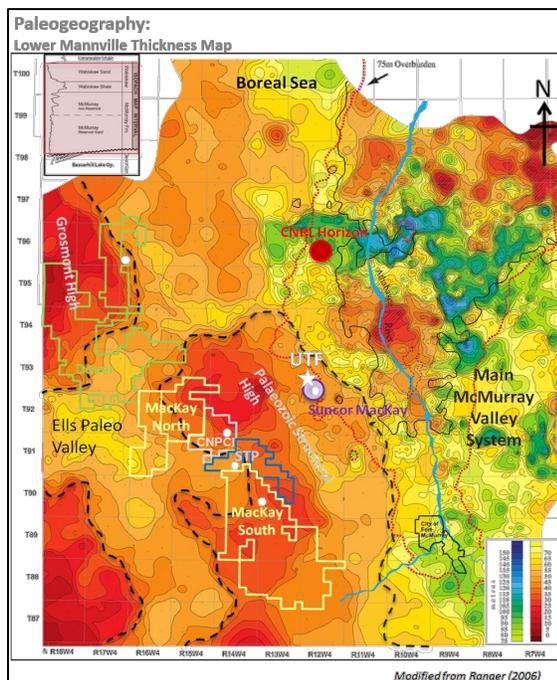


## Overcoming SAGD Reservoir Challenges in the Upper McMurray Formation

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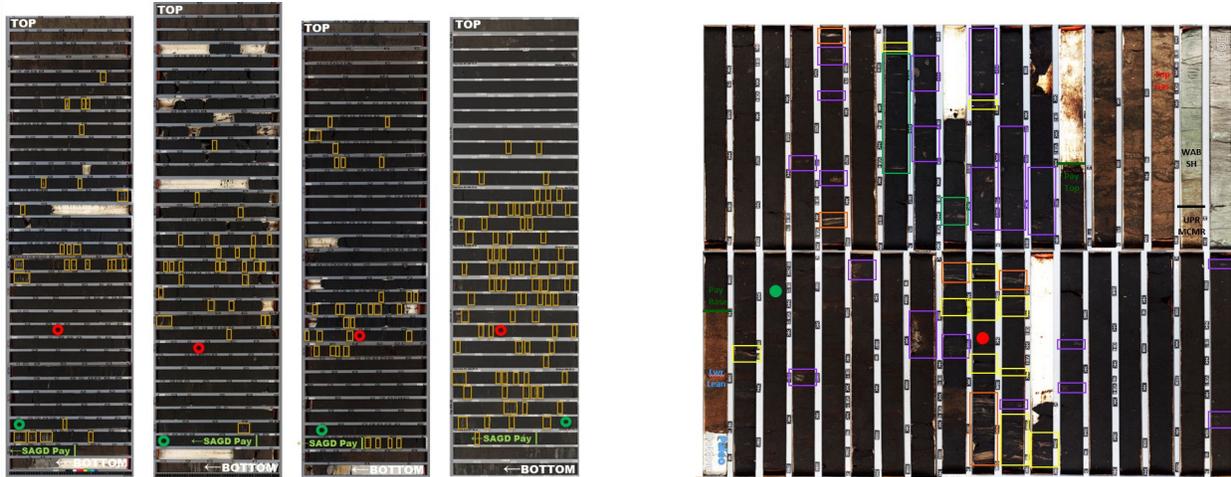
### Abstract

The Upper McMurray Formation is the main reservoir of the PetroChina Canada (PCC) MacKay River Commercial Program (MRCP). Many major SAGD and In Situ Oil Sands producers are located within the main McMurray valley system where higher energy depositional systems dominated. There, Lower and Middle McMurray sediments form the bulk of the high quality reservoirs being produced. PetroChina Canada's MRCP is located within the Ellis Paleovalley which is a tributary valley west of the main McMurray valley system. This tributary valley at MRCP contains a modest amount of Middle McMurray (non-reservoir) and predominantly Upper McMurray sediments in a more marine influenced depositional environment.



Reservoir challenges are present in any oilsands scheme. The primarily marine influenced depositional environment at MRCP leads to specific reservoir differences and challenges. When comparing the different reservoirs we observed differences in mineral composition, grain size, clay content and, most importantly at MRCP, mud lamination frequency and size. The original

Geomodel proved too simple to explain the complexities seen during initial ramp up and early SAGD operations. The geoscience team undertook the arduous task of identifying, classifying and recording every mud lamination for every cored well in the MRCP development area. This valuable data was captured as LAS logs and incorporated in a detailed Geomodel, which has been used to help explain production at MRCP.



The new Geomodel captured over ten thousand hand picked mud laminations and proved to be very valuable when developing mitigation plans for the reservoir challenges at MRCP. Zones of high frequencies of muds (HFMZ) were identified, mapped, helping to explain the cause of the observed production patterns. PCC used this new arsenal of data to create a challenging play concept to overcome the HFMZ's by drilling infill wells with multi-lateral up-tracks. The up-tracks were designed to mechanically create pathways through reservoir challenged with a higher percentage of mud beds to promote steam chamber growth through the mud baffles and provide a conduit for bitumen to flow back to the producer. To date, all of these new infills are outperforming the original neighbor wells. Also important to note is that the data gathered during the drilling of the up-tracks confirmed what was predicted in the Geomodel and the observations from 4D Seismic. PCC has incorporated many technical engineering and geological mitigation practices at MRCP and will continue to bring forward and test other innovative techniques to overcome the production challenges of this reservoir. PCC will also continue to learn from the multi-lateral up-track infill program and use it to improve on future drilling programs.

