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Investigating the seafloor below the Ekström Ice Shelf: the Sub-EIS-Obs project at East Antarctica's continental margin

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Knowledge of sub-ice shelf sedimentary sequences, ice-ocean interactions, and biological activities is still relatively sparse, largely due to the challenges involved in accessing ice shelf cavities. The Sub-EIS-Obs project, funded by the Alfred-Wegener-Institute (AWI) and the Federal Institute for Geosciences and Natural Resources (BGR) in Germany, is a multidisciplinary study, which aims to recover and characterize sediment sequences beneath the Ekström Ice Shelf (EIS) in East Antarctica. The project addresses several research objectives, such as the crustal evolution during the breakup of Gondwana, the build-up and variability of the East Antarctic Ice Sheet (EAIS) throughout the Cenozoic, reconstruction of grounding-line dynamics, sedimentary and erosional processes beneath the ice stream and shelf, and multidisciplinary observations of climate induced changes in ice-ocean interactions.

A pre-site seismic survey campaign was carried out on the Ekström Ice Shelf in 2016/2017 and 2017/2018, resulting in 615 km of multi-fold seismic data. Based on these data, four different units were defined, which, according to preliminary interpretation, document geologic history of the breakup of Gondwana in the Jurassic (Explora-Wedge volcanic deposits) and ongoing marine and glacio-marine sedimentation during the Meso- and Cenozoic. On top of all strata a glacio-marine surface cover deposited during the Last Glacial Maximum and Holocene sedimentation is indicated in the seismic profiles. In order to sample all units separately, coring locations were selected accordingly. A hot water drilling system was used to drill holes through the shelf ice (ice thicknesses range between ~210 and 330 m), enabling the deployment of a gravity corer, a Wippermann Grabber, a vibro- and a hammer coring system manufactured by Jilin University (Changchun, China), and a UWITEC percussion corer (BAS corer). Moreover, a camera installed in a pressure housing enabled recording of high-resolution video footage of the seafloor and associated benthic ecosystems as well as the base of the ice shelf. In addition, a Conductivity-Temperature-Depth probe was attached to all coring devices in order to record the oceanographic properties of the water column. Here, we present first results from the Sub-EIS-Obs sediment sampling campaigns 2017/2018 and 2018/2019. We present an overview of the long-term project aims, sampling strategy, performance of the hot water drilling operation, and recovered geological samples, and the video footages of the seafloor.