Structures Generated from the Bearpaw Uplift and their Effect on Gas Accumulation in the Eagle Sandstone of North Central Montana

K.J. Arnold
Arnold Geoservices Inc., Calgary, Alberta

S.R. Alexander*
PanCanadian Energy, Calgary, Alberta
sean_alexander@pcenergy.com

J.J. Straka
Straka Energy Associates, Calgary, Alberta

and

B.A. Zaitlin
PanCanadian Energy, Calgary, Alberta

The Upper Cretaceous (Santonian) Eagle Fm. has an estimated 600 Bcf of biogenic gas in place in Blaine and Hill counties, north-central Montana. The Eagle is characterised by varying reservoir facies associated with coastal plain, proximal shoreface and distal lower shoreface environments. The gas is trapped by structures developed by the Bearpaw uplift.

Stacked marine shorefaces of the Eagle prograde eastward. The best reservoir is associated with the proximal shoreface facies that consist of amalgamated shoreface parasequences of 24-32% porosity and rates of .5–10 mmcf/day. They separate into 6 distal lower shoreface cycles. This reservoir has porosities of 15-19% and rates of .08-.5 mmcf/day. Mudstones, coals and tight sandstones of the coastal plain facies do not produce.

The emplacement of the volcanic Bearpaw intrusives during Eocene time uplifted the Eagle strata. The uplift triggered gravity sliding. The Eagle and its overlying strata slid downward off the uplift in thrust sheets. The sheets are separated by a series of radial shear faults. The friction associated with the sliding of these sheets caused the strata in places to buckle, randomly thrust or pop-up, depending on the competency of the depositional facies. Due to its more brittle nature the proximal shoreface facies is dominated by pop-ups. The various configurations of the fault blocks trap the biogenic gas.

High resolution 2D seismic provides an efficient way to map the reservoir compartments. 2D seismic is acquired perpendicular to the orientation of the structures, to establish the style of trapping, and the optimum updip drilling location.