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Concept and testing of hot-water coring system with PDM-motor drive

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Hot water drilling technology is prominent in many kinds of polar investigations due to its environment-friendly medium and fast drilling speeds. However, its disadvantage is that it cannot directly obtain ice and bedrock cores. To sample cores from specific intervals, we propose to replace the bottom nozzle with PDM-motor + drill tools that can be directly driven through hot water flow to rotate the drill bit. The ice/bedrock cores can be obtained by installation of the different drill bits according to the type of formation. The PDM motor was chosen by estimating of the temperature difference and pressure loss of hot water from the surface to the bottom. Double-wall core barrel produces high flow resistance. Thus, according to flow field analysis, to ensure the quality of the ice cores, outlet flow rate should be controlled within 90 L/min. Testing was done under different flows and different temperature conditions: drilling speed increased with the increase of temperature and flow. Maximum drilling speed reached 7 m/h. The core recovery was about 80 %, and the diameter of cores/bit diameter ratio was over 80 %.

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