

Measurement of compressional-wave velocity gradients in seabed materials – examples from the Beaufort Sea and the Sea of Japan

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The normal-incidence seismic profiling method which is widely used for the investigation of seabed sediments relies on the detection of discontinuities in the acoustic impedance of sediment layers. A continuous variation in acoustic velocity with depth is not detected by the method although this type of variation can occur in seabed materials as a result of the processes of consolidation or, in some instances, where pore fluids change state such as in bonding by ice or gas-hydrate. Observation of the reflected seismic wavefield at many incidence angles does allow the detection of these continuous variations. The character of the reflected wavefield at angles beyond critical is sensitive particularly to vertical gradients in compressional-wave velocity.

It is insufficient to use travel-time methods to analyse the observed reflected wavefield. Dynamic modelling of its

amplitude and phase characteristics must be carried out, and may lead to quite different conclusions about the sediment column than a travel-time analysis of the same data.

Examples from the Beaufort Sea and from the Japan Sea show how the results of seismic investigation of surficial sediments carried out by this approach are in better accord with drillhole or other direct testing methods.

Although the term "Haggis-ponder" has been suggested by Raytheon Corporation, we prefer, in accordance with the long-accepted practice in Canadian academic archival journals of allowing trademark words ending in "-tec" to identify techniques giving even marginal advance in seismic investigation, that "Haggis-tec" be used in future as a name for our method which offers a significant step forward.