



**A DETAILED SEISMIC STUDY OF THE  
BARNETT HYDROCARBON DISCOVERY,  
SOUTHERN BONAPARTE BASIN, AUSTRALIA.**

**A THESIS SUBMITTED TO THE  
NATIONAL CENTRE FOR PETROLEUM GEOLOGY AND GEOPHYSICS  
FOR PARTIAL FULFILMENT OF THE M.Sc. DEGREE  
IN PETROLEUM GEOLOGY AND GEOPHYSICS**

**BY**

**PAUL WALSHE**

**1996.**

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## **STATEMENT OF ORIGINALITY**

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**Paul Walshe**

4th February 1996

## ABSTRACT

The Barnett Field is one of several minor hydrocarbon accumulations which have been discovered in the offshore Bonaparte Basin. The Barnett-2 well flowed at 921 BOPD and the Barnett-3 appraisal well was planned to intersect the reservoir sands up-dip from Barnett-2. However, results from Barnett-3 showed that there were considerable variations in the thickness of a Permian limestone overlying the Late Carboniferous reservoir sands. Hence there were unexpected variations in the geometry of the reservoir as defined by the seismic data. In addition, a marked thinning of the reservoir sands was noted between Barnett-2 and Barnett-3. There was also a gas discovery at Barnett-2, where rates of 90 MCFPD were recorded from fractured Early Carboniferous sediments beneath a Tournasian unconformity. The geometry of the gas reservoir was difficult to define on the existing seismic data.

A 'true amplitude' seismic processing sequence has been developed which appears to preserve amplitude variations that are due mainly to geological changes underneath the seismic line location. This sequence avoids the use of some of the common noise attenuation and data scaling processes which can result in the distortion of amplitude information, particularly in the common shot and stacked CMP domains. Seismic data processed using this sequence compares favourably with data processed using a more complex processing flow.

Through quantitative analysis of the seismic reflection from a thin Permian carbonate unit, referred to as the Orange Unit in this study, it has been possible to determine which seismic processes have the greatest influence on the the peak to trough amplitude of the reflection from this unit.

The peak to trough amplitude profile measured from the Orange Unit reflection shows a striking periodicity of approximately 500 m wavelength. This appears to be caused by geological changes at, or near, the horizon. This periodicity cannot be dismissed simply

as an acquisition or processing artefact and may be the result of cyclical thickening and thinning of the Orange Unit limestone.

Geophysical modelling using the log data at the three wells indicates that the Orange Unit can be considered as a thin bed at Barnett-1 and Barnett-2, but the top and bottom of the bed should be seismically resolved at Barnett-3. Amplitude maps were produced using 3-D seismic data, which was processed in a non-'true amplitude' fashion. These maps show little amplitude variation and do not correlate with the predicted amplitudes at the well locations, probably due to a distortion of the amplitude information by some of the algorithms used during processing. Amplitude maps produced from the 'true amplitude' reprocessing of data from the Barnett-2 and Barnett-3 area show a different amplitude distribution to the amplitude maps from the 3-D data set and again do not correlate with the predicted amplitudes for the two wells. This lack of correlation is attributed to Fresnel zone effects, high noise levels, positioning errors, and other factors.

Amplitude and character changes of the reflections from lithologies at the top of the Kuriyippi Formation appear to be due to factors other than sand content.

Interval velocities calculated from well data show a 5% increase in interval velocity at the top of the Kuriyippi Formation at Barnett-3, when compared with Barnett-2. This is considered to be due to the increase in Orange Unit limestone thickness at the former location. The failure of interval velocity analysis of the CMP gathers to detect a similar increase in velocity between the two wells is attributed mainly to the small magnitude of the change in velocity, high noise levels and Fresnel effects.

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