

## A paleo-environmental study in JARE Phase X - Deep ice coring in the Dome Fuji area for “Oldest Ice Core”-

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In order to reconstruct paleoclimate and to investigate the roles of the Antarctic in the Earth’s climate system, JARE has drilled two deep ice cores at the Dome Fuji station in the 1990s (2503 m, 340 kyr) and 2000s (3035 m, 720 kyr). To advance our knowledge and understanding of the climate system, one of the next challenges in paleoclimatic research is to extend the reconstruction further back in time into the period when glacial-interglacial cycles were dominated by ~41 kyr periodicity. Continuous reconstructions of the Antarctic climate and greenhouse gas concentrations in the ~41-kyr glacial cycles and the transition into the ~100 kyr cycles (Mid-Pleistocene Transition) will enable us to better understand complex interactions within the global climate. The International Partnerships in Ice Core Sciences (IPICS), supported by SCAR, PAGES and IACS, sets a priority project “Oldest Ice Core”, which states the importance to drill two or more ice cores at different sites in Antarctica to ensure reliable reconstruction of climatic records.

During the JARE Phase X, we propose to drill an oldest ice core in the vicinity of Dome Fuji. Towards the goal, during the current Phase IX under the main scientific theme “Earth system changes approaching from Antarctica”, the subtheme 3 “Antarctic paleoenvironmental reconstructions for unraveling the Earth system variations (AJ0903)” has been conducting glaciological research activities including radar sounding of the ice sheet, shallow coring, firn air sampling, surface mass balance and flow observations, combined with ice flow modeling to identify the drilling site. The Phase IX project has also conducted the developments of deep ice-core drills and analytical capability for the oldest ice core, maintenance of the second Dome Fuji borehole, and transportation of the second deep core from the Dome Fuji station to Japan. The goals of the Phase IX fieldworks in terms of the next deep drilling, after identifying the drilling site, is to establish the drilling station and prepare for the actual drilling. The deep drilling is proposed to start in the first year of Phase IX and, given the absence of major technical or logistical issues, continues to the third year to reach the bedrock. Our plan includes bedrock coring, borehole logging (at least one year after the end of the drilling), and inland glaciological and atmospheric observations. We will also seek opportunities for international collaborations in the Dome Fuji ice core drilling.

### Third Dome Fuji deep ice core drilling

Year	JARE Phase IX			Phase X				
	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	• • •
Drilling, Logging & Science personnel		3	8	8	8	8	5	
Logistics personnel	2	6-7	6-7	6-7	6-7	6-7	6-7	
Field activities in Antarctica	Fuel transp. (PES -> DF)	Transportation of fuel and construction materials to site	Trenches (3-m deep) and camp construction, Pilot hole (120m), Casing	Drilling to 1000 m	Drilling to 2000 m	Drilling to bed, Bedrock coring, Borehole logging	Borehole logging,	
Main activities in Japan (developments, preparations)	Drill (1) test, Drill fluid, Casing, Living modules, Generators, Site selection	Drill (2), Chip collection, Reamer, Bailer, Consumables, Spare parts	Logging system, Short drill	Bedrock drill				