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Geophysical Characterization of the Canol and Bluefish Oil Shales, Central Mackenzie Valley, NWT, Canada

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Abstract

The oil shale play of the Central Mackenzie Valley (CMV) started first as an idea developed by several industry and government geoscientists who realized that the Western Canadian Basin organic rich shale fairway extended into Northwest Territory. Long known as the source rock for the Norman Wells light oil accumulation, the Canol Formation was previously studied as source rock and captured in geological surface and subsurface maps used to explore for additional conventional reservoirs. Based on preliminary geochemical studies of the rock outcrops, cores and cuttings both the Canol Shale and the older Bluefish Shale looked like potential lucrative unconventional plays. The next investigative step for these unconventional plays was to evaluate their thickness, regional distribution and predictability using seismic data.

Geophysical investigations of the Middle to Late Devonian shales were performed in parallel with geological and geochemical studies. The first step was to identify the organic shale intervals on the gamma ray logs recorded in all post-1980s exploration wells and correlate the intervals into the sonic and density log displays. The main play - Canol Shale- varies in in thickness from 0 m (when truncated by the Base Cretaceous Unconformity) to more than 120 m (in distal basinal locations). In places, the Top Canol Formation has a clear seismic impedance contrast and can be effectively tracked on superior quality seismic lines. In other locations, the Canol can only be ghosted within the Devonian clastic succession overlying the Hume Formation. The Top of Hume horizon is marked by a very strong, widespread amplitude peak which can be used to 1) correctly place the bottom of shale oil prospective sequence and 2) indicate a lower parallel surface to both Base Canol and Top Bluefish formations separated by the roughly constant thickness Hare Indian inorganic shale.

Once tied to all usable wells in the area, the variable quality seismic horizon Top Canol can be regionally mapped, converted to depth and isopached using the seismic regional grid in order to evaluate the potential volume of unconventional reservoir. A similar technique can be used to map and isopach the Middle Devonian Bluefish Member.

Better quantification of the prospective Devonian shale oil volume can be done using the high resolution seismic data recently acquired by Explor. This Three-Component (3C) vibroseis program is Canadian

Arctic's most advanced data set allowing for: 1) correct ties to the shale oil intervals, 2) a further examination of lateral shale properties and 3) more accurate planning of future directional drilling.

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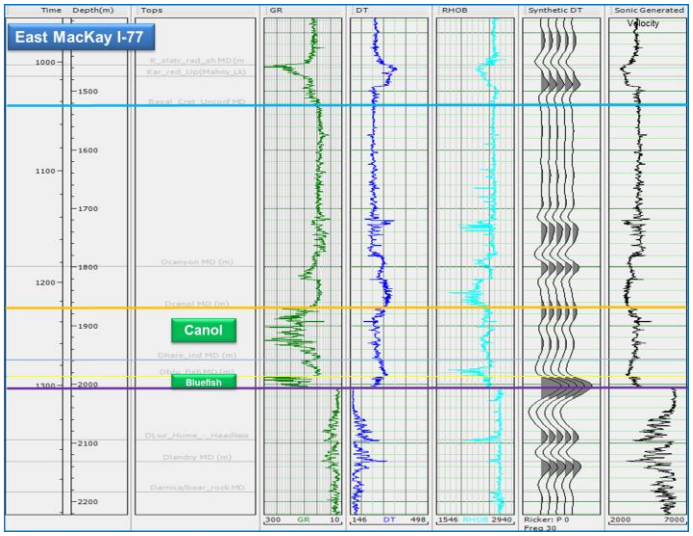

Figure 1. Log characteristics and synthetic seismogram for East MacKey 1-77, CMV.

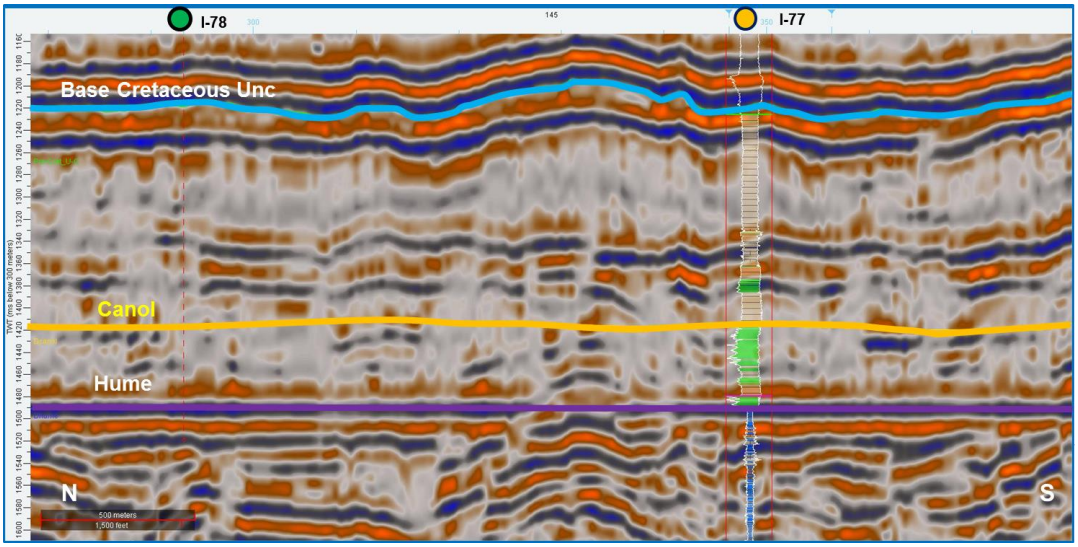

Figure 2. Seismic line flattened on Top Hume showing interpretation of Top Canol oil shale in CMV.