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New evidence for large episodic volcanic events on the seafloor **Kiel marine researchers used new methods for dating of lava flows at the Kolbeinsey Ridge**

5 April 2016/Kiel. Scientists at the GEOMAR Helmholtz Centre for Ocean Research Kiel trying to understand how the Earth's surface was formed have used new technology to date lava flows at the North Kolbeinsey Ridge about 500 kilometers north of Iceland. They found evidence of large, deep-sea volcanic eruptions, which probably formed almost half of the Earth's crust. The study is going to be published in the next issue of the international journal *Earth and Planetary Science Letters*.

The Icelandic volcanic eruptions of Eyjafallajokull and Bardabunga have produced impressive images of the volcanic activity on the island in recent years. As Iceland is part of the Mid-Atlantic Ridge these eruptions also strikingly demonstrate how new material for the Earth's crust is permanently produced at mid-ocean ridges. Scientists of the GEOMAR Helmholtz Centre for Ocean Research Kiel now publish a study in the international journal *Earth and Planetary Science Letters* in which they present evidence that volcanic eruptions, many times larger than those recently observed on Iceland, are likely to have formed nearly half of the Earth's surface.

The study, focuses on the world's mid-ocean ridges formed thousands of meters underwater by volcanic eruptions on divergent tectonic plate margins, where the Earth's tectonic plates are moving apart.

"About 70 percent of the surface of the Earth was formed by volcanic eruptions at mid-ocean ridges, where depressurization in the mantle underneath the ridge allows melts to form and travel up to the seafloor where they erupt, so what we're doing here is trying to understand the fundamental processes that created our planet," said Dr Isobel Yeo, lead author of the study.

"The tectonic plates move at different speeds, but most of the time they are moving slowly apart and where this happens lava can't easily reach the seafloor. While we have some good estimates and hypotheses, the frequency and size of these eruptions, which are occurring under the oceans globally, is basically unproven." said Dr. Yeo.

However, using a new method developed at GEOMAR the scientists have been able to simultaneously survey and date young lava flows on a segment of the Mid-Atlantic Ridge north of Iceland and show that large volume, episodic eruptions must be occurring.

The new method, developed using the Autonomous Underwater Vehicle (AUV) ABYSS at GEOMAR utilizes acoustic data of the seafloor collected by the robot alongside records from sediment cores collected in the vicinity. It allows any young seafloor surveyed to be dated without any destructive sampling.

Applied for the first time during research cruise POS436 aboard the German research vessel POSEIDON to a section of the Mid-Atlantic Ridge north of Iceland called the North Kolbeinsey Ridge, the scientists were able to prove that there must have been repeated phases of volcanic eruption on a timescale of at least tens of thousands of years.

"In the past we have used the AUV predominantly for mapping the seabed, but now we can also use it to determine the age of young lava fields," said Dr. Yeo. The data obtained not only identified the position of the mid-ocean ridge in the area for the first time, but also revealed that despite there being 18 lava flows in the area in the last few thousand years, the volume of the eruptions was not enough to build the amount of new crust required by the plate separation.

"The amount of lava that we found would not have been enough to maintain the normal crustal thickness of 7 to 10 km in the region," says Dr. Yeo. "In fact, over the last 8,000 years we see at least 5,000 years with no volcanic eruptions whatsoever and what we do see the rest of the time isn't nearly enough. This means there must be periods of much higher volcanic activity, probably with volumes tens of times those observed during recent Icelandic eruptions."

Much of the mid-ocean ridge system is unmapped and very little has been studied in any detail, but this new method has big implications for future studies. "It allows almost instant dating during an expedition as opposed to more traditional analyses that need to be done onshore." "The quick availability of age data and good spatial coverage will allow sampling and visual observation surveys to be targeted to get maximum coverage, hopefully reducing the need for repeat expeditions saving tens of thousands of euros. It also means no equipment needs to be deployed on the seafloor in biologically sensitive areas." said Dr. Yeo.

An expedition, planned for July 2016, will return to the area to carry out further surveys. "On this cruise we will be working with a brand new camera system developed by Dr. Tom Kwasnitchka at GEOMAR and the Remotely Operated Vehicle PHOCA to constrain the new dating method better and collecting samples to investigate the geochemistry of the lava flows we've imaged." announced Dr. Yeo.

Reference:

Yeo, I.A., C. W. Devey, T. P. LeBas, N. Augustin, A. Steinführer (2016): Segment-scale volcanic episodicity: Evidence from the North Kolbeinsey Ridge, Atlantic. *Earth and Planetary Science Letters*, 439, 81–87, <http://dx.doi.org/10.1016/j.epsl.2016.01.029>

Links:

www.geomar.de GEOMAR Helmholtz Centre for Ocean Research Kiel

Images:

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