14. Sedimentary Rocks II

(p. 208-217)

Depositional Environments

Sedimentary rocks can tell us a lot about the type of environment in which they formed, such as a river, a beach, or a glacial environment, and the past distributions of such environments. These types of studies of sedimentary depositional environments form a sub-discipline of geology called:

________________________.

Sedimentary Structures

Sedimentary structures provide clues about the type of depositional environment a particular sedimentary rock formed in.

Sedimentary structures are the __________________________ that form during or after deposition as a result of physical or biological processes in the depositional environment.

In other words, they are generally some form of observable characteristic of the rock appearance, EXCLUDING rock color or the type of sediment present.

Types of structures:

1) Layers within sedimentary rocks form a type of sedimentary structure called:

__________________ (or stratification)

How thick are beds? _________________________

Beds represent a more or less continuous episode of deposition of sediment. They are separated by flat surfaces called ________________________ along which the rock tends to part or break.

Bedding planes represent one of the following two possibilities:

(1) _______________________________________________________________________

(2) _______________________________________________________________________

At some later time after a bed has formed, a new layer of sediment is deposited on top of it, forming a new bed.

2) Sometimes we can see gradual changes in the size of sediment grains from the bottom to the top of an individual bed. This is a type of sedimentary structure called:

________________________

What size sediment is at the bottom of a graded bed? ____________ or ____________

What size sediment is at the top of a graded bed? ____________

The reason this happens is because of a gravitational effect in flowing water. The larger, heavier clasts are hard for the water to carry, so they are the first to sink to the bottom when the water slows down and
loses energy. As the speed of the water decreases, progressively smaller clasts settle down on top of the larger clasts, forming a graded bed.

Graded bedding is commonly related to these two causal factors:

1. ___________________________ (form when the water slows down); and
2. ___________________________ (due to submarine landslides)

3) In many sedimentary rocks, the beds will appear to have fine layers inside them cutting from the top to the bottom of the beds at an angle to the bedding planes. This type of sedimentary structure is called: ________________

In what three environments is cross-bedding common in sandy sediment?

1. ___________________________
2. ___________________________
3. ___________________________

Cross-bedding forms as a result of flowing water or wind that topples sediment over the edges of dunes or underwater ripples. As a result, the dune or ripple creeps forward, with cross-beds forming on the front slope because of the sediment grains sliding down.

Cross-beds are always inclined downwards in the direction of the flow of the wind or water current that formed them. For this reason, cross-beds can tell us about ancient water or wind flow directions, which we call ________________.

Make a sketch of a cross-bed:

4) The rippled appearance of sandy sediment along the bottom of river beds are like tiny underwater sand dunes created by flowing water. These ripples sometimes get preserved in sedimentary rocks, where they are called: ________________

They can also form on top of sand dunes in deserts by wind currents.

Which type of ripple shape forms where there is a more or less constant water or wind flow direction?

asymmetric or symmetric?

For this reason, asymmetric ripple marks are also called ________________.

e.g., environment where asymmetric ripples form: ________________

Such ripple marks can therefore indicate the paleocurrent direction (i.e., ancient flow in a consistent direction).
Which type of ripple shape forms where there is a constant back-and-forth motion of water or wind? 

asymmetric or symmetric ?

For this reason, symmetric ripple marks are also called ____________________.

e.g., environment where symmetric ripples form: ____________________

5) The type of sedimentary structure that forms due to wet mud shrinking and cracking as it dries out is: 

______________________

They indicate that the sediment must have been deposited in an environment where periodic drying occurred.

Examples: __________________,  __________________,  __________________

Rock Color

The color of unweathered sedimentary rocks is NOT a type of sedimentary structure. Nonetheless, color is useful in that it can tell us about the amount of oxygen in ancient depositional environments.

Dark colors like grey, green and black are often due to iron in the sediment that formed in a _______________ environment, meaning there was very little oxygen present.

Reds and browns indicate lots of oxygen- an _______________ environment- which causes iron to form Fe-oxides like hematite.

Fossils

Fossils are the remains of plants and animals preserved in sedimentary rocks.

Give examples of fossil animal remains (hard parts): ________________________________

Give examples of types of fossil plant remains: ________________________________

Sometimes, evidence of organic life occurs in the form of tracks, trails and burrows on or in the sediment. These are not actual remains of the organisms, just evidence of their presence, and are a type of fossil called ________________.

Organic remains are very delicate and can get destroyed by many sedimentary processes so it's important that they get buried by sediment soon after being deposited to protect them from being eroded away or broken apart by water or wind currents.

Fossils can tell us about ancient depositional environments because some plants or animals must have lived in ____________________, whereas others must have lived in ____________________.

Fossils are very important for determining the age of sedimentary rocks. Certain species of plants or animals only existed at a certain time period in Earth's history. So if you see a particular type of fossil in a
rock, you know the rock must have formed during the interval of Earth’s history during which that particular species existed on Earth.

**Sedimentary Bed Variability**

Why do differences occur from one bed to the next in sedimentary rocks (e.g., different colors, grain sizes, sorting and rounding, and bed thicknesses)?

The types of changes that can occur in depositional environments over time include:

- rise and fall of sea level
- rivers changing course
- glaciers advancing or retreating
- lakes swelling or evaporating
- deserts migrating and growing
- tides moving in and out

Whenever a particular type of sediment is distinguishable from another type of sediment that formed in a different depositional environment, we say that each sediment type represents a particular type of __________________________.

What are the different types of sediment characteristics that we can use to distinguish one sedimentary facies (i.e., formed in different environments) from another?

__________________  ____________________  ____________________
__________________  ____________________  ____________________

Because depositional environments have a limited lateral extent on the Earth’s surface, we see lateral variations in the sedimentary facies of the sedimentary rocks that are ultimately produced. For example, right near the beach, the high energy of the waves produces well sorted quartz sand grains. Slightly deeper in the water, finer sediment like silt and clay sinks to the ocean floor. In deep water, bioclastic carbonate sediment may be collecting on the ocean floor.

List the three different facies types associated with these three environments and the three types of sedimentary rocks they will create:

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<tr>
<th>FACIES</th>
<th>ROCK TYPE</th>
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These three facies can therefore tell us about the __________________________ as well the fact that the water must get __________________________.
Sediment Types in Depositional Environments

We can divide sediment up into two categories based on depositional environment:

- ________________: forms on land
  Examples: ____________________________

- ________________: forms in the ocean
  Examples: ____________________________