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## The Cenozoic Arctic Climate and Sea Ice History - Scientific objectives, challenges and implementation update of IODP Expedition 377 (ArcOP)

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The Arctic is both a contributor to climate change and a region that is most affected by global warming. Despite this global importance, the Arctic Ocean is the last major region on Earth where the long-term climate history remains poorly known. Major advances in understanding were achieved in 2004 with the successful completion of IODP Expedition 302: Arctic Coring Expedition – ACEX – implemented by ECORD, marking the start of a new era in Arctic climate exploration. Although the ACEX results were unprecedented, key questions related to the Cenozoic Arctic climate history remain unanswered, largely due to a major mid-Cenozoic hiatus (or condensed interval) and partly to the poor recovery of the ACEX record. Building on ACEX and its cutting-edge science, IODP Expedition 377: Arctic Ocean Paleoceanography (ArcOP) has been scheduled for mid-August to mid-October 2022. The overall goal of ArcOP is the recovery of a complete stratigraphic sedimentary record on the southern Lomonosov Ridge to meet the highest priority paleoceanographic objective: the continuous long-term Cenozoic Arctic Ocean climate history with its transition from the early Cenozoic Greenhouse world to the late Cenozoic Icehouse world. Furthermore, sedimentation rates two to four times higher than those of ACEX will permit higher-resolution studies of Arctic climate change in the Neogene and Pleistocene. Key objectives are related to the reconstruction of the history of circum-Arctic ice-sheets, sea-ice cover, Siberian river discharge, and deep-water circulation and ventilation and its significance within the global climate system. Obtaining a geologic record of a 50-60 million year time span will provide opportunities to examine trends, patterns, rates, causes, and consequences of climate change that are important and relevant to our future. This goal can be achieved through (i) careful site selection, (ii) the use of appropriate drilling technology and ice management, and (iii) applying multi-proxy approaches to paleoceanographic, paleoclimatic, and age-model reconstructions.

In August 2022, a fleet of three ships, the drilling vessel “Dina Polaris” and the powerful

icebreakers "Oden" and "Viktor Chernomyrdin", will set sail for a location on Lomonosov Ridge in international waters far from shore (81°N, 140°E; 800-900 m of water depth). There, the expedition will complete one primary deep drill site (LR-11B) to 900 meters below seafloor (mbsf) which is twice that of the ACEX drill depth – certainly a challenging approach. Based on detailed site survey data, about 230 m of Plio-Pleistocene, 460 m of Miocene, and >200 m of Oligocene-Eocene sedimentary sequences might be recovered at this site. In addition, a short drill site (LR-10B) to 50 mbsf will be supplemented to recover an undisturbed uppermost (Quaternary) sedimentary section to ensure complete recovery for construction of a composite section spanning the full age range through the Cenozoic.

In this talk, background information, scientific objectives and an update of the status of planning and implementation of the ArcOP Expedition will be presented. For further details we refer to the ArcOP Scientific Prospectus (<https://doi.org/10.14379/iodp.sp.377.2021>).