

Sub-segmentation Waveform Analysis Integrated with Well Control: Case History Onshore Canning Basin (Bunda 3D Seismic Survey)

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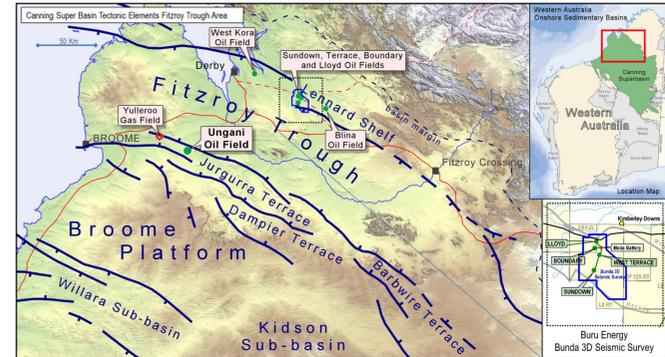
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Introduction

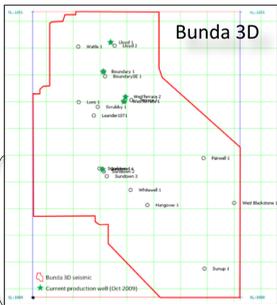
Buru Energy acquired the Bunda 3D seismic survey in 2009, providing coverage over a number of producing fields located on the Lennard shelf in the onshore portion of the Canning Basin. Global pre-interpretation processing (Seisnetics™) was applied to the data automatically extracting all peak and trough surfaces enabling the rapid review of the volume.

Both automated and user guided segmentation of the seismic waveform were utilised to create seismic facies maps. The transitions between different depositional and stratigraphic regimes at selected surfaces were analysed from these seismic facies maps.

With correlation to synthetic seismograms generated from the well log database, surfaces associated with production, hydrocarbon shows and recoveries along with unconformities and reservoir seal pairs were quickly targeted. Moreover, formational and intra-formational geometries are revealed through the examination of multiple surfaces from the visual database of GeoPopulations™.

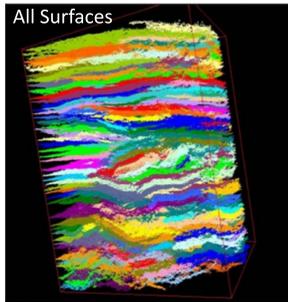


Methodology



3D Seismic Database (post stack)

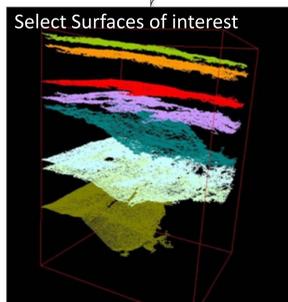
Seisnetics™: Fully Automated segmentation process inspired by the Human Genome Project creates a visual database containing virtually all Peak and Trough surfaces. Each surface consisting of a population of genetically related waveforms.



Workflow commenced with an automated and unbiased pre-interpretation of the Seismic Volume extracting all peak and trough surfaces into a 3D visual database. The review of this database based on a range of criteria yields surfaces selected for integration, correlation and calibration with information from the geological database.

This approach helps to develop a geological model based on a review of all of the available data rather than just a small subset.

Review Visual Database of Pre-Interpretation surfaces for GeoPopulations™ of interest, using TWT, Amplitude and Fitness attributes.

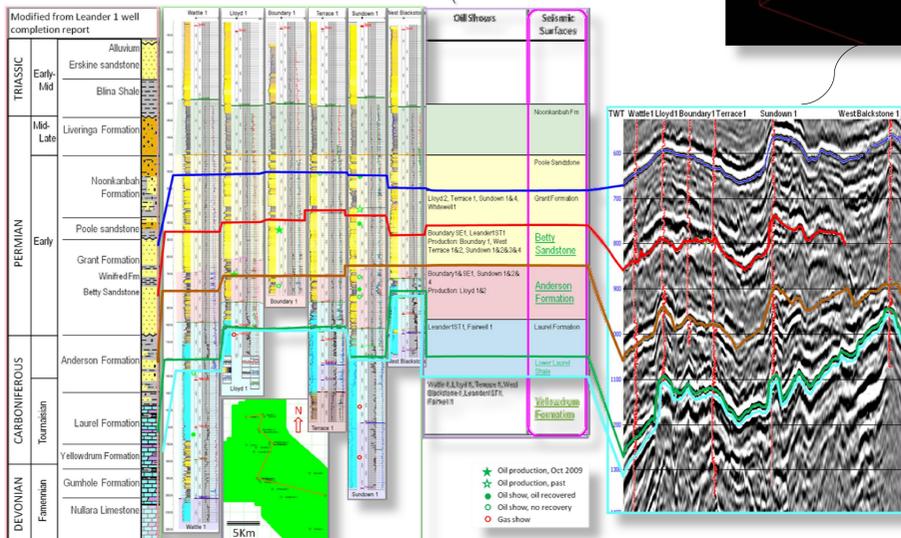
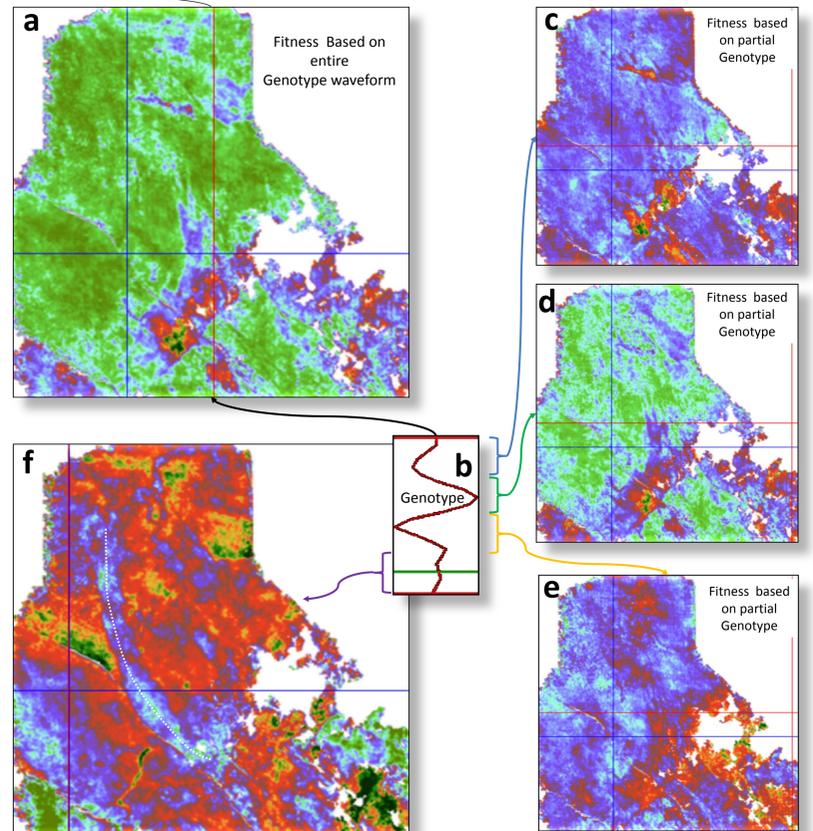


Application to Bunda 3D Seismic

Review Genetic variability within population (Seisnetics™) & Sub Segmentation for Seismic Facies Mapping

★ Application example: Top Grant Formation

Full Segment and Sub-Segment Fitness maps from the Top Grant Formation are shown below. (a) shows a map of the full waveform Fitness. The map displays the genetic similarity between each individual (trace) in the population and the common waveform (Genotype) shown at (b); Images (c), (d) and (e) show the sub-segment Fitness (Genotype Sequencing) recalculated over different portions of the waveform; Image (e) shows the sub-segment Fitness from the lower portion of the waveform revealing significantly different features (dashed white line, compared to the other Fitness maps).



Stratigraphic column depicting Devonian through to Triassic sedimentary units, correlated to well data and an arbitrary seismic line through the Bunda 3D. The figure highlights the seismic expression of major reservoir units and the location of some oil and gas production zones.

Conclusions & Further Development

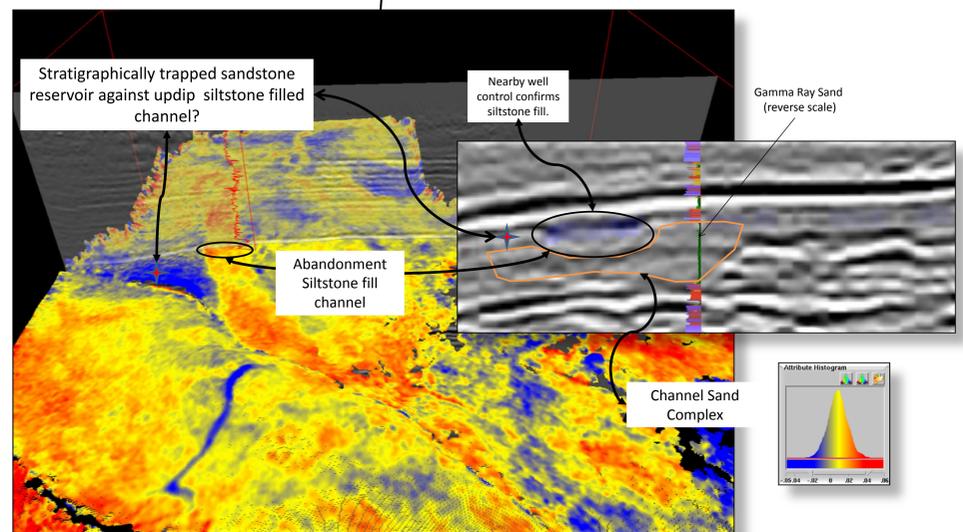
Comparison of waveform and sub-waveform variability to the associated common waveform (Genotype) contained in each surface (GeoPopulation™) reveals insights about structure, stratigraphy and provides an indication about the suitability of the data for certain types of attribute analysis. This technique integrated with geology and other seismic attributes, enable the interpreter to discover different depositional domains captured within a single seismic waveform. Channelling in the uppermost portion of the Grant Formation presents opportunity for structurally enhanced stratigraphic trapping, a pathway for migration into younger reservoirs (e.g. Poole) and has implications regarding the effectiveness of the Top Grant regional seal.

While the methodologies described are helping Buru Energy develop data driven geo-models based upon a review of certainly much more data, we expect ongoing refinement of the process is required before the Canning basin reveals all her secrets!

If you have questions or would like to see how we are extending this process by automatically applying surface analysis and data mining techniques to hundreds of these automatically extracted surfaces, please visit the Total Depth Pty Ltd booth (20) at this conference.

Acknowledgement

The authors wish to acknowledge Seisnetics Pty Ltd for the application of their technologies. We would also like to thank Buru Energy for permission to show these results.



Any of the other Geo-Populations™ (surfaces) automatically identified during the automated pre-interpretation processing can be analysed in this manner. This enables new fitness maps to be created which helps identify features which lead to the Eureka Moment.