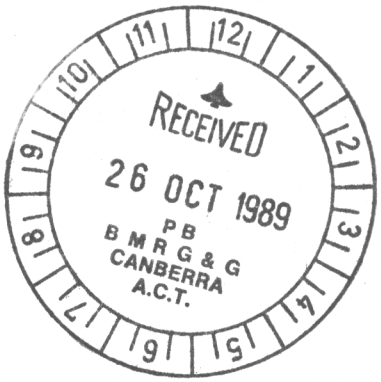
PETROFINA EXPLORATION AUSTRALIA S.A.

INTERPRETATIVE

Sedimentological Interpretation

of the Latrobe Group

in Angler-1



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LIST OF ENCLOSURES

LIST OF TABLES

1. INTRODUCTION

A detailed sedimentological study of the Latrobe Group has been carried out at Angler-1. The interval covers 1537m of section from 2800m (21m above the Top Latrobe unconformity) to 4337m (TD).

All available wireline logs were used in this study, including the MSD processed dipmeter log. Results from Core #1, cuttings descriptions and palynological results were also integrated in this work. The interpretation has been draughted as a sedimentological log, incorporating the composite log, the MSD dipmeter log (tadpoles and SHDT resistivity traces), and the sedimentary interpretations (Enclosure 1).

2. LATROBE GROUP SEDIMENTARY INTERPRETATION

Three main depositional environments have been identified in the Latrobe Group at Angler-1. These are shallow marine; deltaic; and lower coastal plain environments, similar to those previously described in the other wells situated in the Central Deep of our licence (Questiaux and Tringham 1988). Figure 1 schematically illustrates a typical log for the three depositional environments and their sub-environments, while Table 1 summarizes their main diagnostic features.

3. WELL INTERPRETATION RESULTS

3.1 4337m (TD) - 4213m (Top Campanian "B" Sandstone)

This interval shows a general upward coarsening trend, with offshore marine siltstones at the base grading up to lower and upper shoreface sandstone units. The dipmeter indicates a uniform

south-southwesterly structural dip of 5° to 6°, but displays no clear sedimentary trends.

3.2 4213m - 3850m

This thick intra Campanian interval consists of a massive siltstone sequence deposited in a pro-delta environment, with some minor interbeds of poorly developed delta front sandstones near the top. The interval has a high seal potential and effectively seals the underlying Campanian "B" sandstones.

Structural dip of 6° to 7°, with a uniform trend to the south-southwest, is evident below 4150m, and swings sharply to the south-southeast above 4040m with an associated decrease in the dip amount to around 4° to 6°. The lack of computed dips between 4150m and 4040m is thought to be the result of bioturbation. This change in structural dip marks a possible unconformity in that interval, not reflected by any of the other wireline logs.

3.3 3850m - 3715m

This intra Campanian interval contains a series of blocky and upward coarsening stream mouth bar sandstone units, capped by siltstones and coals deposited in delta plain marshes. The dipmeter displays sedimentary blue and red patterns with a general trend to the south-east.

3.4 3715m - 3517m (Top Campanian)

This upper Campanian interval is made up of a mixture of stacked, upward coarsening stream mouth bar sandstone units similar to those in the underlying interval, interbedded with argillaceous lower delta front siltstones. Unlike the previous interval, no delta plain deposits are present, reflecting greater marine influence during deposition.

Overall, the interval shows a marked upward coarsening trend indicating a regressive depositional cycle. Sedimentary dips show up as a mixture of blue and red patterns trending from south-southeast to southeast.

3.5 3517m (Top Campanian) - 3252m (Top Selene Sandstone)

The top of the Campanian marks a major marine transgression, with pro-delta siltstones directly above the unconformity grading rapidly upwards into argillaceous lower delta front sandstones and massive stream mouth bar sandstones with excellent reservoir potential. The interval as a whole shows an upward coarsening trend, characterising a regressive depositional cycle. The presence of coastal plain coals and siltstones near the top of this interval indicates the start of non-marine influcence in the depositional environment at that level. The dipmeter shows a mixture of red and blue sedimentary patterns, with a bimodal azimuth trend to the south-southwest and to the south-southeast, indicating possible lobe switching during the progradation of this deltaic wedge.

3.6 3252m - 2958m (Intra-Maastrichtian)

This intra Maastrichtian interval is a continuation of the underlying regressive cycle, with only marginal marine influence present during deposition. Sedimentary units alternate between non-marine coastal plain siltstones and coals and deltaic stream mouth bar sandstones. Sedimentary dips trend to the south-southwest with only minor switches to the south-southeast, especially near the top of this interval. Some herringbone dip patterns are evident in the deltaic sequences and are interpreted as possible tidal bars.

3.7 2958m - 2909m (Intra-Maastrichtian)

A marine transgression marks the base of this interval, with lower delta front siltstones deposited directly above stream mouth bar sandstones at 2958m. This delta front siltstone is in turn overlain by a massive sandstone unit, whose blocky nature, together with its sharp erosional base and steep sedimentary dips to the southeast, indicates a likely distributary channel unit.

3.8 2909m - 2821m (Top Latrobe Unconformity)

A marine transgression eroding into the blocky sandstone described above marks the base of this interval. The sequence is made up of interbedded argillaceous siltstones and glauconitic sandstones deposited in offshore and lower shoreface environments.

4. CONCLUSION

The sedimentary facies in the Maastrichtian at Angler-1 were very much as predicted, with shallow marine shoreface units directly below the Top Latrobe Unconformity, grading downward to a mixture of non-marine coastal plain and deltaic sequences. The Selene Sandstones were, as predicted, a thick sequence of stream mouth bar sandstones with excellent reservoir potential.

The Campanian interval was found to be essentially deltaic/shallow marine as opposed to the thick non-marine coastal plain sequence found in the same interval at Hermes-1, and which was thought to be present in the Campanian in the Central Deep area of our licence. The marine nature of the Campanian at Angler-1 indicates the presence of a paleo-shoreline close to the well at that time. One implication is the possibility of upper shoreface sandstones with excellent reservoir potential being present in the Campanian, a feature not previously recognised. This strongly increases the prospectivity of the Campanian, moving some emphasis from the Selene Sandstones to deeper targets.

5. REFERENCES

Questiaux, J.M. and Tringham, 1988, A Sedimentological Interpretation of the Latrobe Group in Wells of the VIC/P20 area, Petrofina Exploration Australia S.A., Unpublished Report.

TABLE 1

SUMMARY OF SEDIMENTARY ENVIRONMENTS

MAIN ENVIRONMENT	SUB-ENVIRONMENT	LITHOLOGY	DIAGNOSTIC FEATURES AND LOG RESPONSE	DIAGNOSTIC SEDIMENTARY STRUCTURES	GEODIP/CLUSTER TRENDS
SHALLOW MARINE	UPPER SHOREFACE	**Sandstone** (med-crse)	Massive Bedding c.u. Cycles	Trough X-Bedding	Blue and Red Patterns Diverse Trends
	LOWER SHOREFACE	**Sandstone** (f-crse) Siltstone Shale	Interbedded c.u. Cycles	Hummocky X-Bedding	As above
	OFFSHORE	Siltstone **Shale**	Thin bedded siltstones Thick shales	Ripples Bioturbation	Green Pattern
DELTA	STREAM MOUTH BAR	**Sandstone** (med-crse)	Blocky Log Pattern Massive Bedding c.u. Cycles	Sharp Bases Trough X-Bedding	Blue and Red Patterns Unimodal Trends
	UPPER DELTA FRONT	**Sandstone** (f-med) Siltstone	Interbedded c.u. Cycles	Trough X-Bedding Parallel Lamination	As above
	LOWER DELTA FRONT	Sandstone (f) **Siltstone** Shale	Interbedded c.u. Cycles Individ. Sandstones f.u.	Ripples Parallel Lamination	Green Pattern
	PRO-DELTA	Siltstone **Shale**	Thin Bedded Siltstone Thick Shales	Ripples Bioturbation	Green Pattern
LOWER COASTAL PLAIN	FLOOD PLAIN	**Shale** (coaly) Siltstone		Parallel Lamination Root Bioturbation	Green Pattern
	MARSH	**Coal** Shale (coaly)	High Resistivity & Sonic Low Density		None
	CREVASSE SPLAY	**Sandstone** (f-med) Siltstone	c.u. or f.u. Cycles Thin Bedded, Spikey	Trough X-Bedding	Blue or Red Patterns Unimodal Trends
	CHANNEL FILL	Shale **Siltstone** Sandstone (v.crse-f)	f.u. Cycles	Sharp Erosional Base Trough X-Bedding in Sandstone	Red Pattern Diverse Trends
	POINT BAR	Siltstone **Sandstone** (v.crse-f)	f.u. Cycles	Sharp Erosional Base Trough X-Bedding	Red and Blue Trends Diverse Trends

FIGURE 1

LATROBE SEDIMENTARY ENVIRONMENTS