Depth Conversion methodologies, uncertainty, quantification and application; Hebron Field, Offshore Newfoundland Canada

John D. Logel - Petro-Canada Oil and Gas
Craig Coulombe - Chevron Resources Canada
Stan Volk - ExxonMobil Canada

Introduction
The Hebron field is located 350 kilometers SSE of St. Johns, Newfoundland. The field has three pay zones and estimated 2 Billion Barrels in-place. The field has very subtle relief and some of the accumulations are very sensitive to velocity determination and depth conversion. The field was depth converted using two different methods to better quantify uncertainty, and because neither method could be proved to be superior to the other.

Methodology
Seismic time to depth conversion is a process to convert from recorded seismic travel times to depth. This process is carried out to determine drilling depth, reservoir understand and structural validity. The process is to build a detailed velocity model that is robust enough to allow for lateral and vertical variations, that ties the wells and does not induce anomalies or artifacts. The process can be done a number of different ways from very simply extrapolating time/depth tables from wells to pre-stack coherency inversion and tomography. The basic data can include strictly well data or a combination of well and seismic processing velocities. The difference being in the time and cost expenditure.

The methods used for the Hebron field mapping was to use a layercake based method that employed both a tied and smoothed stacking velocity based model and a well based method that would account for the instantaneous change of velocity as a function of depth. This change is expressed as an acceleration value (k) and surface intercept of (V0).

Quantifying errors
The use of two equal and "valid" velocity models continued to be a source of uncertainty and question. The differences were small, as shown in the difference map in Figure 1. But in some accumulations, accounted for over 100 million barrels. To try and resolve the problem and converge on a single model, other source of data were incorporated. These included average and interval velocity mapping, cross-validation with well control, fault seal and juxtaposition analysis, hydrocarbon contact correlation and pre-stack depth tomography.

Conclusion
These methods were integrated together in an overall velocity model building and used independently and in combination to try and encompass a wider range of gross-rock-volume (GRV) uncertainty.

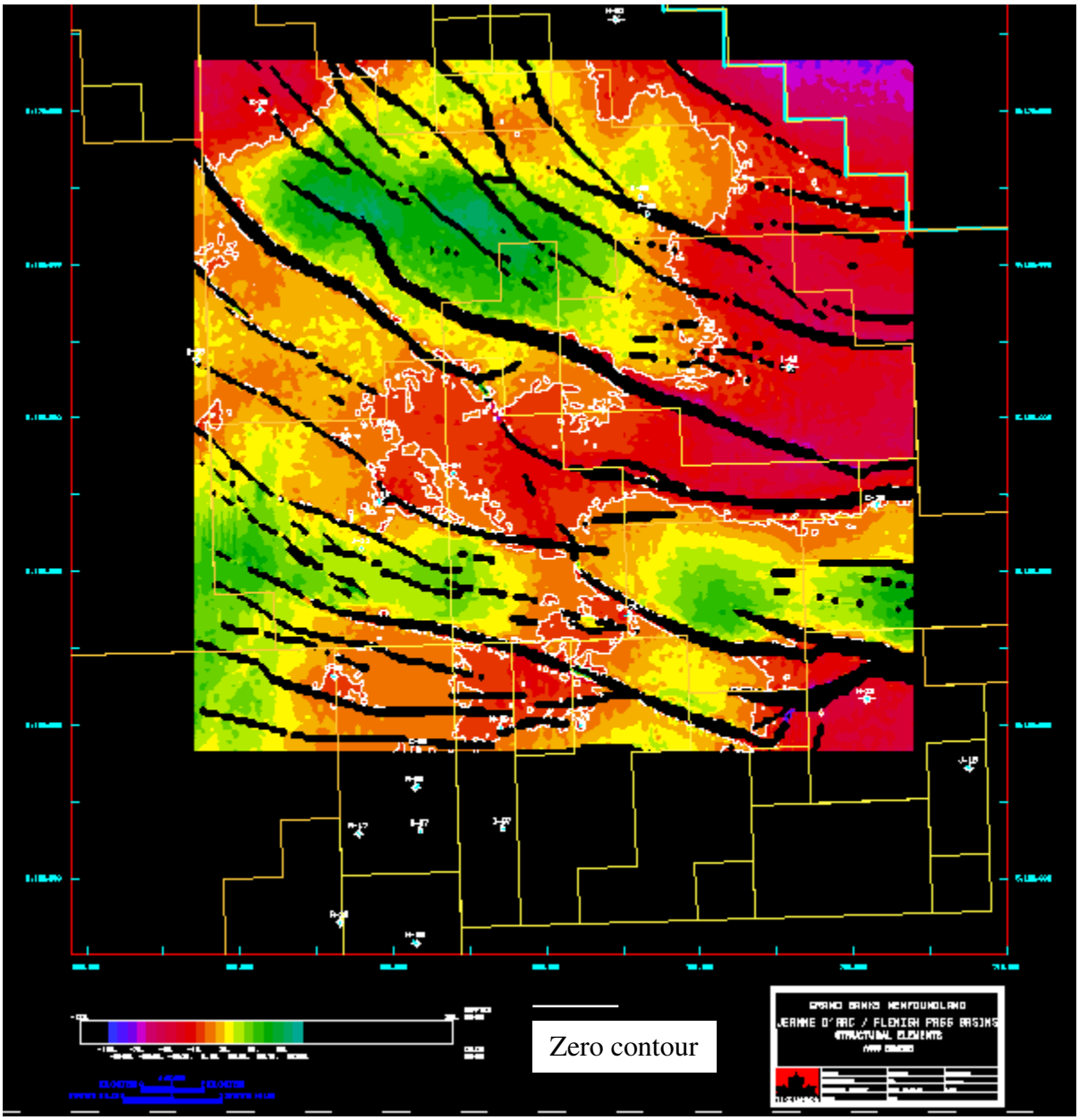

Figure 1. Difference map between Stacking velocity based model and Instananeous Velocity Model