Advances in Type Seismic Response for Gas Hydrate in Light of Recent LWD Drilling

McConnell, Daniel R.[1]; Zhang, Zijian [1] (1) AOA Geophysics, Houston, TX.

Recent drilling results have identified gas hydrate occurrences in sand-prone sediments from northern Alaska, Cascadia margin, and Gulf of Mexico. These programs have been able to test seismic signatures suspected to be associated with gas hydrate with high resolution logging tools. While the data are still sparse, the data advance the understanding of type-anomalies can be considered as direct gas hydrate indicators in seismic interpretation during the gas hydrate exploration.

In general, for Late Pleistocene marine sands in the Gulf of Mexico, the acoustic impedance of water saturated sand is slightly less than that of clay in shallow section of the Gulf of Mexico. The acoustic impedance of gas saturated sand is significantly lower than that of water saturated sand and clay. Rock physics models indicate that the acoustic impedance of hydrate saturated sand is slightly increased with low hydrate saturation and dramatically increases with high hydrate saturation.

This study presents drilling results through three classes of amplitude anomalies, bright spot, phase reversal, and dim-out. that have either been discussed in the literature or tested as part of the recent drilling programs: High positive amplitude anomalies, bright spots with opposite polarity to gas, occur within expected gas hydrate stability zone when high concentrated gas hydrate sufficiently fills the pore space of sand. The acoustic impedance of high hydrate saturated sand, in this case, is dramatically greater than the water saturated sand or overlying clay. A phase reversal is associated with the gas and gas hydrate interface. It can occur in tilted sand layer with high impedance hydrate saturated sand within the gas hydrate stability zone and low impedance gas where the sand is below the gas hydrate stability zone. saturated sand. Dim-out anomalies <blanking> were not specific targets of the gas hydrate drilling, but the acquired data shed insight on the im-out event occurs when few gas hydrates fills in the pore space of sand. Low hydrate saturated sand has close acoustic impedance to overlying clay.

The data from recent gas hydrate drilling in the Gulf of Mexico are used in this study.