



FACULTY OF SCIENCE

DEPARTMENT OF GEOLOGY

MODULE CODE	GLG3A10
MODULE NAME	Sedimentology and Stratigraphy
CAMPUS	APK
EXAM	June 2014

Date	June 2014
Assessor(S)	Professor Bruce Cairncross & Dr Michiel de Kock
Internal Moderator	
External Moderator	Dr Zubair Jinnah University of the Witwatersrand
Duration	3 hours
Marks	180

Number of pages	5
Instructions	Answer all the questions Answer Section A and Section B IN SEPARATE ANSWER BOOKS USE SKETCHES WHEREVER POSSIBLE!

SECTION A

QUESTION 1

“Clastic sedimentary rocks form by weathering of pre-existing rock, and subsequent erosion, transport, deposition and lithification of the clastic sediment”.

Using a COARSE GRAINED GRANITE as an example of a pre-existing rock, explain in detail the processes described above, that is, what changes occur during the weathering of the granite, erosion of the granite, AQUEOUS transport, deposition and lithification of the resultant sediment, that would cause the original granite to ultimately produce an ORTHO-QUARTZ ARENITE end-product. Describe all the changes the clastic sediment undergoes during this process, from start to finish. (30)

QUESTION 2

What evidence would a geologist look for in a clastic sedimentary rock in order to determine whether it is in fact a sedimentary rock? Use an ARKOSE as your example of the rock. (5)

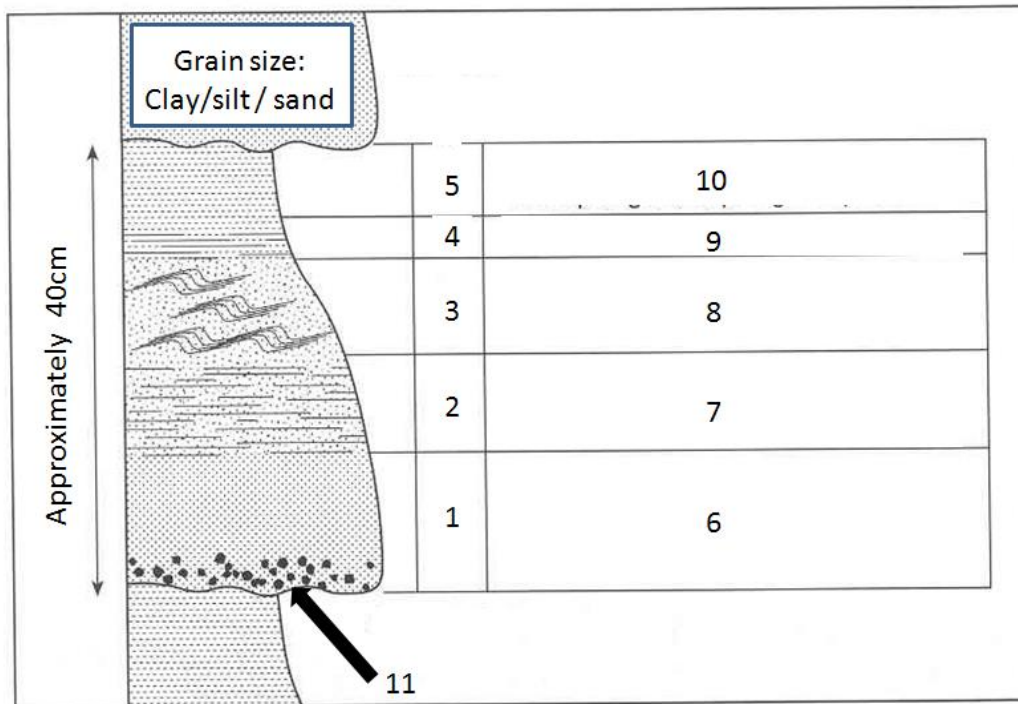
QUESTION 3

“Primary sedimentary structures preserved in clastic sedimentary rocks provide information pertaining to the conditions under which the sediment was transported and subsequently deposited”.

Referring to the statement above, discuss how sedimentary structures can provide hydrodynamic information related to the grain size of the sediment, transport conditions of the sediment and the resultant sedimentary structures. Give examples of the structures and use sketches where possible. (30)

QUESTION 4

Observe the following diagram and answer the questions below:



1. What sedimentary sequence is represented by this vertical section of sediment? (2)
2. After whom is this sequence named? (2)
3. For each number 1 to 11, write down the relevant information for the corresponding part of the lithology (grain size) column.

1 to 5	(5)
6 to 10	(10)
11	(1)
4. What sediment transport process / mechanism produced this sedimentary sequence? (5)

TOTAL (25)

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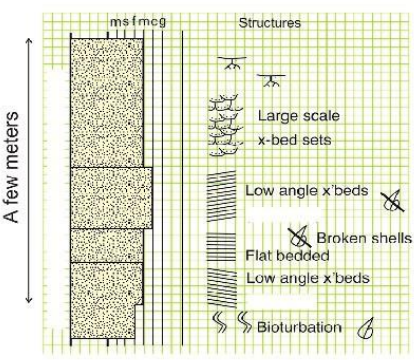
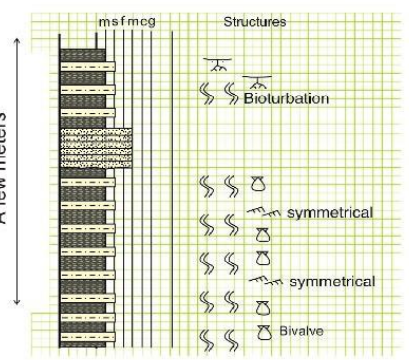

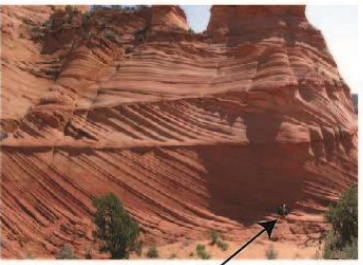
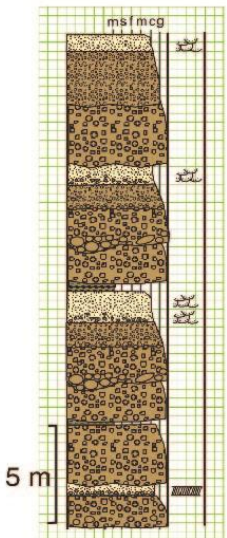

SECTION B

QUESTION 1

(30 Marks)

Comment on the **processes or conditions (and if applicable, how they change)** during the deposition of sedimentary structures, features or successions represented in each of the diagrams or photographs. (2 marks each)

In each case also **suggest a possible sedimentary environment** (*If there is more than one possibility, just name and motivate for one*) in which the structure, feature, or succession could have formed. Clearly state your reasoning for why you opt for that specific environment. (3 marks each)

<p>1.1.</p>  <p>A vertical sedimentary column on a grid. The left side is labeled 'A few meters' with a vertical arrow. The top is labeled 'ms f mcg'. The column shows alternating layers of coarse and fine material. To the right, under 'Structures', are symbols for 'Large scale x-bed sets', 'Low angle x'beds', 'Flat bedded', 'Low angle x'beds', and 'Bioturbation'. There are also symbols for 'Broken shells' and a small shell icon.</p>	<p>1.2.</p>  <p>A vertical sedimentary column on a grid. The left side is labeled 'A few meters' with a vertical arrow. The top is labeled 'ms f mcg'. The column shows alternating layers of coarse and fine material. To the right, under 'Structures', are symbols for 'Bioturbation', 'symmetrical', 'symmetrical', and 'Bivalve'.</p>
<p>1.3.</p>  <p>A photograph of a sedimentary rock surface showing wavy, undulating bedding. A geological hammer is placed horizontally in the foreground for scale.</p>	<p>1.4.</p>  <p>A photograph of a sedimentary rock face showing distinct, wavy, undulating bedding. A geologist is standing at the base of the rock face, indicated by an arrow and the text 'Geologist for scale'.</p>
<p>1.5.</p>  <p>A vertical sedimentary column on a grid. The left side is labeled '5 m' with a vertical arrow. The top is labeled 'ms f mcg'. The column shows alternating layers of coarse and fine material. To the right, under 'Structures', are symbols for 'Large scale x-bed sets', 'Low angle x'beds', 'Flat bedded', 'Low angle x'beds', and 'Bioturbation'.</p>	<p>1.6.</p>  <p>A photograph of a sedimentary rock core showing distinct, wavy, undulating bedding. A person's finger is placed next to the core for scale.</p>

QUESTION 2

(35 marks)

2.1. What is progradation? How does it influence the age relationships between facies within a delta?

(5 marks)

2.2. What are the differences between modern tidal-dominated deltas and river-dominated deltas, and how would you distinguish the two types in the rock record?

(30 marks)

QUESTION 3

(25 marks)

Answer one of the following questions:

3.1. Discuss the significance of the concept of facies, and of Walther's Law in sedimentology.

3.2. Explain how you would go about reconstructing the depositional environment of a succession of sedimentary rocks encountered in the field.