Santos

Seismic Interpretation Report

SS04 2D (T/36P) Seismic Survey

Offshore Southern & Western Australia Exploration

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Introduction

The SS04 Seismic Survey was acquired in Permit T/36P by Santos in 2004 as part of the work commitment for the second permit year. Acquisition was completed in December 2004, using Multiwave's Pacific Titan. Processing was undertaken by Robertson Research and was completed in April 2005. However Quality Control review of processing showed minor problems with final stacks and further processing was undertaken by Fugro.

The SS04 2D seismic survey consisted of 16 lines totalling 680km of 2D seismic, over the T/36P exploration permit (Figure 2). These lines in-filled existing 2D that was reprocessed during the 3rd Quarter 2004.

Permit History

Exploration Permit T/36P in the Sorell Basin (Figure 1) was awarded to Santos Ltd and Unocal South Australia Pty Ltd on 27th November 2003 for an initial term of 6 years. In 2005 Chevron Australia Pty Ltd merged with Unocal.

The permit consists of 64 whole, and 18 part, 5 minute by 5 minute graticular blocks covering an area of approximately 4647 km^2 (GDA).

Santos Ltd is Operator of the Permit. The current interest holders in the permit are:

Company	Percentage Interest
Santos Ltd	**50%**
Chevron Australia Pty Ltd	**50%**

The work program for the primary commitment (Years 1 to 3) and the secondary contingent term (Years 4 to 6) is set out in the following table:

Permit Year	**Minimum Work Requirements**
Year 1	Reprocess 1100 km of 2D seismic, G&G, environmental studies
Year 2	Acquire 576 km of 2D seismic, G&G
Year 3	G & G studies (mapping)
Year 4	G&G, 3D design
Year 5	Acquire 210 km^2 of 3D seismic, G&G, detailed well design
Year 6	One well

Exploration History

Described below are the results of the offshore wells closest to the T/36P exploration permit. Well completion reports issued by the Operator and the updated interpretation of seismic data provide the primary source of information for detailing the exploration history. Cape Sorell 1 was drilled on the permit.

Prawn-A1 (Esso, 1967). Intersected 712m of Waarre Formation equivalent. Measured porosities in the sandstone exceeded 20% with permeabilities up to 235 mD.

Clam-1 (Esso, 1969). Tested structural closure of the basal Tertiary and updip pinchout of Cretaceous sediments against the Clam High. Good reservoir sandstones with porosities up to 20% were intersected. Clam-1 reached a depth of only 1592m, intersecting Devonian conglomerates on Pre-Cambrian metamorphic basement. The penetrated sedimentary section is immature for hydrocarbon generation.

Whelk-1 (Esso, 1970). Drilled an anticlinal closure 120 km north of Clam in the southern Otway Basin to test anticipated Waarre Formation sandstones with good reservoir characteristics. Although 94m of Waarre Sandstone was intersected, top seal (Belfast Mudstone) lithologies were not developed.

Cape Sorell-1 (Amoco, 1982). Planned to test a mapped Waarre closure however the section penetrated proved much younger in age and the well reached total depth at 3528m in Maastrichtian-aged sediments. Weak oil shows were reported near the base of the well.

Geology and Hydrocarbon Prospectivity

The Sorell Basin formed during oblique rifting between the Australian and Antarctic continents in the Late Cretaceous. While relatively open ocean conditions existed to the north and west in the Otway Basin, a restricted marine embayment was formed in the Sorell region, bounded to the southeast by a land-bridge between the two continents, which did not separate until the Eocene.

Late Cretaceous reservoir sandstones, belonging to the Waarre Formation, Flaxman Formation and Thylacine Sandstone Member (Figure 3), form the main productive zones within fields such as Casino (Santos-operated), Minerva, La Bella, Thylacine and Geographe, located north of the deep water acreage trend. These sandstones exhibit excellent reservoir quality with average log porosity in the range of 15-28% and permeabilities of up to 8 Darcies.

These sandstones are mapped extending southwards into Santos' deepwater permits. Deposition of coarse-grained siliciclastics in the Turonian-Santonian is associated with periodic fluvio-deltaic pulses into an overall upwards-deepening/fining section (Belfast Mudstone), providing an effective reservoir-seal couplet. Regional regression in the Campanian led to renewed coarse-grained, fluvio-deltaic input to the basin as the Paaratte and Timboon sandstones. Potential sealing sequences of the Skull Creek and Timboon mudstones and the Massacre Shale are observed to thicken into the basin. Mild structural inversion in the latest Cretaceous was followed by rapid subsidence and transgression resulting in retrogradation of the deltaic systems and deposition of the Wangerrip Group in the Palaeogene. Eventually the marginal sedimentary systems were drowned and, in association with the opening of the seaway in the late Eocene and subsequent formation of the Circum-Antarctic current, deposition came to be dominated by cool-water carbonates that persist through to the present day.

Six offshore discoveries have been made to date proving in excess of 1.4 TCF recoverable gas. These discoveries have been full to spill, with liquids content increasing generally from north to south. Hydrocarbon charge in the basin is considered to come from Albian-aged, Eumeralla Formation source rocks.

The Strahan Sub-Basin is a half-graben in the southern Sorell Basin. Extension of the basin-bounding faults is interpreted to have commenced in the Cretaceous, with sediment infill up to 8km in places. There is one well within this sub-basin, Cape Sorell-1, which was drilled in 1981 and intersected oil shows in the Maastrichtian section.

Discussion of Seismic Record Quality

Seismic data is of good quality right down to basement, with the exception being in the steeply dipping section below the major basin-bounding faults, where the steep horizons faults most likely resulted in complex ray paths.

The well tie to Cape Sorell-1 is fair, with the Maastrichtian coals forming a band of high amplitudes that can then be mapped throughout the permit.

There are several canyons at the base Tertiary that have removed substantial amounts of section. These can be clearly and reliably mapped from line to line.

There are also several gas chimneys which cause local degradation of data beneath them, and line up along some faults within the permit.

The previous reprocessed data had been identified as having navigation problems, with shifts of ~200m necessary for many lines, with some even greater. These navigation problems were thought to be mostly resolved during reprocessing. Acquisition and processing of the new seismic data identified a few additional corrections necessary for the existing reprocessed data. Due to these shifts made to the older data-sets, it is recommended that any wells drilled in this permit be located on a new SS04 seismic line if possible, to reduce this uncertainty.

Seismic Mapping

Area and Data Mapped

The new SS04 seismic data infilled the existing reprocessed data (MXT90 and W81 surveys). This SS04 data was focussed around the Strahan sub-basin, in the southern portion of T/36P. The new seismic includes a cross-cutting line which ties the Cape Sorell-1 well and runs across the sub-basin, as well as a tie line in the west, which continues north to tie with the seismic data in T/33P. The new data was incorporated into the interpretation of the existing seismic data.

Interpretation Methodology

Geoframe IESX was used in the structural interpretation of this seismic data. A synthetics well tie was created in Geoframe for the Cape Sorell-1 well (Figure 4), which ties directly to four of the new and reprocessed seismic lines. The Cape Sorell-1 well only penetrated as far as the Maastrichtian, due to its location close to the basin-bounding fault. However, it is apparent on the seismic that there is unpenetrated stratigraphic section below the Maastrichtian in the deeper areas of the half-grabens. It is postulated that this unpenetrated section is also Late Cretaceous in age.

The Base Tertiary (T1) unconformity was an easily correlated horizon, due to the often angular nature of the unconformity, particularly where canyons had been eroded into older sediments. The Maastrichtian coal package (MAAS) could be correlated with reasonable confidence throughout most of the Strahan Sub-Basin. Basement (BASE) was also an excellent seismic pick, due to the strong acoustic impedance contrast and generally characterless section below. The exception to this is in the deeper parts of the sub-basin, against the basin-bounding faults, where seismic signal has deteriorated due to the steep reflectors and complex ray paths.

Less continuous seismic events, both in the Tertiary and Cretaceous section, have been mapped where they can be correlated. However, further from the Cape Sorell-1 well, it is difficult to determine exactly which horizon is being interpreted, due to the complex nature of the depositional environment in this half-graben sub-basin.

Seismic interpretation was undertaken using the all-offset pre-stack time migrated volumes. The new SS04 data was interpreted in conjunction with the older reprocessed data.

Horizons Interpreted

Key horizons interpreted include the water bottom (WB), base Tertiary (T1), Maastrichtian coals (MAAS), and Basement (BASE). Other horizons have been mapped locally, but are hard to correlate on a regional basis.

Depth Conversion

Depth conversion was undertaken in Petrosys using a time-depth relationship determined from time-depth pairs in Cape Sorell-1. More detailed depth conversion will need to be undertaken prior to drilling of any of the prospects.

Structure Maps Prepared

Structure maps prepared include the water bottom (WB), Base Tertiary Unconformity (T1), Maastrichtian coals (MAAS) and Basement (BASE) depth maps (Enclosures 1-4).

Play Types

The play types targeted in this permit are largely Cretaceous in age, with late-Cretaceous reservoirs. Top seals are most likely to be intra-formational and highly facies-dependent due to the syn-depositional half-graben, but could be located in either the Late Cretaceous or early Tertiary section. The Maastrichtian coals intersected in Cape Sorell-1 (with oil shows) look to be a good oil-prone source facies (similar age to the Gippsland Basin source), although were only in the early-mature window at the Cape Sorell-1 well location. Mapping of this interval throughout the sub-basin indicates there are regions of the permit where this unit becomes buried deeply enough to enter the oil and/or gas window. Trapping styles vary from low-side fault closures, anticlines complex structural/stratigraphic traps.

Leads and Prospects

The largest prospects and leads in the permit are Almond, Flaxseed, Olive and Sunflower (Figure 5).

The Almond Prospect (Figure 6) is a 4-way dip anticline at Maastrichtian level, with a fault-dependent upside. A lead had been identified at this location by earlier operators and was previously called Teton. This prospect is immediately adjacent to the interpreted mature source kitchen, which reduces the charge risk for the prospect. There is also a gas chimney located at the spill point of the structure where it meets one of the larger faults. The key concern with this prospect is depth of burial, as the target horizons have ~3000m of overburden. Formations at similar depths in Cape Sorell-1 had reduced porosity and permeability. It is hoped that the reservoir at the Almond location would be better sorted and reworked, due to the greater distance from the basin-bounding faults and sediment input.

The Flaxseed Prospect is a low-side fault closure in the north of the Strahan sub-basin. The key risk for this prospect is fault seal, as the main fault is one of the basin-bounding faults. Cape Sorell-1 was drilled in a similar location and was found to be particularly sand-prone and lacking in suitable sealing facies. There is a gas chimney where this structure meets a small fault just south of the crestal location, suggesting charge probably did reach this area. A lead had been identified at this location by previous operators and was called Trial Harbor.

The Olive Prospect and Sunflower Lead (Figure 7) are the largest prospects within Permit T/36P and are located in the southern area of the Strahan sub-basin. They are unfortunately located south of the densest area of 2D seismic coverage, although both prospects are still identified on multiple seismic lines. Both prospects are mapped at the Base Tertiary unconformity. The overlying section is interpreted to be shale-prone due to its bland character and distance from the basin-bounding faults, however seal still remains a key risk for these prospects. There is also a lateral seal element for these prospects, with fault seal required, as well as seal against a Tertiary canyon to the south. Seismic character within this canyon is bland except in the very bottom (below the level of the reservoir) and interpreted to be shale-filled. Analogous erosional canyon-bounded fields can be found in the Gippsland Basin. Both prospects exhibit elevated seismic amplitudes, which appears to be limited structural closure (assuming the canyon is sealing). A flat spot which cross-cuts bedding has been identified on one line of the Olive Prospect. 3D seismic is recommended to further delineate these prospects to determine whether the amplitude extent and flat spot do conform to structural closure.

Conclusions

The SS04 seismic data is of good quality; slightly better than the reprocessed older seismic data.

Interpretation of the SS04 seismic data and incorporation into the regional grid has led to a better understanding of the prospects and leads. 3D seismic is recommended prior to drilling in this permit, with the Olive Prospect and Sunflower Lead the best candidates.

Figures

Permit Location Map

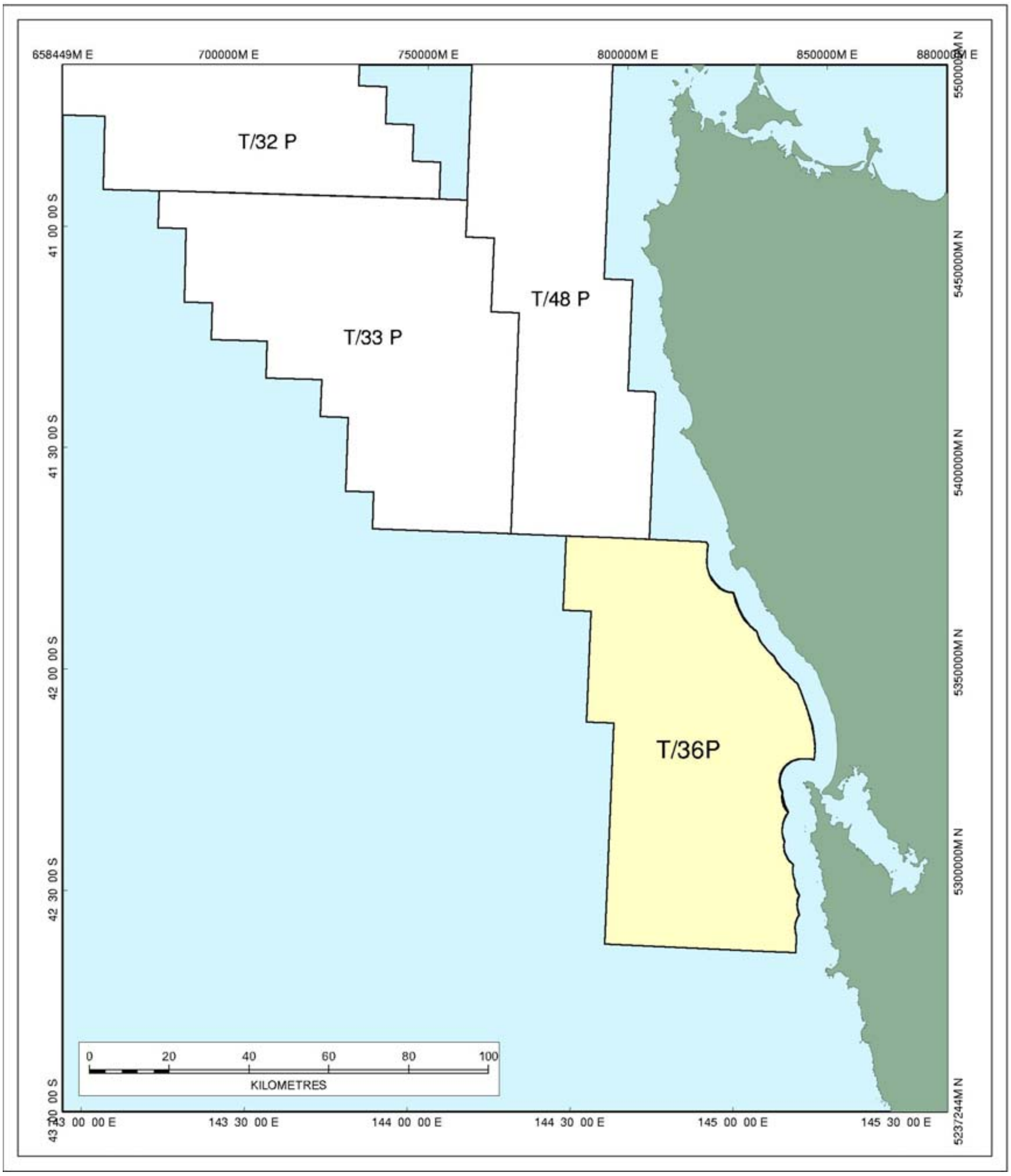

Figure 1. T/36P Permit Location Map

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Data Location Map

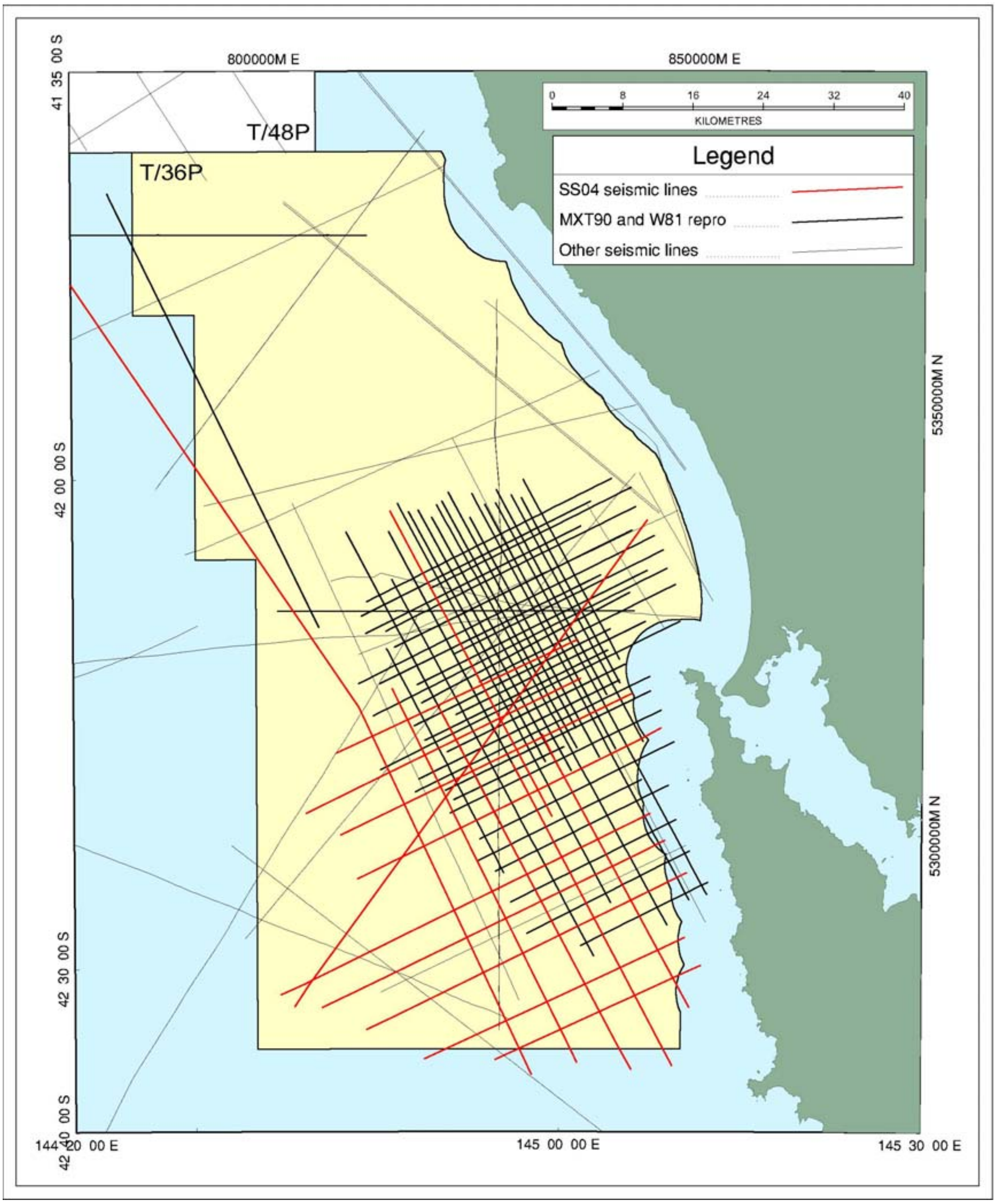

Figure 2. Seismic Line Location Map

Stratigraphic Chart

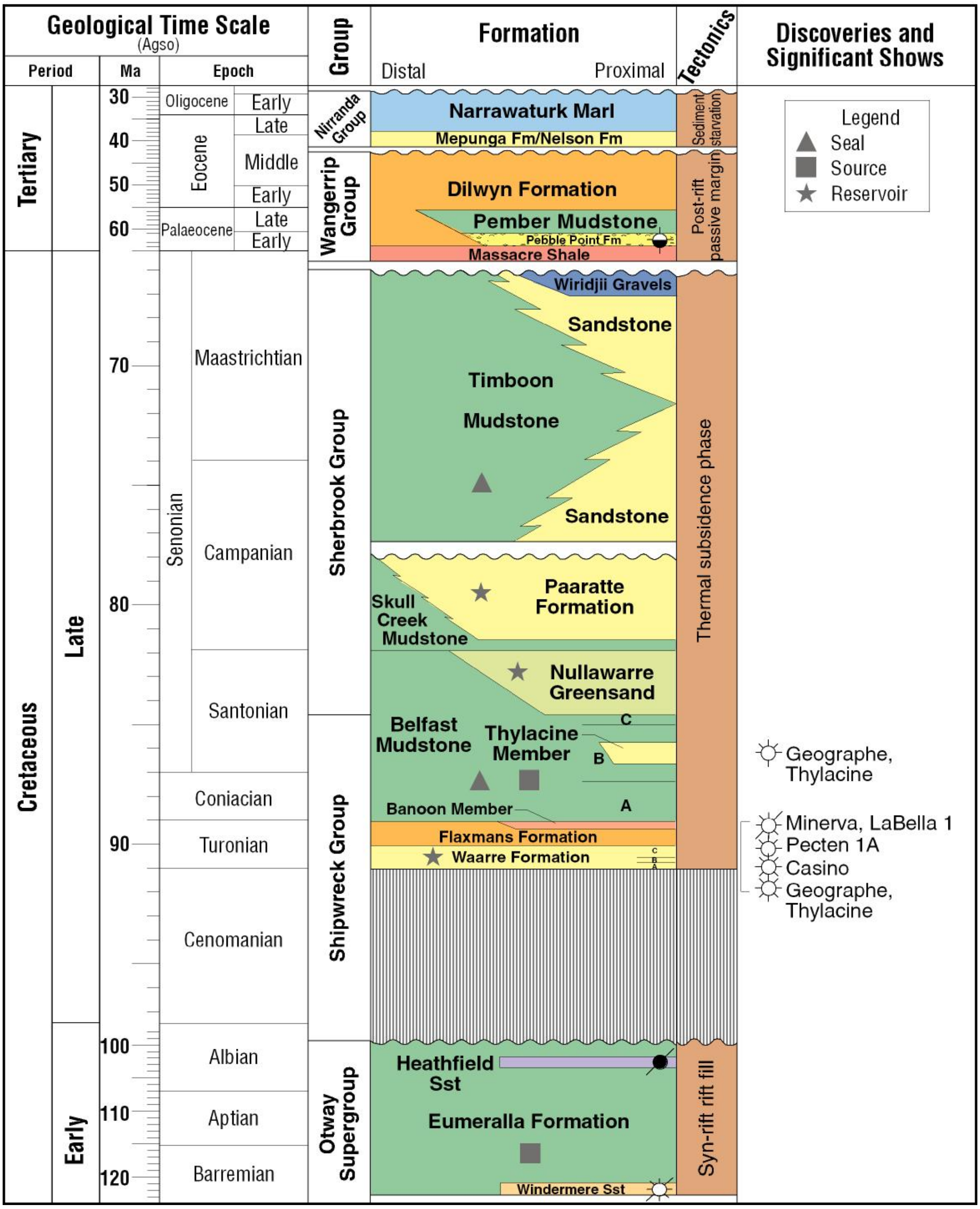

Figure 3. Stratigraphic Chart

Synthetic Seismograms

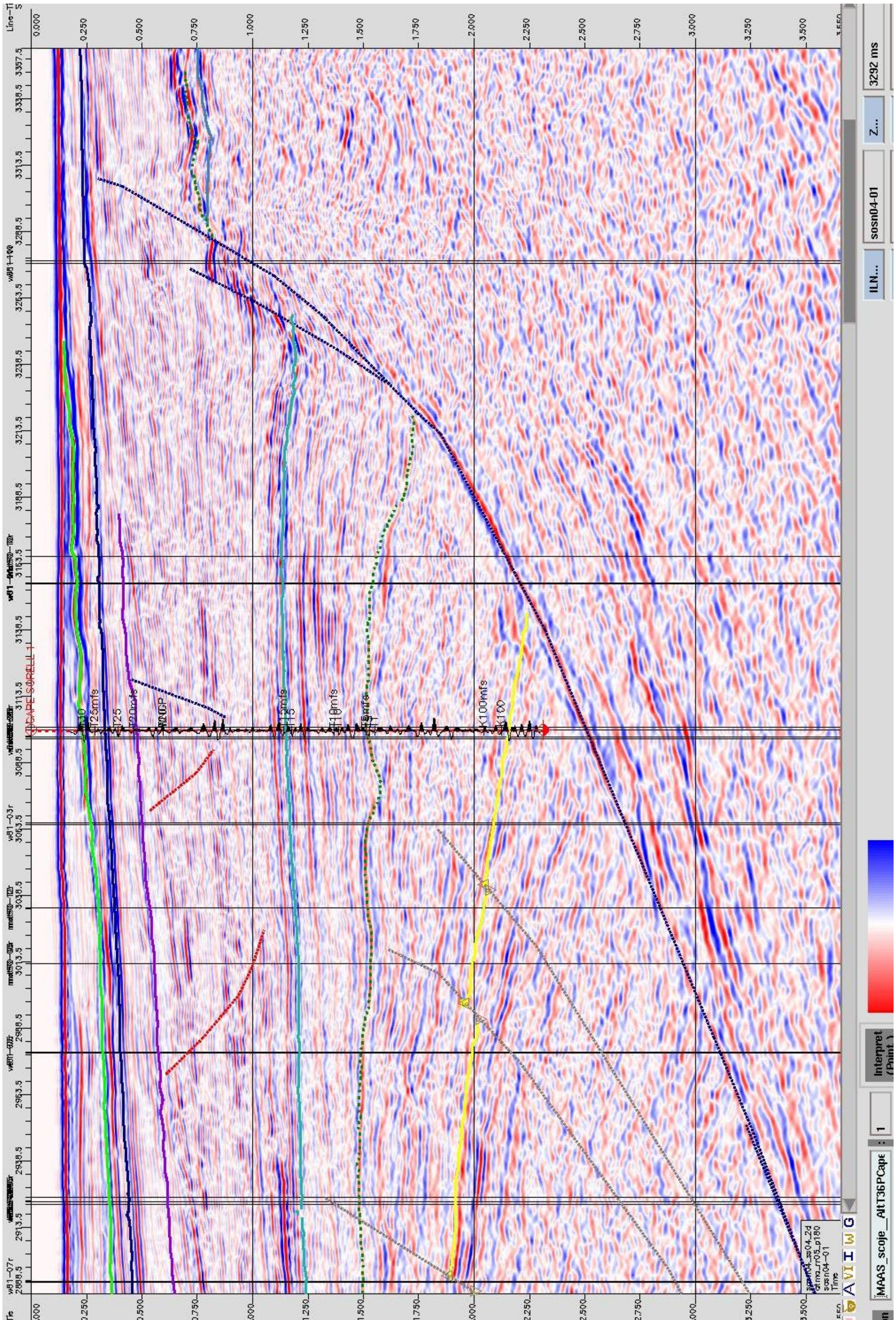

Figure 4. Synthetic seismogram at Cape Sorell 1.

Prospect Location Map

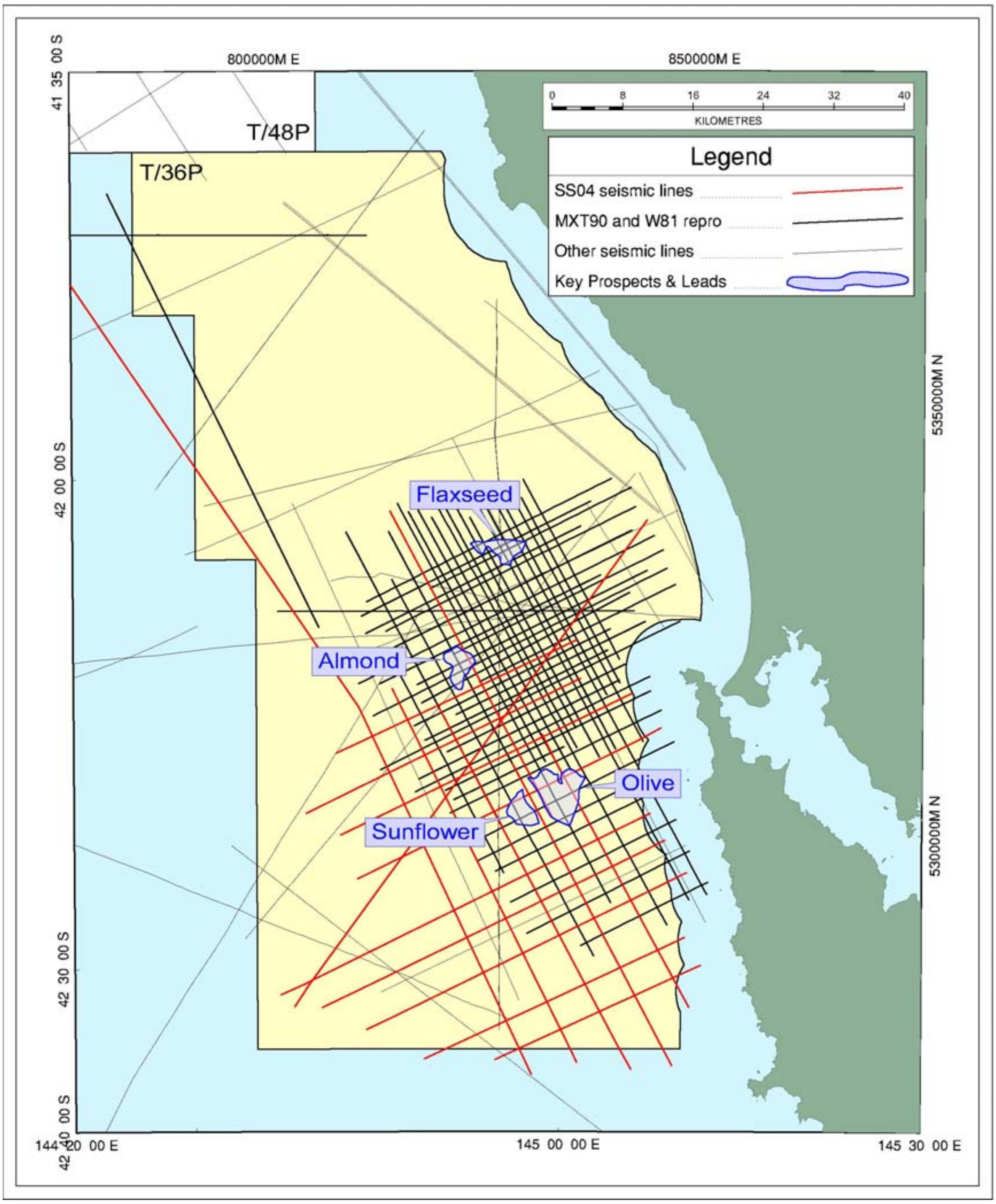

Figure 5. Prospect and Lead Location Map.

Interpreted Seismic Sections

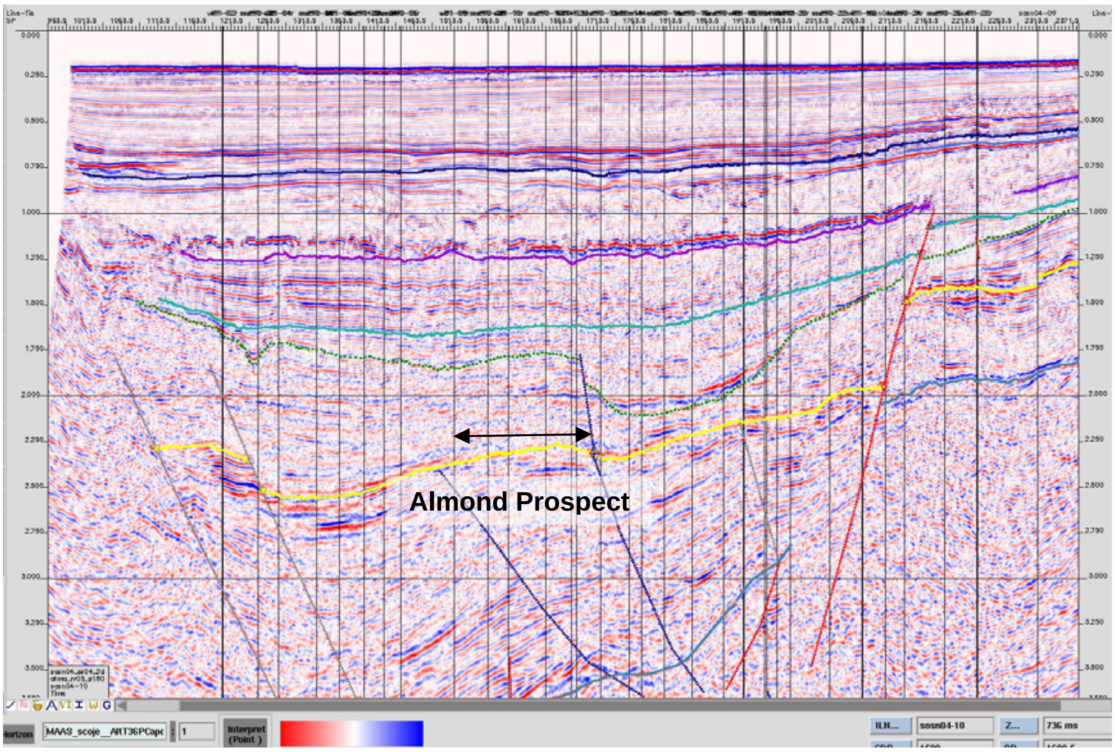

Figure 6. Seismic section (line SS04-10) through the Almond Prospect.

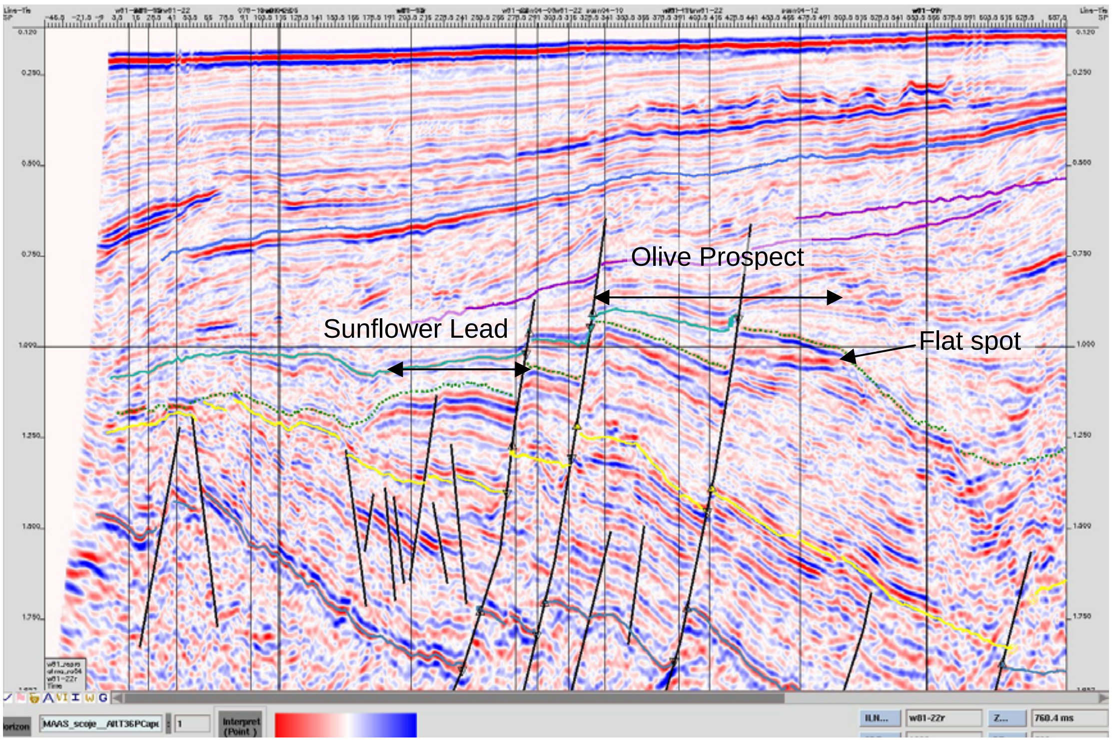

Figure 7. Seismic section (line W81-22R) through the Olive Prospect and Sunflower Lead, showing elevated amplitudes at the Base Tertiary Unconformity, and a flat spot which appears to cross-cut bedding.

Enclosures - Maps of Key Horizons

Enclosure 1. Water bottom (WB) depth structure map

Enclosure 2. Base Tertiary Unconformity (T1) depth structure map

Enclosure 3. Maastrichtian coal package (MAAS) depth structure map

Enclosure 4. Basement (BASE) depth structure map