

# **The Fish Scales, a Hybrid Shale Gas Play – Characterization, Regional Extent and Controls on Productivity**

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## **Summary**

The Geological Atlas of the Western Canada Sedimentary Basin describes the Fish Scales Zone as a basin-wide marker that demonstrates the Albian/Cenomanian boundary (Lower/Upper Cretaceous) and which contains abundant fish remains within finely laminated, generally non-bioturbated, very fine sandstone and siltstone. Most geologists are familiar with its characteristic high gamma ray and resistivity deflection but only in the last few years has the zone been recognized as a commercial gas reservoir. The Fish Scales Zone has a complex and variable mineralogy, complicating log interpretations. However, detailed geological, mineralogical and geochemical as well as modern log data have allowed elucidation of the main controls on its productivity. The variable nature of these unconventional play types should be considered as a characteristic.

## **Introduction**

The Upper Cretaceous rocks in the Plains and Foothills of the Western Canada Sedimentary Basin record essentially uninterrupted deposition through the epoch. They grade from marine shale at the base to continental sandstone at the top, the rocks deposited in a broad, slowly-subsiding epeiric seaway, flanked on the west by the ancestral cordillera and on the east by a low Precambrian shield area. The Fish Scale sandstone marker horizon is taken at the base of the Fish Scales zone where the sandstone is better developed and contains abundant, easily recognized fish scales.

The Fish Scales Formation is less than 20 meters thick and consists of mudstone to claystone with associated sandstone and conglomerate beds. Bioturbation is sparse to absent and TOC abundances are variable up to 8 weight percent and comprises a mixture of Types II and III. The log responses in the Fish Scales Formation are variable reflecting a heterogeneous lithology that includes numerous bentonites, variable organic matter content, the presence of well-developed Barons Sandstone lenses in southwestern Alberta and bioclastic debris beds composed largely of phosphatic skeletal remains in south and central Alberta. In south and central Alberta the conventional net pay ranges from 0.5 to 8 meters with core porosity up to 21% and permeability up

to 150 milliDarcies. The sandstones have been described as the proximal facies of an upward coarsening/shoaling parasequence. They are finely bedded quartz siltstone to medium grained sandstone, wave-rippled, finely interbedded with shales and normally non-calcareous.

Oil and Gas production from the Barons sandstone in southwestern Alberta has been well known and exploited trend, but more recently gas has been found in the radioactive sandstones of the Fish Scales zone in southern and central Alberta.

## **Method**

Initially, sonic and density data was averaged in shales over the basin to identify a corridor where the zone was in the correct facies and where porosity was preserved. Thin section, x-ray diffraction and scanning electron microscope data was used to calibrate log data and derive mineral composition. The geologic work identified positive areas which were pattern drilled with cost and economics in mind.

EOG Resources Canada has completed hundreds of wells in the Base Fish zone as an independent production zone or co-mingled with other producing zones. Cross-sections, petrophysical evaluation plots and production histograms will be used to characterize the reservoir properties of the Fish Scales zone in the Wintering Hills, Bindloss and Chinook areas of Alberta.

## **Conclusions**

- The Base Fish Scales is widespread in the Western Canada Sedimentary Basin but it's reservoir potential is confined to specific areas.
- An integrated approach and multidisciplinary analysis is necessary to high grade producing areas.
- Production from the BFS zone varies widely between 2 and 244 Mcf/d and this variation should be viewed as a characteristic of unconventional play types.
- Innovative drilling and completion techniques, taking costs into account are necessary to unlock potential in the BFS economically.
- The BFS is best exploited as an add on production zone.

## **Acknowledgements**

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