Geology of the Gull Lake North Alkali/Surfactant/Polymer Tertiary Flood, Upper Shaunavon Formation, Southwest Saskatchewan

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Abstract

The middle Jurassic Upper Shaunavon Formation in the Gull Lake area is composed of a series of up to six shallowing upward shale to shallow marine carbonate and fine grained sandstone sequences. There are two reservoirs in the Gull Lake North Upper Shaunavon oil pool - a large tidal channel near the top of the Upper Shaunavon Formation and several small tidal bars stratigraphically above the channel. The channel is the main reservoir for the pool and is the target for the tertiary flood. Within the channel, sandstones have retained most of their primary porosity. Diagenesis of the carbonates within the reservoir has reduced most of the porosity to non effective levels.

Oil migration into the area was driven by a north-south trending hydrodynamic low along the west side of the reservoir. Gas associated with the oil moved structurally updip to the northeast leaving the reservoir with low GOR oil in the updip part of the channel and a water leg in the downdip part.

The Gull Lake pool met several key criteria for an alkali/surfactant/polymer (ASP) tertiary flood – size, lack of a gas cap, very little clay, an intermediate API crude and a thick, high quality reservoir with no apparent permeability barriers. The only negative feature of the Gull Lake pool affecting the ASP flood is the potential for injected fluid dilution from contact with the water leg.

The tertiary flood of the Gull Lake pool began with the injection of softened water on June 1st, 2009 followed by alkali/polymer on October 1st and full alkali/surfactant/polymer on December 1st, 2009.