

# Core of ice

Massimo Frezzotti and colleagues saw their 17-ton vehicle drop 10 m into an ice crevasse in their quest to recover the climatic history of East Antarctica.

## ■ What was the objective of the work?

The goal of the TALos Dome Ice Core (TALDICE) project was to document the palaeoclimate history of the last glacial–interglacial cycle from a coastal area in East Antarctica where palaeorecords are relatively scarce.

## ■ Why did you choose this location?

Talos Dome is an ice dome on the edge of the Antarctic ice sheet. It is strategically located at the junction between the East Antarctic plateau and the Transantarctic Mountains, at a distance of about 250 km from the Southern Ocean. Ice domes are sites where the ice sequence is the least disturbed, allowing the recovery of long and continuous climate records. Between 1996 and 2003, more than 2000 km of radar surveys and 10 shallow ice cores were collected in the region in the framework of the Italian Antarctic Research Programme, to build an understanding of the climatic and glaciological conditions of the dome area and to identify the best deep-drilling site.

## ■ What sort of samples were you after?

The ice core was retrieved using French–British electromechanical drilling equipment in four consecutive expeditions. Drilling started during the Austral summer season in 2004 to 2005 and eventually reached a depth of 1,620 m during the 2007 to 2008 season. Polar ice provides a cornucopia of climatic proxies, greater than any other natural climate archive. The ice can be analysed for parameters such as its isotopic and chemical composition, traces of radioactive substances and inclusions within the ice such as wind-blown dust, volcanic ash, bubbles of atmospheric gases and so on. The TALDICE ice core provides very high-resolution data for the last millennia as well as for older periods, which is exceptional.

## ■ Did you encounter any difficulties?

The project is funded by national contributions from Italy, France,



The drilling system at Talos Dome, where the TALDICE team extracted a palaeoclimate record of 1,620 m of ice.

Germany, Switzerland and the United Kingdom. It took a decade of administrative, logistic and scientific effort and coordination to collect these data. Before we could start the presurvey and the deep drilling, we had to convince the national stakeholders to take on the risk and cost of drilling deep in a tough workplace, with strong winds and a mean annual temperature of  $-41^{\circ}\text{C}$ . Because the environment is so challenging in Antarctica, technical problems are quite common during ice coring. At Talos Dome the drill got stuck at 700 m depth in 2006, and there was a serious risk of losing the equipment and having to abandon the borehole. However, our fantastic and skilled team of experienced drillers and mechanics managed to rescue the drill system with a small winch, and the coring continued on schedule.

## ■ Any encounters with dangerous animals, or low points?

Fortunately no polar bears or dangerous animals occur in Antarctica, but the environmental conditions are the hardest

in the world and crevasses in coastal areas are very dangerous. In 1996, during the first oversnow traverse from the Italian coastal station to Talos Dome, a vehicle of 17 tons fell 10 m deep into a crevasse. Fortunately the crew was saved immediately and the vehicle was recovered without any damage. This was the most shocking experience of my life.

## ■ What was your highlight?

The most exciting scientific highlight came during the last campaign when the drilling went 200 m deeper than expected from ice-thickness interpretations of geophysical data. When we plotted the data, we realized that the palaeoclimatic signal preserved in deeper ice was coherent, and that it was older than we expected: we had obtained the longest ice record ever collected from a coastal area of Antarctica!

## ■ How did you get the cores back to the lab?

The logistics of the ice-core expedition were amazing. They involved mechanics, drillers and scientists from five nations as well as the storage and transport of more than  $2,500\text{ m}^3$  of ice. The ice was first flown from Talos Dome to the coastal Italian station, and then brought back by ship to European laboratories — at temperatures permanently below  $-25^{\circ}\text{C}$  — to preserve the climate signal in the ice. The ice cores were cut and processed at the Alfred Wegener Institute for Polar and Marine Research, Bremerhaven (Germany) ice core facility by about 25 young scientists.

## ■ Any ideas for future research projects?

After the success of European deep-ice-coring projects, the international ice-core community is now engaged in the challenge to obtain a 1.5 Myr record of climate and greenhouse gases in the framework of International Partnerships in Ice Core Sciences. Glaciological studies show that the oldest ice is expected to be found south of the East Antarctic ice divide, in the most extreme environments on the Earth's surface.

*This is the Backstory to the work by M. Frezzotti and colleagues, published on page 46 of this issue.*

