Progress of glaciological research activities at the Dome Fuji II Camp

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Summary

Ice cores from the Antarctic interior have provided valuable information on past climate changes. After the deep ice coring at the Dome Fuji station in the 2000s, the Japanese Antarctic Research Expedition (JARE) has completed transporting all the ice core samples to Japan, providing samples for paleoclimatic studies over the last 720,000 years. JARE, in collaboration with international partners, has also conducted field studies to locate a new drilling site for the oldest ice core in the Dome Fuji II Camp. This information paper describes the recent field research and associated activities in the Dome Fuji area.

***1. Introduction***

In January 1995, JARE established the Dome Fuji Station (77° 19' S, 39° 42' E, 3,810 m above sea level) on the highlands of Dronning Maud Land. In the following three years, the expedition teams overwintered at the station and performed deep ice core drilling to a depth of 2,503 m; this project is referred to as the First Dome Fuji Project. Starting in 2002, JARE carried out another deep coring, referred to as the Second Dome Fuji Project, at the Dome Fuji station, to a depth of 3,035 m by 2007.

The next deep drilling (the Third Dome Fuji Project) is planned, and preparatory activities for locating old ice, including international collaborations, have been ongoing in the vicinity of the Dome Fuji station. The Third Dome Fuji Project aims to collect a deep ice core reaching back more than 1 million years to reconstruct past Antarctic environments and atmospheric greenhouse gases concentrations. It will provide crucial information on the mechanisms for the dominant periodicity of glacial-interglacial cycles, which was much shorter than that over approximately 800,000 years. The project is intended to directly contribute to the IPICS Oldest Ice Core Project, which states the need for multiple ice cores going back into shorter glacial cycles. IPICS, the International Partnership in Ice Core Sciences, is an Expert Group of SCAR Physical Science Group supported by Future Earth PAGES (Past Global Changes) and IACS (International Association of Cryospheric Sciences). Implementation of this project is also directly connected to the SCAR Horizon Scan (5. How did the climate and atmospheric composition vary prior to the oldest ice records?) (Kennicutt et al., *Nature,* 2014).

***2. Ice and snow observations and preparatory activities for the subsequent deep drilling in the vicinity of Dome Fuji station***

JARE has conducted Ice and snow observations and preparatory activities for the subsequent deep drilling near Dome Fuji station since the 2018-19 season and reported them in ATCM XLIII IP51 and ATCM XLIV IP95. The JARE 64th (the 2022 - 2023 season) conducted an inland traverse of approximately 1,000 km each way to Dome Fuji. The JARE 64th advance party arrived at Syowa Station by aircraft on 1 November 2022, joined the 63rd wintering party members, and after preparation, departed for Dome Fuji on 19 November from a departure point on the continental coast. On the inland route, surface mass balance observations using a snow scale, snow sample collection, ice sheet surface observations using a microwave radiometer, and ice sheet surface altitude and ice sheet flow velocity observations using high-precision GNSS surveying were carried out. In parallel with the local activities, the final selection for the third Dome Fuji deep drilling site was conducted in Japan. Based on a combination of the results of three field surveys in previous seasons and numerous numerical experiments using ice sheet models (Tsutaki et al., *Cryosphere*, 2022), the site where the oldest ice was expected to be stable was narrowed down to a location approximately 5 km south-southwest (77° 21' 40" S, 39° 38' 38" E) of the Dome Fuji Station (Figure 1). The camp at this location has been named Dome Fuji II Camp.

Following this decision, the team constructed the Inland Accommodation Module, which was used as a living place for the team members once completed. Furthermore, a new drill site was prepared, including making a drill trench and installing equipment. In addition, shallow ice core drilling was carried out, and snow and ice cores 125 m deep were obtained. The team departed there on 17 January and made various observations along the route.

***3. Plan for the coming seasons***

The third Dome Fuji deep drilling work will be scheduled between 2024 and 2028. Deep drilling, bedrock sampling, deviation drilling, and borehole logging will be performed in the four consecutive summers starting in the 2024 - 2025 summer. Each summer activity at Dome Fuji II Camp is expected to last for about two months. For the deep drilling, an electromechanical drill will be used with borehole liquid to prevent borehole closure.

*Figure 1.*  *The Location of*  *Dome Fuji II Camp.*

マップ

自動的に生成された説明