Seismic Imaging Of Sandbox Models

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Introduction

Analogue sandbox models provide cheap, concise data and allow the evolution of geological structures to be observed. Seismic physical modelling is used to study the effects of seismic wave propagation and to improve methods of data acquisition, processing and interpretation. By combining these two independent modelling techniques, the potential exists to expand the benefits of each method. For seismic physical modelling, the data collected contains realistic natural variations that cannot be built into conventional solid models, while the cost and construction time is significantly reduced. For sandbox modelling, the ability to record 3-D seismic images before the model is manually sectioned for conventional 2-D structural interpretation allows far more detailed study of subtle 3-D structures than previously possible.

Previous attempts to use unconsolidated sands for seismic physical models have been unsuccessful due to the lack of control or understanding of the natural variations that occur throughout the models. This research has overcome many of the drawbacks and indications are that in the near future it will be possible to record 3-D seismic images from all forms of analogue sandbox models. However, over and above the original aims of this research, the successful recording of seismic reflections within unconsolidated sands presents an opportunity to dramatically expand the role of seismic physical modelling.

Time-lapse 3-D Seismic

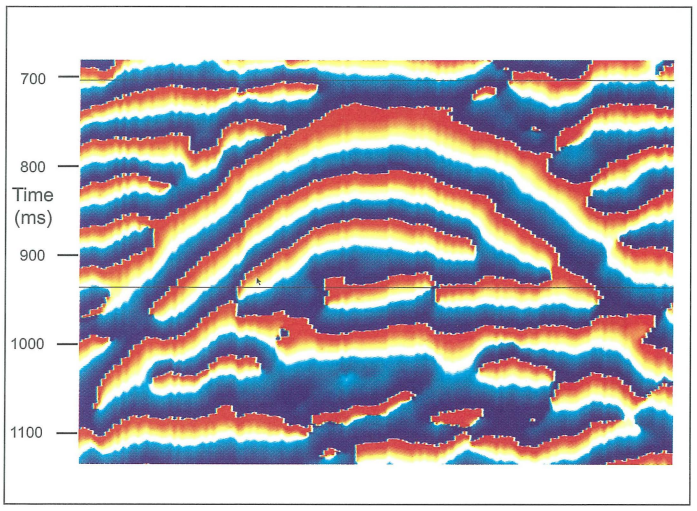
The use of sands in seismic physical modelling allows fluids to be incorporated into the models for the first time, providing a much more realistic analogue of hydrocarbon reservoirs. The computer controlled modelling system allows perfect acquisition repeatability which makes it an ideal environment to study the time variant aspects of reservoirs that occur with production. Time-lapse 3-D (or 4-D) seismic is becoming increasingly important in the management of hydrocarbon production yet there is a distinct lack of model data to support some of the fundamental conclusions being made. Subtle anomalies on difference sections may in fact be artefacts of the different acquisition footprints or manufactured from the complex data processing that is necessary to allow comparison of legacy data sets.

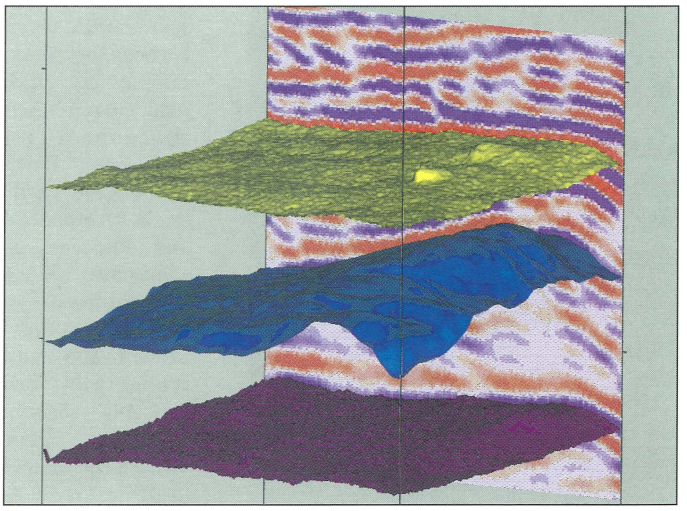
The ability to perfectly repeat the data acquisition on sandbox models bypasses these problems such that any anomalies seen on the difference sections can be directly attributed to changes that have occurred within the model. The development of 4-D seismic physical models will also provide a number of other advantages which are:

1. Inexpensive, real seismic data.
2. The absence of complications from seasonal or climate factors.
3. Rapid data turn around in a matter of days, rather than having to revisit an area years later.
4. Potential to control the variations that occur within the model and compare the seismic interpretations against the known changes.

Biography

Don Sherlock graduated from the University of WA in 1995 with a first class honours degree in geology. Since graduation he has been employed part time at Curtin University as manager of the Physical Modelling Laboratory while working on a PhD in geophysics. He is a student member of PESA, ASEG, SEG, and the AAPG.





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