

September 13, 2021

News and notes

Let's look at a few interesting news items before going on to this week's discussion of depositional environments.

- The [Ogallala Aquifer](#) has been severely depleted, farmers formerly using the aquifer to supply irrigation water are switching to alternative uses for their land: [US Farmers Restore Native Grasslands as Groundwater Disappears](#)
- ['Gold fever is a thing': meet Scotland's new prospectors](#)
- The Middle Cambrian [Burgess Shale](#) continues to deliver surprising discoveries, [Massive new animal species discovered in half-billion-year-old Burgess Shale](#) (Royal Society paper [here](#)); a giant arthropod, a really big bug, that lived off of other creatures in the Cambrian seas - neat stuff.
- [How medical geology can improve health - and even romance](#); this is really a subset of environmental geology, a field that I worked in most of my career. The water and food that we ingest, together with other things like the dust we inhale, will affect our health.
- Moon rocks, [Astronaut geology bound for the moon](#); this builds on the work of the late [Dr. Eugene Shoemaker](#), pioneering geologist for NASA.
- Lots of interest in studying geology, [Tectonic shift in geosciences professions spikes interest in geology major](#). For any young people looking for a challenging, demanding career, take a good look at geology. I covered this in my [News and Notes from June 21, 2021](#).
- Studies in to the end of the last glaciation: [Near-constant retreat rate of a terrestrial margin of the Laurentide Ice Sheet during the last deglaciation](#).
- More on the mass extinction at the end of the Permian Period: [A molecular biomarker for end-Permian plant extinction in South China](#).
- New research on fluvial and alluvial depositional environments: [River sinuosity describes a continuum between randomness and ordered growth](#).

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Depositional Environments for Sedimentary Rocks, Part 8, Carbonate Banks



Figure 1 - Norman Reef in the Northern Great Barrier Reef, Australia

Credit: Rebecca Jackson, [Creative Commons Attribution-Share Alike 4.0 International](#) license.

The highlighted rows in Table 1 summarizes the subject of this week's posting on depositional environments for sedimentary rocks. These three environments are often discussed together under the heading of [carbonate banks](#) or carbonate platforms.

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

[Credit: Steven Earle, Creative Commons Attribution-NonCommercial-Share Alike 4.0 International License](#)

Carbonate banks are not institutions where you can conduct financial transactions. They are, however, among the most important marine [depositional environments](#) and the source of most limestone rocks. Ecologically, they are [extremely diverse environments](#), often called the "rainforests of the sea." They are also major carbon sinks, where much of the world's carbon has been sequestered as calcium carbonate, the main component of limestone. A lot of studies have been done on carbonate banks because of their role in petroleum geology.

Carbonate Bank - Depositional Environment



Figure 2 - Baa atoll

Credit: [Frédéric Ducarme](#), [Creative Commons Attribution-Share Alike 4.0 International](#) license

Carbonate banks form in clear, warm seas where organisms take carbon dioxide out of seawater to make calcium carbonate. In the modern world these creatures are usually corals, but calcium carbonate can also be deposited by calcareous algae, mollusks and other creatures that make their shells out of calcium carbonate. Figure 3 illustrates the general depositional environment of a coral reef.

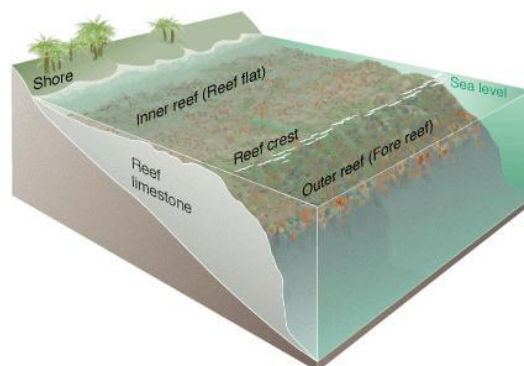


Figure 3 - General Environment of a Coral Reef

Credit: [USGS](#), [public domain](#)

Limestone Rocks from Carbonate Banks

The kind of rock deposited in a carbonate bank depends on the history of the material that gets deposited and the location of deposition. Here are four examples:



Coral limestones are formed directly from the fossil remains of coral. In Figure 4, the rock contains the remains of Middle Devonian rocks tabulate and rugose corals together with some brachiopods, bryozoans and crinoids.

Figure 4 - Coral Limestone

Credit: [James St. John](#), [Creative Commons Attribution 2.0 Generic license](#).



Fine grained **calcareous mudstones** form where weathered material from the coral or the calcium carbonate from calcareous algae is deposited. Calcareous mudstone can form within the lagoons of carbonate banks or on the outer reef where wave action erodes the corals. In a lagoon with tidal action, a [tidalite](#) can be deposited, as in Figure 5.

Figure 5 - Tidalite Limestone

Credit: [James St. John](#), [Creative Commons Attribution 2.0 Generic license](#)



Coquina forms on the margins of carbonate banks where heavy wave action breaks up the remains of shellfish and leaves only coarser grained fragments behind.

Figure 6 - Coquina

Credit: [Wilson44691](#), [public domain](#)



Figure 7 - Oolitic Limestone

Credit: [James St. John](#), [Creative Commons Attribution 2.0 Generic license](#)

Oolites form by rolling back and forth on a shallow seafloor, such as in the lagoons and shallows of a carbonate bank. They are forming today on the Bahamas Platform.

Carbonate Banks as Oil Reservoirs



Figure 8 - Continental No. 9 Oil Well at Woodbend, Alberta

Credit: [Provincial Archives of Alberta](#), [public domain](#)

While carbonate banks only deposit rocks and you cannot withdraw money from them, you can withdraw something more valuable - oil. [A large proportion of the world's oil reserves are found in limestone reservoirs originally deposited in carbonate platforms.](#) These include oil fields located in the Middle East, Libya, Russia, Kazakhstan, and North America. The largest conventional oil field in the world, [the Ghawar field of Saudi Arabia](#), is a former carbonate bank. Much of Alberta's conventional oil is found in [carbonate rocks deposited during the Devonian Period.](#)

Modern Carbonate Banks

Two big examples of modern carbonate banks are the Bahamas and the Great Barrier Reef of Australia.

The Bahamas Carbonate Bank

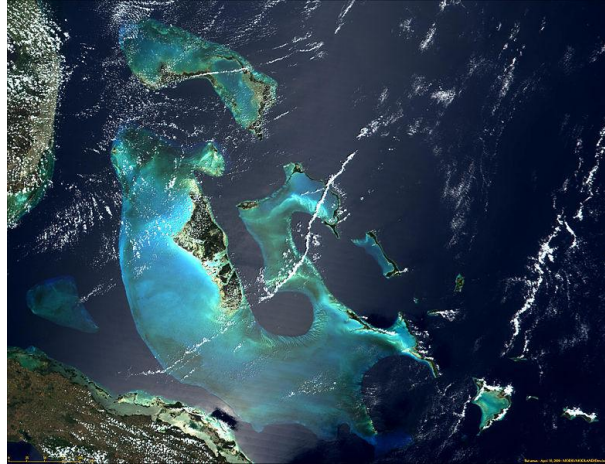


Figure 9 - The Bahamas

Credit: [NASA's Visible Earth](#), public domain

The carbonate bank underlying [The Bahamas](#) has been developing off the southeast coast of North America for the past 150 million years, since the Late Jurassic Epoch. The history of its development is complex, [as discussed in this link](#), leading to the current configuration of numerous troughs and platforms. Cenozoic carbonate deposits show the effects of changes in sea level.

The Great Barrier Reef of Australia



Figure 10 - The Great Barrier Reef of Australia

Credit: [NASA](#), public domain

Today's [Great Barrier Reef](#) began developing off the northeast coast of Australia [58 and 48 million years ago](#), during the Paleocene and Eocene Epochs building on previous carbonate platforms that began development 200 million years ago, during the Early Jurassic Epoch. Sea level changes have repeatedly either drowned or exposed the reef over time. The current reef began its growth during the Glacial Maximum of the Pleistocene Epoch, approximately 20 million years ago. It is the largest coral reef system in the world.

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.