A glimpse at the Earth's crust deep below the Atlantic

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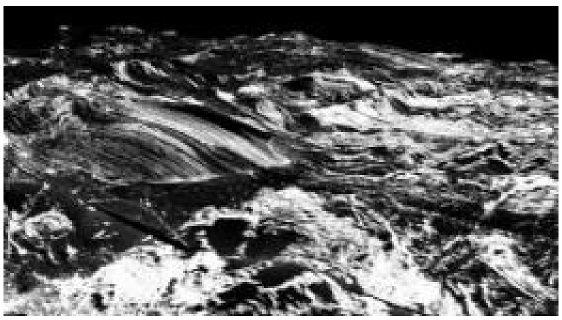

TOBI sidescan sonar imagery draped over multibeam bathymetry provides a unique 3-D view of an active oceanic core complex at 13°19'N, the Mid-Atlantic Ridge. The core complex is the smooth, striated dome forming the left-hand side of the image. To its right is the hummocky neovolcanic zone where recent volcanoes erupt lavas forming the the new oceanic crust. The field of view is around 30km wide. Credit: NOCS

Long-term variations in volcanism help explain the birth, evolution and death of striking geological features called oceanic core complexes on the ocean floor, says geologist Dr Bram Murton of the National Oceanography Centre, Southampton.

Oceanic core complexes are associated with faults along slow-spreading mid-ocean ridges. They are large elevated massifs with flat or gently curved upper surfaces and prominent corrugations called 'megamullions'. Uplifting during their formation causes exposure of lower crust and mantle rocks on the seafloor.

Murton was member of a scientific team that in 2007 sailed to the mid Atlantic Ridge aboard the royal research ship RRS James Cook to study the Earth's crust below the ocean.

"We wanted to know why some faults develop into core complexes, whereas others don't," he says: "It had been suggested that core complexes form during periods of reduced magma supply from volcanism, but exactly how this would interact with the tectonic forces that deform the Earth's crust was unclear."

Using the deep-towed vehicle TOBI equipped with sophisticated sonar equipment for profiling the deep seafloor, Murton and his colleagues discovered three domed and corrugated massifs, from which they dredged and drilled rock samples.

"These massifs turned out to be oceanic core complexes at different stages of a common life cycle," says Murton: "By comparing them we are able to get a much better understanding of the birth, evolution and death of these fascinating geological features."

It turns out that there is indeed a close link between core complex formation and long-term variations in magma supply. "Core complex development may take a million years or so and is associated with suppressed or absent volcanism," says Murton.

Faults that initiate core complex formation start off pretty much like normal faults around them. But in the absence of sufficient magma, the two sides of the fault continue to slip, and this slippage is further lubricated by seawater penetration and talc formation along the fault zones, leading to deep and large off-set faulting.

However, renewed volcanism can increase the supply of magma, overwhelming the fault. "We believe that renewed or increased volcanism is what eventually terminates the process of core complex formation." says Murton.

More information: MacLeod, C. et al. Life cycle of oceanic core complexes. *Earth and Planetary Science Letters* 283, 333-344 (2009).

Source: National Oceanography Centre, Southampton