

3D seismic velocity structure beneath pockmarks and mounds in the deep sea southwest offshore the Sado Island in the Japan Sea

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The METI 'Sado-oki Nansei' 3D seismic survey was carried out in the deep sea southwest offshore the Sado Island (or offshore Joetsu-oki) in the Japan Sea in 2001 and occurrence of BSR was confirmed beneath the sea floor in and around the Umitaka Spur located in the 3D seismic survey area. The Umitaka Spur has pockmarks and mounds where recoveries of massive methane hydrate samples on sea floor, discovery of methane bubble plumes onto water and high resistivity zones beneath the sea floor were reported through various geological and geophysical surveys.

We applied high density velocity analysis to the MITI 'Sado-oki Nansei' 3D seismic data and investigated the underground velocity structure beneath the target area covering the Umitaka Spur as a methane hydrate resource assessment work offshore Japan by MH21 (Research Consortium for Methane Hydrate Resources in Japan).

The occurrence of BSR correspond to the phase boundary, above which the high velocity zone suggesting methane hydrate bearing zones and below which the low velocity zones suggesting free-gas zones. Though top of high velocity zones above the BSR were controlled by sequence boundaries, high velocity zones anomalies beneath pockmarks and mounds were distributed without geological controls and some of them were widespread between sea floor and BSR. Moreover, pockmarks and mound sites were specified with local BSR pull-ups and low velocity zones below the BSR.

The above may suggest the existence of methane hydrate system consisting of (1) upward migration of fluid including methane through paths from deep zones, (2) occurrence of methane hydrate in the methane hydrate stability zone, and (3) construction of locally high velocity zones.