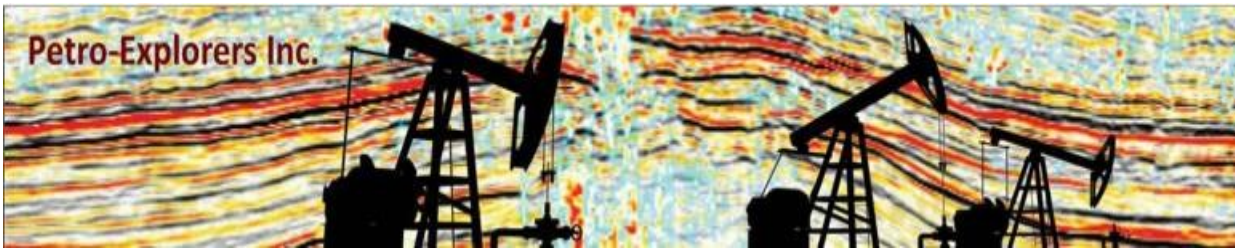


PETROEXPLORERS

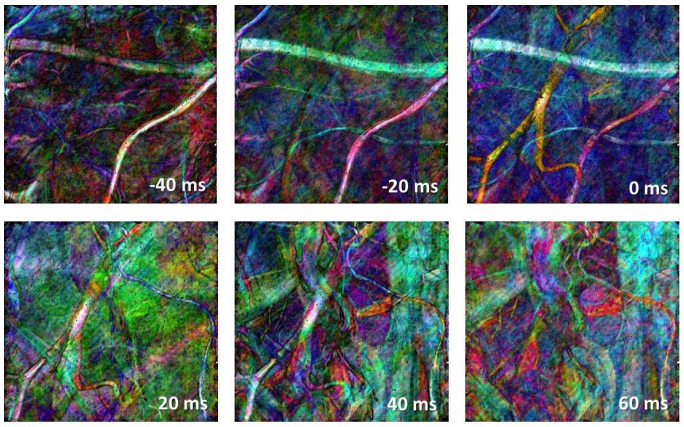
Seismic Geomorphology

The goal of Seismic Geomorphology is to delineate structural, stratigraphic, and tectonic framework of a block or a permit using seismic data available

Spectral Decomposition

Spectral decomposition of seismic amplitude data has proven to be a powerful tool for tasks such as mapping channels, submarine fans, and other sedimentary features to reveal hidden geological features from seismic data. In the spectral decomposition process, a seismic amplitude trace is decomposed into time-varying, localized frequency information. Partyka et al. (1999) observe that lateral instability in rock mass will cause instability in the phase attribute, and thus, phase will respond to lateral discontinuities. Because of this, phase should thus improve the interpretation of heterogeneities in channel fill and rock type in fluvial-deltaic system from where much of the world's conventional oil and gas production comes from.

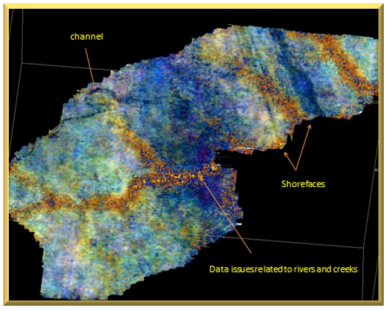
Example of fluvial-deltaic channels identified with the help of



spectral decomposition (40, 60 and 80 Hz) applied for Carbonera formation, Llanos basin, Colombia.(In: Use of Seismic Geomorphology to Re-define Mature Fields: Application of Spectral Decomposition and Neural Networks to 3D Examples from Canada and Colombia. Azer Mustaqeem and Valentina Baranova, AAPG ICE 2013, Cartagena, Colombia)

As there are not many wells in the area and there is none on the 3D, as it is the case for many frontier areas, it is very difficult to differentiate true amplitude response from thin bed tuning. Spectral Decomposition is a process where the data is divided into three spectral bands, low, medium and high. These three bands are than co-visualized to see if the edge responses differ on each stack.

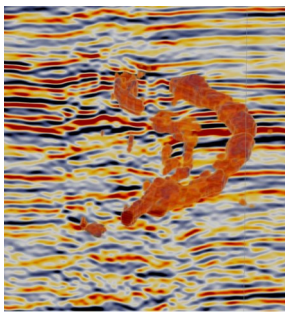
Results of spectral decomposition applied on Cardium shoreface sands in Alberta (Data courtesy of Pulse Seismic)



Example of RGB blended cube with 30, 40, and 60 Hz frequency (Cardium Fm, Western Canada Sedimentary Basin) shows some variation in main sand separating the effects of the lithologies above and below the target tight sands.

Geobody Detection

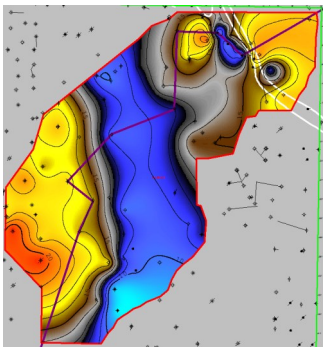
Post-stack attributes, facies maps, and inversion results will be used simultaneously to detect reservoir geobodies. The visualization will also equip integrated platform ability to create hybrid attributes supervised by the areas of higher prospectivity. Integration of qualitative and quantitative interpretation adds higher confidence in future drilling and reservoir development. Below is one of the examples of geobodies detection project.

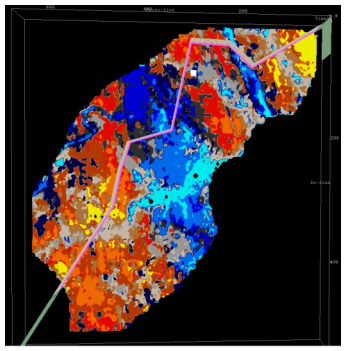


Seismic Facies Analysis

Seismic Facies Analysis is an interval based derivation to quickly reveal the geological facies from seismic data. The Unsupervised Neural Network is first trained on a representative set of input vectors (attributes extracted at different locations) to find the cluster centres. Each cluster centres is then represented by a vector. Before the Network is saved the algorithm sorts the cluster centre vectors on similarity. This has the advantage that in the application phase colours are distributed smoothly over the cluster centres resulting in smoother images which are easier to interpret. In the application phase each seismic input vector is compared to all cluster centre vectors yielding two possible outputs: Segment and Match. Segment is the index of the winning cluster centre. Match is a measure of confidence between 0 (no confidence) and 1 (input vector and winning cluster vector are identical).

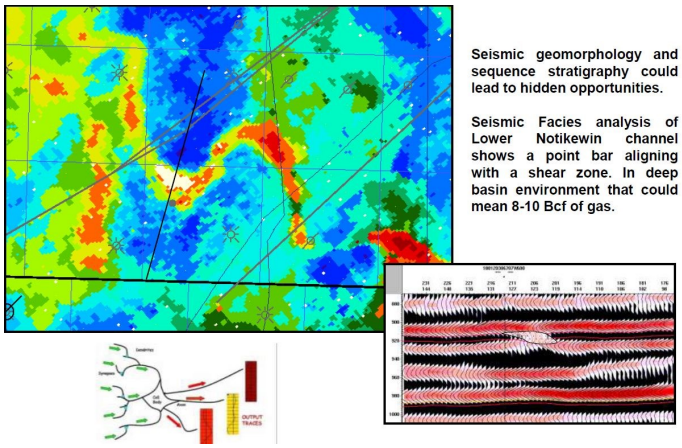
The Unsupervised Waveform Segmentation approach reveals areas with similar seismic responses and is used extensively as an easy-to-use and quick interpretation tool. For the method to be successful one needs a good reference horizon to work from and preferably a layer-cake setting. Furthermore, it should be realized that due to convolution effects the results are influenced by variations in the over- burden and the zones below the area of interest. Variations on the waveform segmentation theme are possible. For example, clustering waveforms from near, mid- and far-stacks incorporates AVO effects.





The Isopachs of Kakwa member shows a major change of thickness in the project area (left). However, the seismic facies (right) closely corresponds to the thickness and reveals many other facies variations.

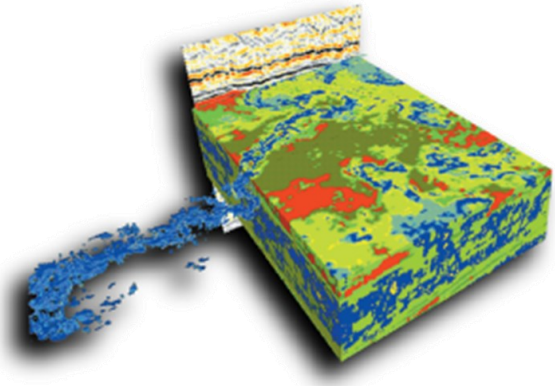
In: Unravelling Cardium Tight Sand Paleo-depositional Trends and Subtle Structural Features using Seismic Reservoir Characterization, by Valentina Baranova, Azer Mustaqeem, Elvis Floreani, Mike Gervais and Brendan Smith, poster Geoconvention 2011, Calgary.



Seismic geomorphology and sequence stratigraphy could lead to hidden opportunities.

Seismic Facies analysis of Lower Notikewin channel shows a point bar aligning with a shear zone. In deep basin environment that could mean 8-10 Bcf of gas.

Seismic Volume Facies Analysis 3D



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