



Seismic Interpretation Report

SS02 2D (T/32P) Seismic Survey

Southern Australia Exploration

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Introduction

The SS02 Seismic Survey was acquired by Santos in 2002 as part of the work commitment for the first permit year. Acquisition was completed on the 30th of December 2002, using Multiwave Geophysical Company's research vessel Polar Duke. Processing was undertaken by WesternGeco and was completed on the 13th of August 2003.

The SS02 2D seismic survey consisted of 1256 km of 2D seismic, over the T/32P and T/33P exploration permits (Figure 1 & 2). 535km of this data was contained within permit T/32P and was focused primarily over the Wolseley amplitude anomaly.

Permit History

Exploration Permit T/32P in the Sorell Basin was awarded to Santos Ltd and Unocal South Asean Ltd on 22 August 2002 for an initial term of 6 years.

The permit consists of 79 whole, 5 minute by 5 minute graticular blocks covering an area of approximately 5151 km².

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

Company	Percentage Interest
Santos Ltd	50%
Unocal South Asean 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:

Year	Work Requirements
1	500 km 2D seismic survey Multiclient seismic uplift fee G & G studies
2	G & G studies
3	G & G studies
4	1000 km 2D seismic survey G & G studies
5	One well G & G studies
6	G & G studies

Exploration History

Described below are the results of the offshore wells closest to the T/32P 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. No wells to date have been drilled on the permit.

Whelk and Clam are the closest wells to the T/32P exploration permit. However, as they intersected condensed/truncated section in the Shipwreck Group (Figure 3), they have limited relevance for the proposed target reservoirs in the deepwater permits. Prawn, Thylacine and Geographe are considered the closest well intersections with direct relevance to the T/32P 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.

Thylacine-1 (Origin, 2001). Successfully tested a mapped Waarre Formation closure, with associated amplitude anomaly. It encountered gas within the Thylacine/Flaxman/Waarre section.

Geographe-1 (Origin, 2001). This well was a successful test of a mapped Waarre Formation closure, with associated amplitude anomaly. It encountered gas within the Thylacine/Flaxman/Waarre section.

Geographe North-1 (Origin, 2001). This well drilled as a follow-up test of Geographe-1 was a dry hole (no full stack amplitude anomaly).

Thylacine-2 (Origin, 2001). This well was an appraisal to follow up success at Thylacine-1.

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, 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.

Discussion of Seismic Record Quality

Seismic data is of adequate quality down to the level of the (Thylacine age equivalent) amplitude anomaly. Below this level, the noise level becomes higher and imaging is much more difficult.

Significant amounts of side-swipe can be seen on several lines. This is most likely due to the angle of the seismic to the faulting, which is often 30-45 degrees, as a result of the need to acquire the seismic data perpendicular to the dip of the seafloor.

Four of the DS01 lines and all the SS02 lines in T/32P were reprocessed in 2004. The main improvements from the reprocessing were increased frequency content (particularly on the DS01 lines), continuity of events, consistency of amplitude response and better imaging beneath the Wolseley amplitude anomaly.

Seismic Mapping

Area and Data Mapped

The new SS02 seismic data infilled the existing (Fugro) multi-client DS01 data by two SS02 lines for each DS01. This SS02 data was focussed around the Wolseley lead, which was identified during gazettal evaluation. The new data was incorporated into the existing interpretation of the multi-client DS01 seismic data.

Interpretation Methodology

Geoframe IESX was used in the structural interpretation of this seismic data. Well synthetics were created in Geoframe for the Thylacine, Geographe, Prawn (Figure 4), Whelk (Figure 5) and Clam wells, and the correlations taken into T/32P using multi-client and older regional seismic lines. Less continuous seismic events such as the Thylacine were interpreted by bracketing/constraining the formation with more consistent chronostratigraphic horizons such as the Belfast and Waarre sequence boundaries (K90 & K77) and using the typical character of the formation (eg. Thylacine deposited on an unconformity).

Seismic interpretation was undertaken using the all-offset pre-stack time migrated volumes. The new SS02 data was interpreted in conjunction with the multi-client DS01 data as well as various other regional lines required to tie the seismic to the wells.

The reprocessed versions of the SS02 and DS01 seismic lines have also been interpreted, resulting in a similar but slightly modified structural interpretation. The main changes were increased frequency content, continuity of events, consistency of amplitude response and improved imaging beneath the Wolseley amplitude anomaly (Figure 6).

Horizons Interpreted

Key horizons interpreted include the water bottom (WB), top Wangerrip Group (T20), base Tertiary (T1), top Belfast (K90), top Thylacine (K84LS) and top Waarre (K77).

Depth Conversion

Depth conversion was undertaken using Geoframe InDepth and involved calculating interval velocities from the seismic stacking velocities over the WB-T20, T20-K90 and K90-K84LS intervals. and then depth converting the individual grids using these interval velocities.

Structure Maps Prepared

Structure maps prepared include the water bottom (WB), top Belfast (K90) and top Thylacine (K84LS) depth maps (Enclosures 1-3).

Play Types

The play types targeted in this permit are largely Cretaceous in age, with late-Cretaceous reservoirs (Thylacine/Flaxmans/Waarre equivalent) and top seals (Belfast or intra-formational shales), with hydrocarbons sourced from the Eumeralla or Waarre coals, within faulted structural traps. These plays have been proven in the Otway Basin fields to the north.

Leads and Prospects

The largest lead or prospect in the permit is the Wolseley Prospect (Enclosure 3), which was identified as a lead during gazettal evaluation on the multi-client DS01 seismic data. The SS02 seismic infill was designed to further delineate this lead. Wolseley is an amplitude-driven structural play, targeting Thylacine equivalent reservoirs. Secondary reservoir targets are thought to be the deeper Flaxman and Waarre equivalents. Prior to interpretation of the SS02 data, no structural trapping mechanism had been identified for the amplitude anomaly; however we now believe the trap is a faulted structural nose. Top seal is the Belfast Shale which is also expected to be the lateral seal across most of the faults.

There are two other leads in the permit which target the same play type. The Savage Lead, in the southern part of the permit, is a three-way dip closure against a fault down-dip of Wolseley (Figure 7). In the north of the permit is the Traegar lead (Figure 8), which appears to be a faulted anticline (horst block) but is currently only defined on two lines. Both of these leads have amplitude anomalies within structural closure at Thylacine level.

Conclusions

The SS02 seismic data is substantially better quality than the DS01 seismic data. The main difference is higher frequency content and better imaging of faults in the SS02 data. However, four of the DS01 and all the SS02 lines in this permit were reprocessed in 2004 by Robertson Research.

The improvement in data quality of the DS01 data after reprocessing was substantial, largely due to the increase in frequency content and enabled a better comparison with the SS02 lines. An increase in data quality was also seen on the SS02 lines reprocessed, although this was less pronounced. The quality improvement on the SS02 lines are thought to be due largely to the eta correction (anisotropy correction) used by Roberston when flattening the seismic gathers, which was not incorporated into the WesternGeco processing sequence. This has resulted in more continuous reflectors and better imaging beneath the Thylacine amplitude anomaly (Figure 6).

Interpretation of the SS02 seismic data and incorporation into the regional grid has led to a better understanding of the Wolseley Prospect, reducing the risk and making the prospect drill-ready.

Acquisition of further seismic data is recommended for the Traeger lead, to better delineate the lead and reduce the risk. 2D seismic would likely be adequate for this purpose.

Figures

Survey Location Map

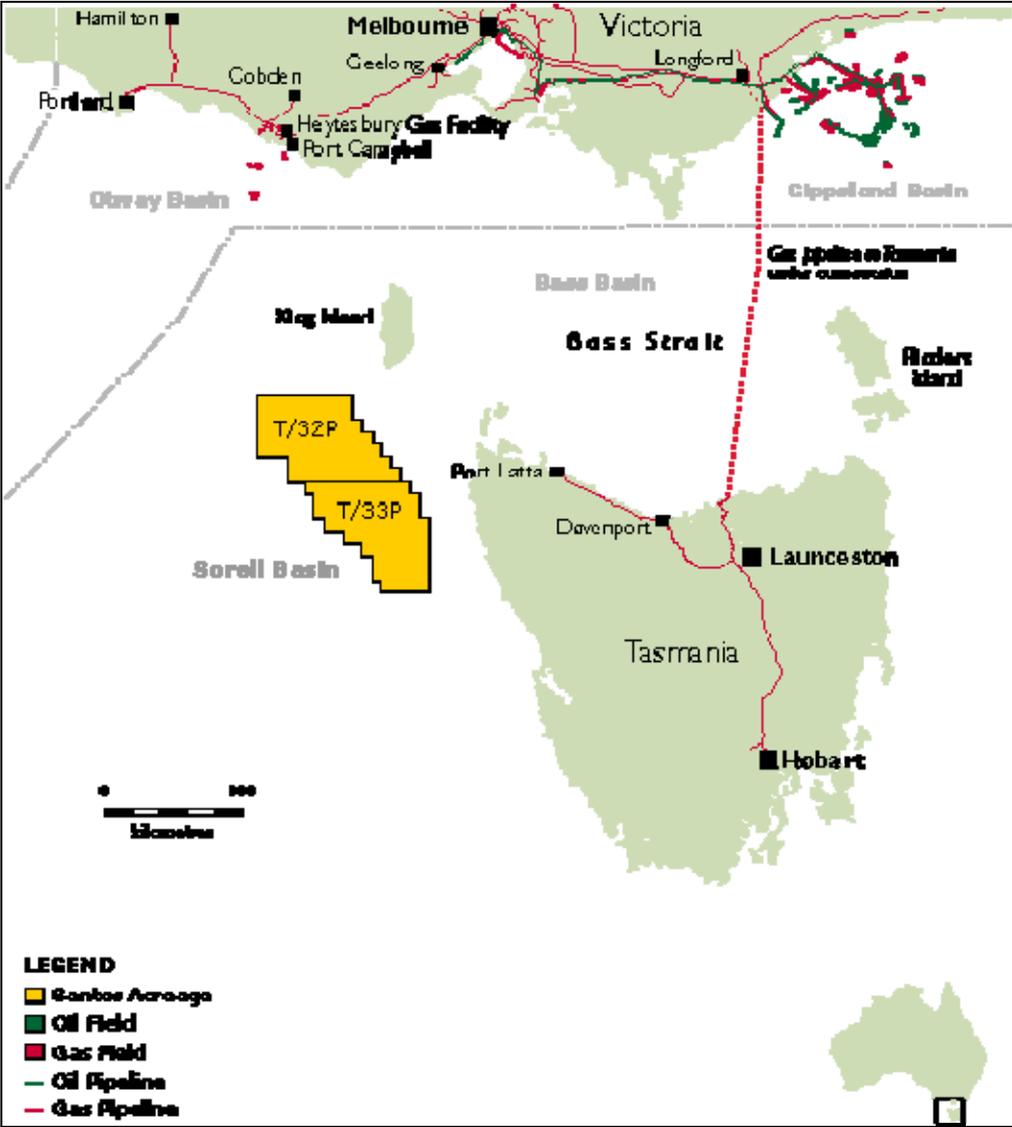


Figure 1. Seismic Survey Location Map

Data Location Map

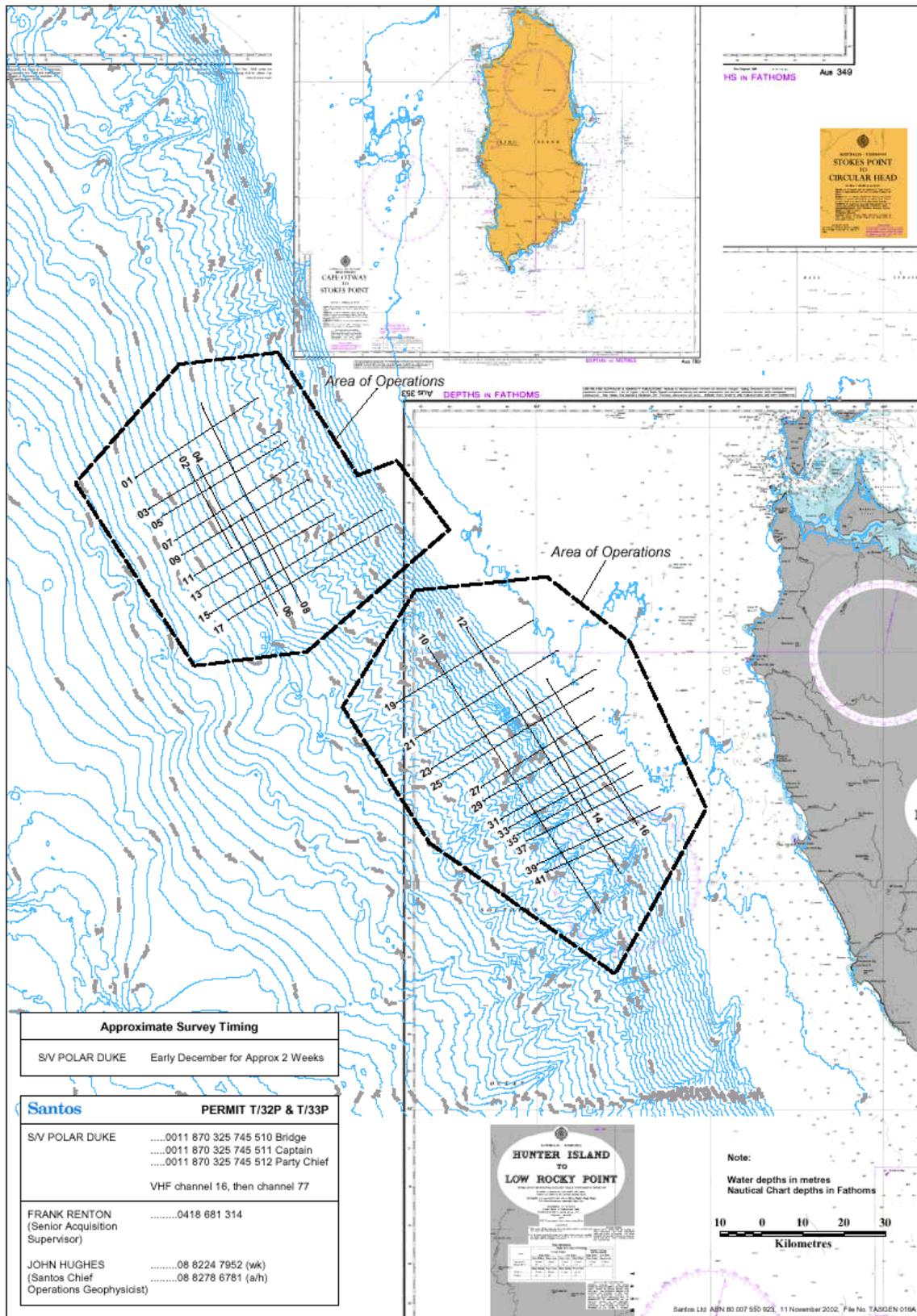


Figure 2. Seismic Line Location Map

Stratigraphic Chart

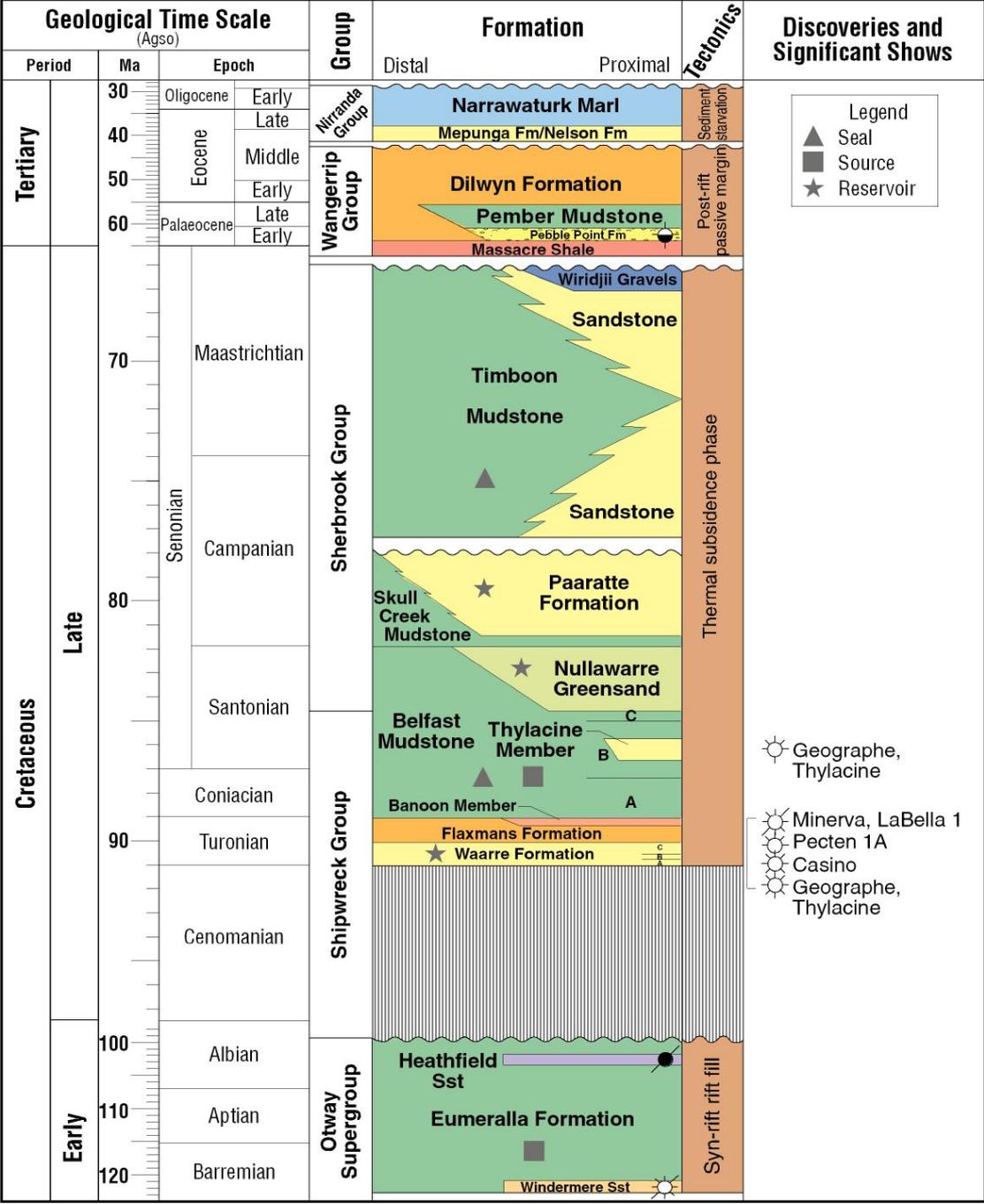


Figure 3. Stratigraphic Chart

Synthetic Seismograms

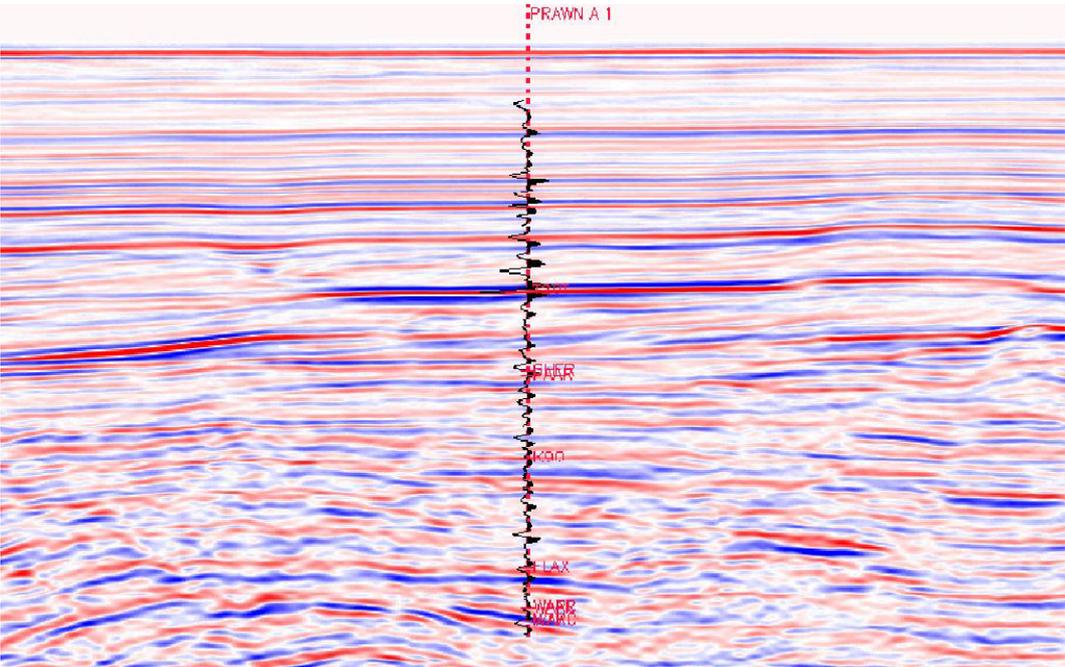


Figure 4. Synthetic seismogram at Prawn 1.

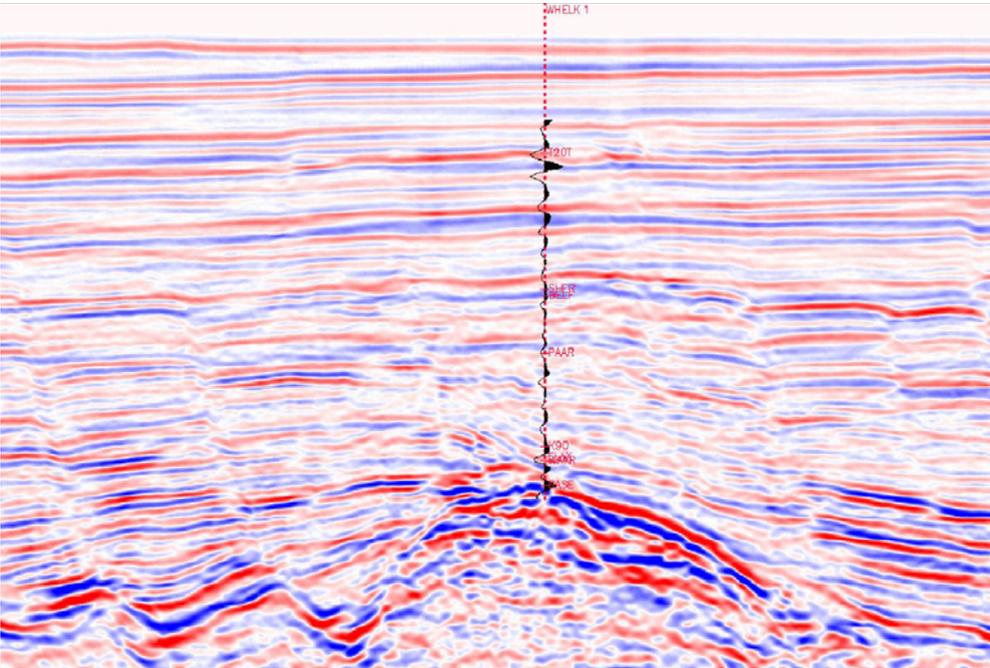


Figure 5. Synthetic seismogram at Whelk 1.

Interpreted Seismic Sections

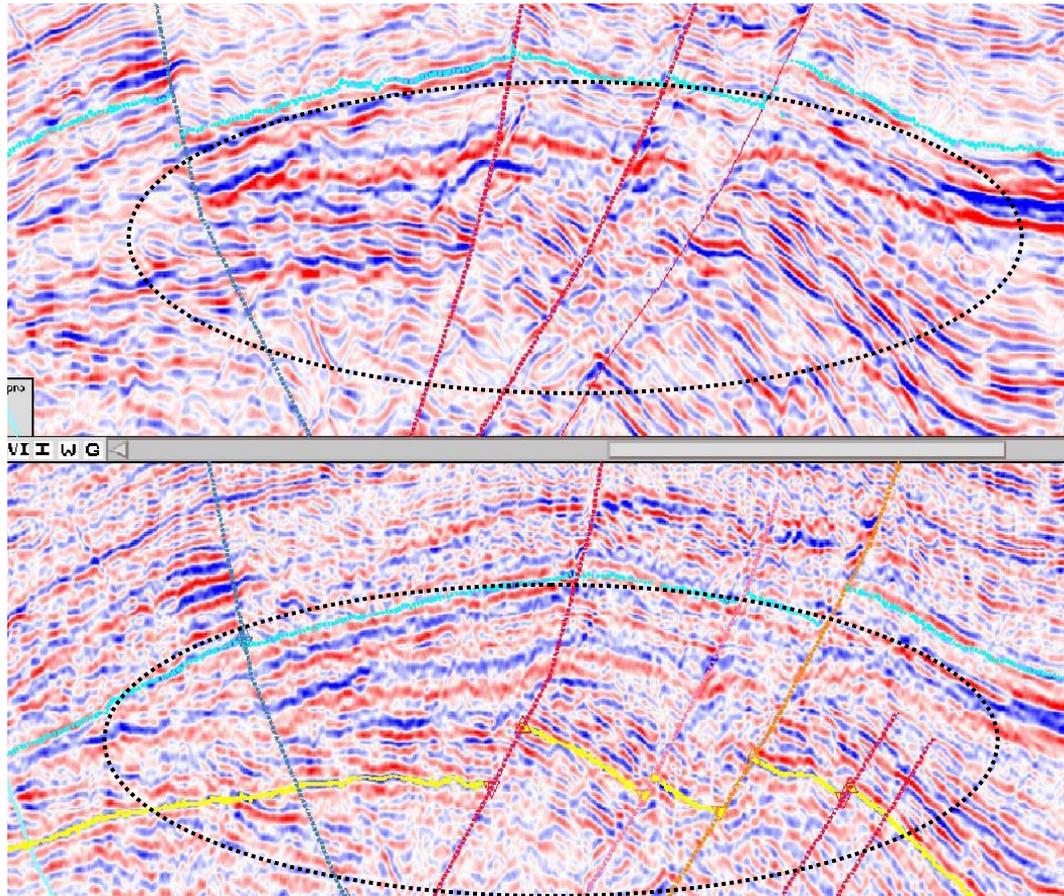


Figure 6. Seismic section (line SS02-04) through the Wolsley Prospect showing the reduced data quality beneath the amplitude anomaly on the original processing (top) and the improvement in imaging due to the reprocessing (bottom).

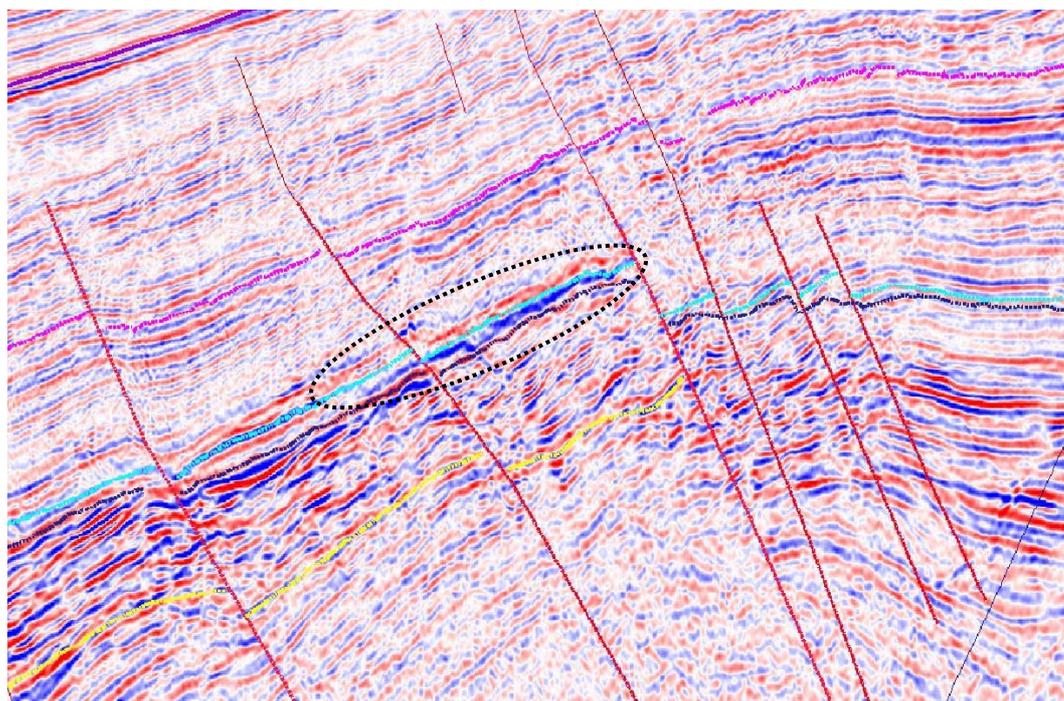


Figure 7. Seismic section (line SS02-17) through the Savage Lead.

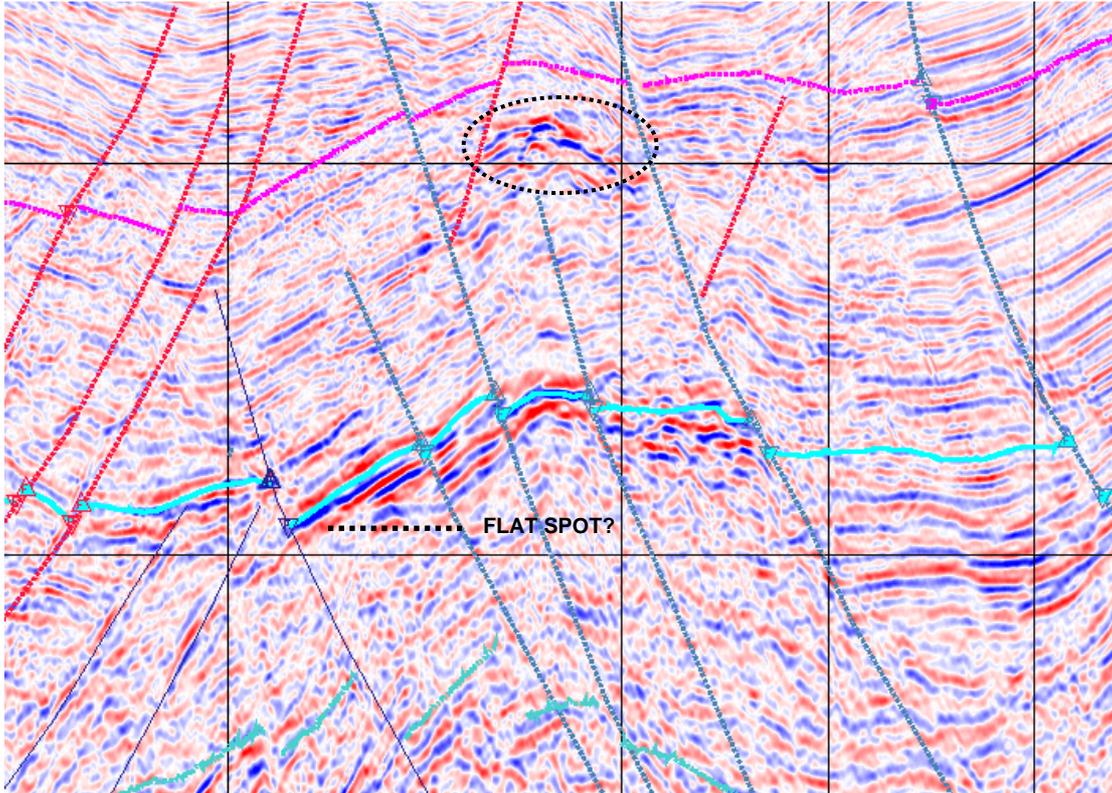


Figure 8. Seismic section (line DS01-206x_a) through the Traegar Lead, showing amplitude anomaly (at Thylacine level) with possible flat spot. Also note additional shallow amplitude anomaly over the crest of the structure (possible Nullawarre gas?).

Enclosures - Maps of Key Horizons

Enclosure 1. Water bottom (WB) depth structure map

Enclosure 2. Top Belfast (K90) depth structure map

Enclosure 3. Top Thylacine (K84LS) depth structure map