

Regional Sweetspotting of Tight Gas Reservoirs in Lower Cambrian Terrestrial Sandstones, North Oman

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ABSTRACT

The Cambrian Amin Formation is a prolific gas bearing terrestrial sandstone play in Oman. Mixed well results warranted a thorough, back-to-basics regional study integrated with production data from existing fields. The objective was to devise sweet spotting rules to assist both exploration and development in delineating what makes the Amin play productive and economical and where, i.e. understanding the key controls on well productivity as wells are deep and often require hydraulic fracturing to achieve commercial production rates. Key study elements included 1) unifying the stratigraphic framework regionally across basins and at field scale, 2) identifying the key sedimentological and diagenetic controls on reservoir quality, 3) analyzing production data to assess fluid flow behavior, and 4) evaluating basin-scale controls and differences in accommodation and structural evolution. Three units were defined with the uppermost unit having the best reservoir potential because of aeolian reworking and deposition. Reservoir quality largely depends on the interplay of depositional (grain size, sorting) and diagenetic factors (secondary porosity creation, bitumen), for example, abundant secondary porosity creation and little bitumen plugging is linked with good primary porosities and early gas charge flushing oil-filled traps. Based on production and petrophysical data a flow unit concept was developed to rapidly screen which type of rock intervals contribute to flow. It was found that production behavior (initial flow rate and expected ultimate recovery) is directly related to flow unit characteristics (presence, abundance and thickness) regardless of basin position. A set of 'big rules' for the creation (and destruction) of flow units allowed to discriminate the main basins and to assess fairway and field differences within these depocentres. The key controls contributing to the occurrence of flow units are 1) primary depositional facies including variations in texture, 2) accommodation space variations resulting in differences in bed thickness development and erosion intensity, 3) burial and charge histories linked to porosity preservation, and 4) structural style in relation to fluid fill and contact evolution. In summary, a regional sweet spotting study is presented for the Cambrian terrestrial sandstone tight gas play in North Oman, which ultimately can be used for portfolio management and to accelerate exploration success and bring asset production forward.