# Under a Frozen Lake in Siberia, Geoscientist Drills For Secrets of Earth's Ancient Climate

December 18 2008

(PhysOrg.com) -- In the next few days, a convoy of bulldozers and trucks will set out from a remote airport in Siberia, heading for a frozen lake 62 miles north of the Arctic Circle, but the trip isn't a holiday visit to the North Pole. Instead, the trucks will deliver core-drilling equipment for a study of sediment and meteorite-impact rocks that should provide the longest time-continuous climate record ever collected in the Arctic.

Once in place next month, the drilling will allow an international team of geoscientists led by Julie Brigham-Grette of the University of Massachusetts Amherst and Martin Melles of the University of Cologne, Germany, to burrow back in time, retrieving core samples more than 3 million years old and answering questions about Earth's ancient past.

Almost impossibly remote, Lake El'gygytgyn (pronounced el'geegitgin), 11 miles in diameter, was formed 3.6 million years ago when a monster meteor, more than a half-mile across, slammed into the Earth between the Arctic Ocean and the Bering Sea. Because this part of the Arctic was never covered by ice sheets or glaciers, it has received a steady drift of sediment – as much as a quarter mile (1,312 feet or 400 meters) deep – since impact. Thus, it offers a continuous depositional record unlike any other in the world, say Brigham-Grette and colleagues, beneath the crater lake that's just over 560 feet deep, equal to the height of the Washington Monument.

This week's convoy will take 25 days to crawl through the frozen dark, building a 224-mile ice road as they go, over which the heavy drilling

equipment can be moved from the remote airstrip at Pevek, in the north of Russia's Chukotka Autonomous Region. "Lake El'gygytgyn is logistically among the most difficult places on Earth to carry out a scientific drilling program," Brigham-Grette acknowledges. But by all accounts, the rewards should be worth all the effort.

In preparation for this day, scientists from institutes in Germany, Russia and Austria as well as UMass Amherst have been flying in by helicopter for focused tests over the past 10 years, drilling pilot cores and taking other samples and measurements. The site has passed every test. For example, the lake bed has been undisturbed by earthquakes, other underground shifting or drying for thousands of years. Pilot cores of 16.7 meters long (54 feet) have already provided a snapshot of climate from 300,000 years ago.

El'gygytgyn thus offers a truly unprecedented and ideal opportunity, Brigham-Grette notes, for piecing together a clearer picture of the hemisphere's prehistoric climate and the dynamic processes of global climate change since the meteor's impact. Notably, the researchers hope they can learn more about the unexplained shift from a warm forest ecology to permafrost, some 2 million to 3 million years ago. Comparing cores from under Lake El'gygytgyn to those from lower latitudes will help the climate scientists with a high-resolution tool to study climatic change across northeast Asia "at millennial timescales," Brigham-Grette says. In addition to climate data, cores may offer the researchers an opportunity to study the 3.6-million-year-old "impact breccia," that is, how Earth's bedrock responded to the meteor's impact.

Some sampling began in November at the science camp drilling site on the lakeshore, where researchers will study the climate history of the permafrost (frozen ground) that surrounds the lake. The other two drill sites will be in the deepest part of the lake. Waiting until Arctic winter to transport and install the equipment, the team can use the frozen lake

surface to support drills specially designed to withstand the extreme weather conditions. The scientists plan to start drilling overlapping cores at these frigid locations in February using the windswept lake ice as a drilling platform. Sampling will continue until May 2009, as part of the International Continental Scientific Drilling Program (ICDP).

To ensure the safety of both scientists and drill-team members on the isolated lake in potentially life-threatening conditions, Brigham-Grette and colleagues have scrutinized how the ice shifts, cracks, and responds to heavy wind and circulation forces before settling on rig placement. Workers and scientists will live in a protected personnel carrier that will also transport cores from the rig on the lake ice to the science camp on the shore.

Sediment cores will be processed for shipment and stored at the lake in a temperature-controlled container until they can be flown to St. Petersburg and later trucked to the University of Cologne, Germany, for study by the international team. An “archive half” of each core will also be stored at the University of Minnesota.

Provided by University of Massachusetts Amherst