

Highlighting seismic interpretation pitfalls using a zero-offset model in complex geologic settings.

Francois Tremblay, OMV Group

Victor Sarmiento Ibanez, OMV Group

Summary

We present a case study of two 2 drill opportunities on a complex structure with low-resolution seismic data. In our case study, fault-like patterns seen throughout the dataset are believed to be imaging effects caused by the lack of resolution and interference between the layers. Understanding whether faults exist is key in designing the trajectories of 2 upcoming well and for an effective reservoir characterization effort. We set out to build a zero-offset synthetic seismic model created from a line through the 2 opportunities. Offset wells are used to derive compaction effects and generate velocity and density logs for shales, brine-sands and gas-sands. Impedance logs and various wavelets are convolved to create several synthetic models.

We adapt our geologic model to attempt to simulate fault-like patterns across the structure. We can generate fault-like patterns by changing bed thicknesses, spacing, overall bounding sequences and the fluid content. This could suggest that the faults previously interpreted on the dataset could simply be discontinuities caused by the imaging, rather than fault offsets.

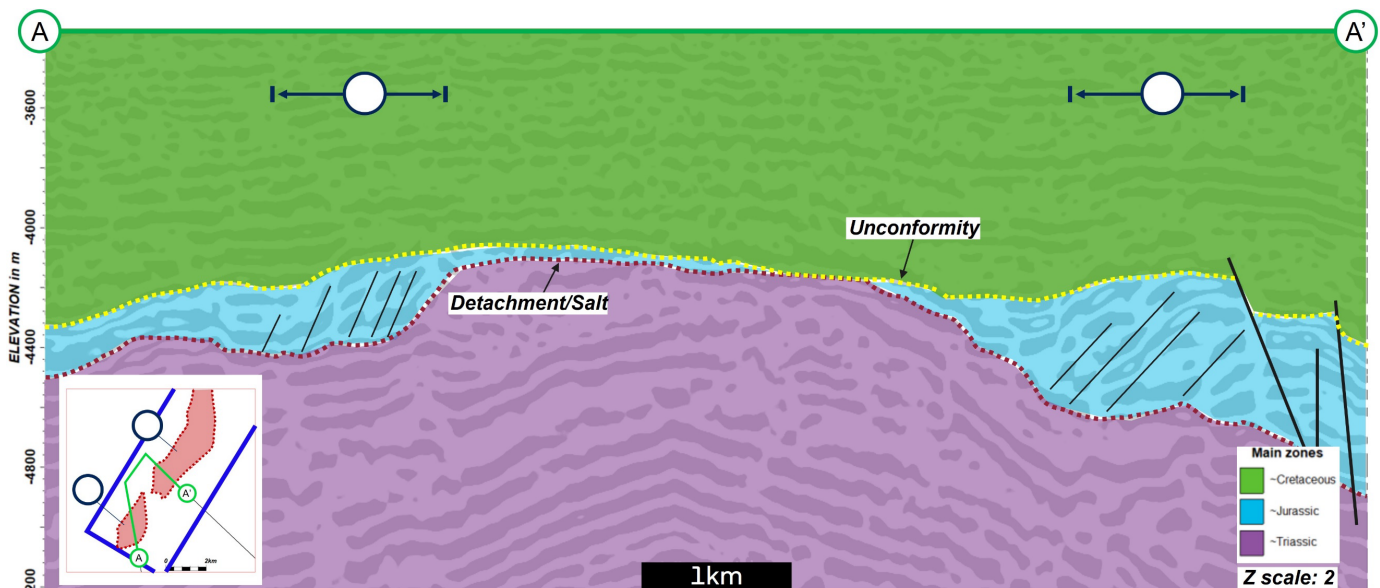
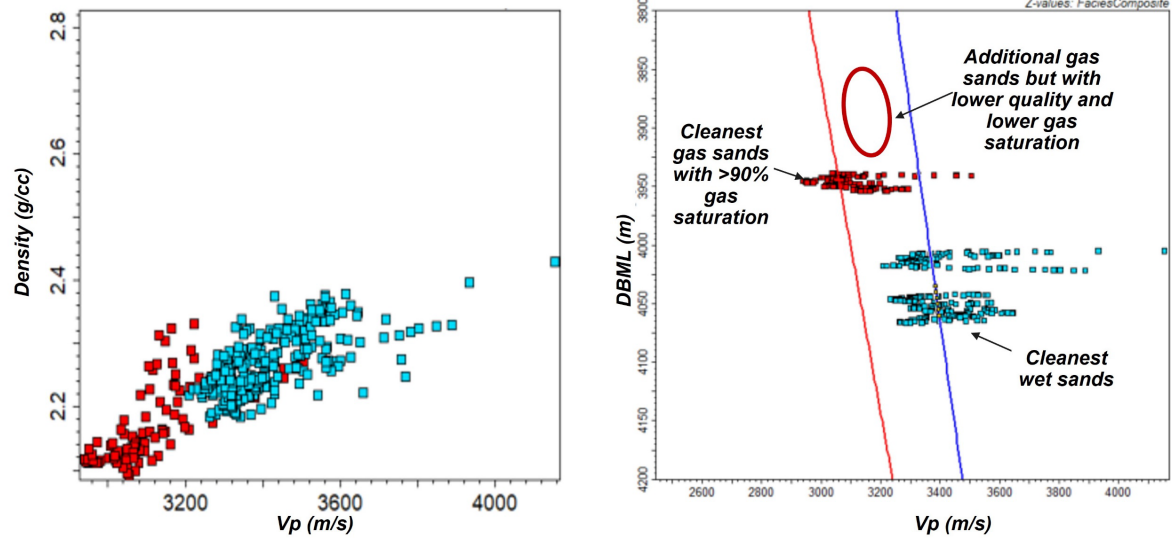


Figure 1: Cross-section through a structural high used to create a zero-offset synthetic seismic model. The Middle Jurassic target reservoir is located between a prominent detachment (~top Triassic) and a regional unconformity (Base Cretaceous).



18

Figure 2: Compressional velocity plotted against density (left) and depth below mudline (right). Both plots highlight a strong delineation between the brine sands (blue) and gas sands (red). Regional trends and this data are used to create trend lines of shales, gas sands and brine sands (such as the red and blue lines displayed).

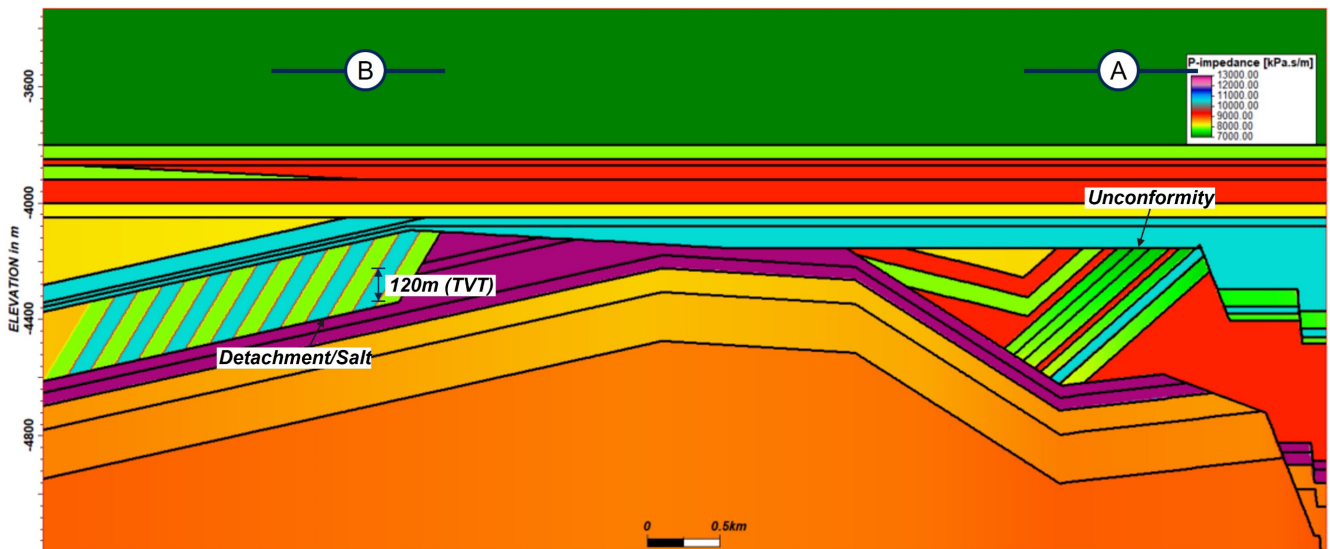


Figure 3: Base case block model of impedance created from the section in figure 1. Structure B is simplified in this model: it consists of alternating layers of sands (lower impedance, green colour) and shales (higher impedance, blue colour). The lower boundary under both structures consists of a high impedance salt layer (purple) acting as a detachment.

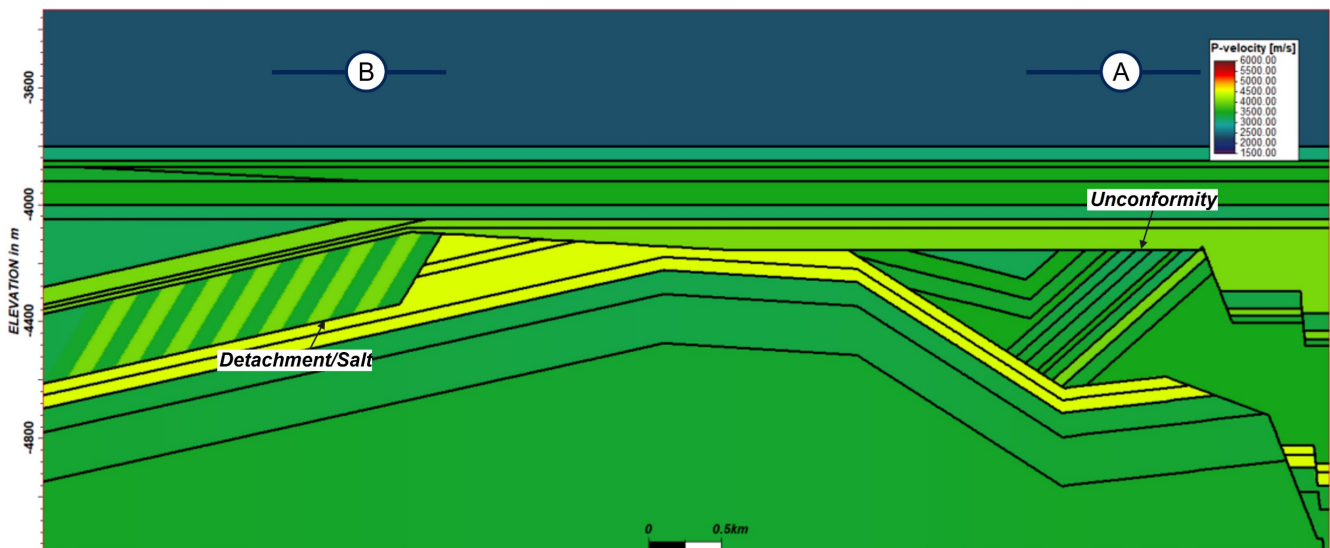


Figure 4: Base case block model of compressional velocity created from the section in figure 1. Structure B is simplified in this model: it consists of alternating layers of sands (lower velocity, green colour) and shales (higher velocity, blue colour). The lower boundary under both structures consists of a high velocity salt layer (purple) acting as a detachment.

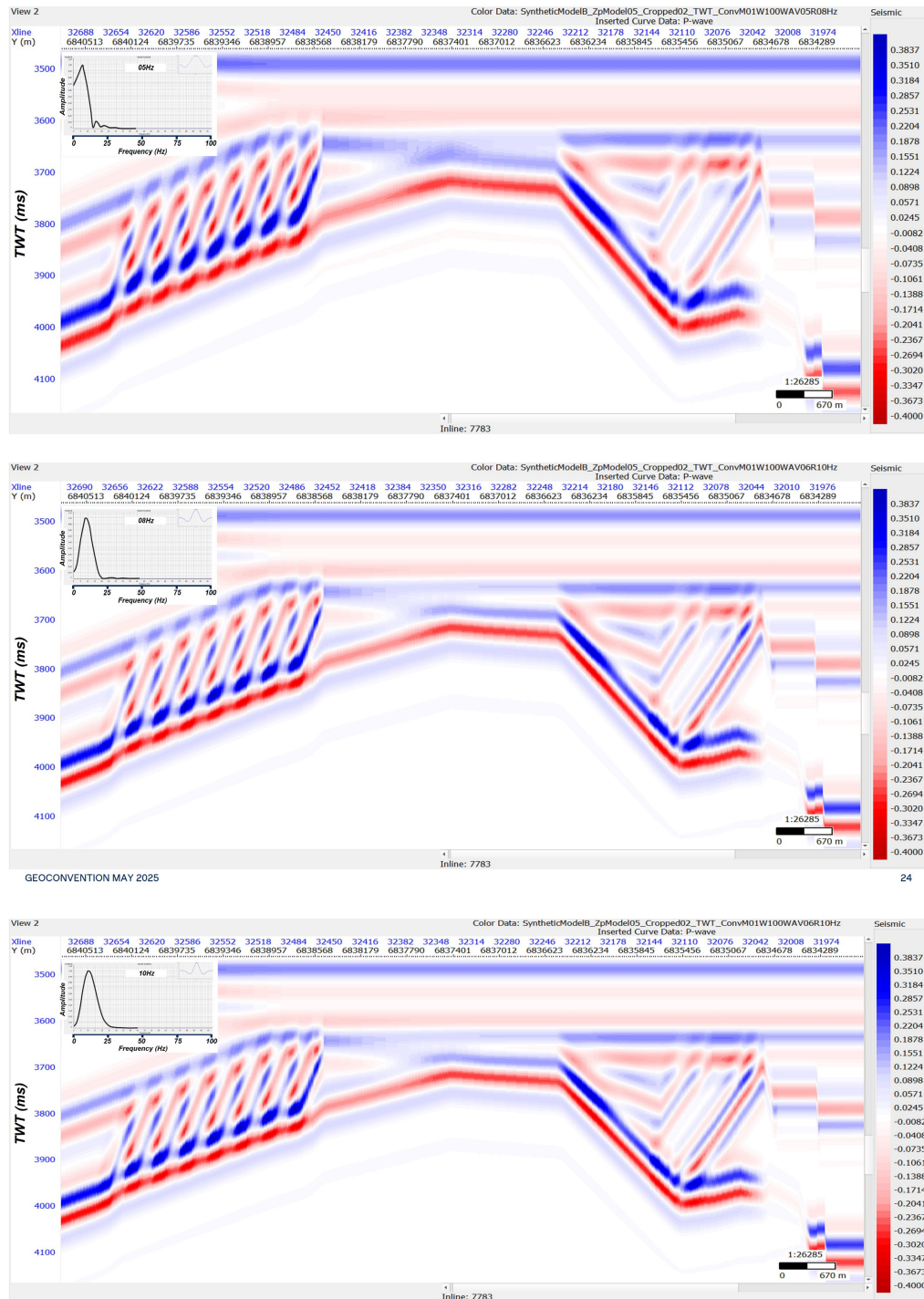


Figure 5: Synthetic model generated from the geologic model from figures 3 & 4 and Ricker wavelets with dominant frequencies of 5Hz (upper), 8Hz (middle) and 10Hz (lower).

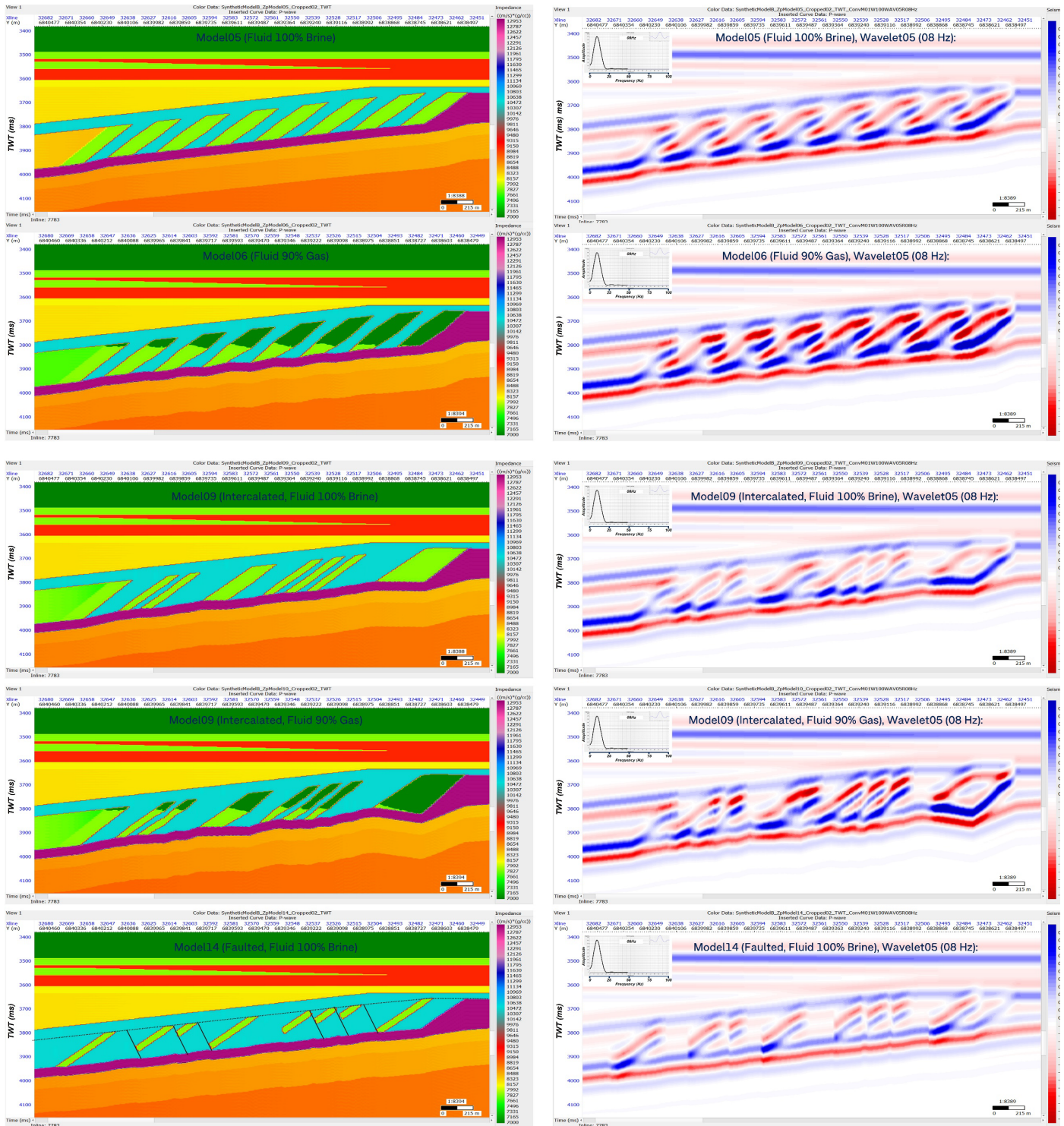


Figure 6: Zoomed-in sections of structure B: five different impedance models (left column) and their synthetic models constructed with an 8Hz Ricker wavelet (right column). The original base case model from figures 4 & 5 are shown in the first row. It is seen that fault-like patterns can be created by modifying the layer properties and ultimately tuning and interference.