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More than ten years of successful operation of the MARUM-MeBo sea bed drilling technology: Highlights of recent scientific drilling campaigns

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Over the last two decades sea bed drilling technology has proven to provide a valuable complement to the services of classical drill ships. Especially for shallow drillings up to 200 mbsf and when working in remote areas difficult to access, sea bed drill rigs are a cost-effective alternative. Recent developments especially concerning borehole logging techniques add to the capabilities of sea bed drilling technology.

The MARUM-MeBo is a robotic drilling system that is developed since 2004 at the MARUM Center for Marine Environmental Sciences at the University of Bremen (Freudenthal and Wefer, 2013). The drill rig is deployed on the sea bed and remotely controlled from the vessel. It is used for core drilling in soft sediments as well as hard rocks in the deep sea. Especially since an upgrade in 2007/2008 for the use of wireline drilling technique, the first-generation drill rig MARUM-MeBo70 with a drilling capacity of about 70 m was successfully deployed on more than 15 research expeditions. Since 2014 the second-generation drill rig MARUM-MeBo200 with an increased drilling capacity of up to 200 m below sea floor is successfully in operation.

In this presentation we focus on results of three recent drilling campaigns, exemplifying the exploitation of the potential of the sea bed drilling technology:

- In early 2017 the MeBo70 was deployed from the ice breaking vessel RV POLARSTERN on the West Antarctic shelf (Gohl et al., 2017), an area difficult to access by a drill ship. We were able to recover a sedimentary sequence of the upper Cretaceous time period as one of the very few terrigenous records from this time in Antarctica. This sequence indicates that about 92 to 83 Mio years ago at a paleolatitude of about 82°S this area was covered by a temperate coastal rain forest, making any Antarctic ice sheet formation at this time period unlikely (Klages et al., in press).
- Also, in 2017 the MeBo70 was deployed in the Arctic off Svalbard. Next to coring a temperature probe was used to assess in situ temperatures and local geothermal gradients (Riedel et al. 2018). Combining these temperature data with the porewater geochemistry of the drilled cores

Wallmann et al (2018) were able to prove the effect of isostatic rebound after deglaciation on gas hydrate dissociation.

- In late 2017 the MeBo200 was deployed in the Black Sea. Geophysical borehole log data of P-wave velocity, electrical resistivity, and spectral gamma ray were combined with core-derived physical properties of porosity, magnetic susceptibility, and bulk density and compared with seismic data of the region (Riedel et al., in press). This study shows the potential of core-log seismic integration for shallow drilling campaigns conducted with a sea bed drill rig.

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