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ICE DRILL TESTING FACILITY

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Abstracts

Based on experience gained in the construction of frozen test wells, an ice drill testing facility was designed and constructed at the laboratories of the Polar Research Center at Jilin University. This facility allows for the testing of all kinds of mechanical and thermal ice drills throughout the year, including electromechanical cable-suspended drills, hot-water drills, rapid air drills, thermal sondes for subglacial lake exploration, and others. By changing the switching sequence of the refrigerators and adding various materials (such as dust, sand, rocks, or sediments) into the water or to the bottom of ice well, different glacial and subglacial conditions can be simulated. Additionally, this testing facility can be used to train drilling personnel prior to field work. The facility has following parameters: (1) an ice well size (inside the steel liner) of ∅ 1 m × 12.5 m; (2) an ice freezing time of < 72 h; (3) a minimum ice temperature of -30 °C. A two-room, heat-insulated building, containing a tall hall (6 m × 6 m × 15.2 m) and an entrance hall (3 m × 6 m × 3 m), was constructed above the ice well. A rotary drilling platform on the second level of the tall hall allows for the drilling of at least nine holes with a diameter of 130–150 mm around the perimeter of the ice well without requiring refreezing. The first tests performed in the facility using a hot-water drilling system and a shallow ice drill illustrated the facility's convenient performance for ice drill testing.

1. Introduction

The climactic, environmental, working, and physical conditions of natural ice formations such as ice sheets, ice caps, mountain glaciers, and ice shelves are different from those present at more common drilling sites with temperate climate due to extremely low temperatures at the ice surface as well as further to the interior, the presence of glacial flow, an absence of access roads and other infrastructure, storm winds and snowfalls, etc. For this reason, technology and equipment specifically developed for the purposes of ice

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