August 16, 2021

News and Notes

Here are a few news items that I thought were interesting:

- The big geology news this week is the catastrophic 7.2 magnitude earthquake in Haiti, many casualties and large scale property destruction.
- By contrast, there were two small earthquakes in Eastern Saskatchewan last week, the epicentre of the earthquakes is fairly deep, 10 km in the Precambrian basement rock.
- A study on the Paleocene-Eocene Thermal Maximum (the main article is behind pay wall) using analysis of carbon isotopes.
- A study of gas hydrate systems at the bottom of the Gulf of Mexico (the main article is behind pay wall). The researchers have given this particular gas hydrate system a humorous name, Moby Dick, but gas hydrates are a serious business since a rise in ocean temperature could cause the release of untold tons of methane gas to the atmosphere. Methane is a very effective greenhouse gas.
- Spontaneous reheating of crystallizing lava, pretty heavy on the chemistry of lava crystallization but the basic story is that as various minerals crystallize, heat can be released.
- After cancelling the Keystone pipeline to deliver oil from Canada to American markets, the American administration is calling on OPEC and its allies to increase oil production as gas prices rise.

  Let's see, which is the best choice for America:

  - Buy a needed product from a neighbouring country whose people are generally favourable to the Americans and who are in fact the best customer for American made products, or
  - Buy this product from people who live on the other side of the world and who universally loathe America to the point that some of them have hijacked airliners and crashed them into major edifices?

- Black Sea oil spill much bigger than first thought, criminal investigation into an oil spill at the port of Novorossiysk on August 7.
- For lovers of flying reptiles from the Cretaceous, Australian researchers have discovered a new species of crested pterosaur

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Depositional Environments for Sedimentary Rocks, Part 6, Marine Depositional Environments, Marine Deltas

This week we're going to move on to move on to a discussion of marine depositional environments, starting with marine deltas, as in Table 1, below.

Table 1 Marine Depositional Environments

Environment	Key Transport Processes	Depositional Settings	Typical Sediments
Deltaic	Moving water	Deltas	Sand, silt, clay, organic matter
Beach	Waves, long-shore currents	Beaches, spits, sand bars	Gravel, sand
Tidal	Tidal currents	Tidal flats	Fine-grained sand, silt, clay
Reef	Waves, tidal currents	Reefs and adjacent basins	Carbonates
Shallow marine	Waves, tidal currents	Shelves, slopes, lagoons	Carbonates in tropical climates; sand/silt/clay elsewhere.
Lagoonal	Little transportation	Lagoon bottom	Carbonates in tropical climates, silt, clay
Submarine fan	Underwater gravity flows	Continental slopes, abyssal plains	Gravel, sand, silt, clay
Deep water	Ocean currents	Deep-ocean abyssal plains	Clay, carbonate mud, silica mud

Sedimentary Facies

This is a good place to discuss the concept of sedimentary facies. Put simply, sedimentary facies are the geological record of the depositional environments where the sediments were deposited. Adjacent sedimentary rocks that were deposited at roughly the same time but were laid down in different environments are said to represent sedimentary facies and are often included in the same formation or group of formations. Figure 1 illustrates the shift of sedimentary facies during rising sea level, or marine transgression, (creating an 'onlap' pattern with the underlying beds) and during a falling sea level, or marine regression (creating an 'offlap' pattern with the underlying beds).

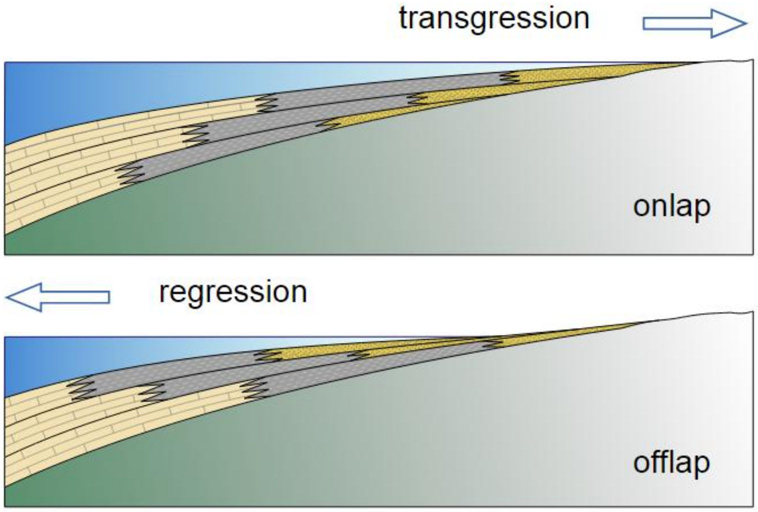

Figure 1 - Sedimentary Facies
Credit: Woudloper, Creative Commons Attribution-Share Alike 1.0 Generic license.

In Figure 1, the sediments deposited, from shallow water to deep (right to left), are sand, clay, and carbonates.

Deltas

Figure 2 - Landsat Image of the Mississippi Delta in 1976
Credit: Jesse Allen and Landsat 1, public domain

In marine environments, deltas form where rivers flow into the ocean. As mentioned in previous blog entries (July 26 and August 9), the key to understanding sediment deposition, in this case a marine delta, is the energy regime. As the relatively fast moving water of the river enters the relatively still waters of the ocean, the clastic sediments (sand, silt and clay) will drop out as sediment.

Over time, this sediment will be compacted into sedimentary rocks, sandstone, siltstone and shale. Also, the river flowing into the ocean will change direction over time. The process is that as sediments build up, the river seeks the lower grade. This is another example of energy relationships. Figure 3, below shows what has happened at the Mississippi Delta during the last 5000 years or so during the Holocene.

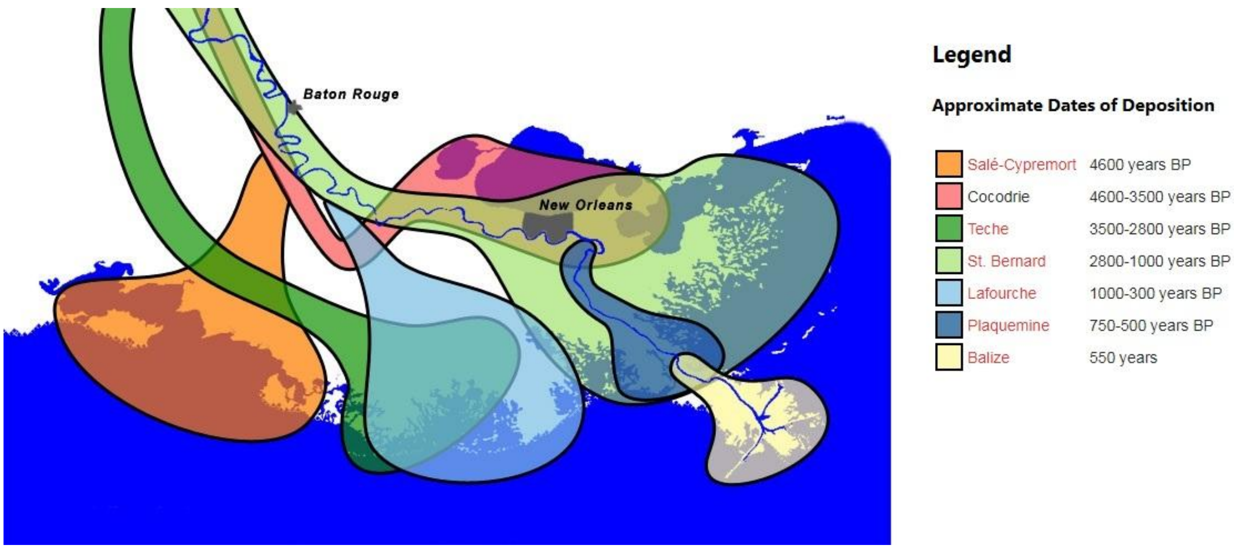

Figure 3 - Mississippi Delta History
Credit: see References 1,2 & 3, public domain

An interesting recent change in the Mississippi Delta has been the shrinking of the current delta lobe. Flood control measures have had the effect of reducing the amount of sediment deposited at the end of the river. Consequently, the delta is losing land to erosion. Figure 1 shows this change dramatically.

Deltas and Petroleum Deposits

River deltas are an important sources of hydrocarbons such as coal, petroleum and natural gas. In deltaic environments, large amounts of organic material are carried by the river and are rapidly buried by copious volumes of clastic sediments. As well, the evolution of deltas often lead to the creation of many backwaters and lagoons. The lagoons associated with deltas are natural repositories of decayed vegetation and many coal deposits appear to be associated with deltaic sedimentary facies.

Figure 4 - Blue Marlin and Ocean Monarch near Port Fourchon, LA
Credit: Jim Hatter, Creative Commons Attribution 2.0 Generic license

Petroleum and natural gas are both associated current and past deltaic environments. Continuing on with the example of the Mississippi Delta, Louisiana is famous for its petroleum and natural gas deposits. Again, once large amounts of organic material are carried by the river and are rapidly buried by copious volumes of clastic sediments, the sediments will eventually be deeply buried and the organic matter will be cooked up into petroleum. If buried deep enough, the heat and pressure will crack the long chain hydrocarbons of the crude oil into natural gas, largely methane.

Standard Caveat

The purpose of my weblog postings is to spark people's curiosity in geology. Don't entirely believe me until you've done your own research and checked the evidence. If I have sparked your curiosity in the subject of this posting, follow up with some of the links provided here. If you want to, go out into the field and examine some rocks on your own with the help of a good field guide. Follow the evidence and make up your own mind.

In science, the only authority is the evidence.

References

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