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Secondary Porosity Generated by Dissolution of Grains, Cement and Matrix in the Lower Cretaceous Viking Sandstone Reservoirs

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Sandstone reservoirs in the Lower Cretaceous Viking Formation commonly show higher-than-normal (compaction) porosities. A petrographic study of a series of samples from a number of Viking reservoirs from Saskatchewan and Alberta, including very fine- to coarse-grained sandstones, indicates that much of the porosity was generated by dissolution of grains, cements and matrix.

Selective leaching of feldspar and some lithic grains is shown by skeletal grains, remnant grains in oversized pores and partially dissolved grains. The dissolution of quartz as manifested by the corroded grain boundaries is very common. Cement (mainly calcite and siderite) dissolutions are also evidenced from partial dissolution of cement, skeletal appearance of cement, oversized pores and elongate pores. Heterogeneous packing is a commonly observed feature in these reservoirs and may have resulted from the selective leaching out of grains and cements, leaving areas of tightly packed grains beside loosely packed fabric. Dissolution and washing out of matrix materials are more commonly displayed in fine-grained, generally bioturbated sands, perhaps because of their initial matrix-rich nature compared to coarser sands. Alternating but irregularly distributed, matrix-free, light-coloured porous areas and matrix-rich, dark, non-porous areas in the fine- to very fine-grained sandstones testifies to the selective leaching of matrix that is not mixed with sticky black bituminous materials which resist leaching/washing out.

The mechanism by which the rock components are leached or washed out is inconclusive in the present study. Although dissolution by corrosive fluids derived from deeper parts of the basin cannot be excluded, it is more likely that the observed secondary porosities resulted from interaction with meteoric water when the sediments were not deeply buried. On-going studies aim to tie these dissolution events with fluctuation of sea level during or shortly after the deposition of the Viking Formation, which resulted in episodic subaerial exposures and incursion of meteoric water in a coastal setting.

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