Time-lapse 3D Seismic Physical Modelling

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Time-lapse 3D (TL3D) seismic techniques are currently being developed to map hydrocarbon reserves within producing reservoirs in an endeavour to monitor hydrocarbon flow for their improved efficient recovery.

TL3D seismic methods are not only applicable to reservoir management but also have the potential to monitor groundwater and contaminant flow within shallow acquifers. Unfortunately, fluid flow effects are not fully understood, as changes in temperature, pressure and fluid types, as well as data acquisition and processing, all contribute toward the TL3D seismic response.

The controlled temperature and pressure conditions, along with the high level of acquisition repeatability attainable using seismic physical models, offer the opportunity to determine direct relationships amongst each of these individual parameters and the TL3D response. These relationships can then be applied in reservoir management to effectively separate each unique response from the combined response for the improved imaging of hydrocarbon flow.

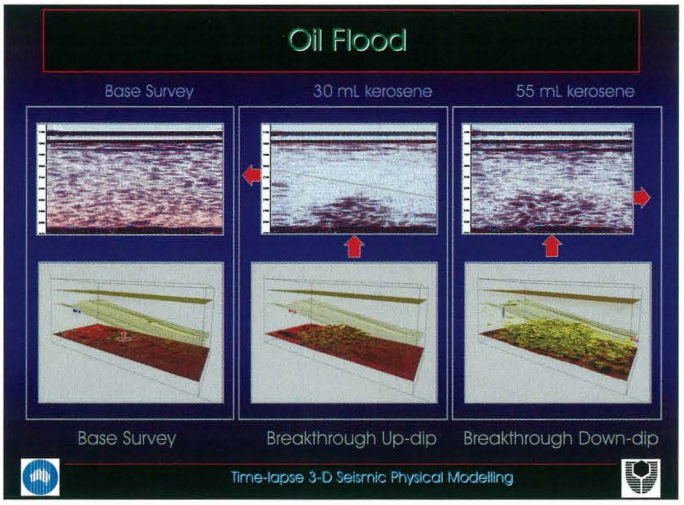

Fig. 1.

Current research has developed the capability to detect stratigraphic reflections from variable layers of water-saturated unconsolidated sand, as well as reflections from contrasting pore fluids. This technology has now been applied to develop qualitative and quantitative relationships between the TL3D response and changes in fluid saturation and effective pressure.

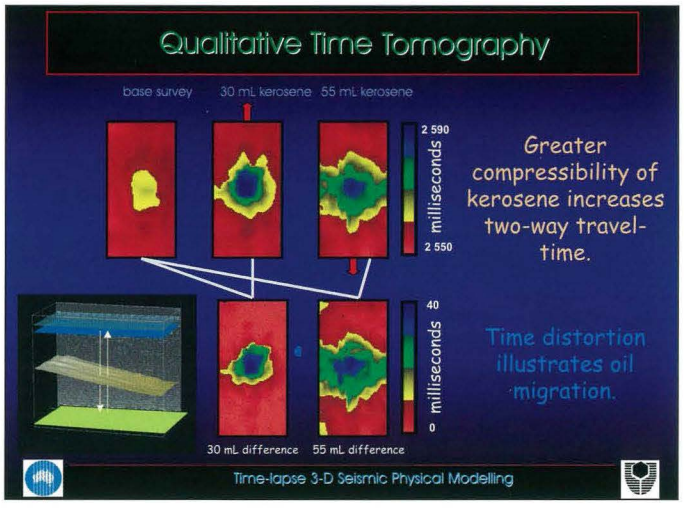

Fig. 2.

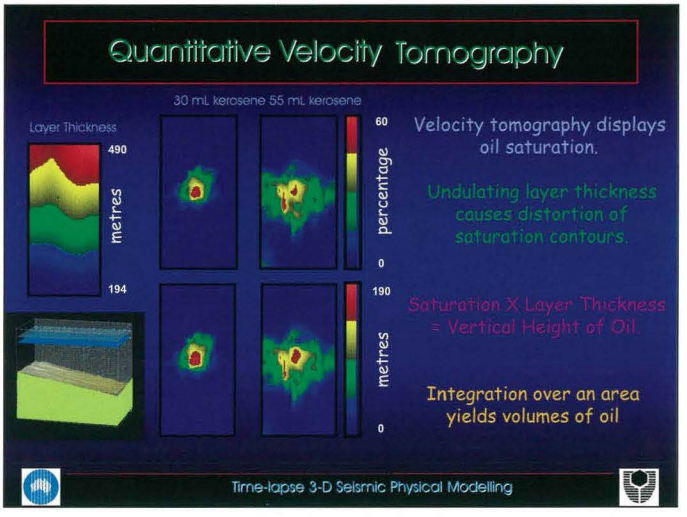

Fig. 3.

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