



908241 001

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**VIC/P43**

**GEOGRAPHE NORTH-1**

**Technical Note and Request  
for Year 6 Exploration  
Well Credit**

**March 2002**

28 MAR 2002

**T** ECHNICAL NOTE**Petroleum Development**

**To:** Department of Natural Resources and Environment

**From:** Woodside Energy Limited

**cc:** Origin Energy Resources Ltd, CalEnergy Resources (UK) Ltd

**Reference:**

**Date:** 22/03/02

**Subject:** **VIC/P43 - Geographe North-1 Exploration Well**

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**1. Introduction**

At the request of the Delegated Authority, Woodside Energy Ltd has prepared the following technical information in support of its planned application for the Geographe North-1 well to be considered as fulfilling the Year 6 exploration commitment well in VIC/P43. In accordance with requests from the Victoria Department of Natural Resources and Energy this technical note includes:

- depth structure map at the Top Flaxman (top porosity) level (Fig. 1)
- amplitude map at the top porosity level (Fig. 2)
- depth structure maps at the Top Lower Waarre level (Fig. 3)
- amplitude map at the Top Lower Waarre level (Fig. 4)
- arbitrary seismic line between the Geographe prospects (Fig. 5)
- a log correlation between Geographe-1 and Geographe North-1 (Fig. 6)
- a seismic-based cross-section over the Geographe prospect area (Fig. 7)
- a pressure summary plot for Geographe-1 (Fig. 8)

A map on the Top Upper Waarre has not been made separately because aerially, this event is not readily resolvable on seismic and was not mapped over the area.

**2. Background**

Following the discovery of a 247 m gross gas column in Geographe-1 but prior to the drilling of the Geographe North structure, the major risk associated with the Geographe North prospect was whether gas spilled from the Geographe South structure to Geographe North.

At the Top Flaxman level, seismic interpretation indicated that both structures could be in communication with a common gas-water contact at approximately 2032 mss. However, seismic amplitudes in the section below mapped top porosity (Top

Flaxman) are only clearly indicative of gas pore-fill over the Geographe South structure.

Seismic and geologic correlation suggested that the Flaxman Formation lapped onto the Geographe North structure and was present only as a thin section over the structural crest. It was thought that, due to differing rock properties at Geographe North (Waarre Formation below Belfast seal), gas might still be present without the seismic response of bright amplitudes. A comprehensive quantitative interpretation study was therefore undertaken to determine the chance for the presence of gas in the Geographe North Prospect. This study concluded that, for all cases modelled, bright amplitudes would be expected on the far-offset seismic data. For this reason, the pre-drill chance of success for Geographe North-1 was decreased to 21%.

Geographe North-1 was drilled and encountered thin Flaxman Formation above Waarre Formation and only minor gas indications. It was concluded that the prospect failed due to either trap failure (fault leakage) or lack of charge due to migration problems.

### **3. Relationship between Geographe South and Geographe North**

#### *Top Flaxman structure and Amplitude*

Figure 1 shows the depth structure at the top Flaxman level tied to both wells. Figure 2 shows the same depth structure draped over the seismic amplitudes measured as the absolute average over a 50 msec TWT window below the top Flaxman.

The GWC established in Geographe-1 at approximately 2032 mss is shown projected over both the Geographe south and north structures, however, the absence of reservoir in the Flaxman in Geographe North-1 indicates that this is not a top porosity structure map. As demonstrated below, structural separation occurs between Geographe North and South at the Waarre level. The true top porosity structure is not known regionally because no seismic event appears to correspond with top effective porosity in a simple manner.

The amplitude response below the mapped top Flaxman in Figure 2 shows high amplitudes in the Geographe South structure with a SW-NE trend. In contrast, amplitudes are low over Geographe North. The high amplitudes terminate in the north along a small-scale fault that offsets the top Flaxman section.

#### *Top Lower Waarre structure and Amplitude*

Figure 3 shows the depth structure at the top Lower Waarre level tied to both wells. The GWC established at Geographe-1 (2030m) is displayed at both the Geographe North and South structures and shows the development of two isolated structures at this level.

The amplitude response extracted at the Lower Waarre horizon on the far offset data (Figure 4) shows high amplitudes in the Geographe south area with a SW-NE trend. Although some high amplitudes are seen on the fars data about the Geographe north structure, they are separate from the amplitudes observed at Geographe south. Structuring in the region is seen to compartmentalize possible reservoirs in this area.

### *Seismic Cross-section*

Figure 5 shows an interpreted arbitrary seismic line (final migrated, full stack data) over the Geographe South and Geographe North structures to demonstrate the seismo-stratigraphic relationships between the two structures. The top Flaxman pick is a peak event (black, soft, positive) at Geographe-1 and a trough event (red, hard, negative) at Geographe North-1 (as supported by well synthetic seismograms). The Flaxman and Waarre gas-filled section in Geographe-1 displays bright amplitudes on the seismic and low amplitudes are present in the Waarre Formation below the GWC. At Geographe North-1, however, the seismic amplitudes are comparatively dull from the Top Flaxman event through the Waarre section.

The interpreted line highlights the location of the GWC and the pinch-out of the Flaxman sequence from Geographe-1 to Geographe North-1. It shows the termination of the bright amplitudes in the saddle area between Geographe South and Geographe North at an apparent fault. It is concluded that, north of this point there is no gas and that there must be either a fault-seal controlling the extent of the gas in Geographe South or a change in geological facies to non-reservoir, or both mechanisms may be acting. This geology may have prevented the gas trapped in the Geographe South structure from migrating into Geographe North.

### *Structural and stratigraphic cross-section*

Figure 6 shows a log correlation between Geographe-1 and Geographe North-1. Lithological and palynological data demonstrates variation in stratigraphic relationships over the two structures. The lithostratigraphic column at Geographe-1 indicates a relatively sandy Flaxman Formation, whilst at Geographe North-1 the section is shaley. Although the accompanying palynological data (displayed on Fig. 6) questions the location of the existing lithostratigraphic picks, it does support observations of variation in lithology in the respective Flaxman intervals at each well. It also indicates that the Flaxman Formation is condensed over Geographe North-1. At Geographe North-1 the biostratigraphically constrained section is completely shale, whilst at Geographe-1 the section comprises thick sand-shale inter-beds.

Figure 7 is a schematic cross-section illustrating the proposed stratigraphic relationships over the Geographe area, interpreted from seismic. It shows how the gas-bearing Flaxman sands terminate at a minor fault, beyond which non-reservoir facies is predicted.

### *Pressure Data*

Pressure data from MDT measurements in Geographe-1 are shown in Figure 8. Good data was obtained through the gas and water legs, although samples taken in the Flaxman Formation are interpreted as supercharged. A single gas column with a gradient of 0.261 psi/m is interpreted in the gas column. A clear water gradient of 1.382 psi/m is interpreted in the Lower Waarre Formation. The intersection of these two gradients provides the basis for an inferred GWC of 2031.8 mss, which is similar to the petrophysically derived GWC in the well.

No pressure data was obtained at Geographe North-1.

**4. Basis for Geographe North-1 to be classed as an Exploration well**

The Geographe North-1 well should be classed as an exploration well on account of the following:

- the well tested non-amplitude supported Waarre
- the well tested a structure that is independent and isolated from the Geographe South structure and the Geographe gas discovery
- the pre-drill chance of success was 21%
- the well encountered weak gas shows only

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of Geographe North-1 Technical Report  
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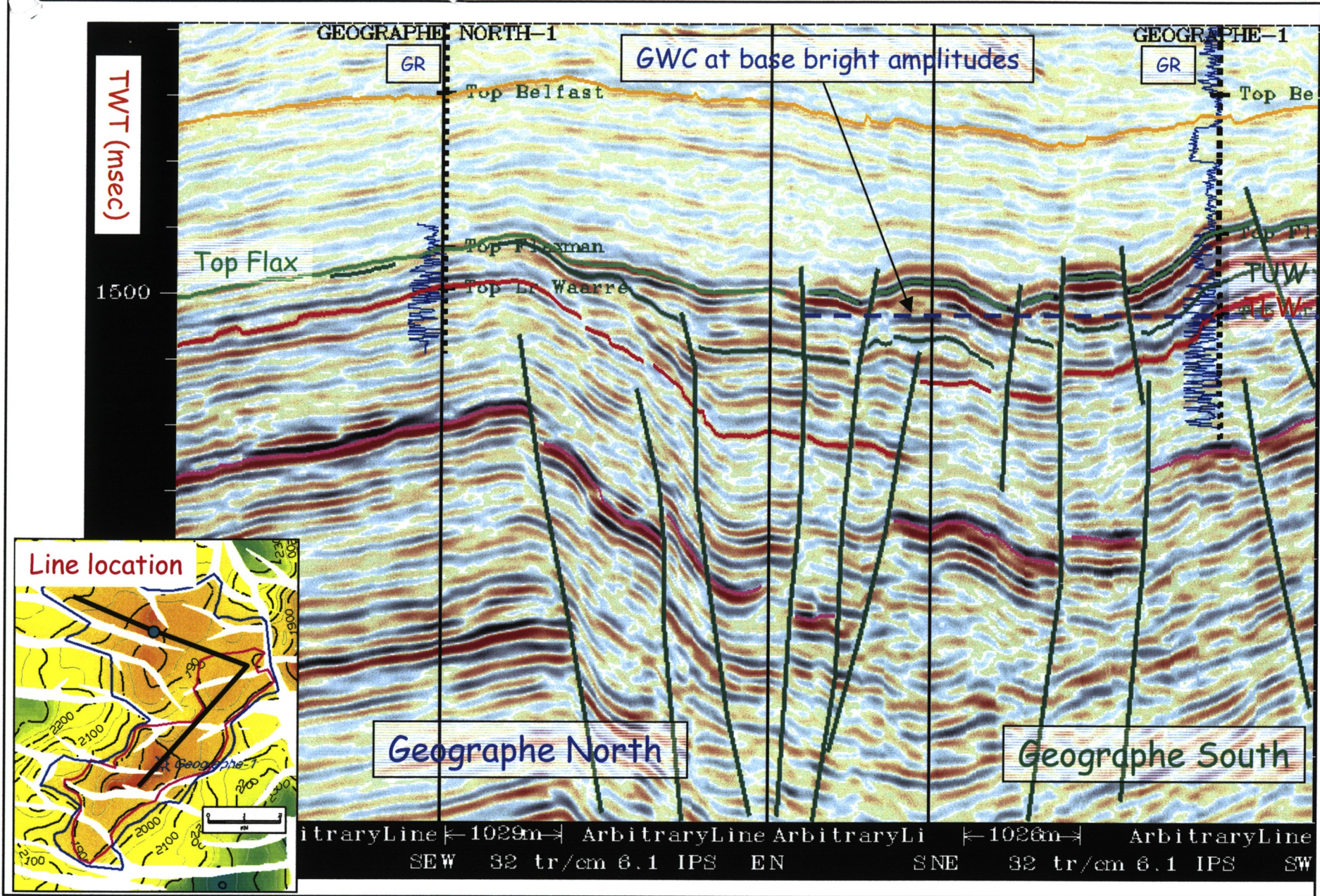
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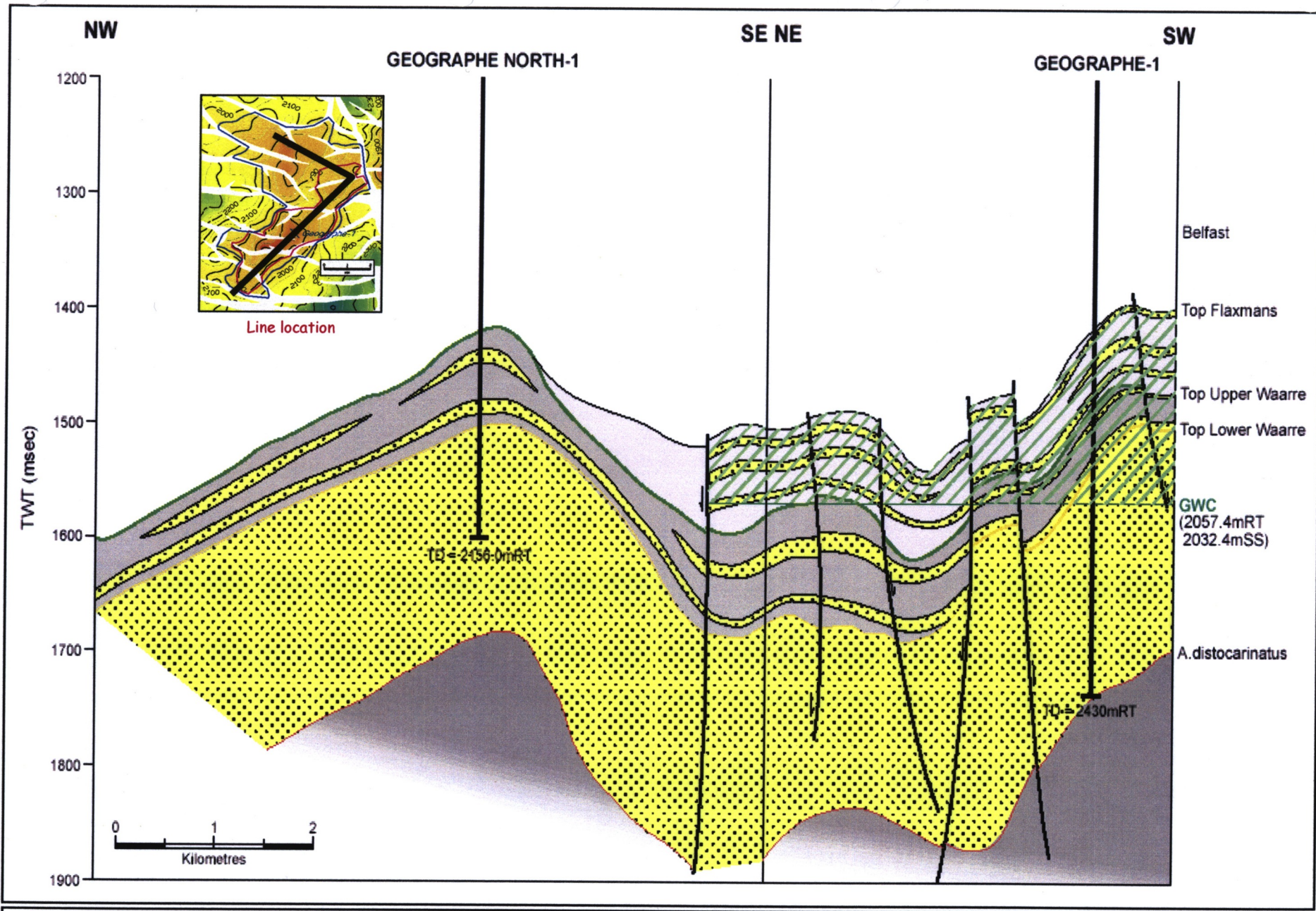
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**Figure 5: Arbitrary Seismic Line Between Geographe-1 and GN-1**



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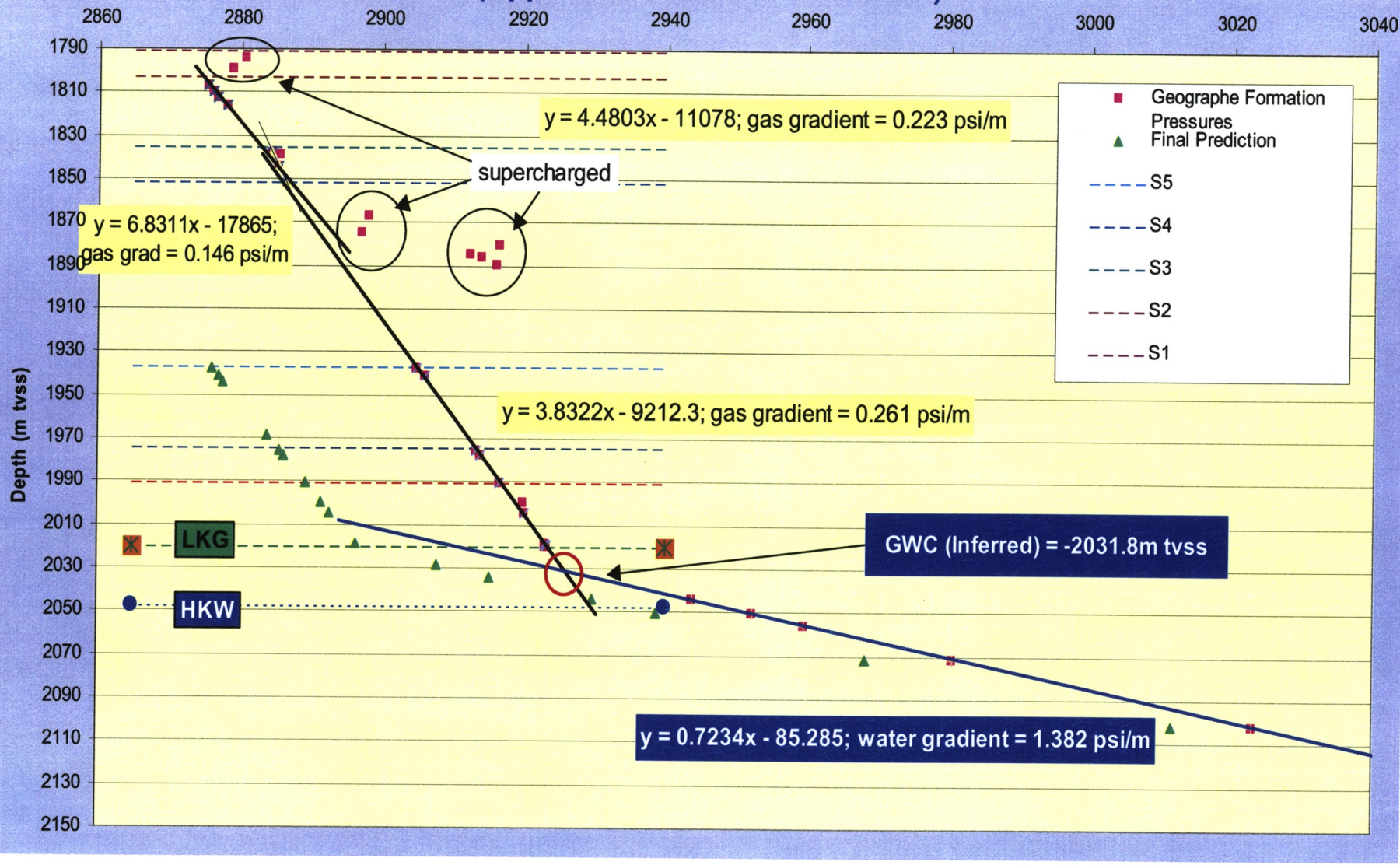


**Figure 7: Schematic Cross-section between the Geographe Prospects (following Figure 5)**



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# Geographe-1 Formation Pressures (CQG, psia) (Upper/Lower Waarre Formation)



**Figure 8: Formation Pressures @ Geographe-1**



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