

# Interpreting Band-limited Elastic ( $I_p$ , $I_s$ ) Volumes from Pre-Stack Seismic Inversion

Rafael R. Sanguinetti\*

Consulting Geophysicist, Calgary, Alberta

rsanguin@shaw.ca

## Summary

Pre-stack inversion is often used when post-stack inversion fails to sufficiently differentiate geologic features with similar P-impedance signatures. Simultaneous (Pre-stack, or AVO) inversion solves for S-impedance and density in addition to P-impedance. While many geologic features can express similar P-impedance characteristics, few will share combined P-impedance and S-impedance traits, allowing improved separation and interpretability. This helps improve discrimination between lithology, porosity and fluid effects.

Band-limited elastic ( $I_p$ ,  $I_s$ , and Density) volumes are delivered to the clients as part of the final products in a regular seismic inversion project, particularly those involved with pre-stack or AVO inversion. Once these volumes are loaded into interpretation systems, the main use of them is to help in the description of faults and horizons: usually, these volumes offer a suitable vertical resolution for doing suitable structural interpretation. It is known, however, these band-limited impedance volumes reveal relative changes of impedances between a layer of rock and the layers in its vicinity depending on the frequency content of the input seismic data. Also, these could reveal other characteristics as sand deposit geometry, size and shape of reservoir rock, and/or any other fluid property.

Methodology includes elastic property crossplotting, geobody capturing, and attribute extraction maps, for a known reservoir interval. After loading these data sets, elastic well logs (P-imp, S-imp, and density), filtered to the seismic resolution, will be used to identify the reservoir interval: these well logs will be crossplotted in order to define elastic behavior of this interval and to capture possible geobodies or geofeatures into this specific interval. After that, possible geobodies will be captured and mapped overlapping attribute extraction maps from these band-limited elastic volumes.

It is expected that results from filtered well logs and band-limited volumes are related to the characterization of reservoir rock in terms of geometry and extension, better discrimination between facies, and/or any other parameter as rock quality or lithology distribution.

## Acknowledgements

Thanks to Fugro-Jason Mexico for providing software and data set for this test.

## References

- Cerney, B., and Bartel, D., 2007, Uncertainties in low-frequency acoustic impedance models, *The Leading Edge*, 26, p. 74-87
- Connolly, P., 1999, Elastic impedance, *The Leading Edge*, 18, p. 438-452
- Latimer, R., Davison, R., and Van Riel, P., 2000, An Interpreter's Guide to Understanding and Working with Seismic-Derived Acoustic Impedance Data, *The Leading Edge*, 19, p. 242.
- Pendrel, J., 2006, *The New Reservoir Characterization*, Recorder, p. 105-109
- Pendrel, J. and Van Riel, P., 1997, *Methodology for Seismic Inversion: A Western Canadian Reef Example*.