Press Release

GEOMAR
Helmholtz Centre for Ocean Research Kiel

32/2022

Linking climatic changes and geological processes at the sea floor
GEOMAR and Harvard scientists receive European Research Council Synergy Grant

25.10.2022/Kiel/Boston. **Supported by a Synergy Grant awarded by the European Research Council (ERC), scientists from GEOMAR Helmholtz Centre for Ocean Research Kiel and Harvard University aim to break a new frontier in the scientific exploration of marine volcanism. Benefitting from synergies among volcanology, petrology, paleo-oceanography, geochemistry and geophysics, the team aims to unravel connections between climatic changes and geological processes at mid-ocean ridges.**

The impact of climate change is so big it even affects the deep-sea floor – but how exactly? Supported by a new Synergy Grant, now awarded by the European Research Council (ERC), a team of marine scientists from GEOMAR Helmholtz Centre for Ocean Research Kiel (Germany) and Harvard University (United States of America) wants to test if changes in pressure on the sea floor due to variations in sea level between ice ages and warmer periods affects processes within the Earth, specifically volcanism along mid-ocean ridges. This 60,000 kilometres long chain of volcanoes forms on the seafloor, where plates are pulled apart and new oceanic crust is produced at rates of up to 15 centimetres per year. While much is known about recent processes at ocean ridges, time series that are able to show changes with time, have been minimal. Because glacial cycles occur over hundreds of thousands of years, time series are essential. Using a novel sampling approach, the Synergy Grant will permit for the first time co-registered time-series of volcanism, hydrothermal activity and geophysical measurements going as far back as 1.5 million years into the past. For the new ERC Synergy Grants, of the 359 submitted proposals only 29 were selected for funding. The successful project “Testing Solid Earth Climate Connections Through mid Ocean Ridge Time Series (T-SECTOR)” by GEOMAR and Harvard University will receive about 14 million Euros over six years.

On land, glacial cover can suppress volcanism. If the ice melts, thereby reducing the loading of the Earth crust, volcanic activity can increase, as has been shown in Iceland, for example. The impact on the mid-ocean ridge system is believed to be the opposite: “Melting glaciers cause the sea level to rise, increasing the load of water – the hydrostatic pressure – on the sea floor”, Professor Dr. Kaj Hoernle explains. The marine geologist at GEOMAR is the lead of the four principal investigators of the T-SECTOR project. “We would like to determine if this impedes submarine volcanism by evaluating changes in lava chemistry, hydrothermal activity – the circulation of hot fluids through cracks in the crust – and ocean crust production, which means its thickness.” The project also has some societally-relevant spin-offs. For example, enhanced hydrothermal activity, such as at black smokers, during glacial periods may have resulted in greater deposits of important metals on the seafloor, potentially guiding future prospecting.

The four experts plan to take sediment cores and carry out seismic studies at three mid-ocean ridges with different spreading rates – the Mid-Atlantic Ridge, the Juan de Fuca Ridge off the US-American west coast and the South East Pacific Rise. Eruptions at these ridges are documented by volcanic glasses archived within the sediment. The chemistry of the glasses can provide information about variations in source composition, degrees of melting and processes in magma chambers, while metal contents of the sediments provide information about variations in hydrothermal activity. Oxygen isotope analyses of foraminifera, ubiquitous single-celled calcifying organisms living at the sea floor,

help to define glacial and warm periods and thus the ages of sediment layers and their enclosed glass fragments.

“Based on the information archived in the sediment cores, we will be able to develop time series of hydrothermal activity that we can directly relate to past sea level changes and climate. The detailed look into the past has been particularly challenging due to the lack suitable sediment samples from the seafloor. The extensive sampling we will carry out is unprecedented. Understanding the past will then enable us to make more reliable predictions about the future”, highlights Professor Dr. Martin Frank, paleo-oceanographer at GEOMAR.

The coring activities during the research expeditions will be complemented by ship-based measurements that assess the morphology of the sea floor and the thickness of the sediments and the oceanic crust. “By integrating information on the thickness of the crust with the results from the time series derived from the sediments, we will be able to reconstruct the volcanic processes of the past and evaluate if they were influenced by variations in the sea level”, explains Professor Dr. Heidrun Kopp, marine geophysicist at GEOMAR.

The innovative project that harnesses synergies between volcanology, petrology, paleo-oceanography, geochemistry and geophysics aims to provide new insights into the past 1.5 million years of Earth’s history. “A continuous, high-resolution time series that looks as far back as this does not exist yet for any volcanic system”, says Professor Dr. Charles Langmuir, igneous petrologist at the Department of Earth and Planetary Sciences at Harvard University. “In addition to testing the glacial cycle-volcano hypothesis, there is the potential in general to open the fourth dimension of time, initiating a new frontier in the scientific exploration of marine volcanism”.

About the European Research Council (ERC)
The European Research Council (ERC), set up by the European Union in 2007, is the premier European funding organisation for excellent frontier research. It funds creative researchers of any nationality and age, to run projects based across Europe. The ERC offers four core grant schemes: Starting Grants (for scientists having gotten their doctoral degrees recently), Consolidator Grants (scientists in the intermediate stage of their career), Advanced Grants (for senior scientists) and Synergy Grants (for projects which require combining the expertise of multiple scientists from different fields). The ERC is led by an independent governing body, the Scientific Council. Since 1 November 2021, Maria Leptin is the President of the ERC. The overall ERC budget from 2021 to 2027 is more than 16 billion euros, as part of the Horizon Europe programme, under the responsibility of the European Commissioner for Innovation, Research, Culture, Education and Youth, Mariya Gabriel.

Links:
https://erc.europa.eu European Research Council (ERC)
https://www.harvard.edu Harvard University
https://www.geomar.de/en GEOMAR Helmholtz Centre for Ocean Research Kiel

Images:
Images are available for download at http://www.geomar.de/n8639-e

Contact:
GEOMAR, Communication & Media, media@geomar.de