Courtesy Jim Channell

As a member of the Integrated Ocean Drilling Program—an international consortium of scientists from the US, Europe and Japan—the Department of Geological Sciences is participating in two major drilling expeditions this year off the coast of Greenland to gather sediment core samples to be used to examine how sudden climate change has occurred in the past. Each 9.5-meter, or 10.3-yard, section of pipe gathered contains 60,000 years of climate history.

getting to the core of climate change

In the recent Hollywood blockbuster *The Day After Tomorrow*, a sudden change in global climate brings on a new Ice Age that freezes the entire Northern Hemisphere in a matter of days. Since the film was released last summer, and following the numerous natural disasters suffered around the world recently, the public has begun to wonder whether we are on the cusp of a major change in worldwide weather. Researchers in UF's Department of Geological Sciences are part of an international team of experts examining how climate change occurred in the past and what we can expect in the future.

"The scenario of an abrupt climate change suddenly affecting us in a short period of time is not science fiction, that could happen," says Geology Professor Jim Channell. As a member of the Integrated Ocean Drilling Program—an international consortium made up of scientists from America, Europe and Japan—Channell recently co-led a two-month drilling expedition off the coast of Greenland to gather sediment samples from the floor of the North Atlantic. "What we were interested in was looking at North Atlantic climate records of the past 2 million years," he says. "The North Atlantic climate has been a very important element in global climate change over the last few million years, and we need to be able to study it in more detail."

A major theory in the scientific community sensationalized in *The Day After Tomorrow* is the idea that the thermohaline circulation of the North Atlantic could shut down due to global warming and, in turn, cause much colder temperatures in the Northern Hemisphere. Channell explains that the Gulf Stream—a warm current that comes up from the tropics, past Florida, and up through the Norwegian-Greenland Sea—is responsible for keeping the continents bordering the North Atlantic, particularly northern Europe, warm. As the warm surface water of the Gulf Stream evaporates as it moves north, it becomes progressively more saline. The salinity increases until the Gulf Stream current becomes dense enough to plunge down into the depths of the ocean, near Iceland, and circulate back southward as North Atlantic Deep Water.

"It is like a big conveyer belt pumping heat from our part of the world into the North Atlantic and it is very important in keeping the high latitudes warm," Channell says. The theory states that if large ice sheets begin to melt, which could be caused by global warming, the North Atlantic would be flooded by fresh surface water produced by the melting ice. This would make the Gulf Stream less salty as it moves through the area and unable to sink into the depths of the ocean, thereby slowing the conveyer system known as thermohaline circulation.

"It could happen very suddenly," Channell says. "Not the 'day after tomorrow,' but on a decadal time scale, which is scary enough. High latitude continental ice is melting right now at an unprecedented rate. The objectives of our drillings are to understand how North Atlantic climate behaved in the past in response to these sorts of ice sheet instability events."

As a member of the Joint Oceanographic Institutions (JOI), the US arm of the Integrated Ocean Drilling Program (IODP), the UF Department of Geological Sciences is one of 20 premier oceanographic or academic institutions working to serve the US scientific community through large-scale, global research programs. The JOI makes up one-third of the larger IODP, which includes a branch from both Japan and Europe. The National Science Foundation funds the JOI, while Japanese and European scientists also have their own internal funding. The IODP organizes drilling cruises throughout the world's oceans to explore the history and structure of the Earth as recorded in seafloor sediment and rocks.

Channell served as co-chief scientist on the first of two expeditions in the North Atlantic for the IODP last fall, overseeing a team of 30 geologists from around the world for two months aboard the 10,000-ton drilling vessel, *RV JOIDES Resolution*. Geology Professor David Hodell served as the stratigraphic correlator on the cruise, running the machinery used to correlate cores from multiple drill-holes at each site.

The team collected sediment core samples from six sites off the coast of Greenland and in the surrounding area, using the abilities of the drill-ship *JOIDES Resolution* to maintain position in deepwater. Each sample accounted for about 60,000 years of history. The mission of the cruise was to collect samples that go back 2 million years in order to map how the climate has changed on Earth over that time.

The entire crew of scientists reconvened this summer in Germany, where the collected cores were being stored, to divide up the materials and begin post-cruise research. All scientists who participated in the expedition have committed themselves to continuing their research on shore. Hodell will be researching the carbonate in the sediment cores and providing chemical analyses on the shell materials found in the cores, while Channell will be looking at the variations in the magnetic field and how it has changed over time.

UF geology graduate student Helen Evans and Simon Neilsen, a geology postdoctoral fellow, set sail this spring on the second leg of the North Atlantic mission, working as an onboard sedimentologist and paleontologist, respectively. The two legs of the North Atlantic drilling expedition took five years to organize—beginning in 1999 with a proposal submitted by Channell and colleagues—and the team expects the post-cruise research phase of the project to take another five years. Next year, the entire group of geologists from both legs of the expedition plans to meet in Hawaii to begin compiling results.

In a world reeling from a devastating year of tsunamis, mudslides and hurricanes, the public has become more interested in the work of groups like the IODP, and Channell says that is the way it should be. "If you have extraordinary weather events, even if they are not related to global warming, it makes the public aware that the climate system is something you really don't want to put out of equilibrium."

—Buffy Lockette