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Edgar B. C. Cutiongco[1], John Warren[2] (1) Philippine National Oil Company - Exploration Corporation, Manila, Philippines (2) University Brunei Darussalam, Bander Seri Begawan, Brunei

Porosity and Permeability Controls in Volcaniclastic Sediments and their Relationship to Wireline Data from the Sultan-Sa-Barongis Prospect, Mindanao, Phillipines

Recent drilling of 3 wells in the Cotabato Basin of Mindanao, Philippines shows the effects of volcaniclastic lithologies on reservoir parameters in a gas-charged Early Pliocene volcaniclastic section. Both SSB-1 and 2 wells flowed gas to surface from the volcaniclastic interval, mainly methane (~186,000 scfpd), during testing, with associated water at around 4,000 bpd, but the gas flows were shortlived.

Core study shows the textural and mineralogical immaturity of the volcaniclastic matrix has drastically reduced reservoir potential during shallow burial alteration. The main factor that adversely affected reservoir quality was the presence of large amounts of volcanic glass, which altered to various clays and zeolites during early diagenesis. Dispersed clays and the presence of large amounts of labiles and feldspars also controlled the development and retention of microporosity in the core. Pumiceous grains are commonplace in the sandier intervals of the recovered core. The result of all this shallow alteration is that current core porosities are a combination of intragranular and dispersed porosities. Raw wireline derived porosities are not direct indicators of effective porosities in these sediments. Using standard plug techniques some thin sands give very high porosities (up to 50%). However, these porosities are ineffective and unconnected (microporosity)so that permeabilities measured on the same plugs are low (<0.1 - 1 md).

Wireline signatures are unusual due to the high volume of volcanogenically derived material, mostly ineffective mesoporosity, as well as widespread gas in clay-rich sediments. Standard quartzofeldspathic sand models for wireline-based prediction of lithology did not give reliable outputs, either in terms of lithology or hydrocarbon distribution. Once wireline data were calibrated to the core data it was found that gas (probably biogenic) is generated and trapped within shale source intervals, not in sands, in contrast to earlier interpretations.