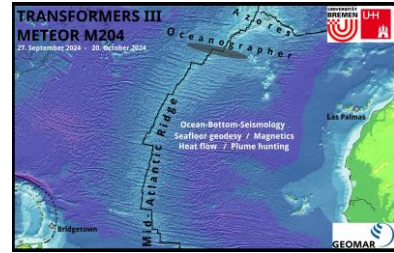


METEOR M204

Bridgetown – Las Palmas
27. September bis 20. October 2024



1. Weekly Report (27.09.- 29.09.2024)

At sunrise on 27th of September 2024, the research vessel METEOR left the port of Bridgetown, Barbados, for its 25-days expedition M204. After about 8 days of transit, the vessel is expected to reach the main study area to the south of the Azores archipelago near 35°N in the north Atlantic Ocean. Activities during M204/*Transformers III* will focus on the Oceanographer transform fault, offsetting the Mid-Atlantic Ridge bei 120 km. Transform faults, mid-ocean ridges and subduction zones build the foundation of plate tectonics. Within this framework, mid-ocean ridges define constructive plate boundaries, where new seafloor is created, while at subduction zones, called destructive plate boundaries, tectonic plates are recycled into the mantle; transform faults define the third type of plate boundary, where two plates slide past each other without forming or consuming lithosphere. Any of the three types of plate boundary is the focus of tectonic and seismic activity.



Port of Bridgetown, Barbados, departure of cruise M204

Recent research, however, suggests that oceanic transform faults – in contrast to transform faults on land – cannot be defined as conservative plate boundaries, but are rather highly dynamic features, nurturing extension and hence crustal and lithospheric stretching below the surface trace of the transform fault. Further, the thinned transform crust is augmented by a second stage of magmatism as it passes the opposing ridge-

transform intersection. These hypotheses will be investigated along the Oceanographer transform fault.

The cruise M204 is linked to the cruise MSM122 of the RV MARIA S. MERIAN conducted roughly one year ago in October 2023. During MSM122, 15 short-period ocean-bottom-seismometers (OBS), 6 broadband OBS, and 6 seafloor geodetic direct-path-ranging transponders were deployed to study local micro-earthquakes as well as distant events and geodetic fault motion. Today, the equipment is still on the seafloor and continuously registering data over approximately one year. The OBS data will be used to reveal tectonic stresses acting on the transform fault and to reveal the structure of the fault zone. Geodetic stations were placed onto the seafloor to measure active fault slip. Recovery of these seafloor-moored stations is in the centre of our activities. Furthermore, heat flow measurements shall reveal the heat loss over transform faults and deep-tow video observations are going to reveal the fine-structure and lateral extend of deformation across the strike-slip plate boundary fault.

The transit from Barbados is bringing used to study two other transforms to the south of Oceanographer, namely Atlantis near 30°N and Hayes at 33°N. We are going to run at both features short surveys. At Hayes and Oceanographer, we will also measure the magnetic field, supplementing profiles obtained during MSM122.



Port of Bridgetown, Barbados, departure of cruise M204

Since leaving the exclusive economic zone of Barbados, we are continuously collecting underway bathymetric data in the framework of a mission issued by the Deutsche Allianz Meeresforschung (DAM). During our transit, we will adjust the course of the vessel to facilitate mapping of six proposed seamounts to better understand the distribution of seamounts and their morphological characteristics, assessing

processes overprinting oceanic crust formed at mid-ocean ridges after lithosphere moved away from the spreading centre.

The expedition M204 is supported by the German Science Foundation (DFG), the GEOMAR Helmholtz Centre for Ocean Research in Kiel, and the European Union (Advance Grant project ERC-Transformers-101096190).

In the name of all cruise participants, best regards from 20°30'N / 52°34'W,

Ingo Grevemeyer

GEOMAR Helmholtz Centre for Ocean Research Kiel