March 5th 2018

Media Release

+++ Embargo March 5 2018, 1 pm GMT (2 PM CET, 8 am ET) +++

International ocean drilling expedition obtains unique record of plate tectonic rifting and changing climate in Greece

The Corinth Rift in Central Greece is one of the most seismically active areas in Europe. It is here that one of the Earth's tectonic plates is being ripped apart in the process of rifting, causing geological hazards including earthquakes, tsunamis and landslides. Young rift basins fill with eroded sediments that are also sensitive recorders of past changes in climate and sealevel and of the chemical and biological conditions of the rift basin. An international team of scientists from International Ocean Discovery Program (IODP) Expedition 381 has analyzed new cores from the Corinth Rift, which provide a continuous, high resolution record of complex changes in past environment and rift faulting rates over the last 1 million years.

Continental rifting is fundamental for the formation of new ocean basins, and active rift zones are dynamic regions of high hazard potential. The Corinth Rift, Greece, is one such location and serves as a unique laboratory in an area of Europe with some of the highest levels of earthquake activity. Geologically the Corinth Rift is very young (only a few million years old) and provides a unique chance to study the very first stages of the splitting apart of a continent and changing climate in the eastern Mediterranean.

An international team of scientists, led by Co-Chief Scientists Prof Lisa McNeill (University of Southampton, UK) and Prof Donna Shillington (Lamont-Doherty Earth Observatory of Columbia University, USA), collected 1.6 kilometers (one mile) of sediment core and data from boreholes at three different locations aboard the drilling vessel Fugro *Synergy* between October and December 2017. These cores have now been opened, analysed and sampled by the scientific team, following a month of intensive work at the University of Bremen during February 2018.

The cores are yielding the most high-resolution record of continental rifting ever obtained. The data recently collected and to be developed over the next months will be used to calculate how fast active earthquake-generating faults are slipping within the rift. This can be used to assess the earthquake hazard potential of the region, which has a populated coastal zone around the Gulf and the city of Athens nearby that can be impacted by future earthquakes.

Analysis of the cores recovered from deep below the seafloor also reveals a series of very complex changes in the chemical and biological conditions within the waters of the basin over the last approximately 0.5 million years. These changes are driven by the global growth and shrinkage of the Earth's ice sheets, which in turn control the height of global sea level. Fluctuations in sea level cause the Gulf of Corinth basin to switch between a normal marine environment, when the Gulf was connected to the world's oceans, and a wide range of more complex conditions when sea level is low. The rift's sediments show that a very unusual range of organisms lived within the basin under these complex conditions.

Lisa McNeill: "The new cores are revealing exactly what we hoped: The potential to accurately calculate the activity of important faults that regularly generate earthquakes with magnitudes 6 to 7 in the area." Researchers have been working in the Corinth Rift region for many decades, examining sediments and active fault traces exposed on land and using marine geophysics to image the basin and its structure below the seafloor. "The missing piece of the jigsaw puzzle has been the age of the basin sediments that record the history of rifting. We know now that the core samples will enable us to complete this piece of the puzzle. This in turn can be used to calculate fault earthquake potential, and, on a longer timescale, unravel the sequence of events as the rift has evolved."

Donna Shillington: "The new discoveries resulting from this expedition will help us to understand other active and ancient rift zones around the world, including others with high hazard potential. The complex story from the microfossils preserved in the sediments and their implications for the living conditions in the basin was unexpected and will significantly widen the impact of the project. Analysis of these results will take many months and we are excited to see what they reveal."

The four main themes of the expedition are:

• Natural Hazards – As one of the most seismically active areas in Europe, what are the implications for earthquake activity in a developing rift?
• Structural Evolution – How does the rift actually evolve and grow and on what timescale? How did the activity on faults change with time?
• Surface Processes – How does the landscape respond to tectonic and climatic changes?
• Paleoclimate reconstruction – What was the climate in the Eastern Mediterranean and the environment of the rift basin in the last 1 to 2 million years?

The Science Team of Expedition 381 includes 35 scientists of different geoscience disciplines from Australia, Brazil, China, France, Germany, Greece, India, Norway, Spain, the United Kingdom, and the United States, nine of whom sailed onboard the DV *Fugro Synergy* October to December of 2017 in the Gulf of Corinth, Greece, to collect the cores and data. After the offshore phase, the whole Science Team met at the IODP Bremen Core Repository (BCR), located at MARUM – Center for Marine Environmental Sciences at the University of Bremen, Germany, in February 2018 to split, analyze and sample the cores and analyze the data collected. The scientists will continue to analyze the cores and samples over the next 2 to 4 years to extract more information from this unique new dataset.

The expedition is conducted by the European Consortium for Ocean Research Drilling (ECORD) as part of the International Ocean Discovery Program (IODP). The International Ocean Discovery Program (IODP) is an international marine research program supported

by 23 countries, which explores Earth's history and structure recorded in seafloor sediments and rocks, and monitors sub-seafloor environments. Through multiple platforms – a feature unique to IODP – scientists sample the deep biosphere and sub-seafloor ocean, environmental change, processes and effects, and solid earth cycles and dynamics.

More information:
About the expedition – www.ecord.org/expedition381
About the research programme – www.iodp.org
About the European part of the programme – www.ecord.org

Expedition Blog:
https://esoexp381corinthactiveriftdevelopment.wordpress.com/

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