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Sampling technology for gas hydrates by borehole bottom freezing

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Exploiting gas hydrate is based on sample drilling, the most direct method to evaluate gas hydrates. At present, the pressure-tight core barrel is a main truth-preserving core sampling tool. This paper puts forward a new gas hydrate-borehole bottom freezing sampling technique. The new sampling technique includes three key components: sampler by borehole bottom freezing, mud cooling system and low temperature mud system. The sampler for gas hydrates by borehole bottom freezing presents a novel approach to the in-situ sampling of gas hydrate. This technique can significantly reduce the sampling pressure and prevent decomposition of the hydrate samples due to the external cold source which may freeze the hydrate cores on the bottom of borehole. The freezing sampler was designed and built based on its thermal-mechanical properties and structure, which has a single action mechanism, control mechanism and freezing mechanism. The technique was tested with a trial of core drilling. Results demonstrate that the new technique can be applied to obtain freezing samples from the borehole bottom. In the sampling process of gas hydrate, mud needs to be kept at a low temperature state to prevent the in-situ decomposition of the hydrate if the temperature of mud is too high. Mud cooling system is an independent system for lowing the temperature of mud that returns to the surface. It can cool mud rapidly, maintain its low temperature steadily, and ensure the temperature of the inlet well mud to meet the gas hydrate drilling operation requirement. The mud cooling system has been applied to the drilling engineering project in the Qilian mountain permafrost in northwest China, and achieved the gas hydrates in permafrost. The ordinary mud could not meet the requirements of good performance at low temperature. Low temperature mud system for NaCl and KCl is developed, whose resistance to the temperature is as low as 20 below zero.In-situ sampling of gas hydrates can be achieved through combination of these three key components.