Earth 333 Sedimentology
Lab 3a - *Sedimentary Structures*
and
Lab 3b – Sandstones

Lab 3a
The purpose of this lab is to identify various sedimentary structures from sediments and sedimentary rocks and to recognize their potential as both depositional and environmental indicators. You will be looking at syndepositional and post-depositional inorganic structures as well as biogenic structures. Visualizing these three-dimensional features and how they form is important to understanding the sedimentary record.

QUESTION 1

   a) Examine the cut face carefully. Once you have figured out the stratigraphic orientation, draw a sketch in this orientation and indicate flow direction. Give reasons for your choices.
   b) Identify layers or beds. Each layer/bed has to be internally consistent. Describe each of the beds you have identified.
   c) Make an interpretation of this sample: discuss the sedimentary processes involved in the transport and deposition of this sample.
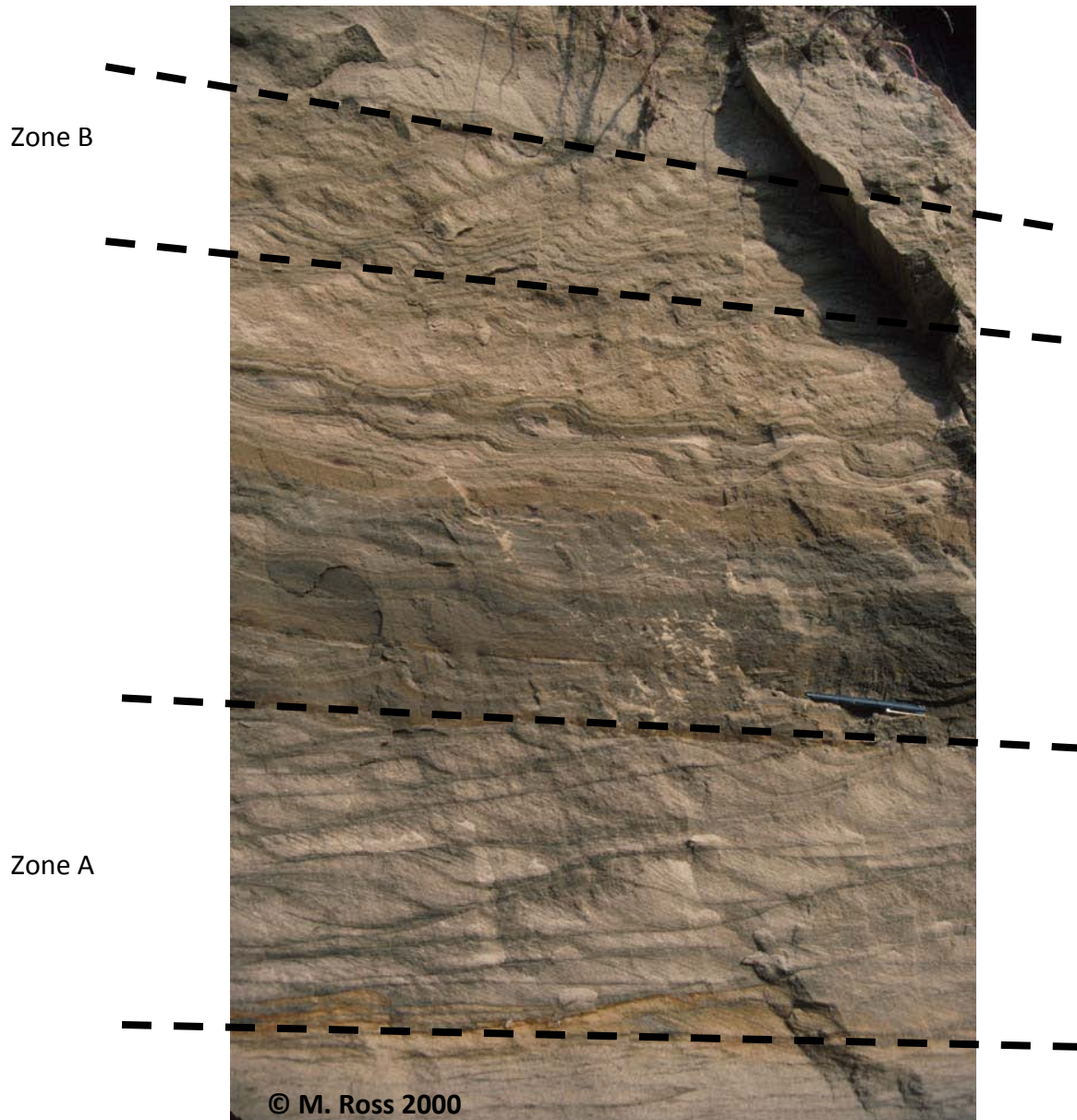
QUESTION 2

   a) Examine the cut face carefully. Once you have figured out the stratigraphic orientation, draw a sketch in this orientation. Why did you choose this orientation?

   b) Identify layers or beds. Each layer/bed has to be internally consistent. Describe each of the beds you have identified.

   c) What type of depositional environment(s) could this sample record? What conditions are necessary for its deposition?

QUESTION 3
   a) Examine the sample and name the sedimentary structures.
   b) Discuss the sedimentary processes involved in the formation of this sample. (Include transport and deposition of beds, formation of any structures, energy involved, sorting, and grain size). Suggest a possible depositional environment.

QUESTION 4

a) Name the sedimentary structures visible between the dashed lines (zone A and B) on the photo below.

b) What does this vertical transition (from one type of structures to another) tell you about possible changes in sediment load, stream velocity and aggradation?

c) Is this kind of structure typical of freshwater or marine setting or both? Explain.

Zone B

Zone A

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QUESTION 5

a) Examine the sample and describe the bedding (give name and configuration).

b) Discuss the processes involved in the formation of this sample (include transport and deposition of beds, formation of any structures, amount of energy involved etc.)

QUESTION 6

a) Examine the black material in the sample. How did this structure form and what is the dark material?

b) Name the structure

c) Is this structure primary or secondary? Explain.

QUESTION 7

a) Examine each of the three samples and identify the sedimentary structures.

b) Describe any differences between the structures in these samples. What do these differences indicate?

c) Discuss the processes involved in the formation of this sample including characteristics of the depositional environment

QUESTION 8

a) Examine the sample and identify the sedimentary structures.

b) Describe the sedimentary processes involved in the formation of these structures. Include any necessary characteristics of the depositional environment

c) Draw a sketch of these structures and indicate the orientation and flow direction. Give reasons for your choice of orientation and flow direction.

QUESTION 9

a) How were these structures formed?

b) Describe the characteristics of the depositional environment

c) Identify the structures as specifically as you can.

QUESTION 10

a) Examine the sample carefully. Once you have figured out the stratigraphic orientation, draw a sketch in this orientation and indicate the flow direction.

b) Describe the sedimentary processes involved in the formation of this sample. (e.g. energy level, transport method, characteristics of the depositional environment)

c) Name the structures

QUESTION 11

a) What kind of structures do you see in this sample?

b) How do they form? Explain.

QUESTION 12

a) What is the deformation structure visible on this sample?
b) How are these structures formed?

c) Explain how you would use these structures to indicate the top or bottom of a bedding plane.

QUESTION 13

a) Examine both cut faces of the sample. Once you have determined the stratigraphic orientation, draw a sketch in the correct orientation and indicate the flow direction.
b) Name the structures.

QUESTION 14

a) Describe the sediment structures and general facies of that sample

b) Explain how these structures form?

QUESTION 15

a) What type of bedding structure is seen in this sample?
b) Describe grain size, type of bed groupings, and potential origin.

Question 16

A popular way to present directional data is with a rose diagram. This is simply a histogram converted to a circular distribution. You are going to make three **rose diagrams** using:
a) direction of movement data
b) line of movement data, and
c) data from several different structures.
Use a class interval of 30 degrees.

a) You are given twelve dip directions of cross-bed foresets (in degrees):, 75, 93, 172, 114, 107, 111,121, 97, 130, 51, 140, 103

    i. Create a rose diagram.
    ii. Which direction did the current move?
    iii. What is the modal class?

b) You are given compass bearings of eight groove casts (in degrees): 84(264), 38(218), 46(226), 13(193), 80(260), 5(185), 107(287), 70(250)

    i. Create a rose diagram.
    ii. Which direction did the current move?

c) You are given compass bearings of four groove casts: 83(263), 98(278), 44(224), 65(245); three flute casts: 63, 52, 74; and six cross-bed foreset dip directions: 38, 70, 57, 101, 37, 67

    i. Create a single composite rose diagram (using lines and rays).
    ii. Which direction did the current likely move?

Lab 3b – Sandstones

In today's lab you will be looking at some thin sections of sandstones as well as grab samples of sandstone

Question 1: Thin section 4311

a) Name the samples (using the extended QFR classification).
b) What primary structures can you see?
c) What do you think the dark "blobs" are?

Question 2: Thin section 3125 – Laminated Sandstone.

a) What are the long narrow minerals?
b) Take a good look at the preferred orientation of these minerals. How does the orientation compare with the bedding planes?
c) What is the most likely depositional environment? Base your interpretation on grain size, sorting, preferred orientation of minerals and the amount of matrix.

Question 3: Thin section 6304B

a) Estimate the percentages of the framework (clasts), matrix and cement components of the sample.
b) What is the primary structure in the rock sample?
c) Name this sample using the QFR chart.
d) Give a brief history of deposition and diagenesis (use the information obtained from the answers above).

Question 4: Thin section 8718 – Sibley Sandstone.

a) Identify and estimate the percentages of all clast, matrix and cement minerals (list separately)?
b) Estimate the sorting of this sample.
c) Name this sample using the QFR chart.
d) Suggest a depositional environment and diagenetic setting for this sample. What is your evidence?

Question 5: Thin section 4318 – Huronian Quartzite
and thin section 241 – Penrith Sandstone.

a) Using a thin section worksheet from the previous lab as a guideline, fill in the following sections for both samples: sample number, framework, matrix, cement, primary structures, and QFR classification.

b) What differences exist between the coarse and fine layers in sample TS 4318? You may have to look at more than one slide to answer this.
c) Use a chart to compare the samples in terms of:
- Compositional differences
- Internal structure of quartz grains
- Relationship of grains to cement (proportion and general distribution)
- Nature of grain-to-grain contacts
- Post-depositional environment, diagenesis. Note down your evidence.

Question 6: Thin section 4310 – Red Sandstone.

a) Identify and estimate the percentages of all clast, matrix and cement minerals (list separately).
b) Is there a clear separation between clasts and matrix in this sample?
c) Look carefully at the sample. What do you notice about the "arrangement" of the particles?
d) Suggest a depositional environment and diagenesis history for this sample. What is your evidence?

Question 7: Thinking ahead….

a) Based on your thin sections, which sample (TS 241 or TS 4310) would make a better reservoir? Why?

Question 8: Sample 141

a) Identify two minerals that make up this sandstone.
b) Why is this rock dark?
c) Name the sample (using the extended QFR classification).