPT THE QUESTION.
4. CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT)

**REQUIREMENTS** : DRAWING INSTRUMENTS

**QUESTION 1**

Gold prospecting is in progress in an area shown on the attached map. All elevations are in metres above sea level and strata dips are constant in the area.

Preliminary work has shown that a prominent quartzite layer overlying a 30 metre (vertical thickness) sequence of shale forms the hills in the area. The base of this quartzite layer outcrops as shown on the map. The base of the shale outcrops at point 'A' and 'B'. Below the shale there is a sandstone unit with a thin, gold-bearing conglomerate at the base of this sandstone. The gold-bearing conglomerate (Reef) outcrops at point 'C' as shown on the map, and was also intersected in a short, vertical borehole drilled at point 'A'. The depth to this reef in the borehole at point 'A' is 20 metres. This gold-bearing conglomerate overlies a very thick sequence of siltstone, the base of which is not seen in the map area.

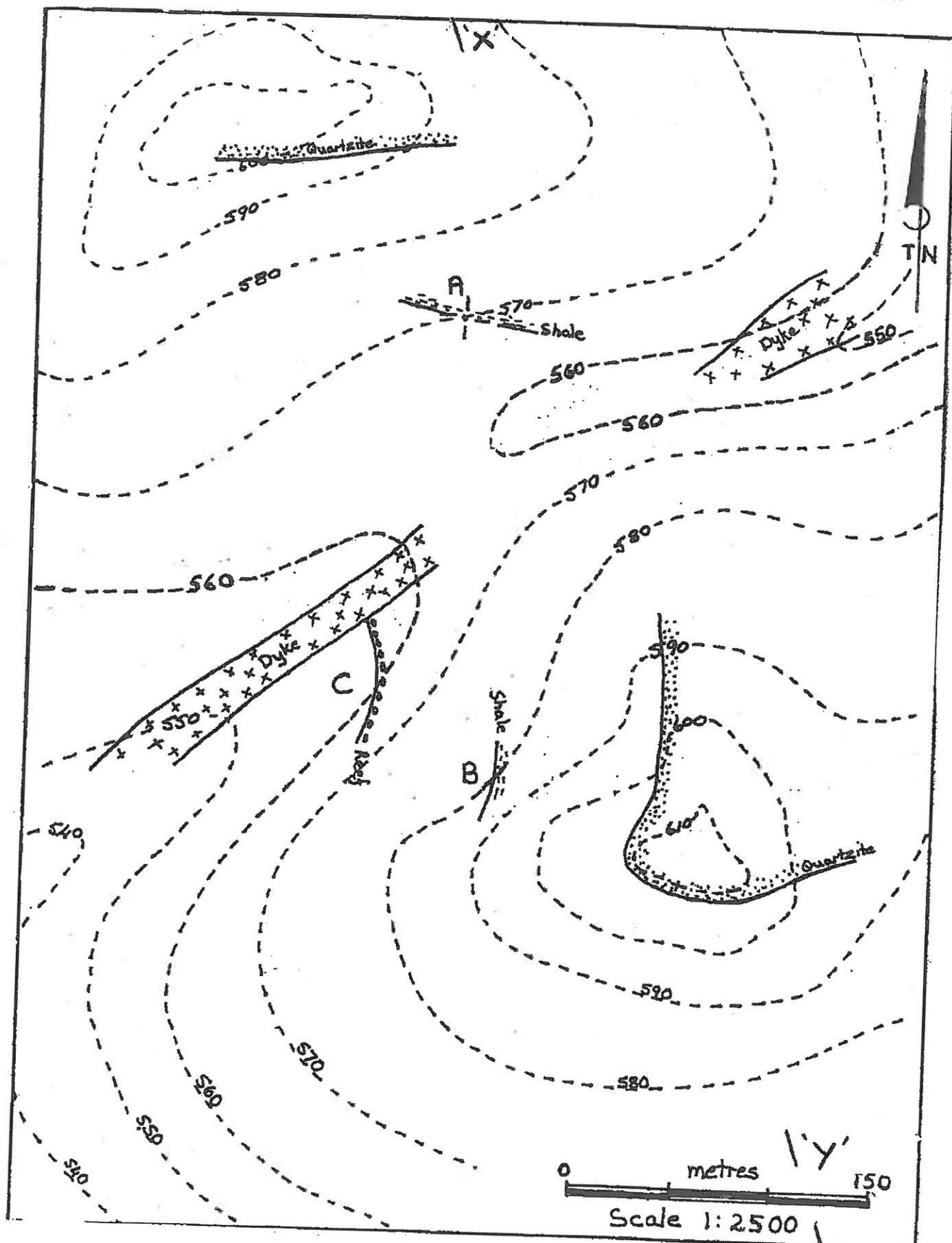
A thick dyke outcrops in the valley as shown on the plan and disrupts the gold bearing conglomerate near point 'C'. It is likely that this dyke has intruded along a fault plane.

Using the information given above, construct contours for the geological structures and answer the following questions.

- 1.1 Complete the outcrop pattern of the dyke over the map area. (5)
- 1.2 Determine the amount and direction of dip of the dyke. (6)
- 1.3 Complete the outcrop pattern of all the geological units over the whole map area. (18)
- 1.4 Draw the lines of intersection between the conglomerate reef and the dyke. (4)
- 1.5 Determine the vertical throw of the fault (5)
- 1.6 Shade the area on the map that is underlain by gold-bearing conglomerate reef.  
**DO NOT SHADE ANY OTHER AREAS.** (4)
- 1.7 Draw a true-scale section along X-Y (north-south) on the graph papers provided. (8)  
(NB: Use a vertical scale of 1: 1 000)

(50)

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**QUESTION 2**

The attached map, shows an area near Pongola where gold prospecting is in progress. A thin, gold-bearing conglomerate layer (the Pongola Reef) has been found outcropping at the base of thick sandstone until at a position E while mapping in the area. The sandstone is overlain by mudstone with the stratigraphic thickness of 8.481m. Underlying the thin Pongola Reef is another layer of grit with the vertical thickness of 5m. The map shows the surface contours in metres above sea level at 10 metres intervals. The scale is shown on the plan (1: 1000).

Further mapping and some drilling has commenced on the exploration program and has resulted in the following information:

- A major fault outcrops at position 'A' and 'C' in the valley.
- The top of the sandstone outcrops at 'B' and a short vertical borehole at this position to test the sandstone base intersected the same fault at a depth of 20 m.
- A vertical borehole at position 'D' intersected the top of the sandstone at a depth of 30m and the base of the sandstone with the Pongola Reef at 60m. The sandstone has a constant vertical thickness of 30m.
- The Pongola reef at the base of the sandstone outcrops at 'E'.
- On the eastern side of the valley the top of sandstone outcrops at 'F'.

Answer the following questions:

- 1.1 Use strike line construction to determine the amount (angle) and direction of true dip of the fault. (4)
- 1.2 Plot the outcrop of the fault on the plan. (4)
- 1.3 Using strike lines determine the amount (angle) and direction of true dip of the Pongola Reef. (4)
- 1.4 Plot the outcrop of the Pongola Reef, the sandstone, mudstone and the grit over the whole map area. (12)
- 1.5 Determine the vertical throw of the fault. Classify the fault (normal or reverse) and motivate why. (3)
- 1.6 Calculate the stratigraphic thickness of the sandstone. (3)
- 1.7 Draw the lines of intersection between the Pongola Reef and the faults. Is there a gain or a loss of ground? (4)
- 1.8 It is planned to open up the reef in a prospect decline using trackless equipment.

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- In what direction must the prospect decline the development starting from position 'E' if the decline is to remain at a decline angle of  $8^\circ$ ? (8)
- 1.9 Shade in the opencastable Pongola Reef if the overburden thickness is 15m. (6)
- 1.10 At what depth will boreholes drilled at G, H and J intersect the gold-bearing reef? (6)

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This sheet must be handed in with your examination script!

