

LAB 2. SEDIMENTARY ENVIRONMENTS & FACIES

Homework: EXERCISE 2.1. Introducing Depositional Environments

Prior to Lab 2, use the material within Lab 2, the textbook and/or the internet to write a short description of what is meant by the following depositional environments.

Table 2.1: Descriptions of Depositional Environments

| | | DEPOSITIONAL ENVIRONMENT | DESCRIPTION OF ENVIRONMENT |
|-------------|---------|--------------------------------|----------------------------|
| Terrestrial | Glacial | Moraine | |
| | | Outwash Plain | |
| | | Glacial Lake | |
| | Stream | Alluvial Fan | |
| | | Braided River | |
| | | Meandering River (Channel) | |
| | | Meandering River (Flood Plain) | |
| | | Lake* | |
| | | Swamp* | |

*Use the textbook and web materials for these environments.

Table 2.1: Descriptions of Depositional Environments (*Continued*)

| DEPOSITIONAL ENVIRONMENT | | DESCRIPTION OF ENVIRONMENT |
|--------------------------|----------------|----------------------------|
| Terrestrial | Arid/semi-arid | Alluvial Fan |
| | | Playa Lake |
| | | Desert Dune |
| Transitional | | River Delta |
| | | Tidal Flat |
| | | Beach |
| | | Barrier Island |
| Marine | | Lagoon |
| | | Delta Bay |
| | | Reef |
| | | Shelf |
| | | Continental Slope |
| | | Deep Marine Basin |

EXERCISE 2.2: Identifying Depositional Environments

Exercise 2.2A. Canadian Basin, Arctic Ocean

Examine Figure 2.3 in the Lab Manual. It is a combined image showing topographic (green/yellow=land) and bathymetric (blue=ocean) features of part of the Arctic Ocean.

Which location (labelled A through H) corresponds to each of the following clastic environments?

1. Meandering River: _____
2. Delta Complex: _____
3. Beach: _____
4. Shelf (Storm Dominant): _____
5. Shelf (Tidal Dominant): _____ *Hint: Where might currents be generated by tidal changes in ocean level?*
6. Continental Slope and Submarine Fans: _____
7. Basin Floor: _____
8. Glacial Moraines: _____

Exercise 2.2B. Glacier Bay, Alaska

Refer to Figure 2.4 in the Lab Manual, which shows an oblique view of Brady Glacier which is located within Glacier Bay National Park in Alaska. A number of terrestrial and transitional depositional environments have been labeled with letters on the image. What depositional environment corresponds to each of letters A through F?

Fill in the depositional environment corresponding to each letter.

A. _____

B. _____

C. _____

D. _____

E. _____

F. _____

EXERCISE 2.3: Introducing Sedimentary Facies

Have your completed Table 2.1 with you as you read the sections *Descriptions of Depositional Environments* and *Sedimentary Transport Systems* in the Lab Manual.

Using just the information in those sections, fill in Table 2.3 (on the next page) with some preliminary ideas as to what sediments you might find in each of these environments. Include only the following:

- (A) Is this setting likely to have Clastic/Chemical/Both sediment types.
- (B) What is the general energy level (high, med, low).
- (C) Based on (B), what grain sizes (clays and silts/sands/gravels) might be expected.
- (D) Colour (red/brown in air, grey or grey-green in water).
- (E) Might there be fossils (y/n) and what type - terrestrial or marine.

Table 2.3: Preliminary descriptions of the sediments found in each depositional environment.

| DEPOSITIONAL ENVIRONMENT | | YOUR PRELIMINARY DESCRIPTION OF SEDIMENT CHARACTER | |
|--------------------------|-------------------|--|-------|
| Terrestrial | Glacial | Moraine (terminal, lateral) | |
| | | Outwash Plain | |
| | | Glacial Lake | |
| | River (Alluvial) | Alluvial Fan | |
| | | Braided River | |
| | | Meandering River (Channel) | |
| | | Meandering River (Flood Plain) | |
| | Swamp* | | _____ |
| | Lake* | | _____ |
| | Arid/semi-arid | Alluvial Fans | |
| Playa Lake* | | _____ | |
| Desert Dunes | | | |
| Transitional | River Delta | | |
| | Tidal Flat | | |
| | Beach | | |
| | Barrier Island | | |
| Marine | Lagoon | | |
| | Delta Bay | | |
| | Reef | | |
| | Shelf | Storm | |
| | | Tidal | |
| | Submarine Fan | | |
| | Continental Slope | | |
| Deep Marine Basin | | | |

*Note: These were included in Table 2.1, and are repeated here so the tables match, but do not fill these in as we will not be covering them further.

EXERCISE 2.4: Identifying Sedimentary Facies

Download Tables 2.4, 2.5, and 2.6 from the Lab Manual. These tables explore idealized sedimentary facies in both clastic and carbonate environments.

Use your new knowledge of modern depositional environments and the idealized sedimentary facies tables to determine the ancient depositional environment for each of the observed sedimentary facies descriptions below.

1. Intermixed coarse gravel and boulders grading laterally (sideways) to sheets of gravel, sand, and clay with fine laminations; asymmetric current ripples.

2. Mature, tan coloured, 10 metre-scale cross-beds in sandstone; reptile skeletons.

3. Medium to large-scale cross-bedded dunes, abundant *Cruziana* trace fossils.

4. Halite, gypsum interbedded with micrite, nodular siltstone, mud cracks and algal laminations.

5. Erosional surfaces beneath sandstone and siltstones with cross-beds and lenses of ripple cross laminations in repeated fining up sequences; in turn overlain by siltstone with root traces.

6. Grey laminated siltstone, black shale, containing thin coal seams and *Cruziana* trace fossils.

7. Bioturbated¹ shelf deposits overlain by gently dipping beds of cross-bedded sandstone and siltstone topped by sandstone, siltstone and coal.

8. Massive non-stratified carbonate mounds with skeletal coral; lime mud matrix.

9. Massive, red-brown debris flow cycles: these are unsorted, non-stratified, coarse grained grain-supported gravels showing a rapid lateral decrease to matrix-supported gravel and sand with minor deposits of laminated sand and rare tree root casts.

¹ Bioturbated: sediment that has been burrowed by many organisms so that most sediment layering or structure is destroyed by the mixing action of the burrowing organisms.

EXERCISE 2.4 (Continued)

10. Thick carbonate pellet beds, hummocky units, biosparite and oosparite, abundant horizontal burrows.

11. Biomicrite, unbroken fragile shells, calcium carbonate mud, a small patch reef.

12. Tan to grey, muds and sands with asymmetric cross beds, mud cracks.

13. Pink-brown, immature, grain-supported conglomerate in trough-like beds; fining up to sandstone with conglomerate, mud and plant material.

14. Coarse sands at the base of an upward fining graded bed, laminated sand, laminated mud and deep sea mud.

15. Unsorted, unconsolidated mix of clay, silt, sand, gravel and boulders with some striations on surfaces.

16. Mud and sand, small scale cross laminae, and grey-coloured symmetric cross-bedded sandstones with an eroded surface.

17. Horizontally bedded silts and fine sands cut by occasional elongate deposits of coarser sand deposited perpendicular to the inferred shoreline, marine fossils.

18. Dark grey, finely laminated to massive micrite and the trace fossil *Zoophycus*.

EXERCISE 2.5: Identifying Facies in Fiji

Refer to Figure 2.7 in the Lab Manual to answer the questions below.

Exercise 2.5A

The region shown in Figure 2.7 includes the following depositional environments:

| | | | |
|-------|------|--------|-------|
| Beach | Reef | Lagoon | Shelf |
|-------|------|--------|-------|

Which depositional environment corresponds to each of the letters A through D?

A. _____

B. _____

C. _____

D. _____

Exercise 2.5B

Answer the questions below by giving the letter and also the depositional environment name.

1. Where would you expect to find ooids? _____

2. Where would you find the trace fossil *Trypanite*? _____

3. Where might you find small patch reefs? _____