Regional Petrography and Diagenesis Patterns of the Amin Formation in North Oman

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Abstract

Recent gas discoveries in deep Amin sandstone reservoirs in North Oman have highlighted the need to understand the sedimentological and diagenetic controls on reservoir properties for this formation at both a field and a regional scale. For this reason a study was proposed to identify the key compositional and diagenetic controls on reservoir quality and their regional trends, which may have an effect on reservoir properties.

Thirteen wells from different fields which penetrate the Amin Formation in North Oman were selected based on their data availability. The data used varies from core descriptions, Conventional Core Analysis (CCA) data, textural and modal analysis, fluid inclusions analysis and burial histories supported by additional Qemscan analyses. These analyses were integrated with regional, petrological, mineralogical, and diagenetic data to identify the key diagenetic controls on reservoir quality and their regional trends.

The variations of reservoir quality in generated cross plots indicate that there are different factors that affect the Amin pore systems. The analysis showed that depth (compaction), facies and diagenesis all play a role in the enhancing and reducing the reservoir quality of Amin Formation. Sedimentological attributes were proven to be not the only controller of the reservoir quality in the Amin Formation. This result was indicated by the cross plot of CCA data which reveals locally good reservoir values in some argillaceous sandstone units, thus implying a diagenetic effect.

The main diagenetic controls in Amin Formation are quartz cementation, grain coating chlorite, chert dissolution and minor pyro-bitumen content. Other products were observed in smaller but locally significant quantities, such as ferroan dolomite, K-feldspar overgrowths, anhydrite and barite cements. Quartz cementation is the dominant diagenetic product that reduces the pore system of Amin sandstones. It was observed to form in the early stages of the paragenesis, post-dating the creation of authigenic chlorite which usually stops quartz overgrowth development. Fluid inclusion analysis was applied to some selected samples and gave some understanding of the different phases of quartz cementation and their timing in relation to the basin history. Therefore, this study may help to predict the distribution of reservoir quality in the Amin Formation in North Oman to assist future exploration campaigns.