

Totten Glacier dynamics and Southern Ocean circulation impact on depositional processes since the mid-late Cenozoic: the PNRA Tytan Project

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Abstract

The main objective of the PNRA Tytan Project is to provide insights for reconstructing the depositional environment of the continental margin off the Totten Glacier, a large outlet glacier located on the Sabrina Coast (East Antarctica), starting from the Miocene, when temperatures and CO₂ levels were more similar to those predicted for the next century. This part of the continental margin is a key area to understand the East Antarctic Ice Sheet (EAIS) processes, since the Totten Glacier is thinning rapidly and drains a deep subglacial basin, the Aurora Basin, which has the thickest ice covering the Antarctic landmass. Rapid thinning could cause accelerated melting of the EAIS, however causes and impacts of such ice thinning on the polar environmental conditions, on southern Ocean circulation and on global sea level are uncertain. The Australian project “Interactions of the Totten Glacier with the Southern Ocean through multiple glacial cycles” (Macquarie University, AUS) aims to solve this problem, i.e. to understand how the Totten Glacier behaved during past Holocene and Pleistocene times of warming climate, and the role of ocean warming in melting the Antarctic ice sheet. The PNRA Tytan Project is embedded into the Australian Project and consists in two main research units. The first one is focused on the study of geophysical data collected during the IN2017-V01 cruise which took place during January-March 2017 onboard the *R/V Investigator*. The integrated analysis of the new geophysical dataset and the available data will allow to identify key acoustic features indicative of advances and retreats of the ice sheet, and to detect changes in the depositional setting related to: 1) the transition from highly dynamic temperate to more stable polar regime, 2) outburst ice sheet episodes, 3) the development of the Circum Antarctic current, 4) shifts of alongslope and downslope bottom current pathways, that may occurred during warm intervals. All this information will lead to reconstruct depositional processes that affected the continental slope margin off the Totten Glacier since the mid-late Cenozoic. The comprehensive analysis of the seismic dataset will also be crucial to prioritize areas of interest for IODP deep drilling by identifying expanded and well preserved sedimentary successions. The second research unit will participate in the sediment core analysis collected during the IN2017-V01 cruise, with particular focus on Diatom biomarkers and assemblages and will be focused on the calibration and the age control of the identified acoustic features indicative of advances and retreats of the ice sheet. It will allow to understand the physical and biological dynamics related to the sediment transfer from coastal areas to the continental slope and deep sea and to provide an evolutionary reconstruction of polar floras on this continental margin since the mid- late Cenozoic.

(Fig.1). Multichannel seismic line collected on the continental slope off Sabrina Coast during the IN2017-V01 cruise

Keywords: East Antarctica, Totten Glacier, glacial cycles

Seismic line IN2017-V01-MCS05

CDP HDG 90°N

