

## Geostatistical Reservoir Modeling for the Oil Sands Development

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Oil sands reservoirs which contain extra heavy oil (bitumen) are widely distributed in Alberta, Canada. Several oil sands projects have been initiated and the crude oil production from oil sands in Alberta is now up to 50 % of total production. More than 80 % of oil sands are existed at the depth of 75 meters or deeper, and the steam assisted gravity drainage (SAGD) method is the most common technique for the in-situ recovery. The productivity with SAGD is highly dependent on the local geology, and the target formation consists of the fluvial to estuarine clastic sediments that show the short-range variation in the sedimentary facies in the lateral direction. For the accurate evaluation of the bitumen productivity, a high resolution reservoir model is required. The existence of the mud clasts in the target layer is known to affect the reservoir quality. The key of the modeling is to describe the spatial distribution of the mud clasts in the target layer and its impact on the reservoir quality in the quantitative manner. The following is our approach for the reservoir modeling of the target oil sands to take the mud clasts effect into account. Firstly, effective porosity is obtained by petrophysical analysis, and its spatial distribution is estimated by employing the geostatistical techniques with seismic data as the soft data. Next, a volume fraction of the mud clasts is measured on core photos which are available for almost all wells in the target area. Its spatial distribution is also estimated from the geostatistical approach. And then, sand porosity is obtained from the combination of the effective porosity and the mud clasts volume, which is adopted by the porosity-permeability relationship at cores to derive permeability. Here, a study is conducted to find the relationship between the permeability and the mud clasts volume by employing the flow simulation. Finally, the derived relational expression is applied to the permeability in order to compensate the mud clasts effect. The geostatistical approach which integrates seismic and log data has provided appropriate reservoir models for the reservoir simulation to evaluate the proper production performance.