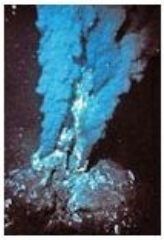
Hottest Water on Earth Discovered



At over 3 kilometres beneath the surface, sitting atop what could be a huge bubble of magma, it's the hottest water ever found on Earth. The fluid is in a "supercritical" state that has never before been seen in nature. The fluid spews out of two black smokers called Two Boats and Sisters Peak.

Koschinsky, from Jacobs University in Bremen, Germany, says it is somewhere between a gas and a liquid. She thinks it could offer a first glimpse at how essential minerals and nutrients like gold, copper and iron are leached out of the entrails of the Earth and released into the oceans.

Liquids boil and evaporate as temperature and pressure rise. But push both factors beyond a critical point and something odd happens: the gas and liquid phase merge into one supercritical fluid. For water, this fluid is denser than vapour, but lighter than liquid water.

Hot 'bubble'

Water and seawater have both been pushed past this critical point in labs, but until Koschinsky and her colleagues sailed to just south of the Atlantic equator in 2006, no-one had seen supercritical fluids in nature. Geochemists suspected that if they were to find them anywhere, they would be coming out of very deep hydrothermal vents.

In 2005, a team of scientists including Koschinsky visited 5° south, as part as a six-year project to investigate the southern end of the mid-Atlantic Ridge. There, they discovered a new set of vents, which they revisited in 2006 and 2007, lowering a thermometer into them each time.

Computer models suggest that the fluid that comes out of these black smokers initially seeps down into surrounding cracks in the seabed, gradually getting deeper and hotter as it approached the Earth's magma. Eventually, at 407 °C and 300 bars of pressure, the water becomes supercritical.

Because supercritical water is far less dense than liquid water, it shoots up to the seabed like a bubble and it is spat out into the ocean through vents.

Melting equipment

Because of the extreme conditions, computer models are the only way of understanding the processes that drag elements out of the seafloor at hot vents. "It's not yet possible to drill into active vents," explains Koschinsky. "Temperatures are so high, much of drilling equipment would melt and joins would not work anymore." The data from the new vents will be invaluable in testing the models.

The Pacific spreads faster than the Atlantic, bringing magma closer to the seabed. For this reason, geochemists expected to find supercritical seawater there too.

'Dry as a biscuit'

In the Pacific, vents tend to cool after a year or so, but it is likely that the Two Boats and Sisters Peak have been active since an earthquake shook the region in 2002. "The magma body underneath is probably enormous," says Koschinsky.

Her colleague Colin Devey of the University of Kiel in Germany is not so sure. "The explanation could be that there's lot of magma, but after a few more years of high temperatures, it's going to get to the point where it will be embarrassing how much magma there needs to be to maintain them for that long."

He thinks the long-standing temperatures could indicate something more fundamental. The fact that vents cool much more quickly in the Pacific could indicate the crust there is much more water-logged than it is in the Atlantic, where it could be "dry as a biscuit".
