Geological Controls on Porosity and Permeability in Clastic Gas Reservoirs, Onshore China

By

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A technical talk was presented by Mr Maarten Wiemer (Head, Geological Services, Sarawak Shell Berhad) to an audience of around 70 people comprising geology staff, stundets and professionals from the industry, at Curtin University of Technology, Sarawak Campus.

After undertaking a sedimentary geology masters at Leiden University and military service in The Netherlands, Maarten joined Shell, and worked as geologist on many projects in different parts of the world, amongst others in Oman, England, Holland, Madagascar, China, and Malaysia.

ABSTRACT

Porosity and permeability trends from different clastic gas reservoirs onshore China have been compared in terms of regional geological and depositional setting, as well as burial history. It is demonstrated that these reservoir parameters are linked to plate tectonic setting (provenance), climate and depositional system (sedimentary facies, primary texture and mineralogy) and subsequent burial history (compaction and diagenesis). Understanding the regional geological setting and burial history is therefore a key requirement to predict reservoir quality.

The late Palaeozoic Ordos Basin data set represents reservoir sands deposited under humid tropical climate conditions in a low gradient fluvio-deltaic setting. Subsequent deep burial and uplift distorted the expected porosity – burial (compaction) trend. In this subsequently 'tight' reservoir sand, especially the milliDarcy range permeability is very sensitive to textural parameters such as grain-size and sorting, as well a detrital mineralogy, i.e. quartz versus rock fragment content of the sandstones.

The much better quality Cretaceous Tarim reservoir sands have been deposited in a more arid climate, mountain belt foredeep setting in a distal alluvial fan – braided river setting with some eolian influence. Due to the thrust related ridge and basin topography of the basin margin, the sediment underwent multiple deposition and erosion cycles, resulting in a much enhanced textural and mineralogical maturity, before the sediment reached its 'final destination' and became buried to ultimately form excellent gas reservoirs. In addition, rapid tectonic loading and burial probably resulted in compaction and diagenesis being 'behind', i.e. still in process to 'catch-up'.

Early gas charge might have played in role in preserving porosity and permeability as well.

Hence although the Tarim Basin Cretaceous gas reservoirs are, today, situated at greater depths than the Ordos Basin late Palaeozoic gas reservoir sands, the Tarim Basin reservoirs have much better retained porosity and permeability due to a very different more favourable structural and depositional setting as well as burial history.

The 1½-hour technical talk session concluded at 7:30pm.

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