SANTOS – INPEX

COMPILED FOR

SANTOS LIMITED

(A.B.N. 80 007 550 923)

HILL-1

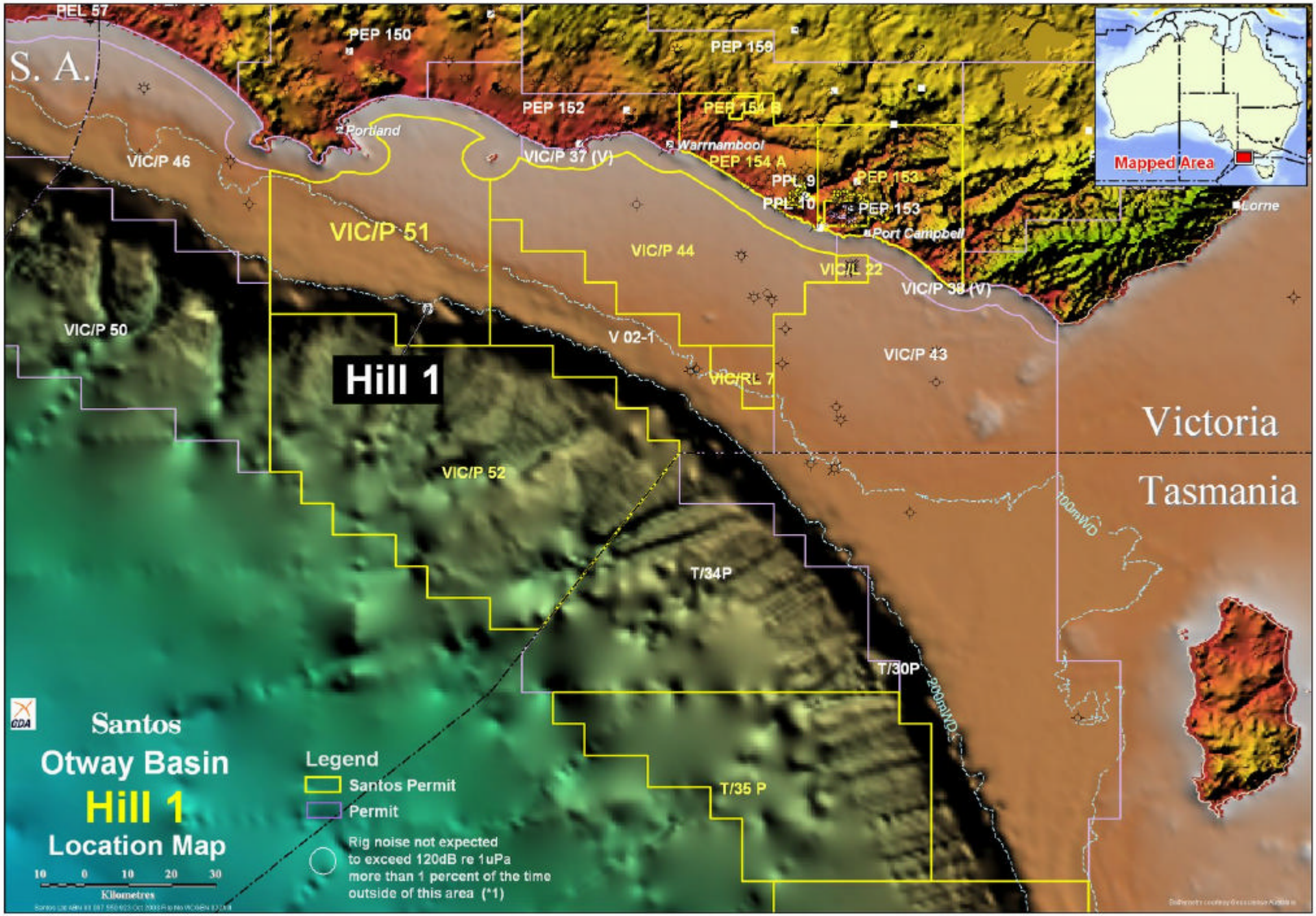
INTERPRETED DATA REPORT

PREPARED BY:
R. SUBRAMANIAN
(CONSULTANT)
APRIL 2004

HILL-1

TABLE OF CONTENTS

LOCATION MAP


REL 57
PEP 150
S. A.
PEP 159
PEP 152
PEP 154 B
Portland
Warrnambool
VIC/P 46
VIC/P 37 (V)
PEP 154 A
PPL 9
PEP 153
PPL 10
PEP 153
Port Campbell
Lorne
Mapped Area
VIC/P 51
VIC/P 44
VIC/L 22
VIC/P 38 (V)
VIC/P 50
V 02-1
Hill 1
VIC/RL 7
VIC/P 43
Victoria
VIC/P 52
Tasmania
100mWD
T/34P
T/30P
200mWD
T/35 P
GDA
Santos
Otway Basin
Hill 1
Location Map
10 0 10 20 30
Kilometres
Legend
Santos Permit
Permit
Rig noise not expected
to exceed 120dB re 1uPa
more than 1 percent of the time
outside of this area (*1)

WELL CARD

WELL: HILL-1	**WELL CATEGORY:** OFFSHORE OIL/GAS EXP	**SPUD:** 08-12-03 **TD REACHED:** 20-12-03
	WELL INTENT: OIL/GAS	**RIG RELEASED**: 25-12-03 **CMPLT:**
		RIG: OCEAN EPOCH
SURFACE LOCATION:		**STATUS**: ABANDONED DRY HOLE (ABDH)
LAT: 38° 48' 50.381" S **LONG:** 141° 50' 39.579" E (GDA94)		**REMARKS**:
NORTHING: 5703525.73M **EASTING:** 573303.40M		
SEISMIC STATION: OSO2 3D IL8714, XL2049		
ELEVATION SEA FLOOR: -212.7M LAT **RT** +22.4M LAT		
BLOCK/LICENCE: OTWAY BASIN - VIC / P 51		
TD 2576 M (LOGR EXTRAP) 2575 M (DRLR)		
PBTD M (LOGR) M (DRLR)		
TYPE STRUCTURE: TILTED FAULT BLOCK CLOSURE		
TYPE COMPLETION: NIL		
ZONE(S):		

HOLE SIZE	CASING SIZE	SHOE DEPTH	TYPE
914MM	762MM	268.0M	680 KG/M X56
445MM	340MM	769.0M	101 KG/M BTC L80
311MM	244MM	1801.2M	31.5 KG/M NEW VAM L80

AGE	FORMATION OR ZONE TOPS	DEPTH (M)		THICK-NESS (M)	HIGH (H) LOW (L)
		LOGGERS RT (M)	SUBSEA (M)		
EOCENE – QUATERNARY	UNDIFFERENTIATED HEYTESBURY / NIRRANDA GROUP	212.7	190.3	1398.8	22M H
EOCENE	WANGERRIP GROUP: DILWYN FM	1611.5	1589.1	70.5	13.5M H
EOCENE	PEMBER MUDSTONE	ABSENT	-	-	-
PALAEOCENE	PEBBLE POINT FORMATION	ABSENT	-	-	-
PALAEOCENE	MASSACRE SHALE	ABSENT	-	-	-
LATE CRETACEOUS	UPPER TIMBOON FORMATION	ABSENT		-	-
LATE CRETACEOUS	LOWER TIMBOON SANDSTONE	1682.0	1659.6	297	22M L
LATE CRETACEOUS	PAARATE	1979.0	1956.6	355	46M H
LATE CRETACEOUS	SKULL CREEK	2334.0	2311.6	216	NP
LATE CRETACEOUS	BELFAST MUDSTONE	2550.0	2527.6	26	5M H
	TOTAL DEPTH (LOGGER EXTRAP)	2576.0	2553.6		

LOG	SUITE/ RUN	INTERVAL (m)	BHT/TIME COMMENTS
PEX-DSI-HALS	**1 / 1**		
GR		2543 to Seabed	87C, 187F / 9:15 HRS
HNGS		2543 to 1801	
MCFL		2548 to 1801	NO REPEAT SECTION
HLLD		2553 to 1801	
HLLS		2553 to 1801	
HCAL		2550 to 1801	
SP		2575 to 1801	
DSI		2549 to 1801	
RHOZ		2550 to 1801	
TNPH		2545 to 1801	
CSAT - Checkshot	**1 / 2**	2570 to 1070	93C, 199F / 16:15 HRS
			TOTAL 30 STATIONS AT 50M INTERVALS. LOST SIGNAL @ 1070M
MDT	**1 / 3**	1978 to 2282	82.8C, 181F / 24:30 HRS
			TOTAL 11 PRETESTS, 2 CURTAILED, 9 NORMAL.
CST-GR	**1 / 4**	2543 to 1842	43 CORES ATTEMPTED. 21 RECOVERED, 15 LOST BULLETS, 2 EMPTY, 5 MISFIRES.

LOG INTERPRETATION						PERFORATIONS	
INTERVAL(m)	Ø %	SW %	INTERVAL(m)	Ø %	SW %	FORMATION	INTERVAL
						Nil	
						CORES	
						FORM / NO. / INTERVAL / CUT / REC	

PRODUCTION TEST RESULTS

NO PRODUCTION TESTS WERE CONDUCTED AT THE HILL-1 LOCATION.

SUMMARY:

Hill-1 was drilled as an Otway Basin deep water exploration wildcat well in the VIC/P51 licence. The Surface Location is Latitude: 38° 48' 50.381" S Longitude: 141° 50' 39.579" E (GDA94), Northing: 5703525.73m Easting: 573303.40m (MGA-94). The well is 59 km south southeast of Portland, Victoria. The Hill structure is covered by the recently acquired OS02 3D survey and lies within the interpreted Paaratte Sandstone play fairway. The water depth at the well location was 212.7m LAT. Hill-1 was drilled by the semi-submersible drilling rig "Diamond Offshore Ocean Epoch".

Hill-1 was drilled as an oil-target with a high probability that gas would be encountered in the reservoir. Hill-1 was a critical test of one of a series of structural closures at the top Paaratte Sandstone. The well would assist in establishing whether an oil model is applicable to the area and also confirm the top seal potential of the Timboon Formation equivalent section for drilling opportunities in the deep water region (VIC/P52). The Hill-1 Prospect was a tilted fault block closure with up to 180m of structural relief over an area of up to 27km2 at the Paaratte Sandstone primary target.

Hill-1 was spudded at 21:00 hrs on 8th December 2003 utilising the semi-submersible drilling facility "Ocean Epoch".

Bit 1, a re-run 660mm (26") Smith DSJ, run in conjunction with a 914mm (36") hole opener, drilled the 914mm (36") phase from seafloor at 235.2m to section total depth at 268m. Returns were to the seafloor. A string of 762mm (30") (680 kg/m X56) casing was run and set at 268m. The casing running tool and 914mm (36") BHA were laid out. Bit 2, a Reed EMS11GC was run in hole to tag the cement top at 117.0m and was used to drill the entire 445mm (17.5") hole section from 268m to 777m. The hole was circulated clean and displaced with gel. A string of 340mm (13.375") (101 kg/m L80) casing was run and set at 769m and pressure tested. The blowout preventers were installed on the marine riser and function tested. Thereafter, the 311 mm (12.25") BHA with Bit 3, Hughes HC605 was used to drill from 780m to 1444m with seawater and gel sweeps. At 1444m, the hole was displaced to 1.03 SG (8.6ppg) KCl/Polymer mud and drilling continued from 1444m to 1810m without major problems. The bit was pulled to surface to run casing. A string of 9.625" casing was run and set at 1801.2m. Bit 4, a Hycalog DSX104 of 216mm (8.5") diameter was run in hole along with Sperry Sun LWD tools to record Gamma Ray, Resistivity and Deviation Survey data. This assembly was used to drill the 216mm (8.5") phase from 1810m to the Total Depth of 2575m (D) which was reached at 01:30 hrs on 20th December 2003. At Total Depth, Schlumberger was rigged up and the following wireline logs were run. Run 1: PEX-DSI-HALS, Run 2: Checkshot survey, Run 3: MDT-GR and Run 4: CST-GR.

The well was drilled close to prognosis with most picks coming at the right geological age and close to the prognosed depth (see Table above), within expected error bands. The only significant variation to the prognosis was at the Top Paaratte (K93) Horizon, where the prognosed top was mapped on a high amplitude marker suggestive of a shale/sand contact. In reality, the presence of a hard cemented streak within the Paaratte Sandstone meant the top Paaratte came in 46m high to prognosis. The presence of an additional basal Timboon sand above the Paaratte, meant the top of the gross sand package was 52.5m above the pre-drill prognosed top sand.

Weak gas shows were encountered in the primary target Paaratte Formation, with up to C5 being detected. No gas or oil shows were encountered over the secondary objective upper Timboon sands. Weak oil shows were also encountered towards the top of the Paaratte. Subsequent log analysis indicated that all sands were wet. Average porosities for different sand-intervals ranged from 15.5 to 28.4%. MDT mobilities indicate fair to good permeabilities.

Hill-1 was Plugged and Abandoned as a dry well with oil and gas shows. Failure analysis indicates the primary cause of failure was due to cross fault seal. With the top gross-sand coming in 52.5 m high to prognosis and the presence of sand-stringers in the top of the Timboon mudstone facies, the amount of mudstone available for cross-fault seal was reduced from 255m to approximately 205m which was enough to set up a possible sand-on-sand juxtaposition across the main fault, at the approximate structural depth of the well intersection. The secondary significant risk factor is the presence and volume of charge. Reservoir and seal have been satisfactorily proven by the Hill-1 well. A small fault-dependent closure remains updip of Hill-1 well but could contain only a small volume of hydrocarbons.

Abandonment plugs were set as per program, Plug 1: 2575m to 2525m, Plug 2: 1831m to 1672m and Plug 3: 310m to 260m. The rig was released at 04:00 hours on December 25, 2003.

AUTHOR: R. SUBRAMANIAN **DATE**: April 2004

1. GEOLOGY

1.1 INTRODUCTION

Hill-1 was drilled as an Otway Basin deep water exploration wildcat well in the VIC/P51 license. The Surface Location is Latitude: 38° 48' 50.381" S Longitude: 141° 50' 39.579" E (GDA94), Northing: 5703525.73m Easting: 573303.40m (MGA-94). The well is 59 km south southeast of Portland, Victoria. The Hill Structure is covered by the recently acquired OS02 3D survey and lies within the interpreted Paaratte Sandstone play fairway. The water depth at the well location was 212.7m LAT.

The Hill-1 Prospect is a tilted fault block closure with up to 180m of structural relief over an area of up to 27km2 at the Paaratte Sandstone primary target.

Hill-1 was drilled as an oil-target with a high probability that gas would be encountered in the reservoir. Hill-1 was a critical test of one of a series of structural closures at the top Paaratte Sandstone. The well would assist in establishing whether an oil model is applicable to the area plus confirm the top seal potential of the Timboon Formation equivalent section for drilling opportunities in the deep water region (VIC/P52).

Hill-1 was drilled by the semi-submersible drilling rig "Diamond Offshore Ocean Epoch".

1.2 FIELD DESCRIPTION

Geological and Geophysical Background

The Hill Prospect is a three-way-dip closure, defined on a tilted fault block at the Paaratte Formation level. Secondary objectives have been defined at the Nullawarre Formation level and near the Base Tertiary Unconformity either in the subcrop trap beneath the unconformity or in the overlying transgressive sandstones.

Beneath the Nullawarre equivalent section approximately 2600m of Belfast Mudstones overlie the Waarre Formation. At the Hill location the Waarre Formation is at a depth of approximately 5100m and was not considered an economically viable target.

The structure is well-defined on 3D seismic data and there was very little risk associated with the presence of a structural high. Nevertheless, considerable uncertainty existed in the actual size of the feature due to depth conversion issues related to the presence of Tertiary carbonates over the structure and variable water-depths. These affect the overall size and shape of the structure but do not affect its presence nor impact markedly on the choice of the location of the initial well.

The Hill Prospect lies within the Paaratte Play Fairway which relies upon either the unproven Belfast Paaratte Petroleum System or an alternate liquids source from the Waarre/Flaxmans sequence for oil success. The Belfast Formation was proposed as a possible mature oil-prone source rock in the deep-water of the Otway Basin. The proven gas-prone Eumeralla-Waarre Petroleum System works in the onshore and nearshore parts of the Otway basin. However in the southern Vic/P51 area, the Eumeralla section generated prior to the emplacement of the Paaratte due to early burial and is currently over-mature for generation. The Belfast Formation is currently within the active oil-window. Onshore and nearshore, the Belfast Formation is a generally poor to gas-prone source but it was anticipated that source quality will improve basinwards.

The presence of an active liquids-prone source was supported by sea-floor seeps and bitumen strandings along the south-eastern Australian coast. In addition, geochemical studies that indicated the potential for multiple charge events into existing gas-accumulations along the eastern flank of the Mussel Platform that implies an early gas-prone charge (Eumeralla) followed by a more recent liquids-prone charge event (Waarre/Flaxman or Belfast).

Reservoir was considered highly likely in the Paaratte Formation. The Paaratte is mud-prone to the east of the Hill Prospect in the VIC/P44 area, but well developed in the northwest, in the Bridgewater Bay/Discovery Bay area. The 3D seismic data exhibited an area of higher amplitudes that are likely to be associated with a deltaic prograding system linked to a northwestern sediment source.

The overlying Timboon Sandstone is a sandstone-dominated section near the basin-margin, but 3D seismic suggested a fine-grained facies overlies the Paaratte sandstones. Logs in existing wells showed a transgressive/regressive pattern that records a regional flooding event. The transgressive mudstone facies is thin in the nearshore area but would thicken and become more laterally extensive towards the basin-centre. The Timboon equivalent mudstones were required to top-seal and also provide a cross-fault seal in the same manner that the Belfast Mudstone seals the gas-accumulations within the Waarre Formation in the nearshore.

The deeper water VIC/P52 portion of the 3D survey demonstrated a similar lobate deltaic section overlain by a blander Timboon equivalent mudstone section. The clarity in the seismic data in this deep water area was greater due to the thin Tertiary cover. Amplitude work and depositional models developed in this area have been applied to the Hill Prospect. Amplitude Variation with Offset (AVO) modeling at Bridgewater Bay and confirmed in other surrounding wells has demonstrated that the rock physics properties of the primary target are dominantly associated with a class 4 response. The characteristic of this class was that there was very little AVO observed on the modeled gathers. This was supported by 3D gathers. The increased amplitude over the prospect area was at least indicating a high likelihood of sandstone development. A stratigraphic trapping component could be inferred by weak indications of structural conformance in the northwest combined with a deltaic limit to the west. An additional bright section to the north could be associated with a faulted deltaic lobe. The Hill Prospect location has been chosen to test the higher amplitude section. In the event of a stratigraphic component to the trap with a pinchout to the east the prospect would spill to the west. In this event the areal extent and potential of the prospect was similar to the structural play.

It was not possible to differentiate on seismic data between water, oil nor gas on the current data unconstrained by well information.

Objectives

Primary Objective:

Formation	Target type	Trap type	Trap sub type	Reservoir
Paaratte	Oil	Anticline/Fault	Tilted Block	Paaratte Sst.

Secondary Objectives:

Formation	Target type	Trap type	Trap sub type	Reservoir
Base Tertiary Subcrop/Sst	Oil/Gas	Anticline	Anticline or combined stratigraphic play	Transgressive Sst or Upper Timboon
Lower Paaratte/ Nullawaare	Oil/Gas	Anticline/Fault	Tilted Block	Paaratte / Nullawaare

Risks

Reservoir :
Reservoir was considered a low risk. The presence of strong amplitude events within the section, its polarity and an amplitude character that was consistent with the presence of sandstone, provide high confidence that some reservoir would be present. Seismic inversion of the data volume supported the presence of a low velocity zone at the top of the primary target. Two deltaic packages were mapped at the K93 and K91 levels. The Paaratte Formation was prognosed to be approximately 500m thick and was likely to consist of a series of interbedded sandstones associated with delta front storm deposits or turbidities, deltaic packages and transgressive events.

Seal :
Seal was considered a moderate risk for the Hill Prospect. Seismic data indicated the presence of a bland section overlying the reservoir target which was consistent with the presence of a mudstone/siltstone section. Geological modeling supported the presence of a transgressive event at K95 which would provide a thick (~255m at the well location) regional sealing event overlying the primary target.

Cross-fault seal was mainly an issue for the deeper intra-Paaratte section with the potential for interbedded sandstones to act as conduits for hydrocarbons to leak across faults. The interval was expected to be of a sufficiently low net to gross to allow seal through mudstone smear along the fault-plane.

Intraformational seals allow for the potential of stacked pay within the structure, but these were regarded as upside and do not affect the primary risk.

The chance of adequacy accounts for the uncertainty of the sealing quality of the overlying sediment and the vertical fault seal.

Charge : (Pch = 0.20 oil & 0.50 gas)
Charge is the largest unknown in the petroleum system story, particularly the type of hydrocarbon expected. The Hill Prospect was being targeted for its potential for oil, but there was considered a high likelihood of gas in the area.

Total chance of hydrocarbon charge was considered to be approximately 70%. This had been derived from the results of maturity modelling along the deep-water trend that showed potential for charge in the Late Cretaceous and in the Tertiary. The change of seismic amplitude character indicated either an extremely porous sandstone that was wet or oil saturated, or a good porous sandstone that was gas saturated.

Of the 0.7 chance of charge, it was considered that there was a 0.2 chance that there would be an oil-accumulation present and a 0.5 chance that the prospect would be primarily gas. This estimate allowed for a 10% chance of gas with high CO_2.

1.3 WELL LOCATION

Hill-1 is located in the Otway Basin, Victoria Offshore VIC/P51 license. The Surface Location which is given below is 59 km south southeast of Portland, Victoria. The well was drilled by Diamond Offshore's semi-submersible rig "Ocean Epoch" in a water depth of 212.7m LAT.

The Surface Surveyed Location for Hill-1 is:

Latitude:	38° 48' 50.381" South
Longitude:	141° 50' 39.579" East (GDA-94).
Easting:	573303.40 m
Northing:	5703525.73m m (MGA-94)

The Seismic Location for Hill-1 is:

Inline 8714, CDP 2049, OS02 3D seismic dataset.

2. RESULTS OF DRILLING

2.1 STRATIGRAPHY & GEOPHYSICAL PROGNOSIS

The well was drilled close to prognosis with most picks coming at the right geological age and close to the prognosed depth, within 30m of their respective prognosed depths as can been seen in the table in the Wellcard. The only significant variation to the prognosis was at the Top Paaratte (K93) Horizon, where the prognosed top was mapped on a high amplitude marker suggestive of a shale/sand contact. In reality, the presence of a hard cemented streak within the Paaratte Sandstone meant the top Paaratte came in 46m high to prognosis. The presence of an additional basal Timboon sand above the Paaratte, meant the top of the gross sand package was 52.5m above the pre-drill prognosed top sand.

2.2 STRATIGRAPHY & DEPOSITIONAL ENVIRONMENT (Drillers MDRT Depths)

The well card at the front of this report tables the subsea elevations and thickness of formations penetrated in Hill-1. A brief description of lithology and interpreted environments of deposition follows. More detailed descriptions can be found in Section 2.1 of the Basic Data Report.

Total depth for Hill-1 was reached at 2575m (D), after drilling 25m into the Late Cretaceous **Belfast Mudstone.** The formation is largely made up of a medium to dark grey, medium olive- to medium brownish-grey claystone with only minor stingers of sandstone (very fine to coarse, common to abundant matrix, moderately hard, very poor to poor porosity).

The claystone is moderately silty, has common glauconite, with a trace of very fine siltstone laminae in part, rare medium brown cryptocrystalline dolomite and very fine partially altered feldspar grains in part, a trace to common carbonaceous detritus and flecks, and a trace of pyrite and micromica. It is firm and subfissile. The Belfast is dated as being mainly Turonian to Campanian (Abele *et al*., 1995), but perhaps only Coniacian to Santonian (Partridge, 1997). It was deposited below storm wave base in a low-energy marine conditions in a prodelta situation.

The **Skull Creek Mudstone,** unconformably overlies the Belfast Mudstone. The top of the Skull Creek Mudstone was encountered at 2334m and is 216m thick. The formation comprises of a medium to dark brownish-grey, grading to brown black siltstone which is argillaceous and grades to a silty claystone. The Skull Creek Mudstone commonly has dispersed fine to medium quartz grains, trace glauconite and trace disseminated pyrite. It is soft to firm and generally amorphous to subblocky. A pro-delta environment of deposition is interpreted for the Skull Creek and an age of Santonian has been attributed to the Skull Creek Mudstone.

The Skull Creek Mudstone is overlain by the late Cretaceous **Paaratte Formation,** the youngest formation of the Sherbrook Group. The top was intercepted at 1979m, 46m high to prognosis. The 355m thick formation is made up of thin to fairly thick, sandstone packages, interbedded with claystone and minor siltstone. The sandstone is very light brownish-grey to very light grey, and towards the base becomes off-white to light brown. Grain size is predominantly coarse to very coarse, though ranges from very fine to pebbly, and decreases in grain size to fine to very fine towards the base. The grains are angular to subrounded, are very poorly sorted, though improve to moderate at the base. There is weak pyrite, silica and calcareous cement throughout the section. A trace of argillaceous and silty matrix occurs at the top, and again at the base where it is common to abundant. Common, decreasing to trace, grey, green and red volcanogenic lithics are found and abundant altered feldspar grains were noted. Trace to common very fine carbonaceous material occurs throughout, in part associated with pyrite. The sandstone is dominantly friable and occasionally moderately hard in part. It has fair to occasionally good porosity, decreasing to very poor, visible porosity at the base. No fluorescence was noted.

The minor thinly interbedded claystone is medium to dark grey to medium brownish-grey, moderately to very silty, in part finely arenaceous, trace to common pyrite, trace to common black carbonaceous flecks and detritus, in part associated with pyrite, trace micromica, soft, in part very dispersive and slightly subfissile.

The Paaratte Formation was deposited in a deltaic environment, in this case, presumably delta plain, and has been dated to be Santonian to Maastrichtian in age in the Otway Basin.

The top of the Lower **Timboon Formation sandstone** was intersected at 1682m. The formation is 297m thick and is made up of thin to fairly thick sandstone packages, interbedded with siltstone. The sandstone is pale grey to grey, clear to translucent, predominantly medium grained to minor coarse grained. The sandstone is moderately well sorted and the grains are subrounded to subangular in part. The sandstone has a weak siliceous cement, has trace lithic fragments and traces of disseminated pyrite. The sandstone is friable to loose, and occasionally in moderately hard aggregates. No hydrocarbon fluorescence was observed. The interbedded siltstone is light to medium brown to brown grey, arenaceous, slightly calcareous with minor disseminated pyrite. The siltstone is firm to moderately hard and subblocky. The Timboon Sandstone was deposited in a deltaic environment, in this case, presumably delta plain, and has been dated to be Campanian to Maastrichtian in age in the Otway Basin.

The **Upper Timboon Formation** was not intersected in Hill-1. The **Massacre Shale, Pebble Point Formation** and the **Pember Mudstone** were also absent at the Hill-1 location.

The **Dilwyn Formation** unconformably overlies the Lower Timboon Formation at Hill-1 and was penetrated at 1611.5m and is 70.5m thick. The section consists predominantly of sandstone with minor interbedded silty claystone. The sandstone is pale to medium grey, also minor pale yellow, is medium to coarse grained, moderately well sorted, with predominantly subrounded to rounded grains and partly subangular grains, with trace pyrite cement, with trace lithic fragments and commonly loose. The sandstone has a fair inferred porosity but no hydrocarbon fluorescence. The claystone is medium to dark grey and dark brown, soft to firm, occasionally hard, with trace pyrite and is very soft, very dispersive and non fissile.

Both macrofossils and microfossils from the Dilwyn have been dated to be Early Eocene. The environment of deposition is interpreted to be shallow marine, with the cleaner sandy portions representing shoreface deposits of a coastal barrier system and the interbedded section possibly back beach lagoon sediments, with some breaching occurring. Another interpretation is that the Dilwyn could have formed in a lower delta plain area with the sands, distributary channels and mouth bars, and the clays, the interdistributary bay fills (Abele *et al*., 1995).

The Heytesbury and Nirranda Groups are undifferentiated in Hill-1. They include the **Mepunga Formation** (the oldest formation of the **Nirranda Group**). The massive sandstone is medium brown to occasionally dark brown, partly medium yellow brown, coarse to very coarse grained and minor medium grained, moderately well sorted, with grains that are subrounded to occasionally rounded and minor subangular. The sandstone has a weak siliceous cement and common Fe-staining. There are traces of glauconite and trace pyrite. The sandstone is poorly consolidated and loose in part and partly friable to moderately hard. The porosity is inferred to be fair with no hydrocarbon fluorescence being observed. There are traces of claystone which is medium brown, slightly to very silty in part, with abundant dispersed very fine to grit-sized brown-stained quartz grains in places. It is slightly calcareous in part, with a trace of glauconite, trace to common pyrite and is very soft, very dispersive and non fissile. According to dating of forams, molluscs and palynomorphs discovered within the Mepunga, an age of Middle Eocene to Early Oligocene has been given. The sandstones have been interpreted as being deposited in beach and nearshore locations as barrier islands, whereas the claystones regarded as estuarine and some as deep lagoonal in origin (Abele *et al*, 1995).

The **Narrawaturk Marl** overlies the Mepunga Formation with a conformable contact. No cuttings of the Narrawaturk Marl were studied in the Hill-1 well since drilling was riserless. Based on offset well information, the formation is generally made up of a calcareous claystone which is intergraded with and intergrading to marl and commonly has fossil fragments of echinoid spines and bryozoa. The fossil fragments have been dated to be Late Eocene to Early Oligocene, but no older than Oligocene in age. The marl was deposited in an open marine environment, mostly below storm wave base.

Formations younger than the Narrawaturk Marl are behind casing and were not studied. These include formations (typically limestones) of the **Heytesbury Group** like the Clifton Formation which grades into the **Gellibrand Marl** which is overlain, with a transitional contact, by the **Port Campbell Limestone**, the topmost formation of the Heytesbury Group. The Port Campbell Limestone is Middle to Late Miocene in age and was deposited in a moderate-energy, continental shelf environment, above fair weather wave base. It is uncertain if all these formations were penetrated Hill-1 prior to installing the marine riser when all returns were to the seafloor.

2.3 HYDROCARBON SUMMARY (Logger's MDRT Depths)

Ditch gas values were monitored and recorded in units (U) by F.I.D (Flame Ionisation Detector) Total Gas detector, where one unit is equivalent to 200 ppm (parts per million) of methane gas in air. The ditch gas was also monitored for hydrocarbon gas composition by a F.I.D. chromatograph. Gas composition refers to percent components of the hydrocarbon alkane series: (methane, ethane, propane, butane and pentane). Gas compositions are quoted as the percentage ratios of these five gases (i.e. 94/2/1/1/1 denotes 94% C1, 2% C2, 1% C3, 1% C4 and 1% C5). Ditch cuttings were tested for hydrocarbon fluorescence by using an ultra-violet fluoroscope.

Weak gas shows were encountered in the primary target Paaratte Formation, with up to C5 being detected. No gas or oil shows were encountered over the secondary objective upper Timboon sands. Weak oil shows were also encountered towards the top of the Paaratte. Subsequent log analysis indicated that all sands were wet. Average porosities for different sand-intervals ranged from 15.5 to 28.4%. Mobilities recorded by a MDT Pressure Survey indicate fair to good permeabilities.

2.4 SUMMARY

Hill-1 was drilled as an Otway Basin deep water exploration wildcat well in the VIC/P51 licence. The Surface Location is Latitude: 38° 48' 50.381" S Longitude: 141° 50' 39.579" E (GDA94), Northing: 5703525.73m Easting: 573303.40m (MGA-94). The well is 59 km south southeast of Portland, Victoria. The Hill Structure is covered by the recently acquired OS02 3D survey and lies within the interpreted Paaratte Sandstone play fairway. The water depth at the well location was 212.7m LAT. Hill-1 was drilled by the semi-submersible drilling rig "Diamond Offshore Ocean Epoch".

Hill-1 was designed to test an interval of high amplitude seismic reflectors within Late Cretaceous sediments in a faulted, structural closure, defined on the OS02 3D seismic survey. The high amplitude reflectors were anticipated to represent interbedded sandstones and mudstones of the Paaratte Formation beneath distal mudstones of equivalent age to the Timboon Sandstone Formation. The well was placed slightly down-dip of the crest of the structure to avoid proximity to the main fault, and to optimally test amplitude anomalies within the Paaratte. A secondary objective was noted where a small 4-way dip closure was mapped beneath the Base Tertiary forming a trap coincident with additional high-amplitude reflectors in the upper Timboon Formation. However, to optimally test the primary objectives, Hill-1 was drilled outside the 4-way closure and no movable hydrocarbons were expected but the interval was monitored for shows that might be indicative of updip hydrocarbon potential.

Hill-1 was drilled as an oil-target with a high probability that gas would be encountered in the reservoir. Hill-1 was a critical test of one of a series of structural closures at the top Paaratte Sandstone. The well would assist in establishing whether an oil model is applicable to the area plus confirm the top seal potential of the Timboon Formation equivalent section for drilling opportunities in the deep water region (VIC/P52). The Hill-1 Prospect is a tilted fault block closure with up to 180m of structural relief over an area of up to 27km2 at the Paaratte Sandstone primary target.

Hill-1 was spudded at 21:00 hrs on 8th December 2003 utilising the semi-submersible drilling facility "Ocean Epoch".

Bit 1, a re-run 660mm (26") Smith DSJ, run in conjunction with a 914mm (36") hole opener, drilled the 914mm (36") phase from seafloor at 235.2m to section total depth at 268m. Returns were to the seafloor. A string of 762mm (30") (680 kg/m X56) casing was run and set at 268m. The casing running tool and 914mm (36") BHA were laid out. Bit 2, a Reed EMS11GC was run in hole to tag the cement top at 117.0m and was used to drill the entire 445mm (17.5") hole section from 268m to 777m. The hole was circulated clean and displaced with gel. A string of 340mm (13.375") (101 kg/m L80) casing was run and set at 769m and pressure tested. The blowout preventers were installed on the marine riser and function tested. Thereafter, the 311 mm (12.25") BHA with Bit 3, Hughes HC605 was used to drill from 780m to 1444m with seawater and gel sweeps. At 1444m, the hole was displaced to 1.03 SG (8.6ppg) KCl/Polymer mud and drilling continued from 1444m to 1810m without major problems. The bit was pulled to surface to run casing. A string of 9.625" casing was run and set at 1801.2m. Bit 4, a Hycalog DSX104 of 216mm (8.5") diameter was run in hole along with Sperry Sun LWD tools to record Gamma Ray, Resistivity and Deviation Survey data. This assembly was used to drill the 216mm (8.5") phase from 1810m to the Total Depth of 2575m (D) which was reached at 01:30 hrs on 20th December 2003. At Total Depth, Schlumberger was rigged up and the following wireline logs were run. Run 1: PEX-DSI-HALS, Run 2: Checkshot survey, Run 3: MDT-GR and Run 4: CST-GR.

The well was drilled close to prognosis with most picks coming at the right geological age and close to the prognosed depth, within expected error bands (see Table in the Wellcard). The only significant variation to the prognosis was at the Top Paaratte (K93) Horizon, where the prognosed top was mapped on a high amplitude marker suggestive of a shale/sand contact. In reality, the presence of a hard cemented streak within the Paaratte Sandstone meant the top Paaratte came in 46m high to prognosis. The presence of an additional basal Timboon sand above the Paaratte, meant the top of the gross sand package was 52.5m above the pre-drill prognosed top sand.

Weak gas shows were encountered in the primary target Paaratte Formation, with up to C5 being detected. No gas or oil shows were encountered over the secondary objective upper Timboon sands. Weak oil shows were also encountered towards the top of the Paaratte. Subsequent log analysis indicated that all sands were wet. Average porosities for different sand-intervals ranged from 15.5 to 28.4%. MDT mobilities indicate fair to good permeabilities.

Hill-1 was Plugged and Abandoned as a dry well with oil and gas shows. Failure analysis indicates the primary cause of failure is likely to be cross fault seal. With the top gross-sand coming in 52.5 m high to prognosis and the presence of sand-stringers in the top of the Timboon mudstone facies, the amount of mudstone available for cross-fault seal was reduced from 255m to approximately 205m which was enough to set up a possible sand-on-sand juxtaposition across the main fault, at the approximate structural depth of the well intersection. The secondary significant risk factor is the presence and volume of charge. Reservoir and seal have been satisfactorily proven by the Hill-1 well. A small fault-dependent closure remains updip of Hill-1 well but could contain only a small volume of hydrocarbons.

Abandonment plugs were set as per program, Plug 1: 2575m to 2525m, Plug 2: 1831m to 1672m and Plug 3: 310m to 260m. The rig was released at 04:00 hours on December 25, 2003.

3. REFERENCES

Santos, 2003	Hill-1 Well Proposal, Prepared for Santos Ltd, (unpublished).
Subramanian, R., 2003	Hill-1 Basic Data Report, Prepared for Santos Limited, (Unpublished).
Subramanian, R., 2002	Casino-1 Interpreted Data Report, Prepared for Santos Limited, (unpublished).
Subramanian, R., 2002	Casino-2 Interpreted Data Report, Prepared for Santos Limited, (unpublished).
Santos, 2001	Penryn-1 Well Completion Report, Prepared for Santos Limited, (unpublished).
Abele, C., Pettifer, G., Tabassi, A. 1995	The Stratigraphy, Structure, Geophysics, and Hydrocarbon Potential of The Eastern Otway Basin. Department of Agriculture, Energy and Minerals of Victoria. Geological Survey of Victoria, Geological Survey Report 103.
Partridge, A., 1997	New Upper Cretaceous Palynology of The Sherbrook Group Otway Basin. Biostrata Pty. Ltd. In PESA News, April/May.

APPENDIX I : ELECTRIC LOG EVALUATION RESULTS

A summary of the Log analysis is presented overleaf.
No pay was identified in the Paaratte Formation.

HILL 1
SAND SUMMARY

NET PAY: POR >10 , VSH<45 & SW <70
DEPTH IN METRES

FORMATION	SAND INTERVAL	GROSS SAND (m)	NET SAND (m)	AVG PHIs (%)	NET PAY (m)	AVG PHIp (%)	WT.AVG SW (%)
PAARATTE FORMATION K93	1971-2193	70.3	64.8	22.4	0	-	-
PAARATTE FORMATION K91	2193-2576	14.6	13.4	16.9	0	-	-

NET PAY: POR >10,VSH <45 & SW <70
DEPTH IN METRES

FORMATION	SAND	SAND INTERVAL	GROSS SAND (m)	NET SAND (m)	AVG PHIs (%)	NET PAY (m)	AVG PHIp (%)	WT.AVG SW (%)
PAARATTE FORMATION K93	19-71	1971-1982	10.8	10.8	19.3	0	-	-
PAARATTE FORMATION K93	19-87	1987-2009	20.7	20.7	26	0	-	-
PAARATTE FORMATION K93	20-Nov	2011-2018	6.7	6.1	28.4	0	-	-
PAARATTE FORMATION K93	20-20	2021-2032	8.8	8.5	25.9	0	-	-
PAARATTE FORMATION K93	20-62	2063-2069	5.8	5.5	15.5	0	-	-
PAARATTE FORMATION K93	20-70	2071-2085	13.1	13.1	16.9	0	-	-
PAARATTE FORMATION K91	21-94	2195-2207	9.3	9.3	16.1	0	-	-
PAARATTE FORMATION K91	22-77	2278-2283	4.1	4.1	18.9	0	-	-

APPENDIX II : MDT PRESSURE SURVEY

Santos

MDT PRESSURE SURVEY (RUN 3)

WELL: HILL 1 RT: 22.4 METRES GAUGE TYPE : CQG PAGE : 1 OF 1
WITNESS: J PITMAN TIME SINCE LAST CIRC : 12:30 HRS ON 20/12/03 PROBE/PACKER TYPE : STANDARD DATE : 21/12/2003

	FORMATION	DEPTH RT MD M	DEPTH SUBSEA M	FILE NO	TEST RESULTS HYDRO BEFORE PSIA	TEST RESULTS FORM PRESS PSIA	TEST RESULTS HYDRO AFTER PSIA	TEMP DEG C	D/D MOB MD/CP	TYPE D/D	INTERPRETATION TYPE BUILD	SUPER CHARGED	COMMENTS
				66								**CORRELATION**	
1	PAARATTE	1978.0	1955.6	67	3417.00	2844.05	3411.57	74.0	37.2	N	GOOD - STABILISED		20cc
2	PAARATTE	1994.0	1971.6	68	3443.00	2866.29	3436.42	75.1	401.9	N	GOOD - STABILISED		20cc
3	PAARATTE	1997.0	1974.6	69	3443.60	2870.78	3441.55	75.6	164.3	N	GOOD - STABILISED		20cc
4	PAARATTE	2005.0	1982.6	70	3462.47	-	3454.50	76.5	-	N	TIGHT ?	TOOL PLUGGING ?	
5	PAARATTE	2005.5	1983.1	71	3457.50	2882.58	3455.49	76.5	75.2	N	GOOD - STABILISED		20cc
6	PAARATTE	2014.0	1991.6	72	3476.50	2894.66	3470.50	76.8	1088.3	N	GOOD - STABILISED		20cc
7	PAARATTE	2016.0	1993.6	73	3475.50	2897.54	3473.60	77.0	608.1	N	GOOD - STABILISED		20cc
8	PAARATTE	2022.0	1999.6	74	3488.78	2905.68	3484.27	77.3	996.30	N	GOOD - STABILISED		20cc
				75								**CORRELATION**	
9	PAARATTE	2074.0	2051.6	76	3587.50	3007.07	3573.55	78.6	1.00	N	SLOW - STABILISED		20cc
10	PAARATTE	2193.0	2170.6	77	3805.55	-	3791.14	80.7	-	L	-		CURTAILED
11	PAARATTE	2282.0	2259.6	78	3955.70	3274.64	3935.40	82.8	4.00	N	SLOW - STABILISED		20cc

TOTAL PRETESTS: 11
CURTAILED 2
NORMAL 9

Expected Water Gradient: 0.433 psi/ft
Mud Weight : 9.8ppg

APPENDIX III: HYDROCARBON SHOW REPORT

SANTOS LIMITED

OIL SHOW EVALUATION REPORT

WELL: HILL 1 GEOLOGIST: J.PITMAN

INTERVAL: 1973 – 1998m DATE:

FORMATION: Timboon

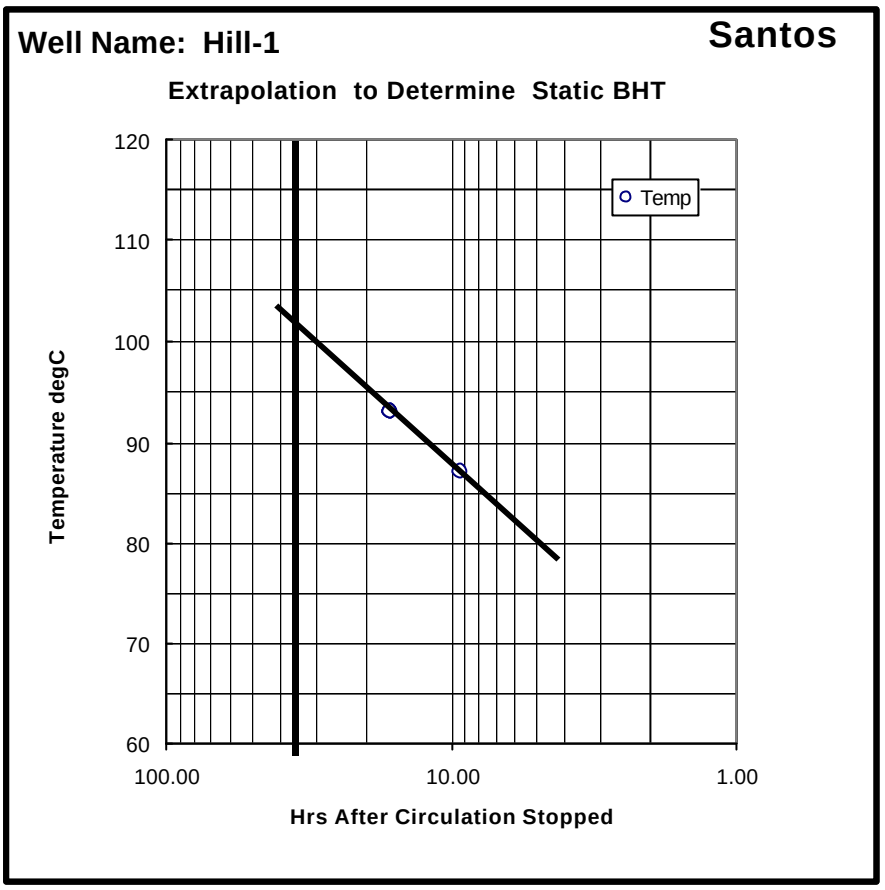
C1 ppm	1 U	10k	20k	30k	40k	50k	100k	150k	200k	>250k
C2+ ppm	5ppm	750	1k	2k	3k	4k	5k	7.5k	10k	>15k
Porosity Ø	tight			poor		fair		good		
% with fluorescence	trace-5%	10	20	30	40	50	60	70	80	>90
Fluorescence appearance	trace		spotted	pinpoint		streaked		patchy		solid
Brightness of fluorescence	v. dull		dull		dim			bright	v. bright	glowing
Type of cut	trace	v. slow crush cut	crush cut	instant crush cut	v. slow streaming cut	slow stream	moderate streaming	streaming	fast streaming	instant
Residue on spot plate	trace	heavy trace	v. thin ring	thin ring	thick ring	v. thick ring	thin film	mod. film	thick film	solid
Show rating	trace		poor		fair		good			
Comments:	SANDSTONE: clear, translucent, light brown in part, very fine to fine grained, moderately well sorting, subangular to subrounded, moderately strong calcareous cement, minor – abundant white argillaceous matrix, trace fine carbonaceous specks, loose in part, poor visual porosity, Fluorescence: trace – 5% moderately bright yellowish white spotted, very slow very faint white crush cut, no residue.									

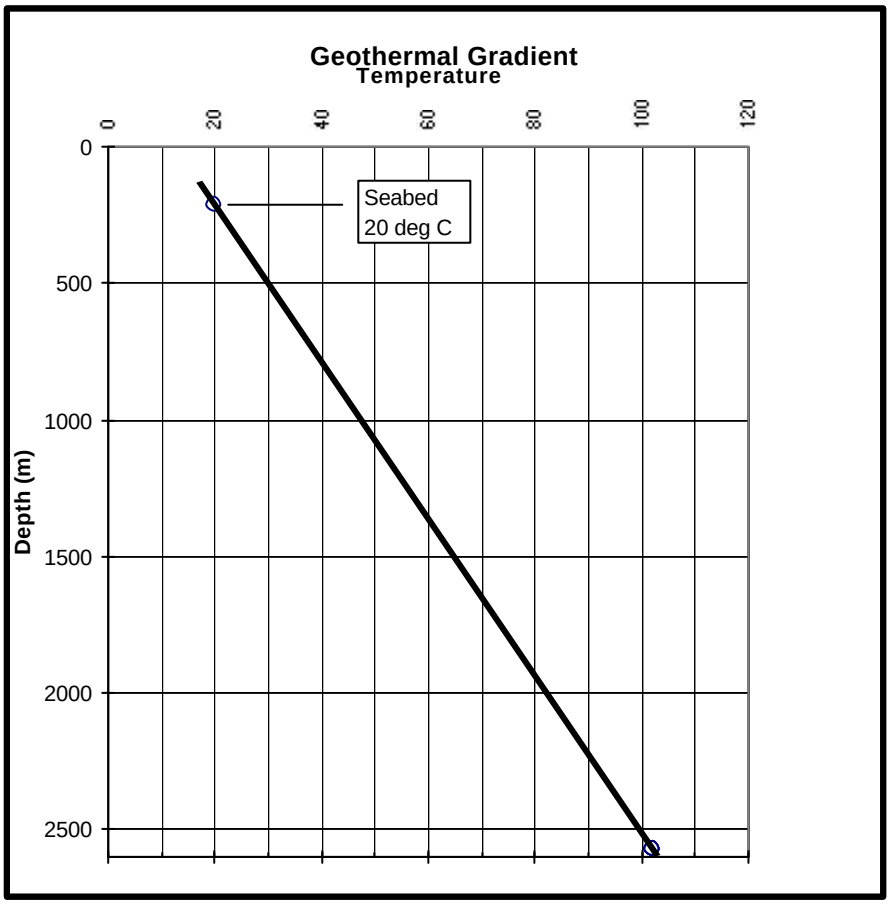
APPENDIX IV : GEOTHERMAL GRADIENT

Data from Wireline Logs were used to estimate a Geothermal Gradient. An extrapolated static bottom hole temperature of 102°C at 2570' (logging depth) and a geothermal gradient of 3.5°C/100m were calculated from downhole temperatures recorded during logging operations. A seabed temperature of 20°C was assumed.

LOG	TEMP	DEPTH	TIME SINCE LAST CIRCULATION
PEX-HALS-DSI-HNGS	87°C	2543m	9.25 hrs
CSAT	93°C	2570m	16.25 hrs
SEABED	20°C	213m	

The results are depicted graphically overleaf.


Well Name: Hill-1
Santos
Extrapolation to Determine Static BHT
Temperature degC
120
110
100
90
80
70
60
Temp
100.00
10.00
1.00
Hrs After Circulation Stopped


Geothermal Gradient
Temperature
0
20
40
60
80
100
120
Depth (m)
0
500
1000
1500
2000
2500
Seabed
20 deg C

APPENDIX V : PETROLOGY REPORT

APPENDIX VI : PALYNOLOGY REPORT

SANTOS PALYNOLOGY SECTION
EXPLORATION SERVICES DEPARTMENT

Palynology Report No. 2003/38

Author: R.HELBY
Approved by: G.WOOD

PALYNOLOGICAL REPORT NO. 2003/38
PALYNOSTRATIGRAPHICAL ANALYSIS

HILL - 1 WELL

Santos Ltd
A.C.N. 007 550 923

Circulation: Geology Operations, Team Leader, EIC, Palynology Files

Introduction

Sixteen sidewall core samples and fifteen cuttings samples from Santos Hill-1, drilled in VIC P51, were examined palynologically.

The palynostratigraphic results are presented in on Table 1.

_____
R.Helby

SAMPLE	DEPTH (M)	PALYNOSTRATIGRAPHICAL UNIT (Age)	INFERRED STRATIGRAPHICAL UNIT	REWORKED ELEMENTS %	REWORKED ELEMENTS AGE	PRESERVATION	YIELD	DIVERSITY	REMARKS
CUTT	1641	*Homotryblium tasmaniense* to *Enneadocysta partridgei* (early to mid Eocene)	Dilwyn Formation	-	-	P-F	Mod.	High	Relatively high diversity dinocyst suite with *Wilsonidinium ornatum, Kisselovia edwardsii/Charlesdowniea thompsoniae, Schematophora obscura, Hystrichokolpoma rigaudiae* and *Paucilobimorpha tripus*. Shelfal marine.
CUTT	1671	*Homotryblium tasmaniense* (early Eocene)	Dilwyn Formation	X	Perm.	P-F	Low	High	Relatively high diversity dinocyst suite with *Homotryblium tasmaniense, Apectodinium homomorphum, Corrudinium obscurum and Schematophora obscura.* The sample is dominated by *Glaphyrocysta* spp. and *Systematophora* spp. Shelfal marine
CUTT	1767	*Isabelidinium korojonense Forcipites longus* (Mid to late Campanian)	Timboon Ss	1	Perm.	P-F	Mod.	High	Restricted (7%), moderately diverse dinocyst suite with *Isabelidinium korojonense, I. pellucidum* and *Nelsoniella glabra. Nummus* spp. prominent (15%). Very high diversity spore-pollen suite includes *Forcipites longus, Tricolporites lilliei* and *Tripunctisporis maastrichtiensis.* Shallow marine.
CUTT	1799	*Isabelidinium korojonense Tricolporites lilliei* (Mid to late Campanian)	Timboon Ss	X	Perm.	P-F	Mod.	High	Moderately diverse dinocyst suite with *Isabelidinium korojonense, I. pellucidum, Nelsoniella glabra,* "frequent" *Cribroperidinium spp., Odontochitina porifera* and *O. nonporifera. Nummus* spp. less prominent (>3%) than above. High diversity spore-pollen suite includes *Tricolporites lilliei, Gephyrapollenites wahooensis, Nothofagidites senectus* and is dominated by *Proteacidites* spp. (23%). *Forcipites longus* not seen. Shallow marine.

SAMPLE	DEPTH (M)	PALYNOSTRATIGRAPHICAL UNIT (Age)	INFERRED STRATIGRAPHICAL UNIT	REWORKED ELEMENTS %	REWORKED ELEMENTS AGE	PRESERVATION	YIELD	DIVERSITY	REMARKS
SWC42	1886.0	*Isabelidinium korojonense* *Tricolporites lilliei* (Mid to late Campanian)	Timboon Ss	5	Perm.	P-F	Mod.	High	Very restricted (1%), low diversity dinocyst suite with consistent *Isabelidinium greenense*, *Spinidinium* spp. and *Spiniferites* spp. High diversity spore-pollen association with *Tricolporites lilliei, Gambierina rudata, Nothofagidites senectus*, dominated by *Proteacidites* spp. (19%) and *Cyathidites* spp (19%). *Forcipites longus* not seen. Shallow marine
CUTT	1959	*Isabelidinium korojonense* ?*Tricolporites lilliei* (Mid to late Campanian)	Timboon Ss	6	Perm.	P-F	Mod.	High	Restricted (7%), moderate diversity dinocyst suite with frequent (5%)*Isabelidinium* spp. (including *I. pellucidum*), *Areosphaeridium suggestium, Chatangiella victoriensis* and *Trithyrodinium suspectum*. Very high diversity spore-pollen suite with *Tricolporites lilliei* (tentative), *Anacolosidites sectus, Gambierina rudata, Grapnelispora spiralia, Lactoropollenites* sp., *Nothofagidites senectus*, dominated by *Proteacidites* spp. (21%) and *Cyathidites* spp (19%). Unequivocal *Forcipites longus* was not recorded. Near shore.
CUTT	1968	*Isabelidinium korojonense* (?) (Mid to late Campanian)	Timboon Ss	5	Perm.	P-F	Mod.	High	Restricted (6%), moderate diversity dinocyst suite lacking zone taxa but including frequent (4%) *Isabelidinium* spp., *Areosphaeridium suggestium* and *Tanyosphaeridium salpinx*. High diversity spore-pollen suite, lacking first order zone markers. *Proteacidites common*, including prominent *P. amolosexinus*. *Nothofagidites senectus and Peninsulapollenites gillii* recorded. Near shore.

SAMPLE	DEPTH (M)	PALYNOSTRATIGRAPHICAL UNIT (Age)	INFERRED STRATIGRAPHICAL UNIT	REWORKED ELEMENTS		PRESERVATION	YIELD	DIVERSITY	REMARKS
				%	AGE				
SWC36	1985.0	Upper *Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Parratte Formation	5	Perm.	P-F	Mod.	High	Very restricted (<1%), moderate diversity, dinocyst suite with *Xenikoon australis, Odontochitina porifera* and *Xenascus sarjeantii*. Very high diversity spore-pollen suite with *Forcipites sabulosus, Gambierina rudata, Gephyrapollenites wahooensis, Nothofagidites senectus* and *Peninsulapollenites gillii.* Near shore.
CUTT	1989	Upper *Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation to Timboon Ss	3	Perm.	P-F	Mod.	High	Restricted (5%), moderate diversity, dinocyst suite with *Anthosphaeridium wisemaniae, Palaeohystrichophora infusorioides* and *Xenascus sarjeantii,* but apparently lacking *Xenikoon australis.* High diversity spore-pollen suite with *Gambierina rudata, Lactoropollenites* sp., *Nothofagidites senectus* and *Peninsulapollenites gillii,* dominated by *Proteacidites* spp. (18%). Near shore.
CUTT	2004	Upper *Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation to Timboon Ss	6	Perm.	P-F	Mod.	High	Restricted (4%), low diversity, dinocyst suite with *Heterosphaeridium spp, Odontochitina sp.*, and *Xenascus sarjeantii*, but apparently lacking *Xenikoon australis.* High diversity spore-pollen suite with *Forcipites sabulosus, Gambierina rudata, Gephyrapollenites wahooensis, Nothofagidites senectus* and *Peninsulapollenites gillii.* Near shore.

SAMPLE	DEPTH (M)	PALYNOSTRATIGRAPHICAL UNIT (Age)	INFERRED STRATIGRAPHICAL UNIT	REWORKED ELEMENTS %	REWORKED ELEMENTS AGE	PRESERVATION	YIELD	DIVERSITY	REMARKS
SWC30	2010.5	Upper *Xenikoon australis* *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	3	Perm.	P-F	Mod.	High	Very restricted (<1%), low diversity, dinocyst suite with *Xenikoon australis* and *Xenascus sarjeantii*. Very high diversity spore-pollen association with *Forcipites sabulosus, Nothofagidites senectus, Peninsulapollenites gillii, Tricolporites apoxyexinus* and very prominent (17%) *Proteacidites* spp . *Latrobosporites amplus* relatively prominent (4%). Near shore.
SWC29	2016.0	*Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	-	-	P-F	Mod.	High	Moderate diversity spore-pollen suite with *Lygistepollenites florinii, Nothofagidites senectus and Tricolpites confessus.* No unequivocal dinocysts observed but palynomorph assemblage dominated (74%) by *Paralecaniella* sp. (cf. *P. indentata*). Possibly brackish.
SWC26	2023.0	*Xenikoon australis* *Nothofagidites senectus* (Early to mid Campanian)	Parratte Formation	-	-	P-F	Mod.	High	Restricted (<3%), low diversity dinocyst suite with *Heterosphaeridium* sp., *Hystrichodinium* sp., *Odontochitina* sp. and *Xenascus sarjeantii. Paralecaniella* sp. (cf. *P. indentata*) prominent (18%). Moderate diversity spore-pollen suite with common *Nothofagidites* spp. (9% including *N. senectus*), *Peninsulapollenites gillii* and relatively prominent *Proteacidites* spp. (>8%). Near shore.

SAMPLE	DEPTH (M)	PALYNOSTRATIGRAPHICAL UNIT (Age)	INFERRED STRATIGRAPHICAL UNIT	REWORKED ELEMENTS %	REWORKED ELEMENTS AGE	PRESERVATION	YIELD	DIVERSITY	REMARKS
SWC22	2075.0	*Xenikoon australis* *Nothofagidites senectus* (Early to mid Campanian)	Parratte Formation	1	Perm.	P-F	Mod.	High	Restricted (7%) moderate diversity dinocyst suite with *Xenikoon australis* and *Xenascus sarjeantii. Paralecaniella* sp. (cf. *P. indentata*) particularly prominent in the kerogen slide. Very high diversity spore-pollen suite with prominent *Nothofagidites* spp. (7% including *N. senectus*), *Peninsulapollenites gillii, Tricolporites apoxyexinus* and relatively prominent *Proteacidites* spp. (12%). Near shore.
SWC21	2078.5	Upper *Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	3 1	Perm. Older	P-F	Mod.	High	Very restricted (<3%), moderate diversity dinocyst suite with *Anthosphaeridium wisemaniae, Xenascus sarjeantii* and *Xenikoon australis.* High diversity spore-pollen suite with prominent *Nothofagidites* spp. (5% including *N. senectus*), *Gambierina rudata, Gephyrapollenites wahooensis, Lactoropollenites* sp., *Peninsulapollenites gillii* and prominent *Proteacidites* spp. (10%). Near shore.
CUTT	2184	*Nothofagidites senectus* (Early to mid Campanian)	Parratte Formation	4	Perm.	P-F	Mod.	Mod.	Moderate diversity spore-pollen suite with *Nothofagidites senectus* but otherwise lacking diagnostic taxa. A single dinocyst was tentatively identified as *Acanthaulax* sp. Near shore.
SWC16	2196.0	Upper *Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	4 X	Perm. Trias.	P-F	Mod.	High	Very restricted (2%), low diversity dinocyst suite with consistent *Xenikoon australis.* Very high diversity spore-pollen suite with *Gambierina rudata* relatively prominent *Nothofagidites* spp. (including *N. senectus*), *Peninsulapollenites gillii, Stereisporites regium* and prominent *Proteacidites* spp. (15%). Near shore.

SAMPLE	DEPTH (M)	PALYNOSTRATIGRAPHICAL UNIT (Age)	INFERRED STRATIGRAPHICAL UNIT	REWORKED ELEMENTS %	REWORKED ELEMENTS AGE	PRESERVATION	YIELD	DIVERSITY	REMARKS
SWC15	2206.0	*Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Parratte Formation	X	Trias.	P-F	Mod.	High	Very restricted (1%), low diversity dinocyst suite with consistent *Xenikoon australis.* High diversity spore-pollen suite with prominent *Nothofagidites* spp. (13% including *N. senectus*), *Gambierina rudata, Peninsulapollenites gillii, Tricolporites confessus* and prominent *Proteacidites* spp. (10%). Near shore.
CUTT	2211	*Xenikoon australis Nothofagidites senectus* (Early to mid Campanian)	Parratte Formation	4	Perm.	P-F	Mod.	High	Very restricted (3%), low diversity dinocyst suite with consistent *Xenikoon australis* and *Hystrichodinium* sp. High diversity spore-pollen suite apparently lacks diagnostic taxa although the occurrence of *Peninsulapollenites gillii* suggests it can be no older than upper *Tricolporites apoxyexinus* Zone. Near shore.
SWC13	2243	Upper *Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	1	Perm.	P-F	Mod.	High	Very restricted (2%), low diversity dinocyst suite with *Xenikoon australis, Dinogymnium nelsonense and Spiniferites* sp. Very high diversity spore-pollen suite with *Nothofagidites* spp. (including *N. senectus*), *Forcipites sabulosus, Gambierina rudata, Gephyrapollenites wahooensis Peninsulapollenites gillii* and relatively prominent *Proteacidites* spp. (10%, of which *P. amolosexinus* comprises a substantial portion). Near shore.

SAMPLE	DEPTH (M)	PALYNOSTRATIGRAPHICAL UNIT (Age)	INFERRED STRATIGRAPHICAL UNIT	REWORKED ELEMENTS %	REWORKED ELEMENTS AGE	PRESERVATION	YIELD	DIVERSITY	REMARKS
SWC12	2271.0	Upper *Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	1	Perm.	P-F	Mod.	High	Restricted (8%), very low diversity dinocyst suite with prominent *Xenikoon australis.* High diversity spore-pollen suite with *Nothofagidites* spp. (including *N. senectus*), *Forcipites sabulosus, Gambierina rudata, Peninsulapollenites gillii, Tricolporites confessus* and relatively prominent *Proteacidites* spp. (7%). Near shore.
CUTT	2274	*Nothofagidites senectus* (Early to mid Campanian)	Parratte Formation	6	Perm.	P-F	Mod.	Mod.	Very restricted (<1%), very low diversity dinocyst suite with questionable *Nelsoniella aceras* but lacking *Xenikoon australis* and other diagnostic taxa. Moderate diversity spore-pollen suite apparently lacks diagnostic taxa apart from *Nothofagidites senectus.* Near shore.
SWC11	2281.0	Upper *Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	3	Perm.	P-F	Mod.	Mod.	Restricted (4%), low diversity dinocyst suite with *Xenikoon australis.* High diversity spore-pollen suite with *Gambierina rudata, Nothofagidites* spp., *Proteacidites* spp. relatively prominent. Near shore.
CUTT	2286	*Xenikoon australis Nothofagidites senectus* (Early to mid Campanian)	Parratte Formation	3	Perm.	P-F	Mod.	Mod.	Restricted (3%), very low diversity dinocyst suite with *Xenikoon australis.* Moderate diversity spore-pollen suite with *Nothofagidites* spp. and *Proteacidites confragosus.* Near shore.

SAMPLE	DEPTH (M)	PALYNOSTRATIGRAPHICAL UNIT (Age)	INFERRED STRATIGRAPHICAL UNIT	REWORKED ELEMENTS		PRESERVATION	YIELD	DIVERSITY	REMARKS
				%	AGE				
SWC7	2365.0	Mid *Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	1	Perm.	P-F	Mod.	High	Rich, low diversity dinocyst suite (34%) with abundant *Xenikoon australis* (27%) *and frequent Nelsoniella aceras* (5%) with *N. semireticulata*. High diversity spore-pollen suite with *Forcipites sabulosus, Gambierina rudata, Lactoropollenites* sp. *Nothofagidites* spp. (including *N. senectus*), *Peninsulapollenites gillii* and *Tricolpites confessus*. Shallow marine.
SWC6	2384.0	Mid *Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	1	Perm.	P-F	Mod.	High	Rich (20%), low diversity dinocyst suite with common *Xenikoon australis* (16%) *and* "frequent" *Nelsoniella aceras* (3%). High diversity spore-pollen suite with *Gambierina rudata, Nothofagidites* spp. (including *N. senectus*) and *Peninsulapollenites gillii*. Shallow marine.
SWC5	2423.0	Mid *Xenikoon australis* Mid-upper *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	3	Perm.	P-F	Mod.	High	Rich (40%), low diversity dinocyst suite with common *Xenikoon australis* (26%), *Nelsoniella aceras* (11%) and *N. semireticulata*. High diversity spore-pollen suite with *Nothofagidites* spp. and *Forcipites sabulosus. Proteacidites* spp. common (10%). Shallow marine.
CUTT	2462	Lower *Xenikoon australis* Upper *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	5	Perm.	P-F	Mod.	High	Rich (34%), low diversity dinocyst suite with common *Xenikoon australis* (13%), *Nelsoniella aceras* (17%) with *N. semireticulata* and *Odontochitina porifera*. High diversity spore-pollen suite with *Nothofagidites* spp. and *Gambierina rudata. Proteacidites* spp. prominent (7%). Shallow marine.

SAMPLE	DEPTH (M)	PALYNOSTRATIGRAPHICAL UNIT (Age)	INFERRED STRATIGRAPHICAL UNIT	REWORKED ELEMENTS %	REWORKED ELEMENTS AGE	PRESERVATION	YIELD	DIVERSITY	REMARKS
CUTT	2472	*Xenikoon australis* *Nothofagidites senectus* (Early to mid Campanian)	Parratte Formation	3	Perm.	P-F	Mod.	High	Rich (34%), low diversity dinocyst suite with common *Xenikoon australis* (12%), *Nelsoniella aceras* (13%) and *Odontochitina porifera*. High diversity spore-pollen suite with *Nothofagidites* spp., *Forcipites sabulosus* and *Proteacidites congfragosus*. *Proteacidites* spp. prominent (9%). Shallow marine.
SWC3	2475.0	*Xenikoon australis* (Early to mid Campanian)	Parratte Formation	X	Perm.	P-F	Mod.	High	Rich (52%), moderate diversity dinocyst suite with abundant *Xenikoon australis* (34%) with frequent *Nelsoniella* spp. (including *N. tuberculata*) and *Odontochitina porifera*. High diversity spore-pollen suite with frequent *Gambierina rudata, Forcipites sabulosus* (?) and *Tricolporites protolilliei*. *Nothofagidites* spp. not recorded. Shallow marine.
CUTT	2505	*Xenikoon australis* *Nothofagidites senectus* (Early to mid Campanian)	Parratte Formation	2	Perm.	P-F	Mod.	High	Rich (29%), moderate diversity dinocyst suite with common *Xenikoon australis* (14%) with frequent *Nelsoniella* spp. (including *N. tuberculata*) and *Odontochitina porifera*. High diversity spore-pollen suite with *Gambierina rudata, Forcipites sabulosus*(?), *Nothofagidites* spp. and *Peninsulapollenites gillii*. Shallow marine.

SAMPLE	DEPTH (M)	PALYNOSTRATIGRAPHICAL UNIT (Age)	INFERRED STRATIGRAPHICAL UNIT	REWORKED ELEMENTS %	REWORKED ELEMENTS AGE	PRESERVATION	YIELD	DIVERSITY	REMARKS
CUTT	2544	*Xenikoon australis* *Nothofagidites senectus* (Early to mid Campanian)	Paaratte Formation	2	Perm.	P-F	Mod.	High	Rich (39%), moderate diversity dinocyst suite with common *Xenikoon australis* (14%), *Nelsoniella* spp. (15%) and *Odontochitina porifera*. Moderate diversity spore-pollen suite with *Forcipites sabulosus* (?) and *Nothofagidites* spp. *Proteacidites* spp. prominent (7%). Shallow marine.

ENCLOSURE I : COMPOSITE LOG (1:500 SCALE)

ENCLOSURE II : DEPTH STRUCTURE MAPS

ENCLOSURE III : LOG INTERPRETATION ANALOGUE PLOT