

3 June 2009 18:06 UK

Origin of Antarctic ice revealed

By Victoria Gill
Science reporter, BBC News



The Gamburtsev mountains have been preserved under the ice sheet

Incredible peaks and valleys, buried beneath ice for 14 million years, have revealed evidence of how the East Antarctic ice sheet first formed.

Scientists used radar to map an area of the Gamburtsev mountains - believed to be the point of origin of the ice. The region would have been cold enough for the first glacier to form.

Writing in the journal *Nature*, the researchers say their findings provide important clues about how the ice sheet will behave as our climate changes.

"This is the largest reservoir of ice on Earth, and the most poorly understood place on our planet," said the British Antarctic Survey's Fausto Ferraccioli, a scientist involved in a separate international project to study the region. He explained that the elevation and location of the Gamburtsev Mountains - in the centre of the ice sheet - made them an "ideal place" for the formation of the very first ice.

Icy unknown

Sun Bo from the Polar Research Institute of China, who led this study, has now provided further insight into the evolution of the ice sheet.

He and his colleagues travelled 1,235km (767 miles) by tractor train from a research station at the edge of East Antarctica, to the summit of Dome A of the Gamburtsev range, near the centre.



“ Peering down at the ice sheet underneath your feet, you just don't know what's under there ”

Martin Siegert
University of Edinburgh

Dr Sun's team then attached radar equipment to the tractor and drove around, meticulously surveying a 30km by 30km square of the glacial region.

Their radar revealed a landscape that, 14 million years ago, looked similar to the European Alps.

"This is true scientific exploration," said Martin Siegert, head of the school of geosciences at Edinburgh University, who was also involved in the study.

"There's nothing to guide you really. Peering down at the ice sheet beneath your feet, you just don't know what's under there."

And for this type of exploration, the use of radio waves is very powerful.

When the waves reach the interface between ice and rock they bounce back, because of the difference in electrical properties between the two.



"You just measure the two-way travel time as they go down and come back up again," explained Dr Siegert. "Then you can convert that to ice thickness, because you know the velocity at which [the radio waves] are travelling." Dr Siegert said the research team was "very lucky" to see such a clear image of the underlying landscape. They discovered a whole valley system - with mountains at the edge of the survey region and the valley in the middle. "That's perfect, because it allows us to work out how the valley would have worked when it was filled with ice, and how the water would have flowed when there was no ice there at all," said Dr Siegert.

Frozen in time

By looking at ancient climate patterns, scientists have previously estimated that the East Antarctic ice sheet formed around 14 million years ago, burying and preserving the Gamburtsev mountain landscape under ice that is now up to 3km thick.

"You need a mean annual temperature of about 3C for the glaciers to form the way they did," Dr Siegert told BBC News.

"The mean annual temperature in this region now is -60 C. So we believe that these mountains are relics of [glacial erosion] in Antarctica before the ice sheet was in place."

He added that the findings provided an insight into the stability of the ice.



Antarctica's landscape was mountainous before the ice formed

"It is a critical part of our Earth's system," said Dr Ferraccioli. "If the whole ice sheet collapsed, sea levels would rise by 60m."

"There's been a lot of climate change over the last 14 million years," Dr Siegert said. "And what we can say about this place in the middle of the Antarctic is that nothing has changed."

But, he warned, if levels of atmospheric carbon dioxide continued to rise, in around 1,000 years they will approach the same levels that existed "before there was persistent ice sheet in Antarctica".

"This puts the ice sheet into the context of global climate and what conditions are needed to grow an ice sheet," explained Dr Siegert. "The worrying thing is that we seem to be going back to carbon dioxide concentrations consistent with there being a lot less ice around."

