Application of high-density velocity analysis technique to hydrocarbon resource potential evaluations

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In reflection seismology, underground velocity structure obtained by velocity analysis is not only required for various processing steps including NMO, DMO, PreSTM, PostSTM, PreSDM, PostSDM and depth conversion, but valued for geological interpretation and analysis. Despite limitations or traps which must be considered in applications of velocity information in processing to interpretations directly, not a little explorers in the petroleum industry have tried to utilize velocity data for their qualitative or semi-quantitative study, of which efforts have been often rewarded, in authors‘ understanding.

High-density (or continuous) velocity analysis technique was developed for the methane hydrate research offshore Japan covering the eastern Nankai Trough area, and obtained velocity information was used to evaluate methane hydrate resource potential.

The technique consists of following steps:

(1) Construct velocity semblance panels.

(2) Scan semblance peaks automatically as RMS veolocities.

(3) Convert RMS velocities to interval velocities using the DIX formula.

(4) Smooth velocity volume in median and mean filters.

The above flow could successfully provide velocity results including various geological information as follows: (a) BSRs, (b) methane hydrate concentrated zones, (c) fluid plumes and so on.

Following factors contributed the result as key elements: (A) Inverse NMO gathers after 3D-PreSTM were used. (B) High density velocity information in both of horizontal and vertical senses was obtained. (C) Quality of data was preserved enough because the target depth beneath the sea floor was relatively shallow.

Acquired knowledge through this study may suggest that high density velocity analysis can be also utilized for conventional petroleum resource potential evaluations.