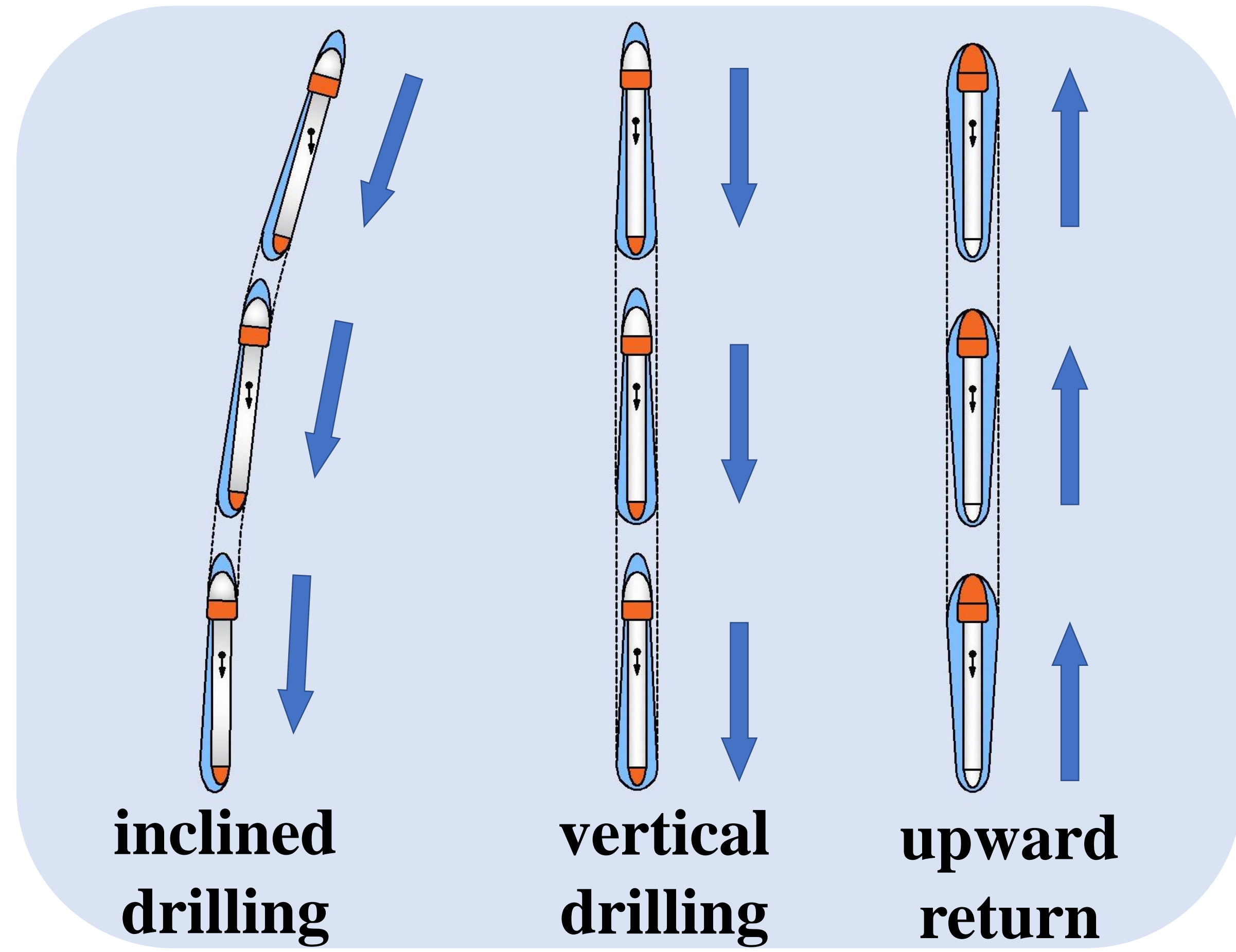




DESIGN AND FUNCTIONAL VERIFICATION TEST OF A PENDULUM-TYPE THERMAL MELT PROBE FOR VERTICAL ICE DRILLING IN POLAR REGIONS

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Requirements for a Pendulum-Type Thermal Melt Probe(PTMP):

1:A support point (heating ring) shall be installed above the center of gravity.

2:The drilling speed of the support point (heating ring) shall be slightly lower than that of the lower thermal melt head.

Under these requirements, the drill body below the support point can remain in a suspended state at all times, thereby ensuring vertical drilling.

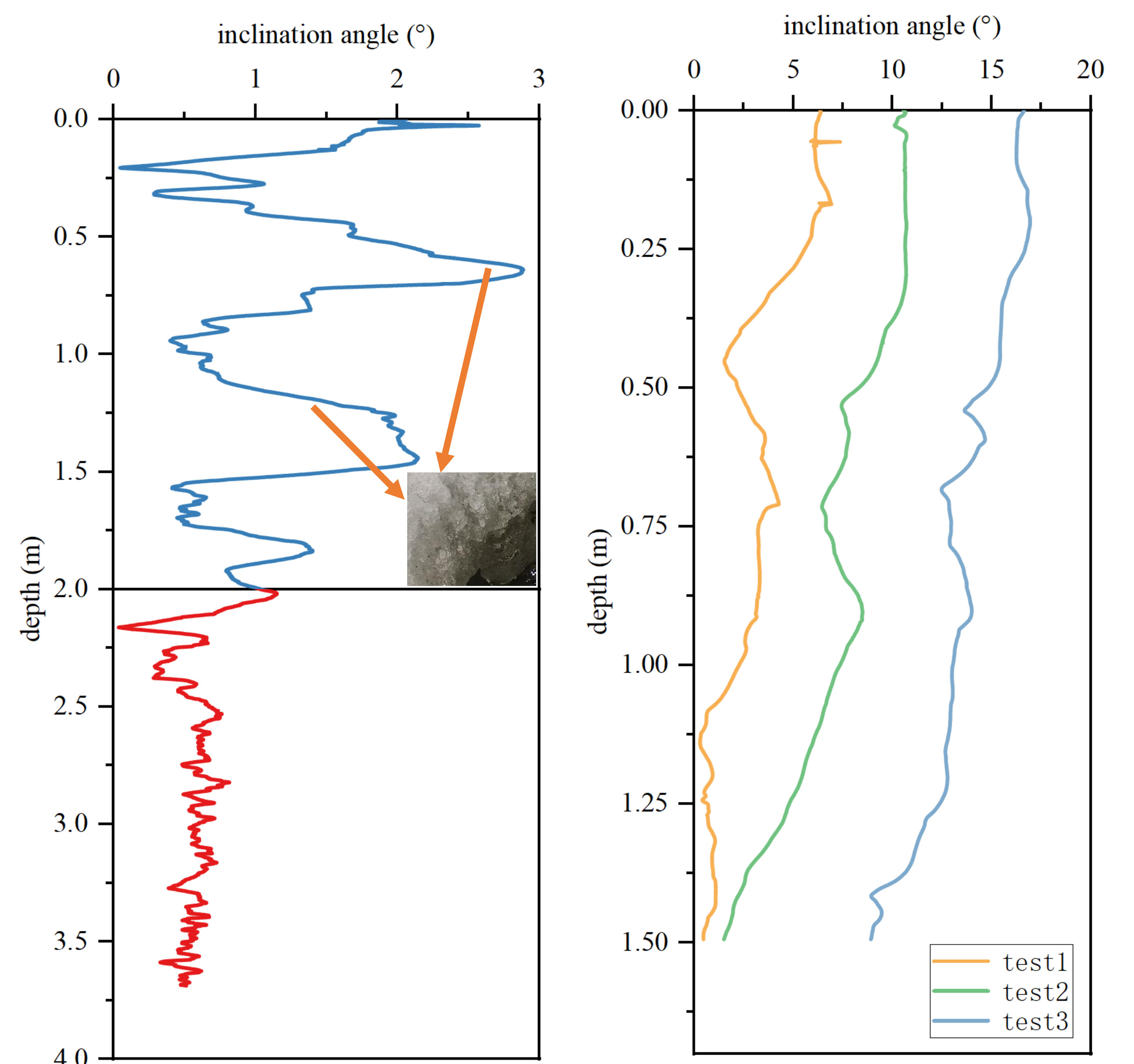
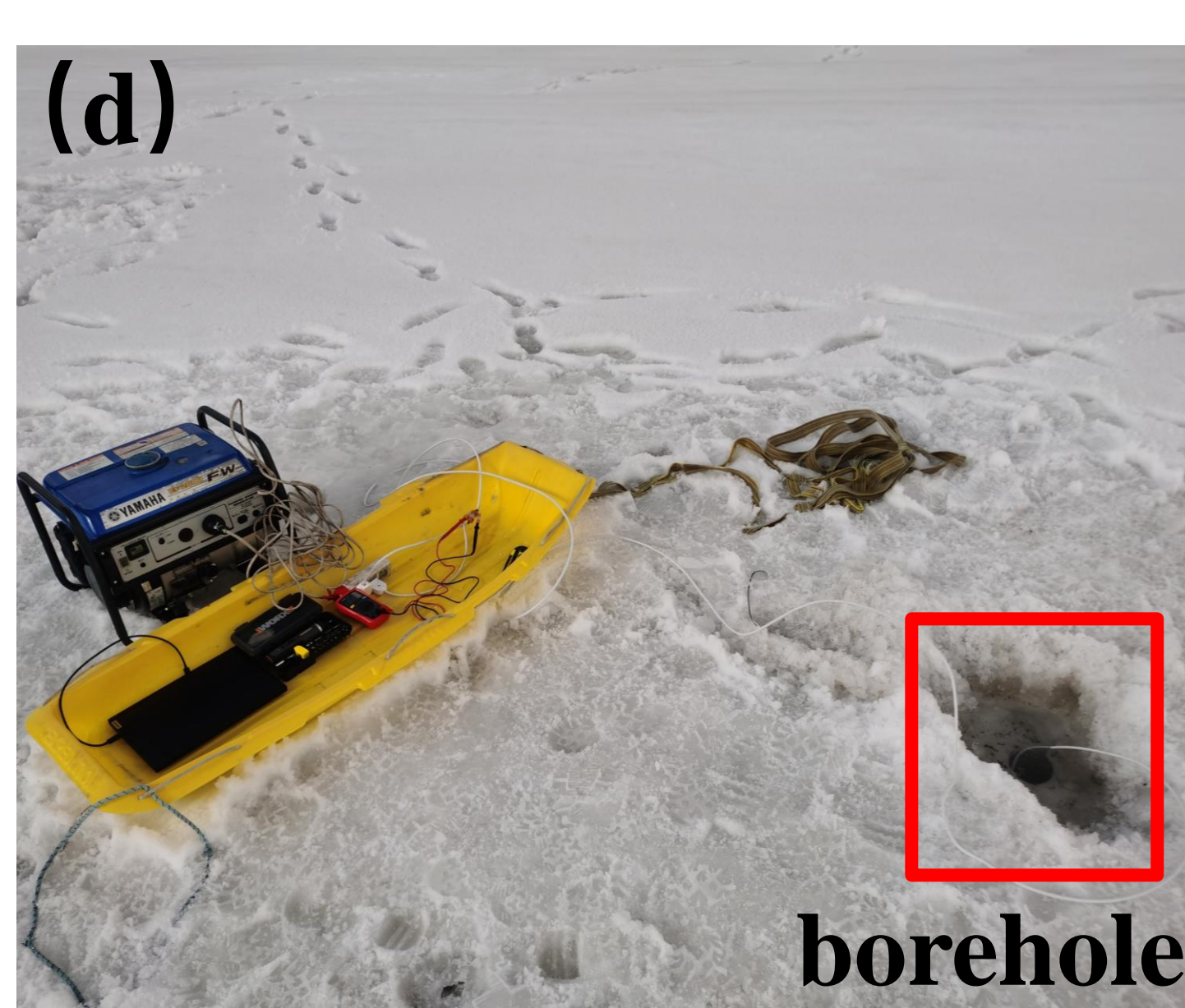
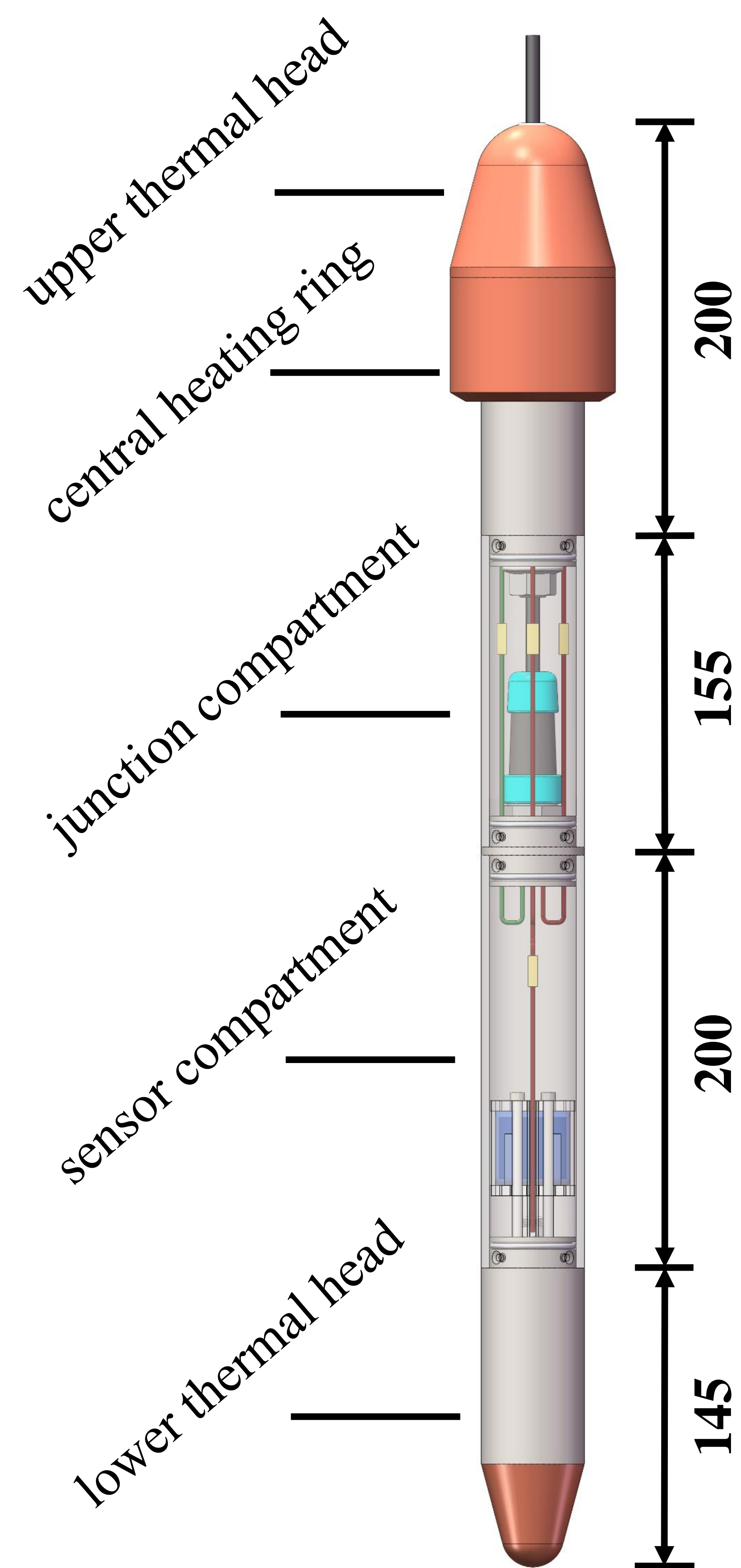
Pendulum-type thermal melt probe (PTMP)

- Integrates three independently controllable heating components: a lower thermal head, a central heating ring, and an upper thermal head. The lower thermal head and central heating ring work in coordination to generate a “pendulum effect,” which ensures vertical drilling and enables rapid inclination-correction. The upper drill head primarily facilitates return of the PTMP.
- Overall length: 700mm;
- Diameter: 80/50mm:
- Maximum power: 1600w (upper thermal head)
1000w (central heating ring)
1000w (lower thermal head)
- Attitude Sensor: Euler Angle Output (Three-Axis Accuracy: 0.005°), SD Card Storage.

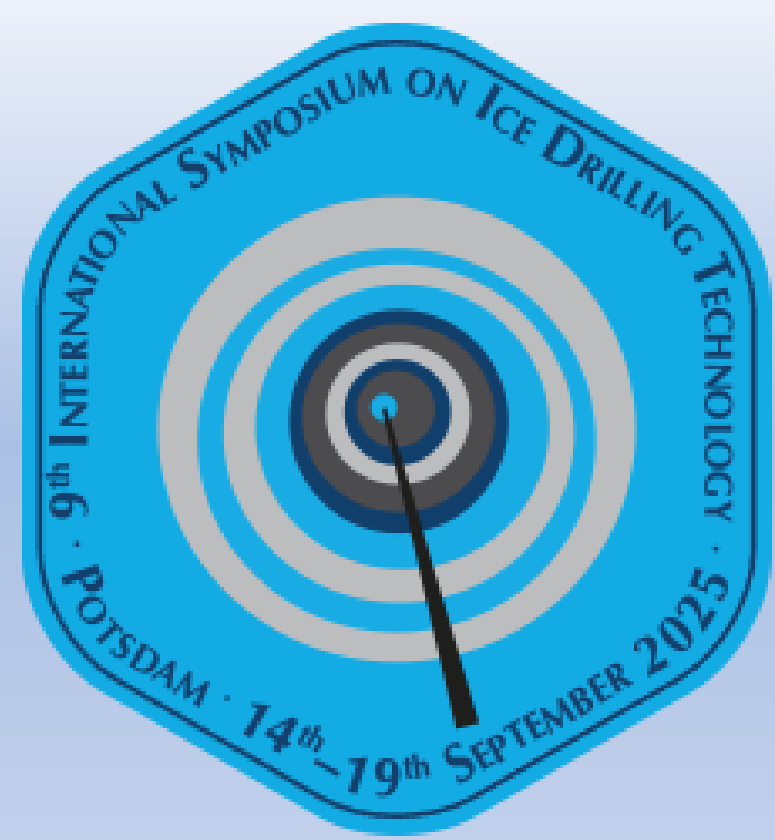
Functional Verification Test

The system underwent preliminary field testing on Laohugou glacier No.12, Qilian Mountain. Field test results showed good performance of the PTMP.

The borehole inclination remained within 3° during 2.5 hours of continuous drilling. The inclination-correction capability of the PTMP was significant, which can reducing the borehole inclination angle from 10.5° to 1.5° within one hour.



(a):drilling location; (b):thermal melt probe ; (c):initial inclination; (d):drilling site.



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Next-Step Plan for the Optimization of PTMP

Research will continue to investigate how key design parameters, such as power distribution, diameter ratio, length, and center of gravity, affect the change rate of borehole inclination, and optimal design parameters will be identified based on the research results.

