Anomalously low velocity sediments in gas hydrate stability zone on the Umitaka spur of Joetsu basin, eastern margin of Japan Sea

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Seismic profiles on the spur and knoll in gas hydrate-bearing area of Joestu basin, have revealed well-developed gas chimney structures, 0.2 to 1.5km in diameter. Gas chimneys serve as effective conduits for the migration of deep thermogenic methane to shallow sediments, and also provide open space for the accumulation of gas hydrate. Thus, gas chimneys are considered to contain both the methane-bearing fluids and solid gas hydrate. The depth of the base of gas hydrate stability (BGHS) is estimated to be 115 m, based on the thermal gradient of 100mK/m and the temperature of bottom water of 0.2 degree C, whereas the depth of BSR has been observed to be 0.20 to 0.23 seconds in two way travel time. Therefore the P-wave velocity of the sediments is calculated to be 1000 m/s, anomalously low velocity compared with normal pelagic mud of 1500-1600m/s. The anomalously low velocity implies that the Umitaka sediments contain free gas bubbles, though the sediments are well within the stability field of gas hydrate. Occurrence of free gas and in gas hydrate stability zone is not readily explained, but we propose the following possible mechanisms for unusual co-existence of gas hydrate and free gas in the study area. (1) Local high salinity effect of residual waters, (2) degassing from ascending methane-bearing fluids, (3) bound water effect and deficiency of free-waters, and (4) micro-pore effect of fine-grained sediments. All of these processes are closely related with the development of gas hydrate deposits of the Umitaka spur.