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Unveiling climate and ice-sheet history from drilling in high-latitude margins and future perspectives

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Polar ice is an important component of the climate system, affecting global sea level, ocean circulation and heat transport, marine productivity, and albedo. During the last decades drilling in the Arctic (IODP ACEX and Bering Expeditions) and in Antarctica (ODP Legs 178, 188, IODP Expedition 318 and ANDRILL) has revealed regional information about sea ice and ice sheets development and evolution. Integration of this data with numerical modeling provide an understanding of the early development of the ice sheets and their variability through the Cenozoic. Much of this work points to atmospheric CO2 and other greenhouse gases concentrations as important triggering mechanism driving the onset of glaciation and subsequent ice volume variability. With current increasing atmospheric greenhouse gases concentrations resulting in rapidly rising global temperatures, studies of polar climates become increasingly prominent on the research agenda. Despite of the relevance of the high-latitudes in the global climate systems, the short- and long-term history of the ice sheets and sea-ice and its relationships with paleoclimatic, paleoceanographic, and sea level changes is still poorly understood. A multinational, multiplatform scientific drilling strategy is being developed to recover key physical evidence from selected high-latitude areas. This strategy is aimed at addressing key knowledge gaps about the role of polar ice in climate change, targeting questions such as timing of events, rates of change, tipping points, regional variations, and northern vs. southern hemispheres (in phase or out-of-phase) variability. This data is critical to provide constrains to sea-ice and ice sheet models, which are the basis for forecasting the future of the cryosphere in a warming world.