



Occurrence of seismic chimney structures associated with mass transport deposit in the Ulleung Basin, East Sea of Korea

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Seismic interpretation and attribute analysis of 3D seismic data reveal that numerous seismic chimneys are developed through the gas hydrate stability zone at the central part of the Ulleung Basin. The seismic chimneys predominantly start from the underlying the thick mass transport deposit or the shear zone related to the mass transport process. Based on spatial distributions and geometries, seismic chimneys are grouped into two different types: (1) mound-like type and (2) pipe-like type. The mound-like type shows 600m-wide elliptical shape in a plane view. It is buried within Pliocene sedimentary succession and connected to underlying the mass transport flow zone. This type is elongated to the strike direction of pressured ridge of mass transport flow. The pipe-like type shows 300m-wide circular shape in a plane view and is vertically extended to near surface. Occurrence of this type is spatially related to the fault systems in the lateral shear zone of the mass transport deposit or the deep-seated faults. Logging and coring data from two gas hydrate drilling expeditions in the Ulleung Basin indicate that mound-like type is generated by intrusive sediment remobilization, whereas pipe-like type is composed of fracture swarms without intrusive sediment structure. Therefore, this study suggests that the mound-like type is generated by the sedimentary remobilization along the pressured ridge of the underlying mass flow deposit during Pliocene, whereas the pipe-like type results from the fracture swarms caused by the excess of pore pressure (i.e. natural hydraulic fracture) during Pleistocene to Holocene.