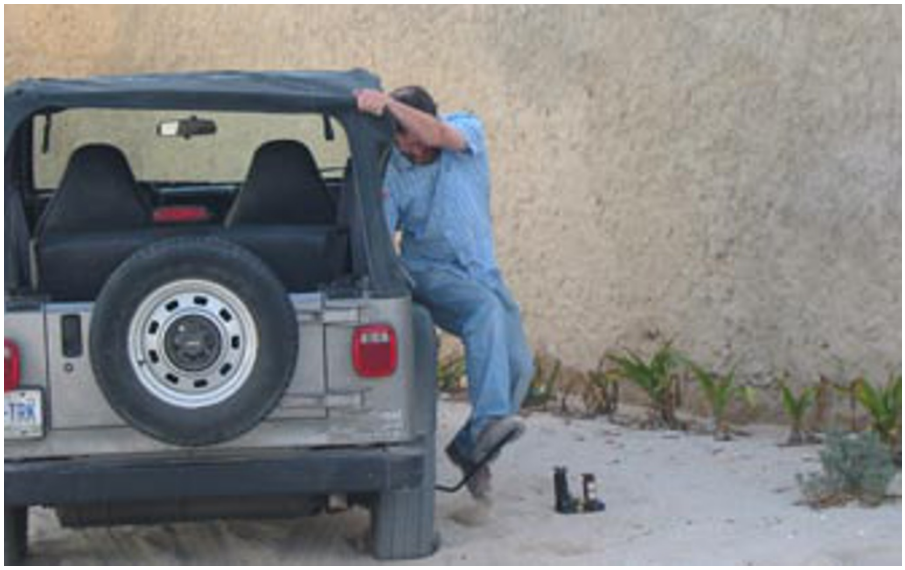
Impact assessment

Sean Gulick and colleagues circumnavigated a flotilla of floating skin divers' platforms to obtain seismic profiles of an impact crater.

What was the objective of the work at the beginning of the project? Did it change as work progressed?
One of our primary objectives was to investigate the structure of the 65 million year old Chicxulub impact crater for signatures of impact direction and angle. Ultimately, we wanted to understand the severity of environmental damage caused by the impact that is famous for its link to the extinction of the dinosaurs. As it turned out, the subsurface images and geophysical data we collected across the crater showed a correlation between sediment thickness and water depth before the impact and asymmetries in the crater resulting from the impact. Thus we changed the focus of our study to look into the influence of local heterogeneities in the Earth's geology on the final structure of an impact crater.

Why did you choose this particular location for the fieldwork?
The Chicxulub crater is one of the three largest impact craters on Earth. The other two craters — Vredefort and Sudbury — formed in collisions around two billion years ago. The Chicxulub crater is also the only pristine large (>150 km) impact crater discovered on Earth. We wanted to improve our knowledge of its structure and geometry.

What data did you choose to collect and how was this done?
Half of the crater lies onshore beneath the Yucatan Peninsula in Mexico and the other half is offshore. In addition, the crater is buried by ~1 km of carbonate sediments deposited over the last 65 million years. Thus, geophysical techniques that can 'see' beneath the surface, such as seismic reflection, are essential to study Chicxulub. In a joint US–UK–Mexican experiment, we acquired two primary datasets simultaneously. In the offshore region, we used the NSF Research Vessel *Maurice Ewing* to acquire ~1,800 km of seismic profiles across the impact crater, and deployed 28 ocean-bottom seismometers on the seabed to record the sound sources used for the profiles. Our data sets were completed by 87 land seismometers placed in the rather challenging brush country — known locally as the Monte — of the Yucatan coast. In all, the whole exercise lasted over two months. Local Mexican assistance, in particular from our colleagues Jaime Urrutia and Mario Rebolledo, was instrumental in our success.



STEFFEN SAUSTRUP

Changing tires was a vital skill while collecting seismic data in the Mexican brush country.

Did you encounter any difficulties, for example, of a technical, human or administrative nature?
In the offshore region, we sometimes had to change our plans regarding transects across the crater owing to the prevalent fishing in the region. On one occasion there was a flotilla of small boats without propulsion that were being used as platforms for skin divers to collect octopus. As they had no engines, it was of course up to us to go around them. Onshore, one of our seismometers got caught in a local brush fire and the bin that held the batteries and GPS antenna was burned to the ground. Luckily, the seismometer itself was buried in the ground beneath the bin and survived the fire — with its data intact! The Monte and rocky roads also proved to be especially adept at puncturing tires. Changing tires was a vital skill for the onshore team. On the administrative side, we encountered some delays due to challenges with getting all the proper permits in place for the experiment, but this was compensated for by an extension of our time in the field from our funding bodies.

Did the trip give you any ideas for future research projects?
Absolutely, the research team and colleagues are currently proposing to drill into the impact crater in a joint Integrated Ocean Drilling Program-International Continental Drilling Project experiment. If successful we should be able to answer fundamental questions about impact cratering as a geologic process and the Cretaceous–Tertiary mass extinction event.

This is the Backstory to work by Sean Gulick and colleagues, published on page 131 of this issue.