



EXPLORATION PERMIT VIC/P45

CGG 2D & 3D Seismic Reprocessing Interpretation Report

August 2002

Seismic Interpretation & Mapping: Ian Ward & Alan Anderson

Report Compilation: Calan McIntyre

File Ref: VICP45/22.09

Date: August 2002

| |
|--------------------------------|
| BHP Billiton Petroleum Pty Ltd |
|--------------------------------|

| |
|--------------------|
| ABN 97 006 918 832 |
|--------------------|

TABLE OF CONTENTS

| | | |
|-----|---------------------------------------|----|
| 1 | CONCLUSIONS AND RECOMMENDATIONS | 4 |
| 2 | INTRODUCTION | 4 |
| 3 | DATABASE | 5 |
| 4 | TIME MAPPING..... | 6 |
| 5 | DEPTH CONVERSION METHODOLOGY | 7 |
| 6 | IMPLICATIONS FOR PROSPECTIVITY | 8 |
| 6.1 | Coelacanth | 9 |
| 6.2 | Galaxias-Archer-Anemone..... | 10 |
| 6.3 | Scampi..... | 10 |
| 6.4 | Grenadier..... | 11 |
| 6.5 | Blowfish..... | 11 |
| 6.6 | Jellyfish..... | 12 |
| 6.7 | Other Leads..... | 12 |

LIST OF FIGURES

| | |
|----|---|
| 1 | Prospects and Leads Map |
| 2 | Seismic data used in interpretation |
| 3 | CGG 2D & 3D reprocessed data |
| 4 | Helios-1 to Archer-1 CGG reprocessed seismic tie |
| 5 | TWT mapping: Base shallow channels |
| 6 | TWT mapping: Base high velocity channels |
| 7 | TWT mapping: Mid Miocene marker |
| 8 | TWT mapping: Top Latrobe Group |
| 9 | TWT mapping: 51.5Ma marker (Top Helios-1 reservoir) |
| 10 | TWT mapping: Top Cretaceous |
| 11 | TWT mapping: Top Golden Beach Group |
| 12 | TWT mapping: Top Golden Beach Group (southern area) |
| 13 | Top Latrobe Group stacking velocities (with mis-tie analysis) |
| 14 | Top Latrobe Group final average velocity |
| 15 | Top Latrobe Group: Depth conversion error analysis |
| 16 | Top Cretaceous final average velocity |

- 17 Depth mapping: Top Latrobe Group
- 18 Depth mapping: Top Latrobe Group (southern area)
- 19 Depth mapping: 51.5Ma marker (Top Helios-1 reservoir)
- 20 Depth mapping: 51.5Ma marker (southern area)
- 21 Depth mapping: Top Cretaceous
- 22 Depth mapping: Top Cretaceous (northern area)
- 23 Depth mapping: Top Cretaceous (southern area)
- 24 Depth mapping: Top Golden Beach Group
- 25 Depth mapping: Top Golden Beach Group (southern area)
- 26 Depth mapping: Water bottom
- 27 Depth mapping: Base shallow channels
- 28 Depth mapping: Base high velocity channels
- 29 Depth mapping: Mid Miocene marker
- 30 Coelacanth Lead
- 31 Galaxias Prospect
- 32 Scampi Lead
- 33 Grenadier Lead
- 34 Blowfish Lead
- 35 Jellyfish Play Concept
- 36 Updip Hermes & Archaeopteryx Leads
- 37 Amplitude Anomalies at Top & Intra Latrobe levels

LIST OF ENCLOSURES

- 1 Top Latrobe Group TWT Map
- 2 Top Latrobe Group Depth Map
- 3 51.5Ma Marker TWT Map
- 4 51.5Ma Marker Depth Map
- 5 Top Cretaceous TWT Map
- 6 TOP Cretaceous Depth Map
- 7 Top Golden Beach Group TWT Map
- 8 Top Golden Beach Group Depth Map

1 CONCLUSIONS AND RECOMMENDATIONS

This report summarises the results of the seismic interpretation of the reprocessed 2D and 3D datasets in VIC/P45. In addition to improved time picking, the reprocessed data has allowed more robust stacking-velocity based depth conversions to be carried out. The revised mapping has downgraded the prospectivity of most of the leads in the northern part of VIC/P45, largely due to the impact of a less favourable depth conversion. In the southern portion of the block, the work has had little impact on Lower Latrobe & Golden Beach fault-dependent closures, primarily because the quality of the 2D data is still insufficient to reliably delineate these plays. Potentially prospective amplitude anomalies have also been recognised at Top Latrobe and Top Cretaceous levels in the southwestern portion of the permit.

While the results of this work are somewhat disappointing, the current seismic dataset is clearly insufficient to develop optimal prospectivity models for VIC/P45. The forthcoming HGP2002A 3D seismic survey will provide the basis for a substantially improved understanding of the structure and stratigraphy of the permit. The revised mapping has demonstrated, as expected, that most of the currently identified prospects and leads are highly sensitive to the depth conversion methodology that is applied. Accordingly, careful high-density velocity analysis is a critical component of the current 3D processing sequence. Furthermore, it is clear that advanced depth conversion techniques, which go beyond previous linear time-to-depth stretching, will be required to accurately ascertain the volumetric potential of subtle closures in the acreage. The potential to include post-stack depth migration in the final 3D processing stream is therefore currently being investigated.

2 INTRODUCTION

An interpretation of the full GGG reprocessed 2D dataset within and adjacent to VIC/P45 was carried out from March to June 2002. This interpretation was also integrated with the results of previous mapping of the reprocessing. The aims of the project were as follows:

- Develop a suite of up-to-date permit-wide TWT maps at key horizons;
- Create a set of calibrated, horizon-based stacking velocity grids for improved depth conversion accuracy;
- Develop to set of revised depth maps at key horizons;
- Based on these products, determine an interim ranking of prospect & leads, thereby providing the basis for a focussed interpretation of the forthcoming 3D data.

Given the tight time-frame between the planned delivery of the new HGP2002A seismic survey (final version due Early December 2002) and the commitment date for the Year 2 well (to be spudded by May 15th 2003), a detailed interpretation of the pre-existing reprocessed data was considered key to highgrading areas of the new 3D for detailed interpretation. However, a change in strategy has now been made, and it is BHP Billiton's intention to seek a further suspension of the permit (or a deferral of the commitment well into Year 3), in order to allow sufficient time to maximise the impact of the HGP2002A survey on the selection of drilling candidates.

Final migrated stacks (SEG-Y with navigation data), the CGG final 2D & 3D reprocessing reports, and BHP Billiton digital interpretation products (TWT horizons, TWT, velocity and depth grids) have been provided to Inpex as part of this data package.

3 DATABASE

The interpretation was carried out using Seisworks 2D-3D and incorporated the following seismic surveys (Figure 2):

- The CGG reprocessed 2D seismic grid in and around VIC/P45 (Figure 3). For those lines where reprocessing was not possible due to missing/degraded field tapes, the original processing version was incorporated into the interpretation. A total of 6700km across thirteen vintages was interpreted.
- The CGG PrSTM and PrSDM (converted back to time) reprocessed versions of the Archer 3D dataset
- In order to provide better interpretation & velocity control in and around the northern part of VIC/P45, the Kingfish 3D survey was also incorporated into the interpretation product.

All wells in the vicinity of the interpretation area were tied to the seismic grid. The following wells, for which a reasonable quality well-tie existed, were further incorporated into the calibrated stacking velocity depth conversion: Anemone-1/ST1, Angler-1, Archer-1, Anthene-1, Ayu-1, Devilfish-1, Edina-1, Gurnard-1, Helios-1, Hermes-1, Kingfish 1 to 9, Melville-1, Moray-1, Mudskipper-1, Nannygai-1, Orange Roughy-1, Pike-1, Roundhead-1, and Selene-1.

The well-ties utilised formation tops picked as part of previous Esso-BHBP regional studies. These are considered to be generally robust and only minor changes were required to form an internally consistent dataset. Synthetic seismograms were not

generated for all relevant wells and this is considered to be a priority task to be completed prior to the delivery of the HGP2002A seismic survey.

4 TIME MAPPING

Horizon picking was carried out for BHP Petroleum by consultants Basian Enterprises Pty Ltd, using Seisworks 2D/3D software. This exercise was hindered by the widely variant line orientations as well as multiple vintages of data. Rather than attempting to generate a single, phase-rotated and time-shifted dataset, the decision was made to handle these complex mis-ties subsequent to the interpretation process using XXXX Pty Ltd's proprietary mis-tie analysis software. It was unfortunately not possible to satisfactorily resolve the mis-tie problems, and consequently there was a requirement to carry out additional smoothing of TWT grids with a consequent loss of detail.

Prior to picking, the reprocessed datasets were phase shifted to mimic quadrature phase. This provides consistency with other (Esso) datasets in the basin, and is also considered an appropriate step given the complex stratigraphy of the Intra-Latrobe and Golden Beach targets. Quadrature phase can be viewed as a coarse, pseudo-impedance log and consequently makes interpretation of thin reservoirs and/or seals more intuitive.

Well-ties were made by making assumptions with respect to the polarity of the event and by bulk shifting wells to achieve a best-fit tie across all horizons. Prior to the interpretation of the forthcoming HGP2002A 3D seismic survey, good quality synthetic seismograms will be generated for all wells to aid in a more reliable tie that can also account for variation in the character of the mapping event across the survey.

Eight horizons were picked across the entire dataset, with character as noted below:

- | | |
|---------------------------------|--|
| 1. Water Bottom: | Interpreted as a peak for convenience |
| 2. Base Shallow Channelling: | Interpreted as a peak for convenience |
| 3. Base High Velocity Channels: | Peak-to-trough zero-crossing |
| 4. Mid Miocene Marker: | Peak-to-trough zero-crossing |
| 5. Top Latrobe Formation. | Peak-to-trough zero-crossing (except over Kingfish where it was interpreted as a peak) |
| 6. 51.5Ma Marker: | Trough-to-peak zero-crossing |
| 7. Top Cretaceous | Peak-to-trough zero-crossing |
| 8. Top Golden Beach Fm | Peak-to-trough zero-crossing |

Figure 4 shows an example of these horizons on the reprocessed 2D line CF91A-41, which ties the Helios-1 and Angler-1 wells. Data quality is very good down to the Top Latrobe level, with little ambiguity in picking. Below this point, data-quality is significantly poorer. This reflects the more complex internal stratigraphy of the Latrobe & Golden Beach Groups; the marked increase in fault density & throw; and a reduction in frequency content and signal-to-noise ratio.

Figures 5 to 12 show TWT maps at each of the interpreted horizons. The maps have been generated from interpretation of the reprocessed 2D & 3D data. Each of these maps has had a least squares mis-tie methodology applied.

5 DEPTH CONVERSION METHODOLOGY

The TWT interpretation of the reprocessed data down to Top Latrobe Group level was similar to that carried out on the reprocessed data set. This was expected given the high-quality seismic data and relatively unfaulted structural setting of the post-Latrobe Group sediments.

Depth conversion, on the other hand, is significantly less well constrained in the vicinity of VIC/P45. A complex velocity field is present due to varying water depth and multiple generations of Tertiary canyon cutting. The commercial importance of accurate depth conversion in the permit is demonstrated by the failure of Helios-1 (1982), which targeted a large four-way dip closure in TWT that was subsequently shown to be outside of closure. The presence of a thickened, high-velocity channel section at the well location is interpreted as being directly responsible for the creation of a time-closure where no depth closure exists.

During BHP Billiton's initial evaluation of the V99-2 gazettal block (now VIC/P45), depth conversion was perceived as a critical area of uncertainty, as it relied upon a substantially incomplete library of 2D stacking velocity data from a wide range of vintages of seismic data. One of the primary reasons for the reprocessing of the 2D data in the permit was to establish a more robust velocity field, through the application of high-density velocity analysis (HDVA) to the reprocessed gathers. The HDVA dataset provides a much more dense and accurate representation of the velocity field in VIC/P45.

Depth conversion of the CGG reprocessed dataset utilised the 2D HDVA velocities together with the velocity field from the reprocessed Archer 3D survey. The varying orientations & acquisition geometries of the multiple vintages of 2D data meant that

significant velocity “mis-ties” existed. These were partially dealt with using a least-squares mis-tie analysis. The resultant average velocity grids show clear regional trends but these are overprinted by high-frequency noise. In order to obtain a suitable product for depth conversion, these velocity grids were smoothed using a constrained algorithm, which ensured that the complexity of the final velocity grid did not exceed that of the two-way-time grid. These grids were in turn calibrated to the well velocities (including a least-squares derived bulk shift to account for the effects of anisotropy), yielding final velocity grids. The depth conversion was then carried out using a simple linear time-to-depth stretch.

The unsmoothed, mis-tie corrected average velocity map for the Top Latrobe Group is shown in Figure 13, while the final product (after constrained smoothing and calibration to wells) is shown in Figure 14. In order to determine the accuracy of the Top Latrobe depth conversion, the well-calibration was applied excluding each well on a one-by-one basis. This process demonstrated an average predictive error of 0.79% at Top Latrobe level (Figure 15), which translates to an error of +/-20m at typical target depths in VIC/P45.

While this outcome is considered reasonable given the imperfect nature of the current seismic velocity database, it is not considered sufficiently accurate for the reliable risk & volumetric characterisation of subtle Top Latrobe Group closures. In order to best address the current uncertainties in depth conversion, HDVA will be a key component of the processing sequence for the HGP2002A seismic survey. The lateral variability of the shallow velocity field also suggests that simple depth-stretching may not yield an optimal depth map and accordingly depth migration workflows are being investigated for the HGP2002A interpretation.

Calibrated depth maps at Top Latrobe, 51.5Ma, Top Cretaceous and Top Golden Beach levels are shown in Figures 17 to 25. For the shallower horizons detailed depth conversion has not been undertaken, but approximate depth maps have been generated on the assumption of a 97.5% calibration between stacking & actual velocities. These maps are shown in Figures 26 to 29.

6 IMPLICATIONS FOR PROSPECTIVITY

Based on the finalised mapping of the reprocessed 2D and 3D datasets, the potential of each of the previously identified leads has been reviewed. In most cases, the mapped closures are somewhat smaller than the pre-bid mapping had suggested, largely as a result of the revised depth conversion. However, it should be stressed that the current

dataset is suboptimal and it remains probable that the forthcoming permit-wide 3D survey will delineate robust prospects to fulfil the two-well commitment in VIC/P45.

6.1 Coelacanth

The Coelacanth structure (Figure 30) is a four-way dip closure at Top Latrobe level located approximately 2.5km south of Helios-1. At the time of the V99-2 gazettal, it was realised that northward thickening of the high velocity Gippsland Limestone channel-fill succession created a time closure at Helios where no depth structure existed. However, two alternative depth conversion methodologies both demonstrated the presence of a Top Latrobe four-way depth closure (Coelacanth) to the southeast of Helios where no time closure existed. While the presence of a thick, high-velocity channel sequence over the Coelacanth-Helios area complicates depth conversion, it is noted that there is a spatial relationship between the axis of this channel system and the crest of the Kingfish field.

As expected, the time mapping at the Top Reservoir (Near Top Latrobe 51.5Ma marker) around Coelacanth on the CGG reprocessed 2d and 3d datasets is little different to that carried out on the original data. However, the depth conversion utilises a much-improved stacking velocity dataset and is therefore considered a key test of the prospectivity of the feature. The revised depth conversion shows a closure height of approximately 15m (2580 to 2595m) and an areal extent of 3km².

This is considerably less than the 40m and 12.5km² estimated during the gazettal evaluation. Whilst disappointing, the revised figures should be no means be considered final. In conjunction with refined TWT picking, a more robust depth conversion utilising the HGP2002A high-density velocity analysis will be carried out at Coelacanth. Given the low relief nature of the closure, the simple linear-stretch depth conversion methodologies that have been carried out thus far are considered sub-optimal and depth migration (either post or pre-stack) will be required prior to drilling.

Because of the low relief of the Coelacanth closure, volumetrics are highly sensitive to the reservoir quality of the uppermost Latrobe Group, and in particular the thickness of probable condensed marine sequences that may behave as waste zones. Accordingly, a significant body of work has been undertaken during 2002 to better understand the stratigraphy of this part of the succession. This work is

nearing completion, but will need to be revisited to incorporate planned seismic-stratigraphic analysis of the HGP2002A seismic.

6.2 Galaxias-Archer-Anemone

Remapping of the Galaxias complex (Figure 31) on the CGG reprocessed datasets was followed by a detailed petrophysical, petroleum engineering and economic review. On the basis of this work, the mean recoverable resource for a two-well development at Galaxias was revised downwards to 14.3MMstb.

As previously communicated to the Joint Venture, this resource is insufficient to justify drilling Galaxias-1 as the first exploration well in VIC/P45. Based on the current interpretation, Galaxias remains a candidate for a future potential tieback, but most likely only if infrastructure costs can be shared with another discovery in the permit. Galaxias will still be remapped in detail on the HGP2002A survey, as it is possible that the new data will bias the current reserves distribution towards the upside.

Furthermore, Archer-1 & Anemone-1 provide valuable calibration points for understanding the trap seal elements of the Intra-Latrobe/Golden Beach play in VIC/P45. At present, there is an unresolved contradiction between the mapping of Galaxias-Archer and the distribution of stacked pays in Archer-1. The present mapping incorporates a north-south fault with a throw of c.20m between the Archer & Galaxias compartments. However, the presence of isolated stacked pays in Archer-1 would require this fault to behave as a seal at all points along its length. "Quantiseal" modelling suggests this is highly unlikely, and that instead the fault is either absent or has considerably lower displacement than is currently mapped. A key objective of the remapping of Galaxias on the HGP2002A survey will be to accurately constrain the presence and nature of this fault.

6.3 Scampi

Scampi is a four-way dip closure at Top Cretaceous level located immediately east of Anemone-1 (Figure 32). The feature lacks time closure, and relies on the existence of a strong velocity gradient (increasing to the northwest) to create reversal of regional dip to the southeast. The inferred closure overlies a northwest-southeast trending fault block at Top Golden Beach level, providing some explanation for the Top Cretaceous closure, which strikes parallel to the northwest-southeast trending faults at Top Golden Beach level.

However, Scampi lacks depth (or time) closure at Top Golden Beach and Top Latrobe levels, casting some doubt on the validity of the current depth conversion. The volumetrics of Scampi are very sensitive to the depth conversion methodology applied, and based on the most recent stacking velocity based methodology, the lead has minimal closure height and an area of less than one square kilometre.

While Scampi is already mapped on the existing GF88b 3d survey, the new HGP2002A 3D is still likely to significantly reduce the uncertainties currently associated with the feature. A careful depth conversion that goes beyond the current linear depth-stretch will be required to accurately assess the potential of the lead.

6.4 Grenadier

The Grenadier structure is a low-side, fault-dependent three-way dip closure mapped at Top Golden Beach level (Figure 33). The play-type has not yet been drilled on the southern margin of the Gippsland Basin, but broad analogues have proved successful on the northern margin of the basin (eg Manta-1, Kipper-1).

Mapping of the reprocessed 2D seismic data has resulted in a more complex fault pattern than previously interpreted, an outcome that potentially increases the cross-fault seal risk associated with the prospect. As currently mapped, Grenadier has an areal extent of approximately 10km² and a closure height in excess of 200m. However, the current 2D seismic grid is clearly insufficient to accurately resolve the structural configuration of the feature and an accurate statement of risks & reserves will not be able to be arrived at until interpretation of the HGP2002A 3D has been completed.

In addition to detailed structural mapping, the new 3D dataset will be critical to mapping the extent of Latrobe & Golden Beach Group marine shales which provide top & cross-fault seals to plays such as Grenadier. A seismic inversion is planned to assist in mapping the distribution of these shales. Given the presence of clear DHIs in analogue discoveries along the northern margin (eg Kipper), significant effort will be applied towards the identification of flat spots and amplitude anomalies.

6.5 Blowfish

Like Grenadier, Blowfish was originally mapped a low-side fault dependent three-way dip closure mapped at Top Golden Beach level (Figure 34). Interpretation of the

original dataset in this area was non-unique, as inadequate strike control and poor data quality below Top Latrobe level led to fault aliasing problems. Unfortunately, the reprocessing has done little to address the uncertainties associated with the lead. The current (reprocessed) interpretation has broken the main southern bounding fault into three en-echelon fragments.

If this interpretation is correct, the trapping geometry at Blowfish is invalid. However, considerable uncertainty in the true interpretation remains, and it is probable that this will be largely addressed by the HGP2002A 3D seismic survey. There is thus some chance that the survey will delineate a robust fault-dependent closure along the Blowfish trend. Other trends to the southwest of Blowfish also have the potential for fault-dependent Lower Latrobe & Golden Beach plays to be developed. As is the case for the Grenadier lead, the critical cross-fault seal risk for these leads will be addressed as part of the permit wide stratigraphic study.

6.6 Jellyfish

Jellyfish is a play concept that targets the pinchout of Lower Latrobe Group Maastrichtian sands against granitic basement along the southern margin of VIC/P45 (Figure 35). Mudskipper-1 (Petrofina, 1990) targeted the play but was drilled beyond the pinchout edge of the sand. The present 2D seismic grid is not able to adequately address the primary risks (trap geometry and top seal) and neither is it sufficient to define a specific lead.

Consequently, no attempt has been made to mature the Jellyfish concept during the current mapping project. Rather, Jellyfish will be addressed by the forthcoming HGP2002A seismic survey, which will provide the foundation for detailed seismic stratigraphy and LFP analysis. While the risked value of the Jellyfish prospect is clearly modest, the possibility exists that the new 3D will firm it up into a high-value drilling candidate.

6.7 Other Leads

Several other leads have been previously identified within the permit. The status of these is summarised below:

Updip Hermes is a high-side, fault-dependent closure at Intra-Latrobe level updip from the Hermes-1 well (Figure 36). A clear untested time closure exists updip of the previous well; however the current depth conversion suggests that this may at least

in part be due to thickening of high-velocity channel-fill sediments towards the bounding fault of the structure. Data-quality in the area is good and it is expected that the prospectivity of the lead will be clearly defined by the HGP2002A seismic survey.

Archaeopteryx (Figure 37) was identified during the V99-2 gazettal evaluation as a four-way dip closure at Top Cretaceous level. On time maps the feature lacks closure due to a northward increase in velocity associated with high-velocity Tertiary canyon-fill. Depth conversion reveals a modest depth closure, currently mapped with 4km² of areal closure and 22m of relief. The crest of the feature is possibly faulted although this is ambiguous on the currently available 2D data. Archaeopteryx lacks closure at Near Top Latrobe and Top Golden Beach levels. Like Updip Hermes, data quality is good, and the HGP2002A 3D data is expected to accurately define the potential of the lead.

Near Top Latrobe Amplitude Anomalies: During reprocessing of the 2D dataset a potentially prospective amplitude anomaly was recognised in the south western corner of VIC/P45 (Figure 37). A high-amplitude, low acoustic impedance event that clearly terminates against the extension of the Foster Fault system is recognised at Top Latrobe level on line GF91A-18. Approximately 100ms deeper in the section, at near Top Cretaceous level, a second amplitude anomaly with a similar morphology is also observed. Amplitudes are also observed at Top Latrobe level on several other 2D lines; however their spatial distribution suggests stratigraphic variation is a significant contributor to their morphology. Given the excellent data quality & simple structural regime at Top Latrobe level in this part of the basin the HGP2002A survey is considered highly likely to provide an accurate understanding of the prospectivity of this amplitude anomaly, and any others that might be recognised.