# Seismic facies differentiation using a multi-variate process of the Early Jurassic, Browse Basin, North West Shelf, Australia.

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## Summary

Basins undergoing extensional tectonics often contain igneous intrusions, on reflection seismic data these high amplitude features can resemble gas filled sandstones. This presentation will introduce a workflow based on multi-variate process to differentiate these high amplitude features and associated clastic litho-facies to better predict depositional facies distribution and their geometries. This study is centered on Jurassic aged fluvial sandstone gas reservoirs of the Browse Basin, Northwest Shelf Australia.

## Methods

The link between specific post-stack seismic attributes and lithology has been explored by Radovich and Oliveros (1998) and Hart (2008), primarily examining the ability to differentiate sands and shales using iterations on the Instantaneous attributes (Taner 1979). This work is aimed at understanding if these attribute concepts can be advanced further using purpose-built software, datamining concepts and further geologic data integration. Understanding the non-uniqueness of un-inverted PSTM data, non-quantitative interpretation focused on facies geometries, extents and patterns is the end-goal of the workflow. Via comparison of lithologies at the wellbore, this workflow identifies unique clustering patterns on PSTM attribute cross-plots and creates seismic facies classes which can be propagated through a stratigraphic interval for horizon-based interpretation. To build the framework of the project, structural analysis followed by well ties and horizon mapping of the early to Middle Jurassic was performed. 32-bit PSTM data along with pre-stack offset volumes shot in 2010 along with comprehensive log and core data from six ConocoPhillips wells drilled from 2009 to 2014 form the dataset for this project. QIPro by Sound QI was used to data mine and build the process that selects the appropriate attributes for each case. OpendTect was used to interpret the seismic data and for attribute generation.

## Results

Techniques derived in the research demonstrate that facies prediction driven by p-wave attribute relationships derived at the wellbore can provide qualitative maps valuable in building geological models in early stages of exploration and development. Gas-sands and volcanoclastic facies can be differentiated within a stratigraphic window where attribute character remains tuned. See figure 1, a map displaying interpreted seismic facies on a horizon 10ms below the top of the reservoir sand at Kronos-1. Volcanic lithologies and gas sands can be differentiated and mapped effectively using the technique as well as low and high porosity gas sands. This work has expanded the potential application of the lithology/attribute relationships identified in the "Sweetness" attribute by outlining in detail how to fine-tune attribute calculations and integrate a comprehensive geological dataset into the process. Instantaneous attributes derived from angle stack volumes can provide unique data required to differentiate lithologies in certain cases. The scale of area being investigated inversely correlates to the non-uniqueness observed in the seismic lithofacies. In the fault blocks studied, no fluid contacts were observed, allowing significant source of non-uniqueness to be isolated.

## Conclusions

This workflow has evolved the ability to differentiate lithologies in the subsurface in the context of non-quantitative interpretation, further work involving AVO attributes could provide the ability to incorporate fluid variation into the process.

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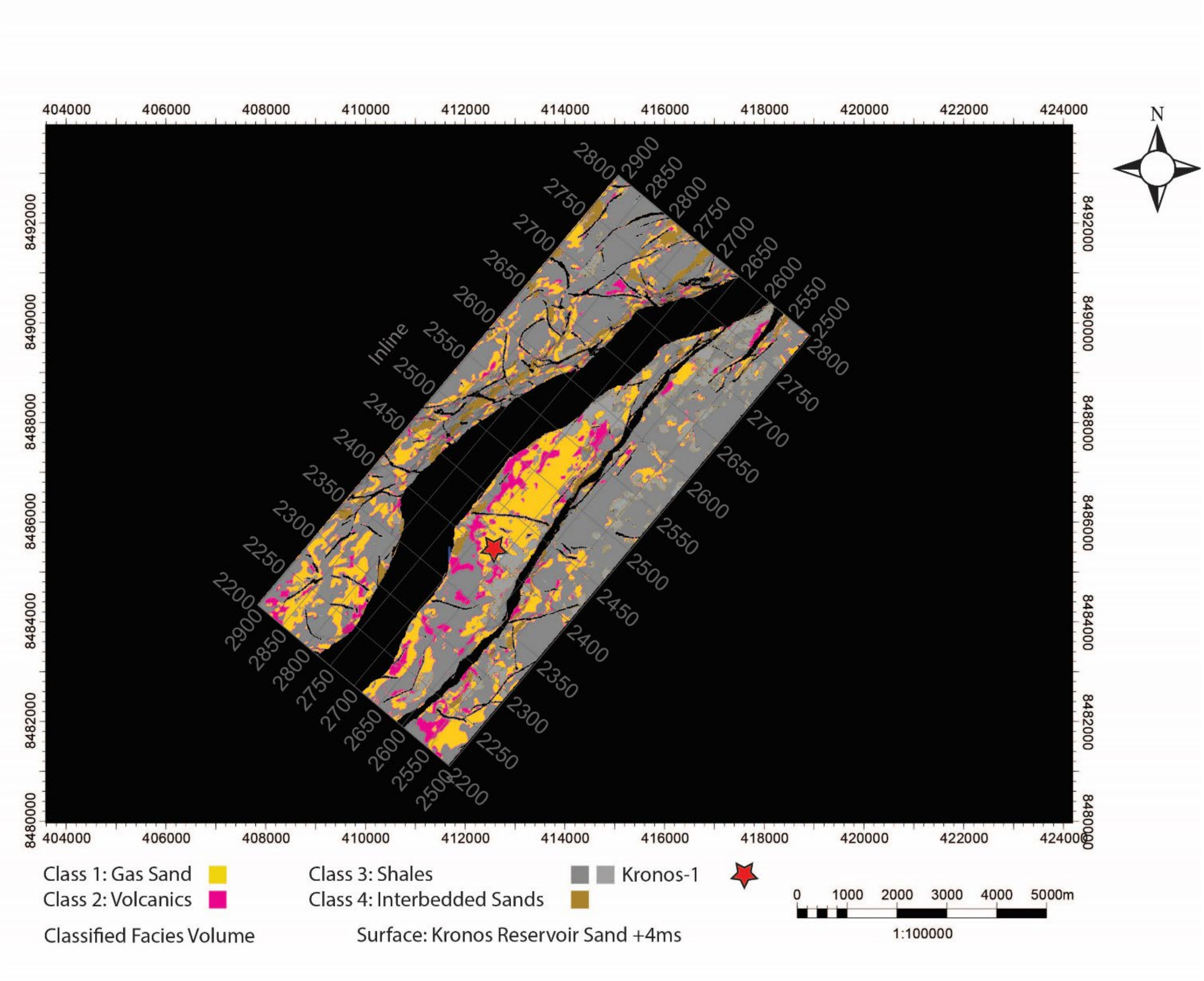


*Figure 1- Horizon map at +4ms below the top of the Reservoir Sand interval with seismic facies classes displayed illustrating the potential distribution of Gas Sand around at Kronos-1.*

## References

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