Scientists core into California's Clear Lake to explore past climate change

May 3 2012

Ryan O'Grady of LacCore examines a 3-meter coring tool after it's brought up from 137 meters below the bottom of Clear Lake. The tool contains a plastic pipe that encases the lake sediments. Credit: Robert Sanders, UC Berkeley media relations

(Phys.org) -- University of California, Berkeley, scientists are drilling into ancient sediments at the bottom of Northern California's Clear Lake for clues that could help them better predict how today's plants and animals will adapt to climate change and increasing population.

The lake sediments are among the world's oldest, containing records of biological change stretching back as far as 500,000 years.

The core drilling is part of a unique, multifaceted effort at UC Berkeley to determine how Earth's flora and fauna responded to past changes in climate in order to improve models that project how life on Earth will adapt to today's environmental pressures. What the researchers learn from their look-back in time will be crucial for state or local planners clamoring for better predictive tools to guide policies crucial to saving ecosystems threatened by climate change.

"We are reconstructing the past to better forecast the future, because we need to know what's coming in order to adequately prepare for it," said project leader Cindy Looy, UC Berkeley assistant professor of integrative biology.

Looy and 16 other UC Berkeley faculty members – including paleontologists, pollen experts, botanists, ecologists and climate modeling experts – will examine the lake cores for pollen grains, charcoal and fresh-water organisms going back at least 130,000 years, long before humans arrived in the area. Using isotope and chemical analysis as well as carbon dating, the researchers will obtain a long series of detailed snapshots – ideally, every 10 years – of the plant and animal communities in the Clear Lake area and how the communities changed in response to "natural" global warming events. The analysis will also provide a measure of the temperature, oxygen content and nutrient levels of the lake, which reflect rainfall and water level.

"One way to check our predictions is to go back in time to a state very similar to today, with the same plants and animals and about the same temperature. The fossilized plant and animal remains from Clear Lake will give us a baseline for what this region of California looked like under similar climatic conditions, and when it was colder or warmer. We

use that information to fine-tune predictive models being developed today," Looy said. "Rates of global warming almost as fast as what we see today last happened during the shift from the last glacial to the current interglacial roughly 12,000 years ago, so that is one time intervals we will focus on."

Focusing on two glacial-to-interglacial transitions

Looy and her team also will look at an even earlier transition from a glaciated Earth 130,000 years ago to a time 113,000 years ago when it may have been locally warmer than today. Learning what the area looked like during that time will help Northern Californians anticipate how conditions will change as global temperature continues to rise over the coming decades.

"There are indications from ice cores and ocean drilling cores that the beginning of the previous interglacial may have been warmer than it is now, which is where it becomes interesting," said Looy. "We know what the Earth is like at today's temperature, but a lot of people are trying to predict what will happen if the earth warms 1 or 2 degrees Celsius (2-4 degrees Fahrenheit), or even more."

Charcoal in the lake sediments will also tell the researchers how Native Americans altered the environment through deliberate fires designed, for example, to increase acorn production by oaks.

One member of the team, Anthony Barnosky, UC Berkeley professor of integrative biology, will correlate this information with mammalian fossils collected from cave deposits in the area and that have been stored for decades in the Museum of Paleontology.

"You can view the core as a time machine by which we can define a continuous record of change, both climatic and vegetational, though the

past 130,000 years, and then we have all these floating snapshots of the ecosystem – the mammal communities – from cave deposits around here," Barnosky said. "We can put names on these fossils and radiocarbon-date them and begin to build a 3-D picture of change through time from the late Pleistocene, some 130,000 years ago, through the last glacial/interglacial transition 13,000 to 11,000 years ago, all the way up to the present."

The study will help to evaluate and refine current models that predict how plants and animals will adapt to a changing world by testing predictions of the models against what actually happened during past times of climate change. Such models are important for state and local planning agencies that must deal with future consequences of climate change, including sea level rise, water shortages and increasing fire incidence that can threaten ecosystems.

"Based on this type of research at UC Berkeley, we want to make the case that adaptation to a changing climate is an issue we have to take more seriously, we have to bring it more into the mainstream of Bay Area planning," said Bruce Riordan, director of the Bay Area Joint Policy Committee, which coordinates regional planning agencies in responding to climate adaptation. "By starting planning now and understanding the problems, the strategies we need to implement and the costs involved, we may find less costly solutions today rather than later. The research can really help inform about both the problems and about the solutions."

Half million years of sediment

Clear Lake is unusual in having survived the advance and retreat of glaciers that scoured and obliterated most lakes outside the tropics, including the large lakes in California's Sierra Nevada. Previous coring in Clear Lake by the U.S. Geological Survey (USGS) in 1973 and 1980

revealed lake sediments half a million years old, with only three breaks in continuity. At the site where UC Berkeley plans to obtain cores, in the upper arm of the lake about 1-3 miles west southwest of the town of Lucerne, the USGS obtained a continuous core in 1973 going back 130,000 years.

Looy and her team hired Utah-based DOSECC (Drilling, Observation and Sampling of the Earths Continental Crust), a non-profit scientific drilling company, to obtain two 120 meter-long (400-foot) cores, each about 8 centimeters (3 inches) in diameter. The cores are obtained in 3-meter (10-foot) chunks that are capped and labeled at the site and will be shipped to a cold-storage facility in Minnesota operated by LacCORE (National Lacustrine Core Facility), a non-profit organization funded by the National Science Foundation and the University of Minnesota. In the facility's cold lab, the team will split each chunk longitudinally, photograph the halves, and then bring one half of each chunk back to UC Berkeley for analysis.

While the USGS sampled its cores once every meter, Looy and her team will sample parts of their cores every centimeter, the equivalent of about 10 years of sediment.

"We will get 100 times better time resolution, and can follow what happens when you rapidly warm the Earth up," Looy said.

"The detail we can get from Clear Lake is really impressive," she added. "The material is well preserved, and the USGS did a great job in describing the whole time interval so that now we know what the interesting areas are to focus on. We know this is not a shot in the dark."

Provided by University of California - Berkeley