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Physical and Acoustic Characteristics of Gassy Sediment in Jinhae Bay, the South Sea of Korea: Implications for Sedimentary Environment

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Chirp acoustic survey has been conducted to investigate acoustic characteristics and physical properties for gassy and non-gassy sediments in Jinhae Bay, the South Sea of Korea. The sediment in the Jinhae Bay is mostly homogenous mud deposited after Holocene transgression. Approximately 240 km track lines were surveyed. Along with the seismic profiling, 18 piston core samples were collected on the track lines. Some cores penetrated gas zone.

Gassy sediments are pretty common and widely occurred in the bay. Based on the high resolution profiles, reflectors of acoustic blanking zone were divided into four types depend upon development of beddings, continuity, and shapes and intensity of reflectors. We also classify the acoustic anomaly into seven types based on the characteristics of the reflectors. The acoustic anomaly types are relatively well coincide with each depositional environment.

Core samples were analyzed for physical properties (porosity, water content, bulk density, grain density, and vane shear strength), acoustic properties (compressional wave velocity and attenuation), and electrical resistivity. Autopycnometers and a motorized shear vane were employed to determine porosity/density and vane shear strength, respectively. Pulse transmission technique that programmed to pick up first arrival signal was used to calculate accurate compressional velocity. The resonance frequency was 1 MHz. Electrical resistivity was measured by the standard four electrode method. Sediment texture was also analyzed using sedimentation method. We maintained 10

cm measurement interval for consistency. Physical properties of gassy sediments are nearly similar to those of non-gassy sediments, and textures are also nearly the same (less than 1%). However, compressional wave velocity rapidly decreases from 1450 to 736 m/s (270∼290 cm at JH 3 core), from 1470 to 1372 m/s (370 cm at JH 5 core), and from 1470 to 1342 m/s (340 cm at JH 7 core), respectively. This is probably due to degassying cracks which developed by escaping gases and free gas bubbles that still trapped in the cores. The cracks were identified well by X-radiograph images. There is no significant downcore variations on texture and other physical properties such as porosity and density regardless of existence of gas bubbles. Electrical resistivity is the only geotechnical property increase in the gas-bearing zone where velocity decrease abruptly. This indicates the possibility of electrical resistivity as an index variable as well as compressional velocity for sediment microstructure because there is little changes in texture and composition of sediment. Methane is a dominant component with about 5% average content in the gassy zones. The carbon isotope analysis suggests that the shallow gas in Jinhae Bay is biogenic origin.