

Apache  
ENERGY



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## **1.0 INTRODUCTION**

This report documents the interpretation of the Sue 3D (GAP04B) Marine Seismic Survey. The survey was commissioned by Apache Energy Ltd and covers approximately 1050 km<sup>2</sup> over license areas VIC/L-1/15/16/17, VIC/RL-1 and VIC/P-58 in Victorian state waters off the Gippsland Basin of Australia.

## **2.0 DATA AVAILABILITY**

Enclosure 1 shows the Sue 3D MSS coverage. Approximately 1066 km<sup>2</sup> of 3D data was acquired and processed by Western-Geco from January 2005 to June 2006. The survey consists of 77 sail lines on average 34.8km long, acquired in a dual source, eight streamer configuration of 4800m length. An acquisition azimuth of 44° was used. The two oil and gas monopods Dolphin and Perch created obstacles within the survey area and were “under-shot” with a single source and using dual vessel operations involving the Multiwave vessel “Pacific Titan”.

The majority of the data was acquired within the license areas noted above, but portions of the lines extended into the adjacent concessions to the north and east to provide full fold coverage to the Vic/P-58 license area boundaries.

## **3.0 DATA QUALITY**

The survey is generally of a high data quality with good imaging of the fault patterns and resolution of the seismic reflectors down to depths of prospective interest. However, some areas are degraded by noise which is probably due to a combination of near surface effects and residual multiple energy. One such area includes the north eastern portion of the survey area. Hopefully, as data processing technology improves in the future, solutions will be found to overcome these noise problems. Generally, good zero phase (SEG American polarity) synthetic seismic ties can be made to the well control in the survey area.

## **4.0 SEISMIC INTERPRETATION**

### **4.1 Top Latrobe Coarse Clastics**

Enclosure 2 shows the two-way time (TWT) structure map to the Top Latrobe Coarse Clastics (TOL). This is a regional marker which can be easily mapped throughout the survey area and provides a structural guide to the deeper Latrobe levels which are poorly imaged in some parts of the survey. The seismic signature of this event does vary from weak to strong and is controlled by the varying sand/shale mix of both the overlying Gurnard Formation and Latrobe clastics at that location. The event is generally stronger in the west of the survey, partly reflecting the changing reservoir quality of the sands at the Top Latrobe event.

These coarse clastics have excellent reservoir quality and are associated with shoreface depositional environments, with sediment supply coming from the NW and being transported basinward to the WSW. The top of this sand is overlain by the regional Gurnard Formation, which provides excellent top seal for the sandstone. The Top Latrobe clastics are therefore highly prospective in many trapping styles and have been a prolific producing reservoir throughout the Gippsland Basin.

At the Top Latrobe level in the south western corner of the survey area, the Top Latrobe event dips upward to the regional high around the Tommyruff-1 well. From the southern boundary of the survey this horizon generally exhibits monoclinal dip either side of the main anticlinal fold which runs toward the north eastern corner and is known as the Dolphin-Perch trend. This broad anticlinal feature has a small degree of NW-SE trending faults which have both setup and breached some hydrocarbon accumulations, demonstrated by previous well penetrations. The TWT structure map clearly shows the Perch, Dolphin and Tarwhine oil fields as well as the structure at Amberjack-1 which was dry. The northern edge of the survey clearly shows the Whiptail and Flying Fish-Snook structural highs which are water wet but on trend with the Golden Beach-1A and Whiptail-1A discoveries.

The final feature which is clearly seen in the time structure map is the tightly folded event running from near the Flying Fish-1 well in the NW, in a SSW direction to near the southern edge of the survey between the Tommyruff-1 and Perch wells. This is an ancient shoreline well preserved since its' time of deposition and gives a good indication of the type of geology present at this level. This shoreline has progressively back stepped to its present day position at Ninety Mile Beach.

#### 4.2 Top Burong Coals

Enclosure 3 shows the TWT structure map to the Top Burong Coals level. This level shows the same general trend as the Top Latrobe as it is only slightly deeper. There is a slightly greater degree of faulting at this level relative to the Top Latrobe. The event is picked on the first occurrence of a succession of coal beds within the Burong Formation.

Generally a well developed coal, the Top Burong seismic event is of high amplitude due to the significant in change in P-wave and Density properties relative to the overlying sediments. The coals themselves are therefore well imaged and very easy to interpret through the survey as they present a very conformable and continuous seismic event which is fairly typical in this region.

While the coals themselves are well imaged throughout the survey, this also introduces two main difficulties in imaging the geological events beneath them, which are well documented in literature. As the acoustic impedance contrast between the coals and overlying sediments is so great, it is firstly difficult to get seismic energy beneath them and secondly the coals can introduce inter-bed multiple energy, which at depth is more difficult to remove from seismic data than shallower multiple events. Thus it is clear that below the coals the quality of the seismic events becomes poorer throughout most of the survey.



#### 4.3 Top Golden Beach

Enclosure 4 shows the TWT structure map to the near Top Golden Beach event. This level represents deposition of sediments in a coastal plain setting and previous well penetrations at this level have shown sands within the Golden Beach Formation are of good reservoir quality. The Golden Beach is absent on the high side of the fault terrace to the south of the Darriman Fault system, which is the large fault system immediately south of the Palmer-1 well. A time equivalent seismic event has been mapped for continuity only along the southern edge of the survey area.

The prospective area is concentrated in the south western half of the survey showing a highly faulted broad anticlinal trend, which has been generally well imaged by the 3D data set. As previously mentioned the data quality is much poorer below the coals of the Upper Latrobe section and so the Golden Beach seismic event is sometimes a weak event also partially contaminated by residual multiple energy. The degradation of the seismic at this level is particularly evident in the north eastern part of the survey where the interpretation is also complicated by poor well control. Potential drilling targets have been identified and consist of a variety of trapping styles.

There are also several volcanic intrusions evident along the eastern edge of the survey below the Golden Beach level and also at the southern edge below the time equivalent Golden Beach seismic event. Below the Golden Beach the higher amplitude events of the Strzelecki Group can be seen throughout the survey area.















