Reconstruction of the East Antarctic ice sheet variability during the last 3 Ma in the central & eastern Droning Maud Land, East Antarctica

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Abstract

Reconstructing past variability of the Antarctic ice sheets is essential to understand their stability and to anticipate their contribution to future sea level rise as a result of global climate change. Recent studies have reported a significant decrease in thickness of the East Antarctic Ice Sheet (EAIS) during the last several million years. However, the geographical extent of this decrease and subsequent isostatic rebound remain uncertain. Recently, we reconstructed magnitude and timing of ice sheet retreat at the Sør-Rondane Mountains in Dronning Maud Land (DML), East Antarctica, based on detailed geomorphological survey, cosmogenic exposure dating, and glacial isostatic adjustment modeling (GIA) (Suganuma et al., 2014). Three distinct deglaciation phases were identified in this area and the ice sheet thinning was estimated to be at least 500 m during the last 3 Ma. This thinning was thought to be caused by a reduction in moisture transport from the Southern Ocean to the interior of the EAIS, probably due to a reorganization of the Southern Ocean circulation with global cooling into the Pleistocene. Although this study was the first attempt to estimate the absolute thickness of the EAIS thinning with GIA modeling, local effects, such as regional ice flow and damming, to the ice sheet thickness reconstruction remain unclear. To provide a better constraint for the EAIS thickness reconstruction, we have carried out new field expeditions in wider area of the central and eastern DML. The main time intervals are: (1) Pliocene-Pleistocene boundary when carbon dioxide level decreased and glacial-interglacial variations happened and (2) more recent changes since the Last Glacial Maximum. The preliminary results indicate that the significant ice sheet retreat since the Pliocene-Pleistocene boundary also occurred in the central DML. These data will contribute further understanding of the glacial dynamism of the EAIS in the warm world and interaction with the reorganization of the Southern Ocean circulation. In addition, we also targeted on rock weathering process under a hyper-arid and hypothermal environment in Antarctica. This study indicates that the amount of iron hydroxide on the rock surface is a good indicator of the rock weathering stage. Thus, the color measurement for exposed rocks in Antarctica by using remote sensing techniques, such as UAV survey, can potentially provide quantitative information regarding the degree of weathering. This also has a potential to contribute Antarctic ice reconstruction and a further understanding of the landform evolution processes.

Keywords: East Antarctic Ice Sheet, Surface exposure dating, Glacial isostatic adjustment (GIA), Weathering index

References

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