Digging for answers to climate change

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Forty miles off the Jersey Shore, an international team of scientists is grappling with a worrisome phenomenon: The oceans are slowly rising. The researchers are not studying the sea itself. Living for weeks at a time on this drilling platform, they are burrowing down into the past, pulling up cores of prehistoric sediment from nearly half a mile below the ocean floor.

By studying how the Earth responded when the sea rose and fell at various times millions of years ago, the team hopes to understand what may happen this time around.

How rapidly do beaches disappear when the Antarctic ice sheets melt? Are the changes abrupt or smooth? What happens to fragile shoreline ecosystems?

And how might such events occur differently in the 21st century, now that the rising waters are attributed to man-made greenhouse gases and global warming?

The quest for answers starts with a 285-horsepower drilling rig that churns for hours on end, bringing up a variety of clues about past sea levels -- evidence contained in fossils, in the chemistry of the water trapped in ancient sediment, and in the nature of the clay and sands themselves.

Kenneth G. Miller, a Rutgers University geologist, speaks loudly in order to be heard over the steady hum of the drill.

"This is what we think is going to be the home run for understanding how fast sea level can change in this area," he says of the project.

There is no question that the world's oceans are rising -- by a few millimeters each year, on average, according to satellite measurements -- and recent research suggests that they are starting to rise faster. Some scholars predict an increase of more than 3 feet by the end of the century, an amount that would dramatically change the coastline, lead to flooding, and endanger aquifers that are a critical source of drinking water.

The New Jersey project is led by Gregory Mountain, also of Rutgers, and Jean-Noel Proust of the University of Rennes, France. It is part of the 24-nation Integrated Ocean Drilling Program.

The platform is actually a boat, with three legs that are pulled up in order to sail. The expedition went to sea from Atlantic City, N.J., in late April, drilling at three separate sites off South Jersey.

Life on the drilling platform has its own unique rhythm, sort of like a small-scale assembly line whose goal is not manufacture of a product, but the acquisition of knowledge.

The scientists -- easy to spot by their bright red jumpsuits -- bustle in and out of on-deck laboratories that are housed in 20-foot-long shipping containers.

Members of the drilling crew wear overalls splattered with mud that they've drawn up from below the ocean floor. They are burly men, outweighing the scientists by a good 40 pounds each or more.

Every few hours, a new core of sediment is pulled up from the watery depths and is cut into sections for preliminary tests. It is then packed in a refrigerator for transport to Germany, where it will be split open for detailed scrutiny.

But the analysis on board the platform already has yielded some tantalizing clues.

A thin slice is cut from one end of each core. By looking at a given sample of sediment, geologists can tell how deep the water was when it was deposited.

On a lab table, the team has displayed one group of four such slices from the second drill site, taken from sediment cores pulled up from more than 1,200 feet beneath the sea floor. The sequence, dated to about 19 million years ago, shows clear evidence of the sea level declining, says Mountain, a geologist by training.

The oldest (and bottom-most) of the slices contains quartz sand, with medium-sized particles. That means it was deposited fairly close to shore, in perhaps 30 to 100 feet of water, where there is still enough wave activity to move the particles. (For sand to be deposited farther out it has to be finer, and lighter.)

The next-oldest slice contains bands of carbonate -- a telltale sign that algae were once present. So when that sediment was deposited, the water was several feet deep.

"This was probably about boot-top level," Mountain says.

In the slice above that, the scientists have identified the remains of prehistoric marshy vegetation, indicating that the sea level was then about zero.

Finally the topmost, and most recent, slice is made of muddy sand. It's the sort of stuff that would have been deposited by a river, above sea level.

It is as if the scientists had captured the receding sea in a series of snapshots -- taken over a period of thousands of years, 19 million years ago.

Even eons later, the section with the marshy material gives off a foul odor. But don't say that to team member Mike Mottl, an oceanography professor at the University of Hawaii.

"To some of us, it smells good," Mottl says, a tad defensively.

The hope is that further analysis will reveal just how much the sea level declined during this 19-million-year-old sequence -- and thus, how much land-based ice had to form in order for the water to drop that much. It might have involved the growth of ice sheets on say, East Antarctica, or possibly the combination of ice on Antarctica and Greenland.

Such information will help to refine climate models that predict the future. If sea-level rise begins to accelerate in staccato fashion, for example, scientists would like to know if that is because of human influence, or if the seas have behaved that way in the past.

English -- the language of science -- is the preferred means of communication among the scientists, though it comes in many flavors as research crews rotate on and off the platform. One day last month, accents in the air included French, Scottish, and even Cajun, the latter from crew members of the Louisiana-based vessel.

"They're all divided by a common language," Mountain jokes.

Yet they have a common purpose -- to study the sea, by drilling down beneath it.

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