Reservoir characterization of methane hydrate bearing turbidite channel in the eastern Nankai Trough, Japan

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We have discussed reservoir characteristics of the methane hydrate (MH) bearing turbidite channel using high resolution 3D seismic and well log data.

Previous studies of 2D/3D seismic surveys and multi-wells drilling acquired by METI reveal that the MH found in the Tokai-Kumano forearc basins along the Nankai Trough is distributed in the pore space of turbidite sand layers which forms MH concentrated zones. More attractive target for the resource assessment is to extract the MH concentrated zone in the turbidite sand layers. Thus, the depositional features and lateral to vertical continuity of the turbidite sand layers are essentially important for the potential reservoir characteristics of MH.

In 3D seismic cube, MH concentrated zone exhibits complex strong reflection patterns comprising patchy like shape of positive and negative reflectors. The groups of these high amplitude reflectors by picking also represent the internal architecture of turbidite channel using 3D visualization technique. MH concentrated zone in the turbidite channel can be roughly classified into three depositional sequences; Kg_h-Og_e, Og_e-f, and Og_f-g. The lower sequence of Kg_h-Og_e is characterized by the mud dominated layer. The net gross ratio (sand:mud) obtained by the well data also represents lower sand ratio (˜30%). On the other hand, middle to upper sequences of Og_e-f and Og_f-g exhibit sand dominated layer characterizing by the trough-fill small fan type or sheet-like turbidite sediment. Compared with MH concentrated zones between north-eastern and south-western parts within the turbidite channel, although the thickness of MH concentrated zone at south-western part exhibits three times thicker than that of north-eastern part, the depositional sequence of south-western part comprises mud dominated layer (Kg_h-Og_e) so that the reservoir potential is significantly poor. In contrast, the depositional sequences of north-eastern part represent sand dominated layer so that the reservoir potential is high even lower thickness of MH concentrated zone. Hence, the different depositional sequence in turbidite channel corresponds to different reservoir characterization of MH.

For constructing geological model, we have examined the lateral continuity of amplitude patterns using horizontally grouped strong reflectors at north-eastern part of channel around well B1 (1km^2). The development of main channel descends from north-east to southwest. However, the distribution of the high amplitude patterns does not show any significant variation irrespective of the flow direction. This fact indicates that the turbidite channel consists of complex stacking patterns of several flow units.