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Occurrence of near-seafloor gas hydrates and associated cold vents in the Ulleung Basin, East Sea

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During the site survey cruise for proposed drill sites of the Ulleung Basin Gas Hydrate Expedition 01, near-seafloor gas hydrates were discovered in core sediments from both regions of basin plain (2066–2012 m water depth) and southern slope (898 m) of the Ulleung Basin. The gas hydrate-bearing cores were exclusively retrieved from high backscatter intensity areas in processed 13 kHz multi-beam data, implying high seafloor reflectivity. In high-resolution (2-7 kHz) sub-bottom profiles, the coring sites are also characterized by narrow (< about 500 m wide) acoustic blank zones reaching seafloor, where they have surface expressions of low-relief (< about 5 m high) mound. In the data from a 38 kHz split-beam echosounder, which was deployed for acoustic characterization of gas bubbles, there are no apparent gas flares associated with the blank zones. The recovered gas hydrates mainly consist of disseminated nodules or veins in clayey mud, which normally occur from 5–6 m below the seafloor to the maximum penetration depth (<8 m) of the cores. In some cases, they were associated with abundant scattered authigenic carbonate nodules. Compositional and structural analyses of selected gas hydrate samples revealed that they consist of structure I hydrates which contain more than 99% methane with carbon isotope values ranging from -64 to -80 per mil (PDB). The preliminary results of the site survey cruise collectively suggest that the near-seafloor gas hydrates are related to cold vents, where high seafloor reflectivity is caused by presence of gas hydrates and authigenic carbonates. Gas seeping activity in the cold vents appears to be currently dormant.