

RAID - NEW OPPORTUNITIES FOR DEEP ICE-SHEET RESEARCH AND RAPID SUBGLACIAL ACCESS DRILLING

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The U.S. Rapid Access Ice Drill (RAID) is a new research drilling technology capable of quickly accessing the glacial bed of Antarctic ice sheets, retrieving deep ice core and rock core samples, providing boreholes for down-hole logging of physical properties, and creating long-term borehole observatories. The RAID platform can support deep ice-sheet reconnaissance for 1.5 million year-old or older ice, validation of englacial ages with optical borehole logging, study of ice deformation, assessment of geothermal heat flow, observation of basal material properties, and recovery of rock cores for study of landscape history and crustal evolution. Recent field trials in Antarctica (Goodge et al., 2021, *Ann. Glac.*, doi.org/10.1017/aog.2021.13) demonstrated the ability of the RAID platform to perform as designed, including fast borehole cutting, recovery of short ice and rock cores near the bed, penetration into hard bedrock, and deployment of a borehole optical dust logger for in-situ dating of ice. A full operational sequence in three boreholes succeeded in augering through firn, creating a borehole seal, establishing fluid circulation, drilling an ice borehole at penetration rates up to 1.2 m min⁻¹, acquiring short ice cores, penetrating the glacial bed at ~677 m, recovering a ~3 m core of ice, basal till and subglacial bedrock, optically logging the borehole on wireline, testing hydrofracture potential during overpressure, and operating in an environmentally benign way. RAID is coming online as much has been learned about very old (up to 6 m.y) ice, subglacial materials, the basal ice-sheet environment, and geotectonic development of Antarctic lithosphere. Together with other novel technologies and methodologies, and with a new generation of scientists engaged in cryosphere and solid-earth research, RAID is poised for impactful deep ice-sheet research in Antarctica.

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