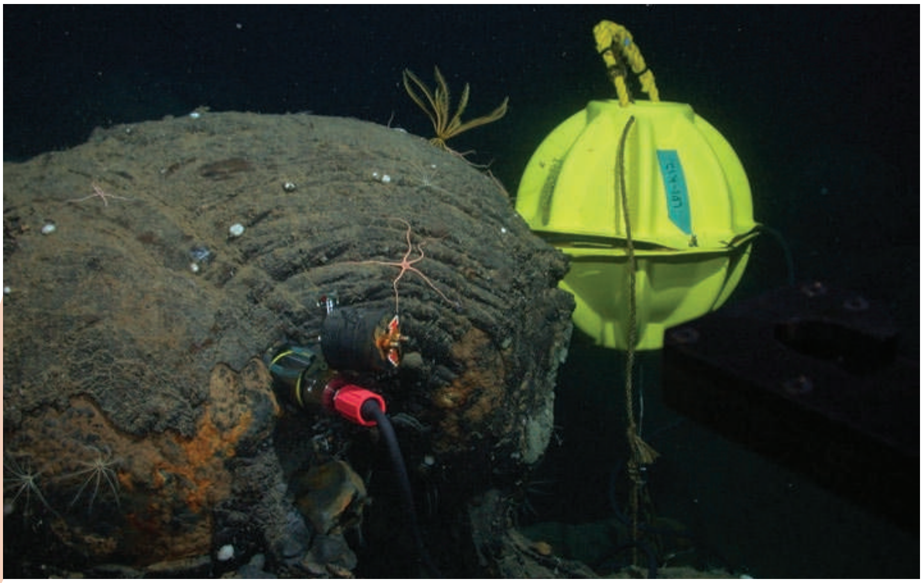
Sensing the sea bed

William Wilcock and a team of scientists and engineers drilled holes in the sea floor, and inadvertently provided a breeding ground for octopuses, in their attempt to understand deep-ocean hydrothermal venting.

What was the objective of the project?
We wanted to test the hypothesis that vigorous hydrothermal venting in the ocean floor is linked to the injection of magma into magma chambers situated below the vents. Our work was part of a larger project aimed at understanding the links between ocean venting, rock deformation and biological activity. We carried out our research at the Endeavour hydrothermal vent system in the northeastern Pacific Ocean.

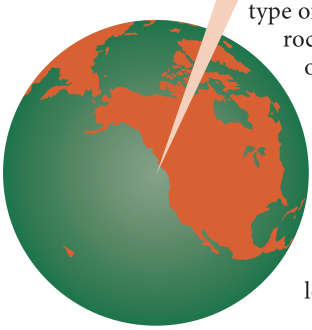


A seismometer inserted in a basaltic pillow, with the logger package (enclosed in a yellow plastic shell) floating in the background. For additional information see http://tinyurl.com/mtblno.

Why did you choose this particular location for the fieldwork?
Hydrothermal venting at the Endeavour segment of the Juan de Fuca Ridge is particularly vigorous and persistent, making it one of the most intensively studied hydrothermal vent systems in the world, and an excellent site for investigating links between magmatic activity and venting. What's more, scientific interest in the Endeavour segment is sure to continue because it is one of the sites being developed for a new cabled underwater observatory.

What sorts of data were you after?
We wanted a continuous record of seismic events at the Endeavour segment. We used seismometers to record the frequency and precise location of earthquakes, which in turn provided information on the movement of magma within the chambers.

Did you encounter any difficulties?
Deploying the corehole seismometers beneath the sea floor proved challenging. To do this we had to use remotely operated vehicles (ROVs) to drill small horizontal holes into vertical basaltic pillows — a type of magmatic rock. These operations were incredibly time consuming, particularly at the start, when scientists and ROV pilots were learning the best approaches. The first borehole took over a day to drill! We spent hours searching the rugged sea floor for a good site where the ROV could drill, and when we did find a suitable location, we struggled to keep the ROV in one place.



Did you have any animal encounters?
Within a day of deploying the seismometers, octopuses discovered that they provided a nice hard surface to attach their eggs to! We also encountered a very angry Humboldt squid that got stuck on the ROV.

Any low points, close misses?
We had a near disaster when deploying the one broadband seismometer. After using the ROV's manipulator arm to gently place the 150 lb spherical sensor on the sea floor, we let go of it to do other work. In one terrible instant our $100,000 instrument rolled away down a slope into a crevice, throwing up clouds of fine sediment as it went. After what seemed like an eternity the water cleared, and we located the instrument, which — amazingly — we were able to retrieve unharmed.

What was the highlight of the experiment?
When we recovered the instruments after their first year below the sea floor, we were ecstatic to find that the clocks were still running and that the hard drive of every instrument was full of excellent data. We worked around the clock to back up the data and prepare the instruments for redeployment.

Did the trip give you any ideas for future projects?
We are really excited that five of our seismic sensors will become part of a new cabled underwater observatory in 2010. Data from these instruments will allow us to understand how earthquakes and magma injections affect deep-sea hydrothermal venting. We also discovered that the seismometers recorded the calls of fin and blue whales present in the area during the winter — we are now studying these.

This is the Backstory to the work by William Wilcock and colleagues, published on page 509 of this issue.