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ABSTRACT

IDENTIFYING GAS – WATER CONTACTS FROM SONIC LOGS (IN SUPPORT OF CONVENTIONAL METHODS)

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Identifying fluid contacts in gas bearing reservoirs is critical in the determination of hydrocarbon volumes. Traditionally a change from high to low resistivity from induction logs as well as fluid gradients from pressure measurements, have been used to identify where fluid contacts exist. The key is to use as much data as possible in order to reduce the uncertainty and give confidence as to how much gas the reservoir actually contains. .

An example of a supporting method for identifying a gas-water contact is a change in sonic velocities (compressional P and shear S waves) and the derived property, Poisson's ratio. The sound waves transmitted from a sonic tool propagate through the mud and through the formation and fluids in the pore spaces then back to the receiver. The velocity of the received signal gives an indication of the depth of the contact as the P-wave velocity component is reduced by the presence of gas and as a result the velocity decreases while the S-wave component is less affected and the velocity remains relatively constant. Normalizing these velocities in known water bearing sand or shales, gives an overlay of the P-wave and S-wave curves. A marked separation is observed as the tool moves from water to gas. A Poisson's ratio curve derived from the P- and S-wave velocities can be used as well in identifying the contact. There is a marked Poisson's ratio contrast as the tool moves from water into a gas and where this occurs, a prognosis of the contact can be made. This contrast when tied in with gas chromatograph data gives some key indications as to where a gas-water contact may exist.

One caveat is that the use of **only** sonic data in identifying a gas-water contact is not recommended. It is critical to use as much data as available to make this prognosis (resistivity, neutron-density, pressures, FMI, mudlogs, etc). The principal reason for not solely using this method is that Poisson's ratio is the same for a reservoir with 5% gas as it is for 60% gas. Residual gas is an example of one such condition where this occurs and the Petrophysicist should examine all available data before saying with some level of confidence that the change in Poisson's ratio is indeed related to a gas-water contact.

In order to demonstrate the application of this methodology, some examples will be shown from offshore Trinidad where gas-water contacts have been supported by the use of Poisson's ratio.