Carbonate Sediments

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Carbonsates act like the Rosetta Stone in their ability to assess changes in the earth’s environment residing in calcium carbonate deposits, coral reefs, and the skeletons of plants and animals. These deposits are faithful recorders of environmental change because most of the calcium carbonate is secreted by organisms that are sensitive to changes in environmental conditions such as sea level, currents, nutrients, carbon dioxide content, and water temperature. Through the study of carbonate sediments, Rosenstiel School scientists address fundamental questions about past and present changes in earth’s environment, including:

- The history of sea level and its future projections from coral reefs and calcium carbonate oozes of the deep sea.
- Changes in concentrations of atmospheric carbon dioxide and ocean chemistry.
- Annual rings in coral skeletons like tree rings that archive temperature and ocean composites for the past several hundred years.
- Past and present changes in biodiversity that can be studied by comparing modern and ancient coral reef deposits.

Geologists at the University of Miami Rosenstiel School of Marine & Atmospheric Science have developed one of the few focused programs in carbonate research. Its location provides ready access to a vast natural laboratory of carbonate deposits and their preserved records. These scientists are leaders in understanding and modeling the present-day ocean currents. They have pioneered the extraction of the record of ocean temperatures and compositions from coral skeletons. These scientists have found creative ways to partner with energy companies, linking them to cutting-edge, interdisciplinary research.

A history of carbonate sedimentology

Rosenstiel School scientists pioneered work in the comparative sedimentology of carbonate sediments in the early 1970s. This early work set the foundation for what would later be part of the Comparative Sedimentology Laboratory at the Rosenstiel School. Research and educational needs led to trips to the Bahamas and Belize on a regular basis. Today’s carbonate sedimentology research at the Rosenstiel School spawned the Industrial Associates Program, which offers participating energy companies rapid access to basic and applied research relevant to exploration and production. A yearly review allows participating geologists to interact with their counterparts in the energy industry and to stay abreast of the latest developments in carbonate research.

Technology that finds the hard-to-find

Rosenstiel School scientists have employed advanced technology in their quest for carbonate reservoirs and their modern analogues. Using remote sensing data and surface samples, scientists capture “spatial trend metrics” to characterize a given area. New generation 3-D, ground-penetrating radar is able to discern key characteristics. Seismic reflection can determine where oil is, but advanced computing is required to see through salt and other distorting deposits.

Exploring the Caribbean and the Gulf of Mexico

Detailed three-dimensional GIS models of the Great Bahamas Bank have been constructed based on a half-century of study that has accrued data from sediment grabs, cores, water samples, as well as optical and acoustic observations. Most recently, these same scientists made a surprising discovery in the Straits of Florida. Using an autonomous underwater vehicle, Rosenstiel School scientists, along with colleagues from Harbor Branch Oceanographic Institute, made high-resolution bathymetry maps of the area and found deep-water coral mounds that were later sampled for possible therapeutic compounds.

Tsunami studies

After the Indian Ocean tsunami in 2004, Rosenstiel School geologists recognized that studying coastal lagoon sediments in Sri Lanka could tell them a great deal about the Indian Ocean’s tsunami history. By employing many of the same tools used to study carbonate sediments, researchers hope to better understand the recurrence frequency of great Indian Ocean tsunamis. This is critical to understanding the mechanics of giant megathrust earthquakes and the influence of tsunamis on coastal sedimentation.

A global environmental view

University-based carbonate sediment research, while a boon to energy companies, is science that also has environmental applications. For example, carbonate deposits act as sensitive “tape recorders” of past environments. The Rosenstiel School is recognized internationally for its climate change research, and the University of Miami’s unique Center for Environmental Science and Policy pulls together a collection of researchers to lead these efforts.

As sea levels rise, the coastal environment will continue to change. Wetlands continue to shrink. Sea surface temperatures grow. And the push to find alternative energy sources must continue. But as energy companies are also making new discoveries of oil in the deepest Gulf of Mexico, the Rosenstiel School is working with them to ensure the quest for energy is a responsible one, aware of global impacts.