DEAIS: Changes in the Drainage Pattern of the East Antarctic Ice Sheet through Time

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**Information Paper submitted by Switzerland**

Summary

This information paper outlines the research activities of the scientists from the Glacial Geology Research Group at the Institute of Geological Sciences of the University of Bern at the Belgian Polar Station Princess Elisabeth Antarctica (PEA). Scientists focused on the changes in the drainage of the East Antarctic Ice Sheet as a response to climate forcing and associated ice surface lowering through time.

Background

Currently, the Antarctic cryosphere is experiencing a rapid environmental change. Continuing ice decay directly contributes to the global sea level rise that threatens the world’s population living in coastal areas. However, the behavior of the East Antarctic Ice Sheet (EAIS) under global warming and its future contribution to global sea level rise is extremely uncertain; model projections for the next centuries vary from tens of cm to 15 m. The timing and amplitude of changes in the behavior of the EAIS under climatic forcing in the past are of utmost importance for assembling information about what could happen in the future.

DEAIS Research Project

As the drainage of the EAIS is poorly constrained in the coastal outflow regions, the Sør Rondane Mountains (SRM) in Queen Maud Land afford the unique opportunity to elucidate how the EAIS responds to changes in climate over time because the SRM dam the ice in the south and play a key role in the drainage pattern of the ice. To track the pace of EAIS’ response to climate forcing and associated surface lowering for the last 8 million years, DEAIS reconstructs the ice surface lowering rates through the detailed study of glacial morphological features on the nunataks and the blue-ice moraines built by the major ice streams in the region.

The project started in 2017 and the research team successfully completed two field campaigns during the BELARE 2017-2018 and 2018-2019 Expeditions during the Austral summers. These field campaigns were carried out under the auspices of the Turkish Republic Presidency, supported by the Ministry of Science, Industry and Technology, and coordinated by Polar Research Institute, TÜBITAK Marmara Research Center. The researchers first identified five sites in the SRM, which are crucial to reach the goals of the project. Then, they employed an UAV to take aerial photographs. These were then converted into first orthophotographic pictures and then into high-resolution DEM (digital elevation model) using the software Agisoft Metashape 1.5.1®, which is a software used in aerial photogrammetry. The DEMs were used as the base for the detailed study of glacial morphological features. To determine the timing of the changes in the drainage and surface lowering, the research team collected 73 rock surface samples from erratic boulders deposited on the nunataks for the analysis of cosmogenic 10Be, in-situ 14C, 26Al, 21Ne, and 36Cl. DEAIS was financed by the Polar Research Institute (TÜBITAK Marmara Research Center), Swiss National Science Foundation [grant number 200021-172475], Swiss Polar Institute, and University of Bern.

Conclusions

First results from the BELARE 2017-2018 and 2018-2019 Expeditions have shown, that the ice masses on the high-elevated plateau and the lower elevated foreland started to separate between 3 and 1 Ma (million years) (i.e., decoupling of the drainage), which suggests that since then, the ice on the plateau and the foreland responded differently and independently from each other to climate changes.