Heterogeneity of Ordovician Red River Reservoirs: A Case of Core Study from 3-8-1-11W2M Well, Southeastern Saskatchewan

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The discovery of prolific Ordovician Red River reservoirs in 1995 in southeastern Saskatchewan was the catalyst for extensive exploration activity, which resulted in the discovery of more than 15 new Red River pools. The best yields of Ordovician Red River production to date have been from dolomite reservoirs indicating that dolomitization has played a major role in forming reservoir quality porosity. Dolomitization patterns in Red River carbonates are complex. In the Yeoman Formation, there are dolomitized *Thalassinoides* burrows with the host matrix preserved as limestones, dolomitized *Thalassinoides* burrows as well as host matrix resulting in complete dolostones, minor saddle dolomite precipitated as cement in vugs and fractures, and limestone sections where both (*Thalassinoides*) burrows and host matrix escaped dolomitization.

The measured core porosities for dolomite samples from 3-8-1-11W2 range from 6 to 16%, averaging around 11%. The porosity is generally much lower (2 to 8%) in the limestone and/or in limestone where dolomitization occurs preferentially in the burrows. The maximum permeability of the dolomite reservoirs in this well varies from 0.5 to 30 mD, with two samples exceeding 30 mD while the maximum permeability of most limestone samples is less than 7 mD. For the Yeoman Formation (or "C" Burrowed Member) there is a good correlation between porous reservoirs, as indicated by porosity logs, and dolomites.

Three types of porosity were recognized on the basis of examination of core samples and thin section. They are intercrystalline pores, dissolution vugs, and fractures. Intercrystalline porosity is the most common and occurs between euhedral dolomite crystals (50-100 micrometer in size) in the matrix of burrow-related dolomite. The burrow in-fills, however, consist of smaller anhedral dolomite (25-50 micrometer) and have a lower porosity. Oil staining occurs preferentially in matrix dolomite due to its higher porosity. Dissolution vugs are commonly observed in the oil-stained dolomitized intervals. The size of vugs ranges from pinpoint size (around 1 mm in diameter) to several cm. Some vugs are connected while others are isolated. Fractures identified in these reservoirs also significantly improved the permeability of reservoirs.

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