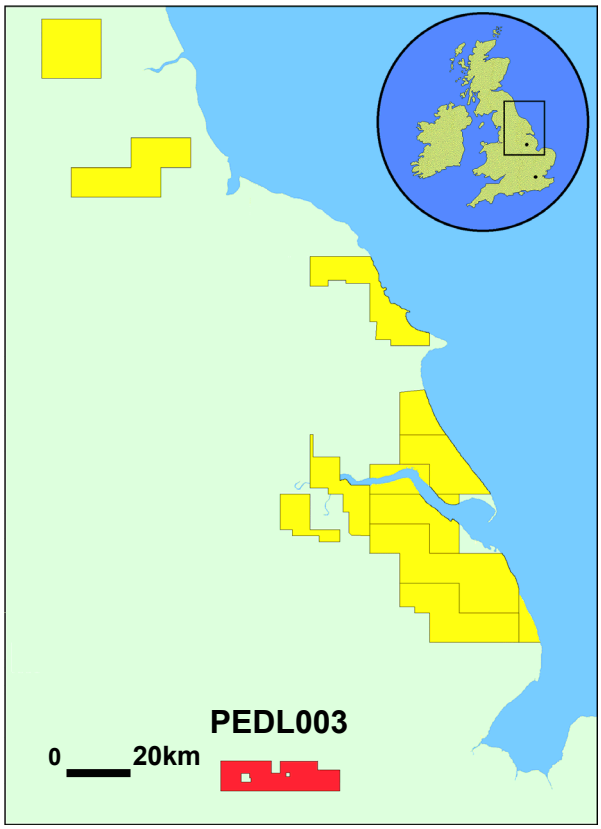
ONSHORE UK
PEDL003
LICENCE RELINQUISHMENT REPORT

June 2005



PREPARED BY

ROC OIL (GB) LIMITED

Tech 2144

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TABLES

FIGURES

1 EXECUTIVE SUMMARY

7th Round licence PEDL003 was awarded to Candecca/Morrison Middlefield in 1996. Roc assumed operatorship in 1999, and relinquished 50% of the licensed area in 2002. Technical evaluation of the licence was based on data from ca 450km of oil exploration and 180km of coal exploration seismic, and over 60 wells. Evaluation of the large volume of data from in and around the licence showed:

3 producing fields within or close to the licence area, producing from the lower Namurian (Rempstone) and uppermost Namurian/lWestphalian A (Plungar and Long Clawson)

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- an active and effective petroleum source and migration system
- presence of effective seals within the Namurian and Westphalian
- reasonable quality reservoirs, with porosities typically varying from 15-25%, but with a 1mD cut-off ranging from 15-20%.
- small, complex leads at depths less than 1000m which could be advanced to prospect status only with additional 2D, or 3D, likely to be costly because of the shallow depths

Two leads were advanced to prospect status:

- Wymeswold, 1km east and downdip from the Rempstone Field which has produced oil from the lower Namurian Rempstone(turbidite) Formation
- Old Hills, 2km SE of the Long Clawson Field which produces from the upper Namurian Chatsworth Grit

The Old Hills prospect was selected for further technical analysis, and then a well was drilled on it.

Interpretation of existing seismic and 26km of reprocessed coal exploration seismic and 9km of newly-acquired seismic over the prospect refined definition of the structure. A well, Old Hills 1, was drilled on a crestal position in January 2004, targeting both the Chatsworth Grit and the Rempstone Formation. A non-commercial hydrocarbon accumulation was encountered in a 2.5m thick pay zone in the Chatsworth Grit.

In drilling the well Roc fully met its licence commitment. In the absence of any other drillable prospects, Roc chose to relinquish the entire licence on 3 April 2005.

2 INTRODUCTION

2.1 Report structure

The report comprises six chapters:

- Chapter 2 deals with the history of oil and coal exploration within and around PEDL003
- Chapter 3 outlines the well and seismic database
- Chapter 4 describes the geology of the Widmerpool Gulf
- Chapter 5 describes the structural mapping undertaken by Roc
- Chapter 6 describes the main prospectivity recognised within the licence, and
- Chapter 7 provides outline results of drilling the well Old Hills 1

2.2 Licence details

The PEDL003 licence was awarded to Candecca Resources on 14 March 1996 as part of the 7th Round of Onshore Licensing. Roc assumed responsibility for the licence after taking over from Candecca in 1999. The licence extended over 344.5 km^2 in the counties of Nottinghamshire, Leicestershire and Lincolnshire in the East Midlands, covering the south-eastern part of the Carboniferous basin known as the Widmerpool Gulf (Figs 2.1 and 2.2).

The PEDL003 licence area was awarded for an initial term of 6 years, with a 'drill-or-drop' commitment within 4 years. The initial work commitment was to:

1. acquire new 2D seismic within three years of the award of the licence;
2. **drill not less than one exploration well within 4 years of the award of the licence, if** the licensee is satisfied that seismic, **geological** and structural **information** available at that time is **adequate for the well to proceed**. If the licensee considers that the information available is not adequate for the well to proceed, it shall inform the Secretary of State of its reasons for reaching this conclusion.

Candecca also undertook to:

1. Acquire all available existing gravity and magnetic data within 1 year of the award of the licence, and
2. Acquire and reprocess all available existing seismic data within 2 years of the award of the licence.

The licence area surrounded two producing fields, Rempstone and Long Clawson. These were discovered by BP in 1985/6, but were developed and are currently operated by Pentex.

By July 2002 Roc had acquired 9km of new 2D seismic data, after which the licence terms were modified in January 2003 to require Roc to:

1. drill not less than one exploration well by 31 December 2003.

A well, Old Hills 1, was drilled to meet this commitment in January 2004, and encountered non-commercial volumes of oil. Roc recognised no other significant prospectivity within the licence, so it was relinquished on 3 April 2005.

2.3 History of exploration activity in PEDL003

2.3.1 Hydrocarbon exploration

The Widmerpool Gulf has been a focus of onshore oil exploration activity, principally by BP (through its fore-runner D'Arcy Exploration), since the Eakring Field was discovered 25km north of the licence in 1939. Success within or near to PEDL003 was initially limited to the Plungar Field, discovered in 1953. Other wells drilled at that time (Hathern, Sproxton, Widmerpool and Wysall) encountered hydrocarbon shows, and also delimited the complexity of the basin, with a deep-water Namurian and Dinantian sequences being encountered in Widmerpool 1, and a much thinner sequence with very thin Namurian overlying Dinantian shallow marine carbonates in Hathern 1. Acquisition of a dense grid of reflection seismic data from the early 1980s onwards, principally by BP (and partners), resulted in more targeted drilling of smaller prospects.

Well	Drilled	Operator	Comment
Cropwell Butler 2	1984	BP	Oil discovery in Kinderscout Grit. EUR 0.14mmstb.
Harston 1	1985	BP	Dry Hole
Kinoulton 1	1985	BP	Oil Discovery in Crawshaw. Reserve quoted as 0.1mmstb based on Material Balance
Redmile 2	1985	BP	Dry Hole
Rempstone 1 and 2	1985/87	BP	Oil with gas cap discovery in two zones in Rempstone Fm turbidites. Two wells on field, but has been produced from single well in single zone. EUR 0.2mmstb.
Belvoir 1	1986	BP	Discovery by experimental micro-drill project in Ashover Grit. EUR 0.894mmstb. No appraisal or devlelopment drilling undertaken.
Long Clawson 2 (A1)	1986	BP	Oil Discovery in Chatsworth Grit. EUR 1.05 - 1.35mmstb.
Ratcliffe-on-Soar 1	1986	BP	Tested low rates of heavily biodegraded oil from Rempstone Fm immediately below Permo-Triassic unconformity.
Saxondale 1	1986	BP	c.2metre oil column identified in very porous and permeable Chatsworth Grit.
Old Dalby 1	1989	BP	Dry well
Scalford	1992	Aran	Minor shows

Table 2.1 Key exploration wells drilled mostly by BP during the 1980s in and around PEDL003.

Approximately 20 wells were drilled across a mosaic of ca 10 individual licences within or near to the initial confines of the current licence. The principal results are summarised above (Table 2.1). This drilling phase resulted in the development of the Long Clawson and Rempstone Fields by Pentex in the early 1990s.

2.3.2 Coal Exploration

In parallel with the search for hydrocarbons, there has been extensive exploration for coal in and around PEDL003, principally in the 1970s, culminating in the development of the 'Vale of Belvoir' coalfield with the Asfordby Mine on the western outskirts of Melton Mowbray in 1988. Coal Measures crop out just NW of the licence, and were known to be present further east at increasing depth, beneath the Permo-Triassic cover. In 1895 a borehole at Ruddington, reaching to over 1870', was the first of over 80 drilled (and mostly cored), in and around PEDL003. The NCB conducted a phase of outline exploration in the mid 1970s with a dense seismic grid and boreholes with a spacing of 2km, broadly between Melton Mowbray and Grantham. A second phase of drilling and dense seismic acquisition, focussed on the development of the Asfordby Mine, continued until 1993. The mine closed in 1997 after only 2 years of production when roadways near to the mine shaft areas were flooded.

Following the privatisation of British Coal, the premature abandonment of the Asfordby Mine in 1997, and the demise of coal mining in general in the UK, much of the closely guarded data which the NCB had amassed over 40 years of activity came into the public domain, via

the regulatory body, the Coal Authority. Although BP had traded much of the pre-1988 NCB data, the 1997 7th Onshore Licensing Round offered Candecca the unique opportunity to acquire a single licence over most of the prospective Widmerpool Gulf, with an unprecedented access to seismic and borehole data.

2.4 Key wells 1943-1954

This section details the results of key wells in and around PEDL003: Long Clawson 1, Hathern , Sproxton, Widmerpool and Wysall.

Long Clawson 1 was drilled in 1943 to a TD of 1434 m on a mid-basin 'ridge' in the Widmerpool Gulf. It penetrated a thick (>478 m) Namurian sequence and confirmed the presence of potential reservoir sandstones in the Westphalian and upper Namurian of the Widmerpool Gulf.

Widmerpool-1 and Sproxton-1 were drilled near the close of World War II, in contrasting positions within the Carboniferous Basin. Widmerpool-1 was drilled where the Carboniferous basin sediments were near their thickest. Gas was tested at very low rates (185 cf/d) from lower Namurian sandstones. It was the first flow of hydrocarbons from turbiditic sands later included in the Rempstone Formation, and the first production of hydrocarbons from the Widmerpool Gulf.

Sproxton-1, drilled on the SE margin of the Widmerpool Gulf, encountered a Westphalian section almost entirely comprising volcanic rocks. These were underlain by a thin section of Ordovician volclaniclastic sediments resting unconformably on Precambrian metasediments.

Follow-up drilling in the western part of the Widmerpool Gulf proved non-marine Namurian and Westphalian sands in **Wysall 1-3** wells. The only oil show was from a thin sandstone in the Westphalian A of Wysall -2, about 100 m above the Crawshaw Sandstone. Drill stem tests of the Rough Rock of Wysall -1 and Wysall -3 flowed brackish water at rates up to 3,500 bwpd, which established the quality of Namurian reservoir in the north-western part of PEDL003.

In 1953, the **Plungar Oilfield** (ML19) was discovered close to the northern margin of the Widmerpool Gulf 3km north of PEDL003. 310000 bo were produced before the field was almost entirely abandoned in 1965, with production from a single well (Plungar 13, gross production 220000bo) continuing until 1980. BP unsuccessfully reappraised the field in 1986, by which time some 32 wells had been drilled. The field is complex, with production from nine thin sands in three zones, with lateral structural and stratigraphic separation.

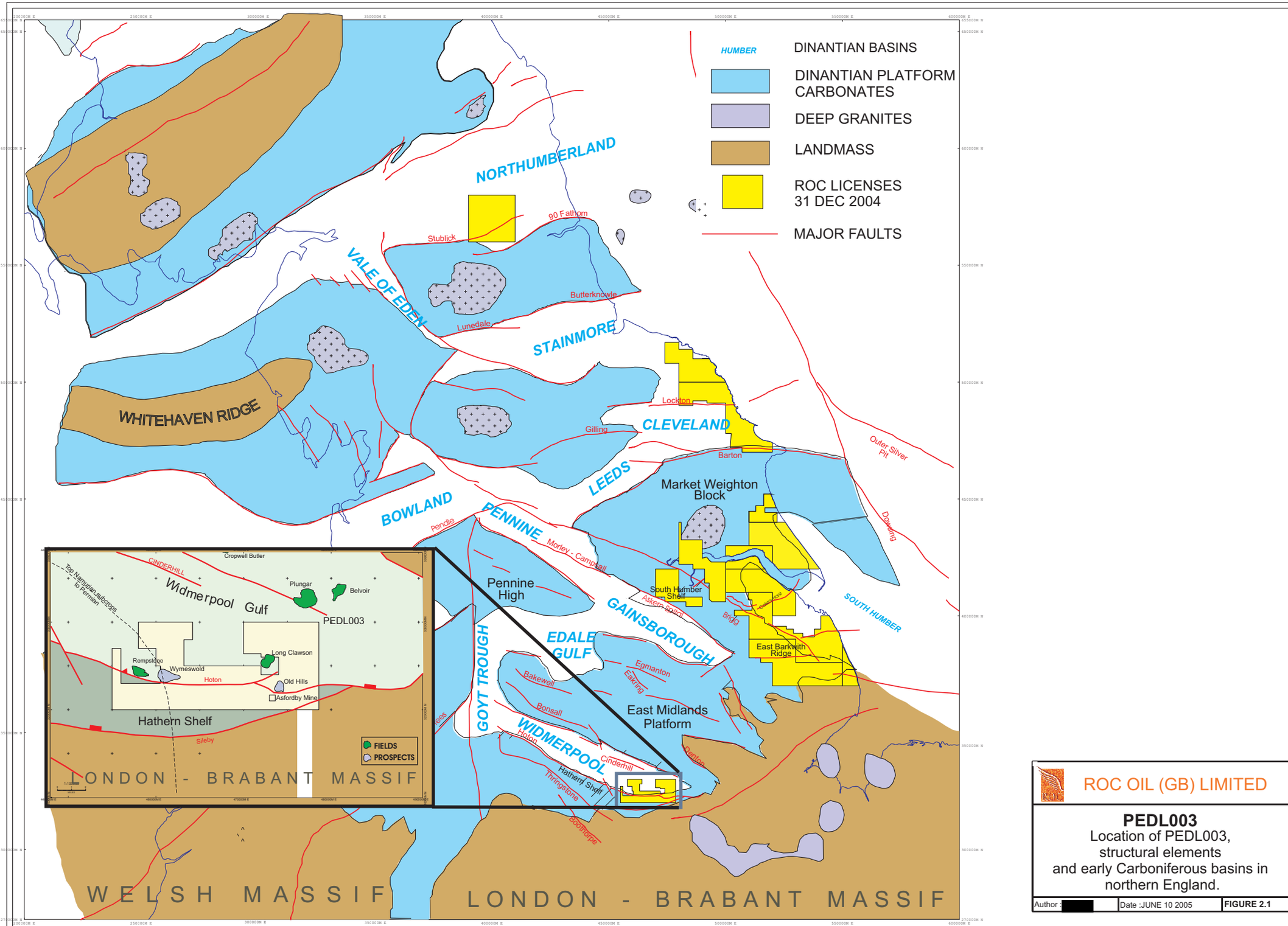
Hathern-1 was drilled in 1954 on the Hathern Shelf, on the southern margin of the Widmerpool Gulf. Upper Namurian sandstones were absent from this well, but lower Namurian shales, equivalent to the Rempstone Formation were encountered. The discovery of almost 100m evaporites (Hathern Evaporite) added a new play to exploration strategy, indicating the likely complexity of the Dinantian shelf carbonate sequences over the southern footwall of the Widmerpool Gulf. A thin sequence of Namurian, mainly sandstones, was also encountered in a similar structural setting in the NCB borehole Kirby Lane.

2.5 1980s exploration

Changes in the onshore tax regime resulted in an hiatus in drilling between the early 1960s and 1984. Once these had been reversed, a BP-led group met with considerable success, albeit with reserve growth of only 4mmbo in the Widmerpool Gulf (Table 2.1). In this phase, hydrocarbons were discovered in the area of PEDL003 at:

- **Long Clawson-2** in the Chatsworth Grit, upper Namurian
- **Kinoulton-1,** Crawshaw Sandstone, Westphalian A, and
- **Rempstone-1,** Rempstone Formation, lower Namurian turbidites

Commercial success in the Rempstone Formation meant that the whole of the Widmerpool Gulf could be considered prospective, even west of the upper Namurian truncation limit.

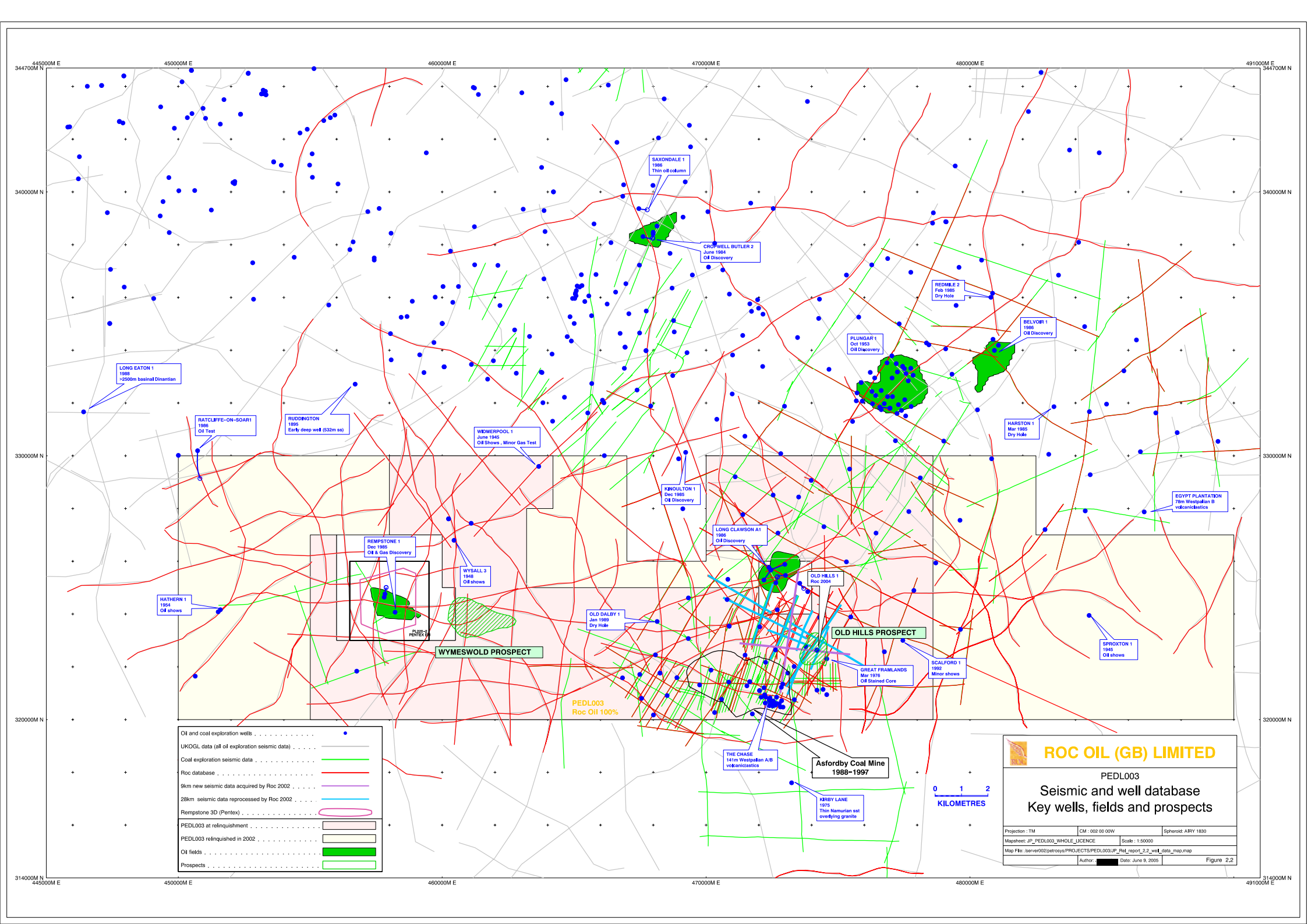


ROC OIL (GB) LIMITED

PEDL003

Location of PEDL003, structural elements and early Carboniferous basins in northern England.

Author : [redacted] | Date :JUNE 10 2005 | **FIGURE 2.1**


445000M E
450000M E
460000M E
470000M E
480000M E
491000M E
344700M N
340000M N
330000M N
320000M N
314000M N
SAXONDALE 1
1986
Thin oil column
CROXWELL BUTLER 2
June 1984
Oil Discovery
REDMILE 2
Feb 1985
Dry Hole
BELVOIR 1
1986
Oil Discovery
PLUNGAR 1
Oct 1953
Oil Discovery
LONG EATON 1
1988
>2500m basinal Dinantian
RATCLIFFE-ON-SOAR1
1986
Oil Test
RUDDINGTON
1895
Early deep well (532m ss)
WIDMERPOOL 1
June 1945
Oil Shows , Minor Gas Test
HARSTON 1
Mar 1985
Dry Hole
KINOULTON 1
Dec 1985
Oil Discovery
EGYPT PLANTATION
78m Westphalian B
volcaniclastics
REMPSTONE 1
Dec 1985
Oil & Gas Discovery
WYSALL 3
1948
Oil shows
LONG CLAWSON A1
1986
Oil Discovery
OLD HILLS 1
Roc 2004
HATHERN 1
1954
Oil shows
OLD DALBY 1
Jan 1989
Dry Hole
SPROXTON 1
1945
Oil shows
PL297=3
PENTEX 3D
WYMESWOLD PROSPECT
OLD HILLS PROSPECT
GREAT FRAMLANDS
Mar 1976
Oil Stained Core
SCALFORD 1
1992
Minor shows
PEDL003
Roc Oil 100%
THE CHASE
141m Westphalian A/B
volcaniclastics
Asfordby Coal Mine
1988-1997
KIRBY LANE
1975
Thin Namurian sst
overlying granite
0 1 2
KILOMETRES
Oil and coal exploration wells
UKOGL data (all oil exploration seismic data)
Coal exploration seismic data
Roc database
9km new seismic data acquired by Roc 2002
28km seismic data reprocessed by Roc 2002
Rempstone 3D (Pentex)
PEDL003 at relinquishment
PEDL003 relinquished in 2002
Oil fields
Prospects
ROC OIL (GB) LIMITED
PEDL003
Seismic and well database
Key wells, fields and prospects
Projection : TM
CM : 002 00 00W
Spheroid: AIRY 1830
Mapsheet: JP_PEDL003_WHOLE_LICENCE
Scale : 1:50000
Map File: /server002/petrosys/PROJECTS/PEDL003/JP_Rel_report_2_2_wel_data_map.map
Author:
Date: June 9, 2005
Figure 2.2

3 DATABASE

3.1 Seismic

There is a comprehensive grid of seismic data in and around PEDL003, mostly acquired by BP during the 1980s (Fig 3.1). Nearly all of the other data were acquired by NCB/British Coal, Aran and Clyde. Within PEDL003, Roc had access to ca 450km of digital 'oil exploration data', and ca 180km of digital 'coal exploration data'. Some of the coal data had been reprocessed by BP. Roc reprocessed a further 26km of coal data acquired since BP and other companies had surrendered their licences in the area. Roc also purchased from Pentex a 5km^2 3D survey acquired over its Rempstone Field, and shot 9km of new data over the prospect into which it drilled the well Old Hills 1 in 2004.

Line	Length (km)
74-05A_R02	2.8
74-05B_R02	4.0
74-08_R02	3.8
87-AFY-05_R02	2.0
91-AFY-50_R02	1.7
91-AFY-51_R02	1.8
92-AFY-46B_R02	2.7
92-AFY-48B_R02	2.5
92-AFY-49_R02	3.6
93-AFY-62A_R02	1.8

Table 3.1 NCB/British Coal seismic lines reprocessed by Roc.

3.2 Well data

All deep (>150m drilled depth, Fig 2.2) well data in and around PEDL003 are now available (with the exception of some wells drilled by BP pre-1966 under Mining Licence terms for which there was no statutory requirement for release), either from the DTI's agent, for hydrocarbon exploration data, or from the Coal Authority archive at the BGS. There are at least 100 such wells, although over a third of these are clustered around Asfordby Mine.

Wireline log data for most of the hydrocarbon exploration, and key coal exploration wells were digitised by Roc, and some digital Coal Authority data was purchased from the BGS.

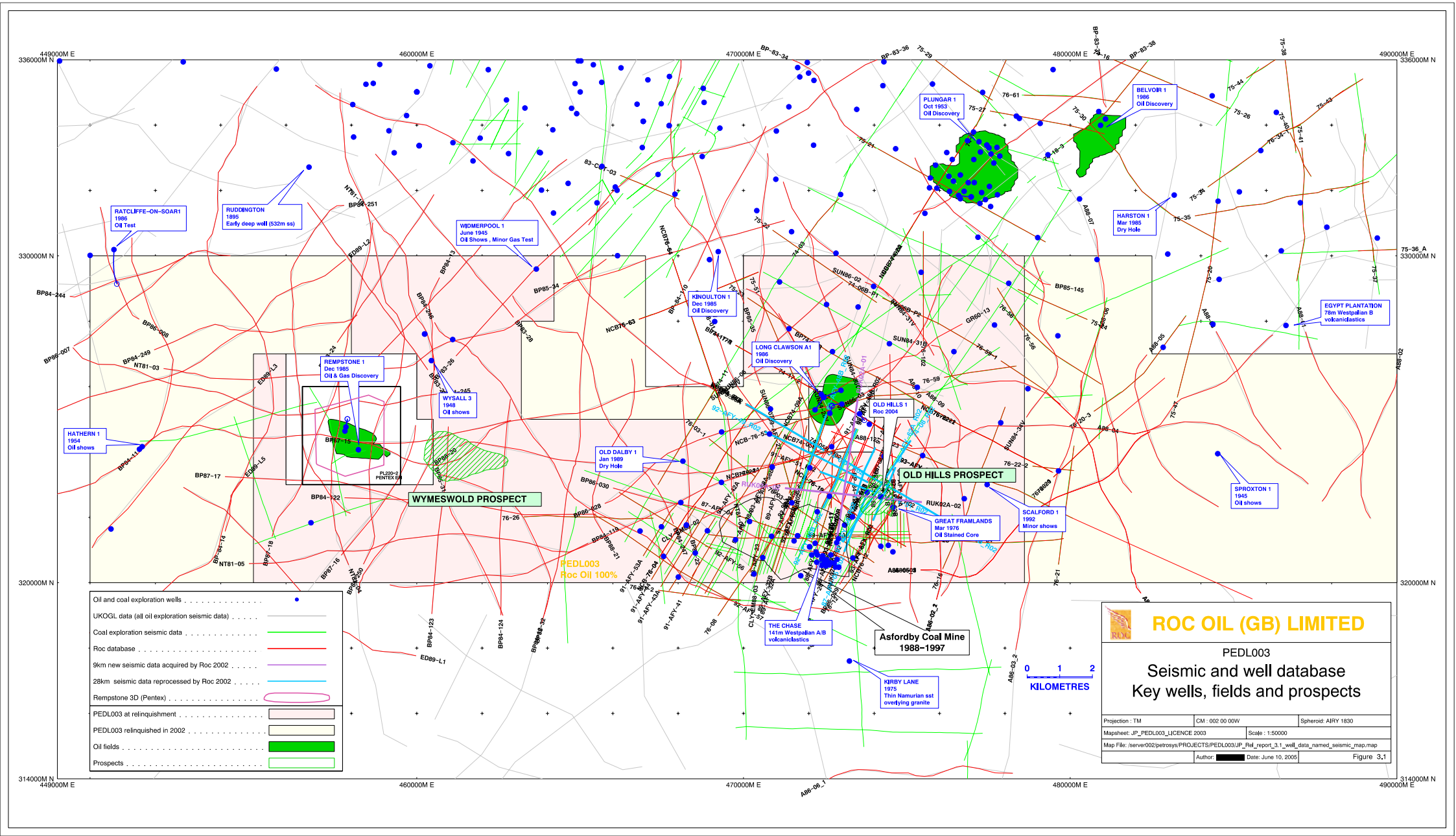
Core data for hydrocarbon exploration wells was examined at the BGS core store at Keyworth. All coal exploration wells were cored in their entirety over the Carboniferous, but most of the core was not retained. A small proportion of this core is preserved at Keyworth, and was examined.

3.3 Gravity data

As part of its evaluation of the East Midlands, Roc licensed onshore gravity data from the BGS. These datasets were reprocessed by Ark (Fig. 4.2).

3.4 Publications

The BGS has published 1:50000 or 1" maps over the whole of PEDL003, together with descriptions of the area to the west (Loughborough-Derby, Carney et al. 2001) and north east (Grantham, Berridge et al. 1999), both of which provide much information of relevance for the licence. The BGS has also published detailed analyses of the data gathered by NCB/British Coal in planning and developing Asfordby Mine, in the form of detailed technical reports for particular 10x10km map sheets (Ambrose 1998, 1999, 2000a and 2000b).


449000M E
460000M E
470000M E
480000M E
490000M E
336000M N
330000M N
320000M N
314000M N
RATCLIFFE-ON-SOAR1
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Oil Test
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Early deep well (532m ss)
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June 1945
Oil Shows , Minor Gas Test
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Oil Discovery
BELVOIR 1
1986
Oil Discovery
HARSTON 1
Mar 1985
Dry Hole
EGYPT PLANTATION
78m Westpalian B
volcaniclastics
KINOULTON 1
Dec 1985
Oil Discovery
LONG CLAWSON A1
1986
Oil Discovery
REMPSTONE 1
Dec 1985
Oil & Gas Discovery
WYSALL 3
1948
Oil shows
HATHERN 1
1954
Oil shows
OLD DALBY 1
Jan 1989
Dry Hole
OLD HILLS 1
Roc 2004
OLD HILLS PROSPECT
WYMESWOLD PROSPECT
SPROXTON 1
1945
Oil shows
SCALFORD 1
1992
Minor shows
GREAT FRAMLANDS
Mar 1976
Oil Stained Core
THE CHASE
141m Westpalian A/B
volcaniclastics
Asfordby Coal Mine
1988-1997
KIRBY LANE
1975
Thin Namurian sst
overlying granite
PEDL003
Roc Oil 100%
Oil and coal exploration wells
UKOGL data (all oil exploration seismic data)
Coal exploration seismic data
Roc database
9km new seismic data acquired by Roc 2002
28km seismic data reprocessed by Roc 2002
Rempstone 3D (Pentex)
PEDL003 at relinquishment
PEDL003 relinquished in 2002
Oil fields
Prospects
0 1 2
KILOMETRES
ROC OIL (GB) LIMITED
PEDL003
Seismic and well database
Key wells, fields and prospects
Projection : TM
CM : 002 00 00W
Spheroid: AIRY 1830
Mapsheet: JP_PEDL003_LICENCE 2003
Scale : 1:50000
Map File: /server002/petrosys/PROJECTS/PEDL003/JP_Rel_report_3.1_well_data_named_seismic_map.map
Author:
Date: June 10, 2005
Figure 3.1

4 GEOLOGY OF THE WIDMERPOOL GULF

4.1 Structural development and stratigraphy

The area of PEDL003 covers the southeastern part of the Widmerpool Gulf (Figs 2.2 and 4.1), one of the major Carboniferous basins of central England. The main basinal features around PEDL003 are also show by the Bouguer gravity map (Fig. 4.2). The preserved stratigraphy of PEDL003 is shown in Figs. 4.3 and 4.4.

The basin was formed on the northern margin of the London-Brabant Massif, itself the result of the accretion of a magmatic arc terrane by the subduction of the oceanic lithosphere of the Tornquist Sea beneath the Midlands Microcraton. This collision between Avalonia and Baltica to the north, took place during the Caradocian. Reactivation of fault systems established at this time was the controlling influence on basin geometry through to the end of the Carboniferous.

Pre-Cambrian rocks occur south of PEDL003, south of the Thringstone-Sileby fault zone, remnants of a late Pre-Cambrian volcanic arc. They comprise the volcaniclastic Charnian Group and intruded diorites. They are overlain by metamorphosed Cambrian mudstones.

Ordovician (Caradocian) plutonic (Rempstone-1, Kirby Lane) and volcanic (Sproxton-1) rocks occur in boreholes over the southernmost part of PEDL003, and can be traced in a belt running south eastwards to Peterborough and St Ives, associated with a magnetic anomaly. Further to the NE beneath the Wash and East Anglia, granitic intrusions in to basinal Odovician sediment have been inferred from gravity data, in a belt which probably extends as far east as the Dowsing-South Hewett Fault Zone. Rocks of these types are probably present at depth beneath the Dinantian of the Widmerpool Gulf, and have been encountered further north in Eakring 146 and Welton 1.

A Carboniferous sequence of variable character and thickness is present throughout PEDL003, controlled by geometry of the Widmerpool half-graben. A detailed account of the basin and its relationship to the development of the Carboniferous over northern England has been given by Fraser and Gawthorpe (1990, 2003). The detailed geology of the East Midlands region, and the Carboniferous in particular, is the focus of a large body of literature. Consequently, the stratigraphy of the licence is well known, and has been summarised recently by the BGS (Carney et al. 2001).

The stage nomenclature for the Silesian, which includes the Namurian and Westphalian, is summarised in Figure 4.2. Marine bands, named after their distinctive goniatite fauna, are

used as a means of identification of the Namurian and lower Westphalian sandstone bodies. Correlation within the Westphalian is additionally dependent on coal seams. Coal seam nomenclature varies between the former NCB mining areas; that for Nottinghamshire have been adopted, although a number of seams merge in the Vale of Belvoir. Correlation of coal seams is the most common basis for correlation of sandstones within the Westphalian Coal Measures.

4.1.1 Widmerpool Gulf

The Widmerpool Gulf is an asymmetric half-graben (Figs 4.1, 4.5-4.9) formed by extension in the late Devonian-Dinantian. It is bounded in the south by the Hoton Fault zone (also referred to where it splays as the Normanton Hills and Yaxley House faults), and in the north by the antithetic Cinderhill Fault. The basin has a width of up to 15km, but extends 70km WNW-ESE, intersecting the Staffordshire Basin in the west. The eastern margin of the basin falls within PEDL003, where the NNW-SSE trending inverted Denton Fault (the Foston High is its inverted hangingwall, and the fault continues northwards where it is referred to as the Eakring Fault) offset the Carboniferous extension northwards to the Sleaford Low (Berridge et al. 1999). Inversion during Variscan compression has resulted in downwards tilting towards the east, and a series of minor anticlines along the Hoton Fault system, and NNW-SSE trending faults. These form the traps targeted in the licence (eg. Rempstone, Fig. 4.7) and further north. There is evidence for further significant reactivation of these faults in the early Jurassic with, the Top Triassic being offset by up to 100m (Fig. 4.9).

The Widmerpool Gulf is bounded on its southern side by a the Hoton Fault, across which the base of the Dinantian is downthrown to the north by more than 2km. The Carboniferous sequence is thin over the footwall in the south (Figs 4.5-4.8). Movement over the Hoton fault continued from the early Dinantian to the early Westphalian. Sequences thicken across the fault, up to the level of the Kilburn Coal. The fault zone is still seismically active. There is increasingly deeper erosion at the Base Permian Unconformity towards the west. Probable Stephanian sediments are present beneath the Permian on the eastern margin of the licence, coal-bearing Westphalian persists to just west of Melton Mowbray, there is no uppermost Namurian or Westphalian present at Rempstone, and on the western margin of the licence at Ratcliffe, the middle Namurian subcrops Permo-Triassic.

4.1.2 Dinantian

North of the Hoton Fault the Carboniferous attains a maximum preserved thickness of ca 3km (Fig 4.5, 4.10), mostly comprising Dinantian and Namurian basinal mudstones. The Dinantian sequence within the basin comprises basinal mudstones with thin limestones. In Long Eaton 1 this sequence, of Courceyan-early Chadian age, has a thickness of 1867m.

The sequence thickens to the SW, to ca 4000m, and may include a basal coarse clastic interval. At the base, a clastic syn-rift sequence of latest Devonian/earliest Devonian age is inferred, similar to the 500m thick sequence drilled in Eakring 146. In Scalford 1 there is a sequence of red/brown sandstones/siltstones beneath the Westphalian. This is undated, but has been assigned to the Devonian. It may form part of the syn-rift, but is more likely to be part of the Silurian-Devonian pre-rift sequence, recognised widely along the margin of the London-Brabant Massif.

Absence of late Chadian/Asbian sediments in Long Eaton 1 points to a phase of inversion during the Holkerian. The upper most part of the Dinantian comprises the Holkerian-Late Asbian Lockington Limestone Fm (max 185m), and the late Asbian-Brigantian Widmerpool Fm (741m).

In the footwall, between the Hoton Fault and the Thringstone-Sileby Fault, an area referred to as the Hathern Shelf, there is a much thinner (ca 250m) Dinantian shelf carbonate system, overlain by thin Namurian (Figs 4.5, 4.10). It is beneath this zone that Ordovician rocks have been found. South of the Thringstone-Sileby Fault system lies the Pre-Cambrian/Cambrian sequence of the Midlands Microcraton.

4.1.3 Namurian and Westphalian

The Namurian and Westphalian section in the Widmerpool Gulf may be more than 1,000 m thick. It consists of a sequence ranging from pelagic-hemipelagic marine shales (Edale shales) at the base, to the varied clastics and coal (Millstone Grit and Coal Measures) of upper delta plain environments.

The lower Namurian Edale Shale Group consists of a sequence of basinal turbidite sandstones and interbedded within basinal shales, which are ca 350m thick in Rempstone-1 and were also penetrated in Ratcliffe-on-Soar-1, Long Clawson-2 and Kinoulton-1. The turbidites were probably sourced from the south and deposited along southern margin of the Widmerpool Gulf. By the late Namurian times the basin had been infilled. Shallow water upper Namurian (Millstone Grit) deltaic sediments prograded southwards. The Millstone Grit reaches a maximum thickness of 220m in Long Clawson 3.

Early Westphalian volcaniclastic sediments (Saltby Volcanic Fm; e.g. The Chase and Egypt Plantation boreholes) up to 144m thick are known from the SE corner of the basin, in the area where the Hoton and Denton fault systems intersect (Figs 2.1, 4.1. The youngest extrusive rocks occur just below the level of the Deep Main Coal. There are also late Carboniferous intrusive igneous rocks, inferred on regional grounds to be Stephanian in age

and related to Variscan inversion. They pre-date the Permian, and dolerites in Harlequin-1 have been dated as 296-302Ma (+/-20).

Shallow water deltaic deposition, dominantly of mudstone continued during the Westphalian, with widespread coal development. The Coal Measure sequence in Old Dalby 1 reaches a maximum thickness of 440m. The uppermost Westphalian 'Barren Measures' (Warwickshire Gp/Etruria Fm) have been eroded over most of PEDL003. 15m of the sequence are preserved in Eastwell, and the sequence is likely to be thicker further to the NE.

The Carboniferous sequence is overlain unconformably by the Permo-Trias. The Permian is generally less than 20 m, with minor carbonate development in the east, only. The Mesozoic sequence of PEDL003 consists of a normal East Midlands Triassic section up to 300m thick and a Lower Jurassic section up to 10 m thick. Sections of the Middle Jurassic up to 25 m thick are preserved in NE PEDL003. A thin veneer of Quaternary boulder clay, commonly less than 10 m thick, covers much of PEDL003.

4.2 Hydrocarbon generation and migration

The entire Carboniferous sequence contains rich source rocks for both oil and gas.

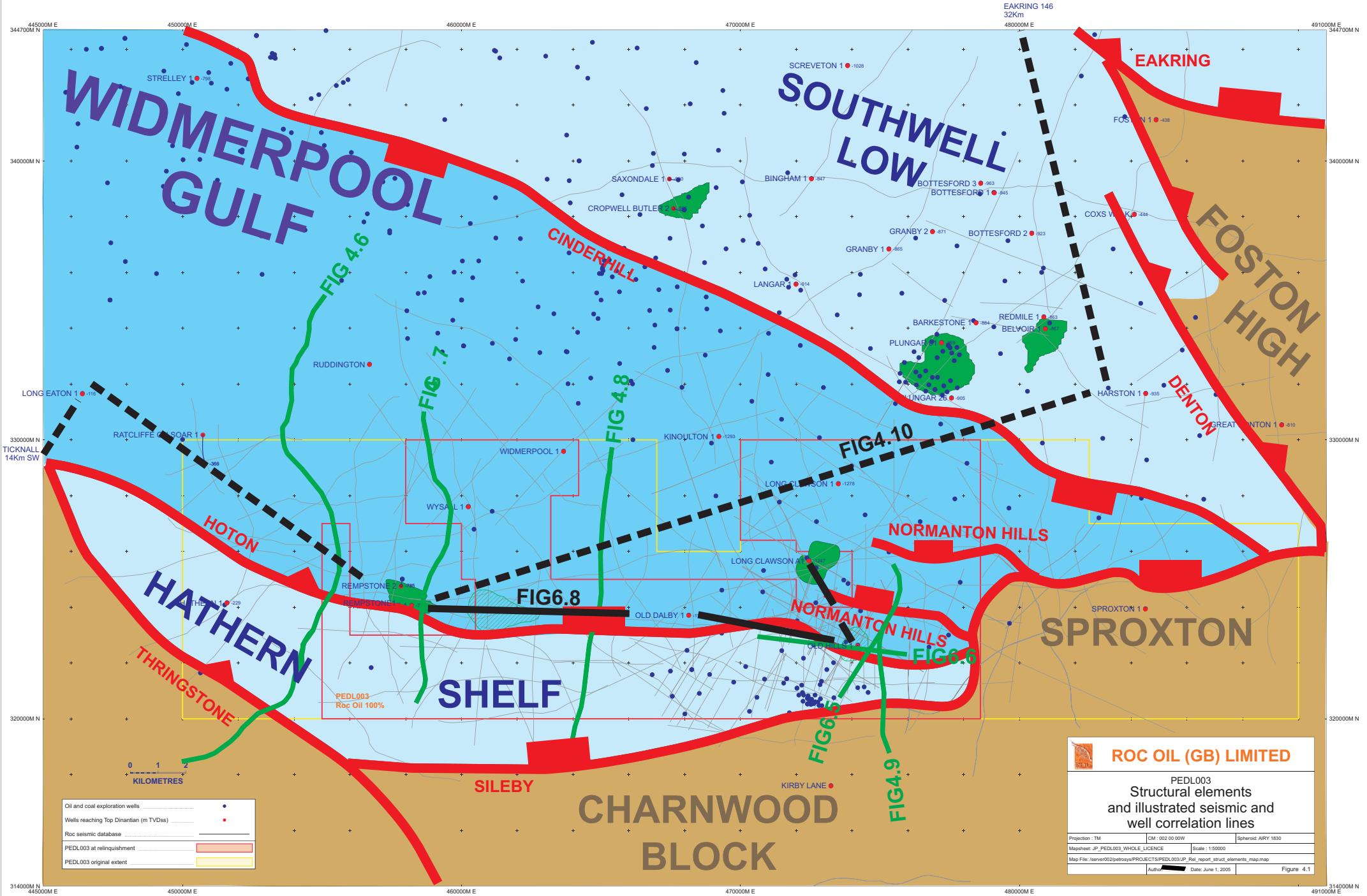
Analysis of oil from the Long Clawson oil field (BP, 1986) demonstrates that it was sourced from low maturity (0.5-0.6 %Ro equiv) lower Namurian and Dinantian shales. Further west, where the sequences are more deeply buried, higher levels of maturity (up to 1.08) are recorded. The presence of multiple source-prone beds within this interval is highlighted by their high gamma ray response and gas chromatogram readings, mostly in the Arnsbergian section. TOC readings up to 5.8% and 4.6% have been recorded in the Rempstone wells and Kinoulton 1.

Vitrinite reflectance samples from Long Clawson A1 show that the shales at the base Namurian are only marginally mature for oil (0.55 %Ro equiv) at the present-day. Maturity increases to the northwest, as the amount of preserved Carboniferous section and thickness of the Namurian basinal sequence increases. This is the likely kitchen area for traps along the southern margin of the basin, although most hydrocarbons will have migrated northwards. In addition, oil may have also been generated from the Dinantian basinal succession. Upper Namurian and Westphalian marine bands have limited thickness and are likely to be immature, but may have contributed to local hydrocarbon shows.

The more deeply buried parts of the Dinantian probably generated hydrocarbons during the late Carboniferous, prior to basin inversion. Maximum burial was reached during the late Cretaceous, prior to removal of the Mesozoic cover following Tertiary uplift.

Present-day levels of maturity were most likely attained prior to early Tertiary exhumation and eastward tilting, significantly later than the timing of principal trap formation at the end of the Carboniferous.

Fault activity has continued to the present day, particularly along the large basin bounding fault system. There is up to 100m of offset at the base of the Permo-Triassic, with lesser offsets in the Lias. No younger rocks are preserved.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314000M N
EAKRING 146
32Km
WIDMERPOOL GULF
SOUTHWELL LOW
EAKRING
FOSTON HIGH
CINDERHILL
DENTON
HOTON
HATHERN
THRINGSTONE
NORMANTON HILLS
SILEBY
SHELF
SPROXTON
CHARNWOOD BLOCK
FIG 4.6
FIG 4.7
FIG 4.8
FIG4.10
FIG6.8
FIG6.6
FIG6.5
FIG4.9
STRELLEY 1
SCREVETON 1
SAXONDALE 1
BINGHAM 1
BOTTESFORD 3
BOTTESFORD 1
CROPWELL BUTLER 2
GRANBY 2
BOTTESFORD 2
GRANBY 1
LANGAR 1
BARKESTONE 1
REDMILE 1
BELVOIR 1
PLUNGAR 1
PLUNGAR 2
HARSTON 1
RUDDINGTON
LONG EATON 1
RATCLIFFE ON SOAR 1
TICKNALL
14Km SW
KINOULTON 1
WIDMERPOOL 1
LONG CLAWSON 1
WYSALL 1
LONG CLAWSON A 1
REMPSTONE 2
REMPSTONE 1
OLD DALBY 1
SPROXTON 1
KIRBY LANE
PEDL003
Roc Oil 100%
0 1 2
KILOMETRES
Oil and coal exploration wells
Wells reaching Top Dinantian (m TVDss)
Roc seismic database
PEDL003 at relinquishment
PEDL003 original extent
ROC OIL (GB) LIMITED
PEDL003
Structural elements
and illustrated seismic and
well correlation lines
Projection : TM
CM : 002 00 00W
Spheroid: AIRY 1830
Mapsheet: JP_PEDL003_WHOLE_LICENCE
Scale : 1:50000
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Author:
Date: June 1, 2005
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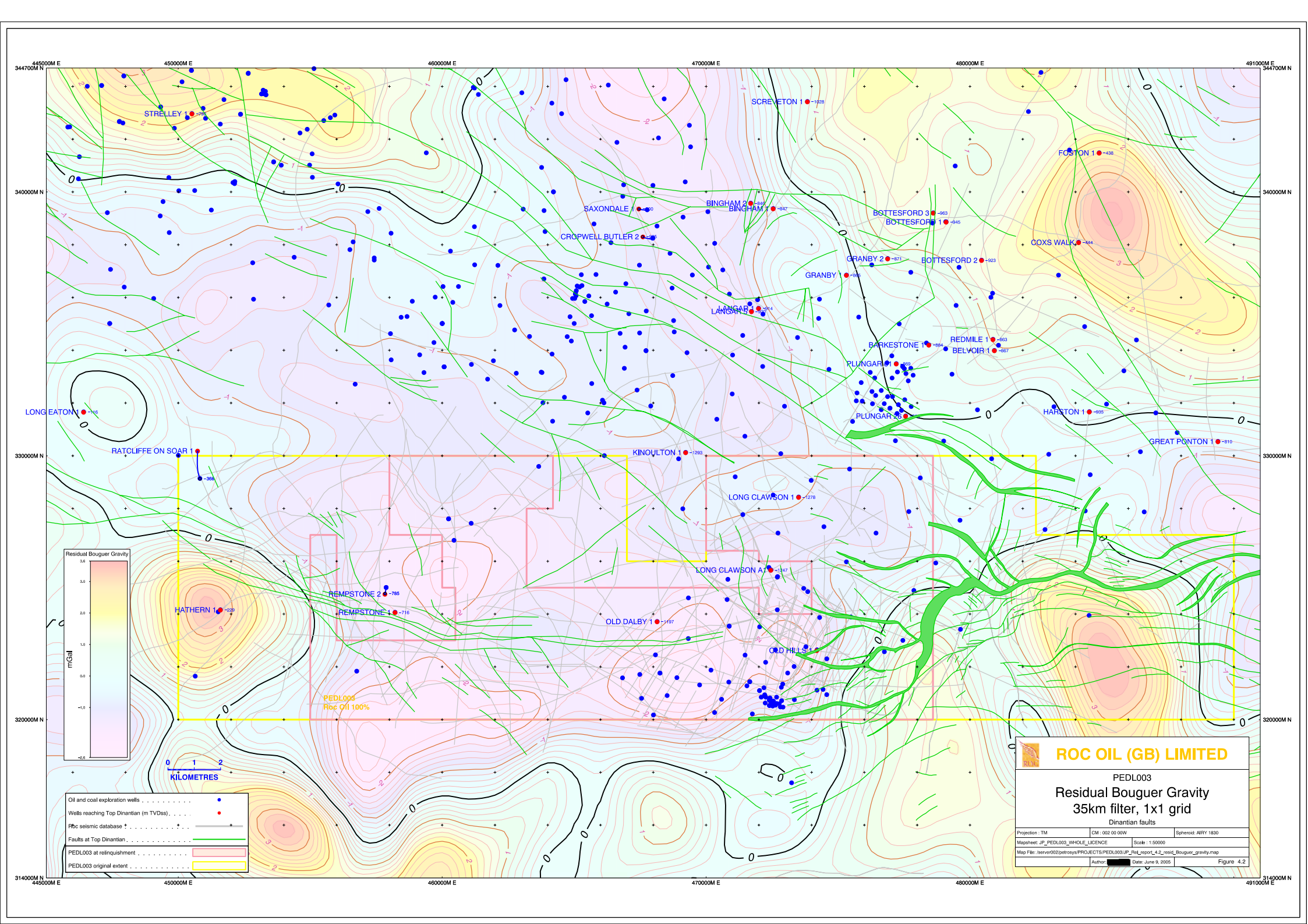
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460000M E
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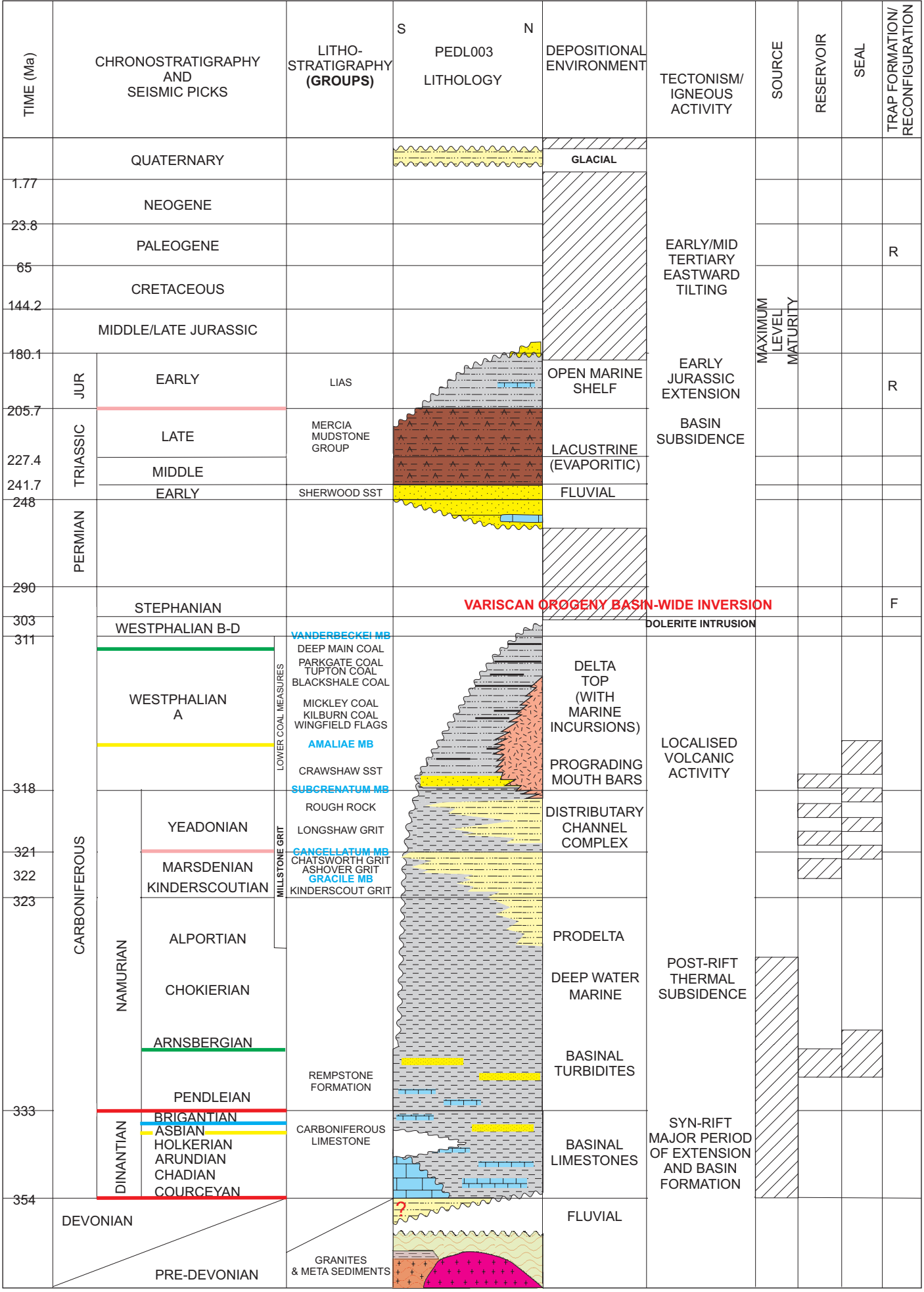
491000M E
344700M N
340000M N
330000M N
320000M N
314000M N
STRELLEY 1
SCREVETON 1
FOSTON 1
SAXONDALE 1
BINGHAM 2
BINGHAM 1
BOTTESFORD 3
BOTTESFORD 1
CROPWELL BUTLER 2
COXS WALK
GRANBY 2
BOTTESFORD 2
GRANBY
LANGAR 2
LANGAR 1
BARKESTONE 1
REDMILE 1
BELVOIR 1
PLUNGAR 1
LONG EATON 1
PLUNGAR 2
HARSTON 1
GREAT PONTON 1
RATCLIFFE ON SOAR 1
KINOULTON 1
LONG CLAWSON 1
LONG CLAWSON A1
REMPSTONE 2
HATHERN 1
REMPSTONE 1
OLD DALBY 1
OLD HILLS 1
PEDL003
Roc Oil 100%
Residual Bouguer Gravity
mGal
0 1 2
KILOMETRES
Oil and coal exploration wells
Wells reaching Top Dinantian (m TVDss)
Roc seismic database
Faults at Top Dinantian
PEDL003 at relinquishment
PEDL003 original extent
ROC OIL (GB) LIMITED
PEDL003
Residual Bouguer Gravity
35km filter, 1x1 grid
Dinantian faults
Projection : TM
CM : 002:00:00W
Spheroid: AIRY 1830
Mapsheet: JP_PEDL003_WHOLE_LICENCE
Scale : 1:50000
Map File: /server002/petrosys/PROJECTS/PEDL003/JP_RoL_report_4.2_resid_Bouguer_gravity.map
Author:
Date: June 9, 2005
Figure 4.2



ROC OIL (GB) LIMITED

PEDL003

Stratigraphic and tectonic history of PEDL003.

Author : [redacted] | Date :JUNE 10 2005 | **FIGURE 4.3**

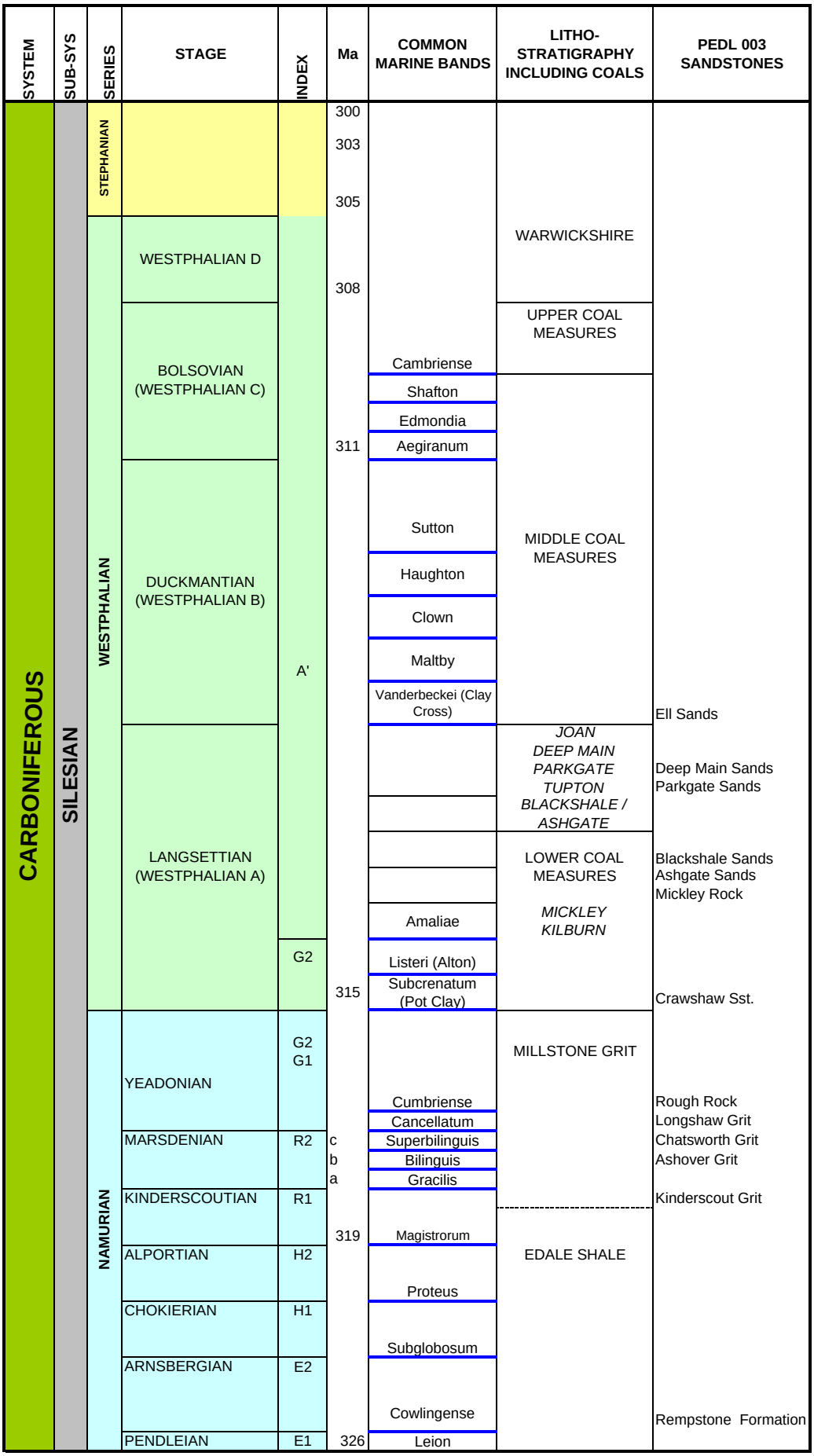
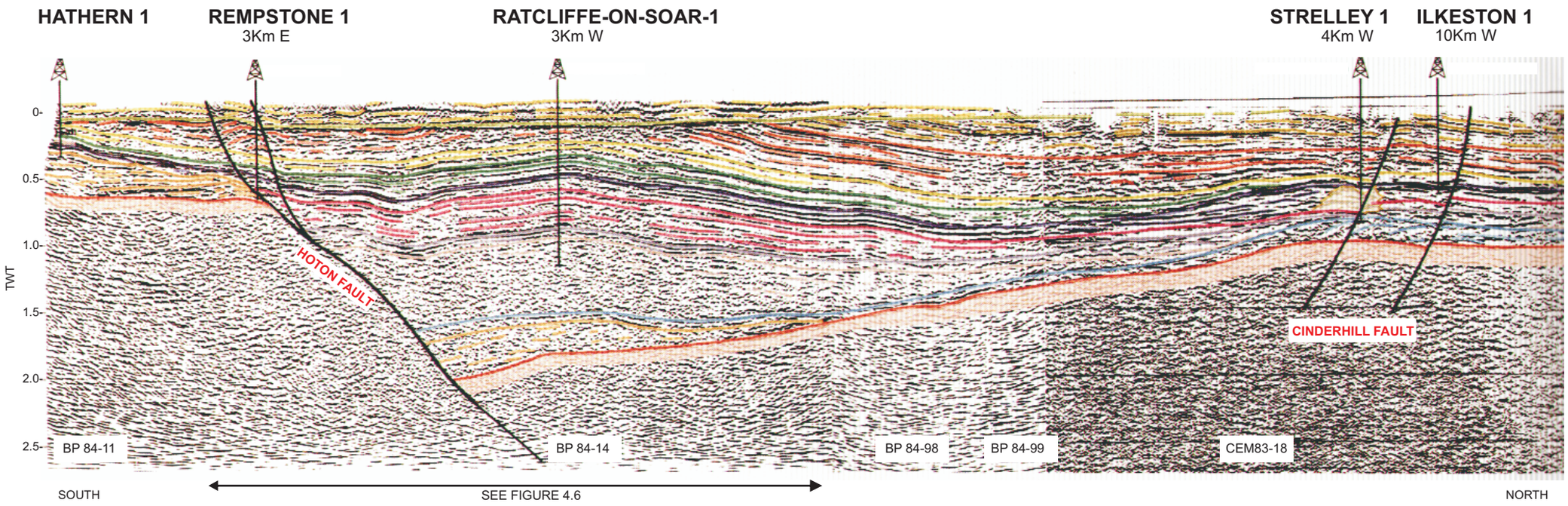
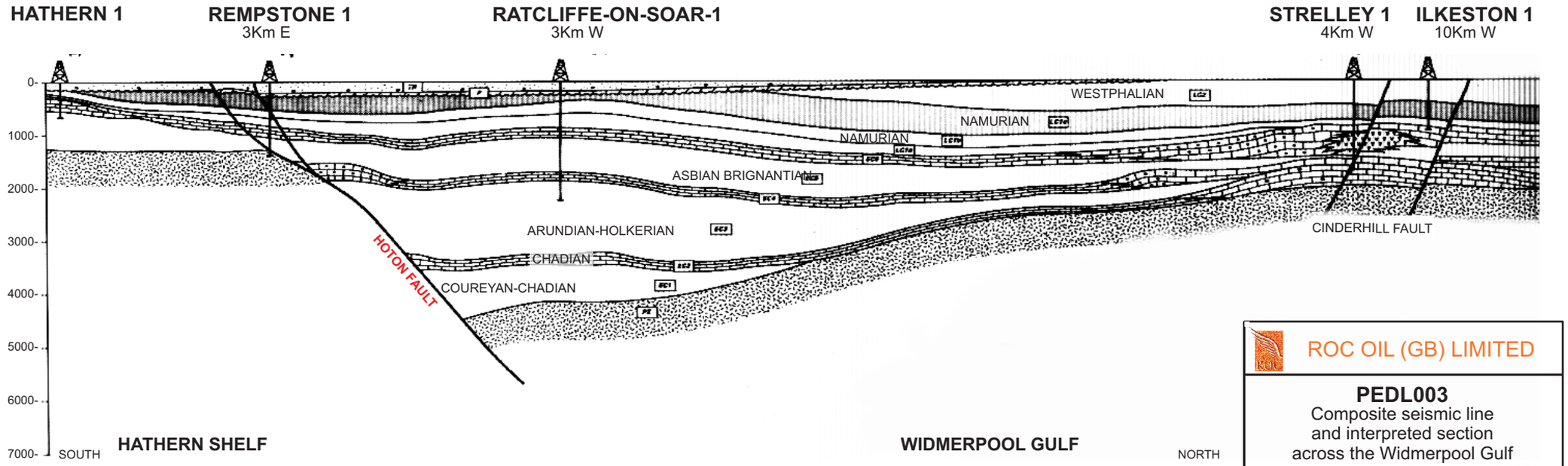


Fig 4.4 Carboniferous stratigraphy of PEDL003



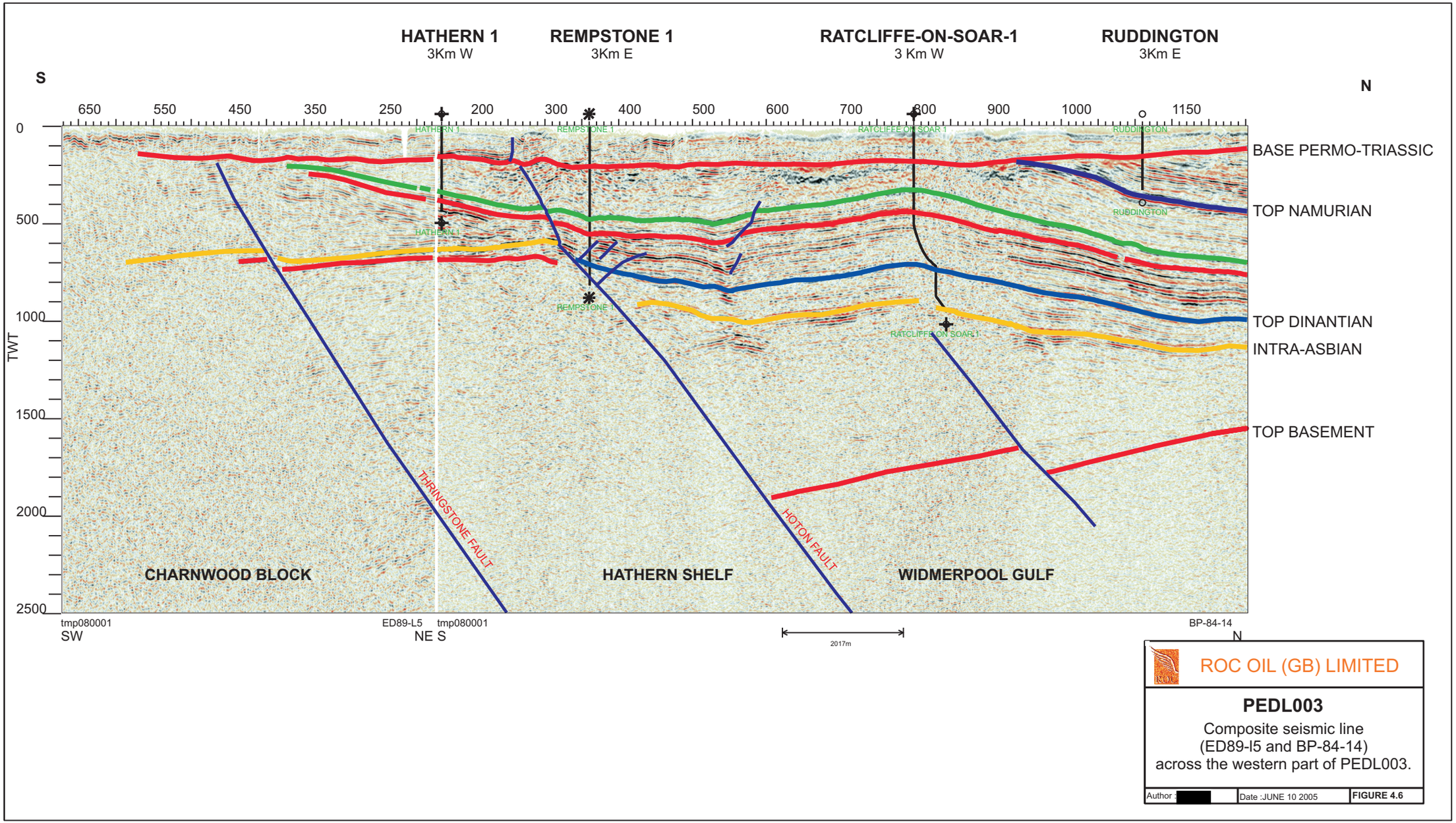


ROC OIL (GB) LIMITED

PEDL003

Composite seismic line
and interpreted section
across the Widmerpool Gulf
(from Fraser and Gawthorpe 2003).

Author	Date :JUNE 10 2005	FIGURE 4.5

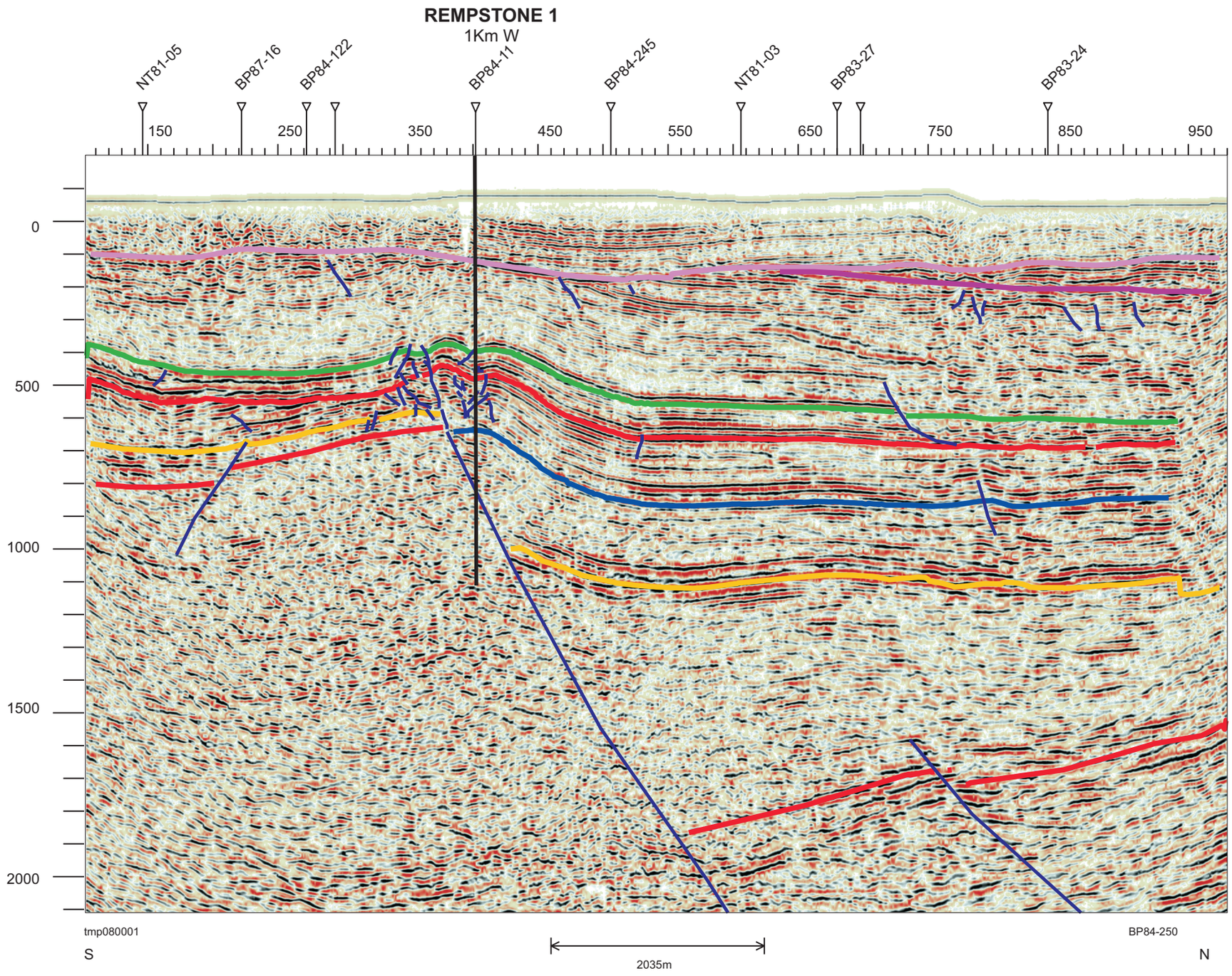


ROC OIL (GB) LIMITED

PEDL003

Composite seismic line
(ED89-I5 and BP-84-14)
across the western part of PEDL003.

Author : [redacted]	Date :JUNE 10 2005	**FIGURE 4.6**

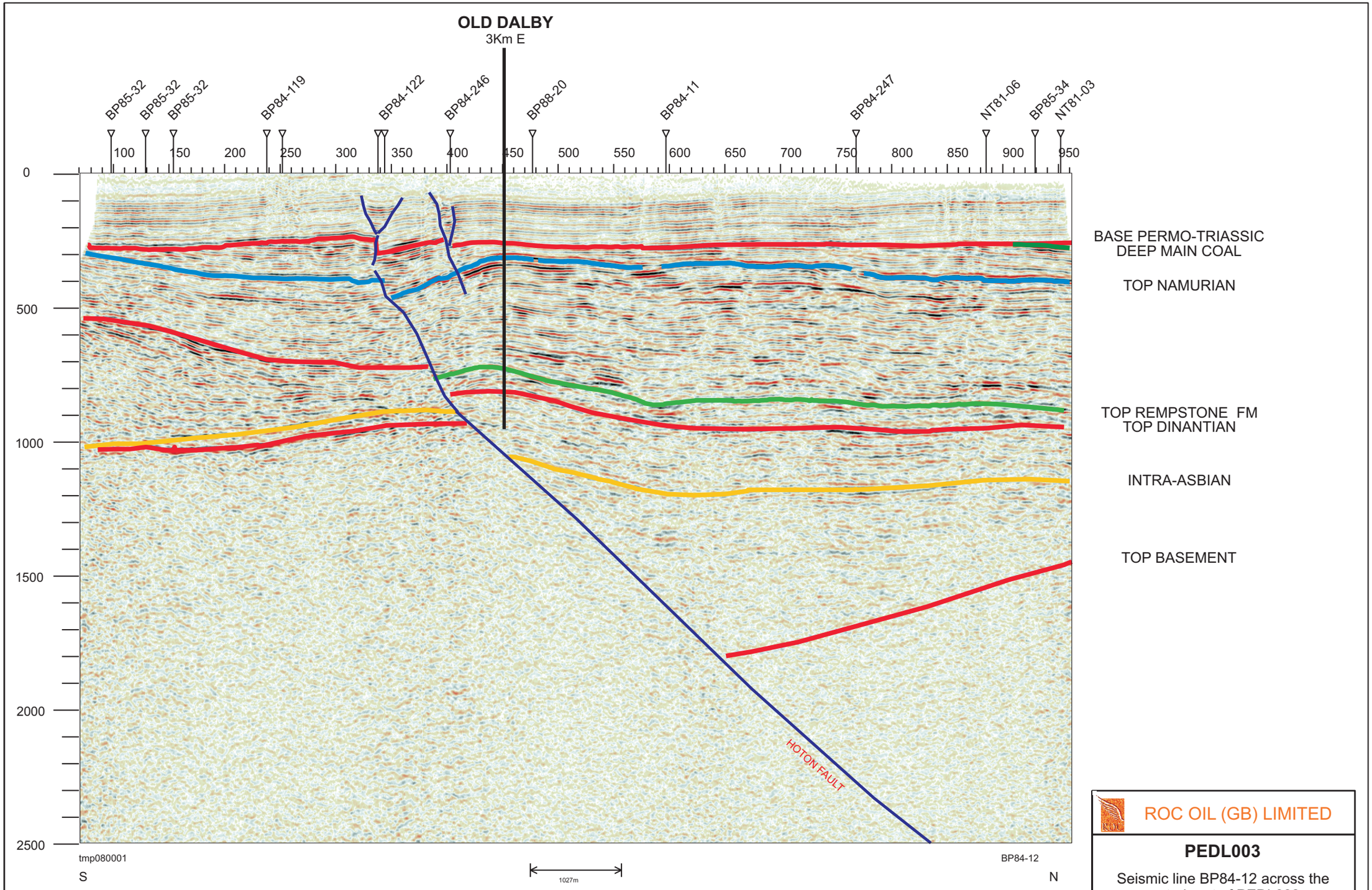


ROC OIL (GB) LIMITED

PEDL003

Seismic line BP84-250 across the Rempstone structure.

Author [redacted] | Date :JUNE 10 2005 | **FIGURE 4.7**

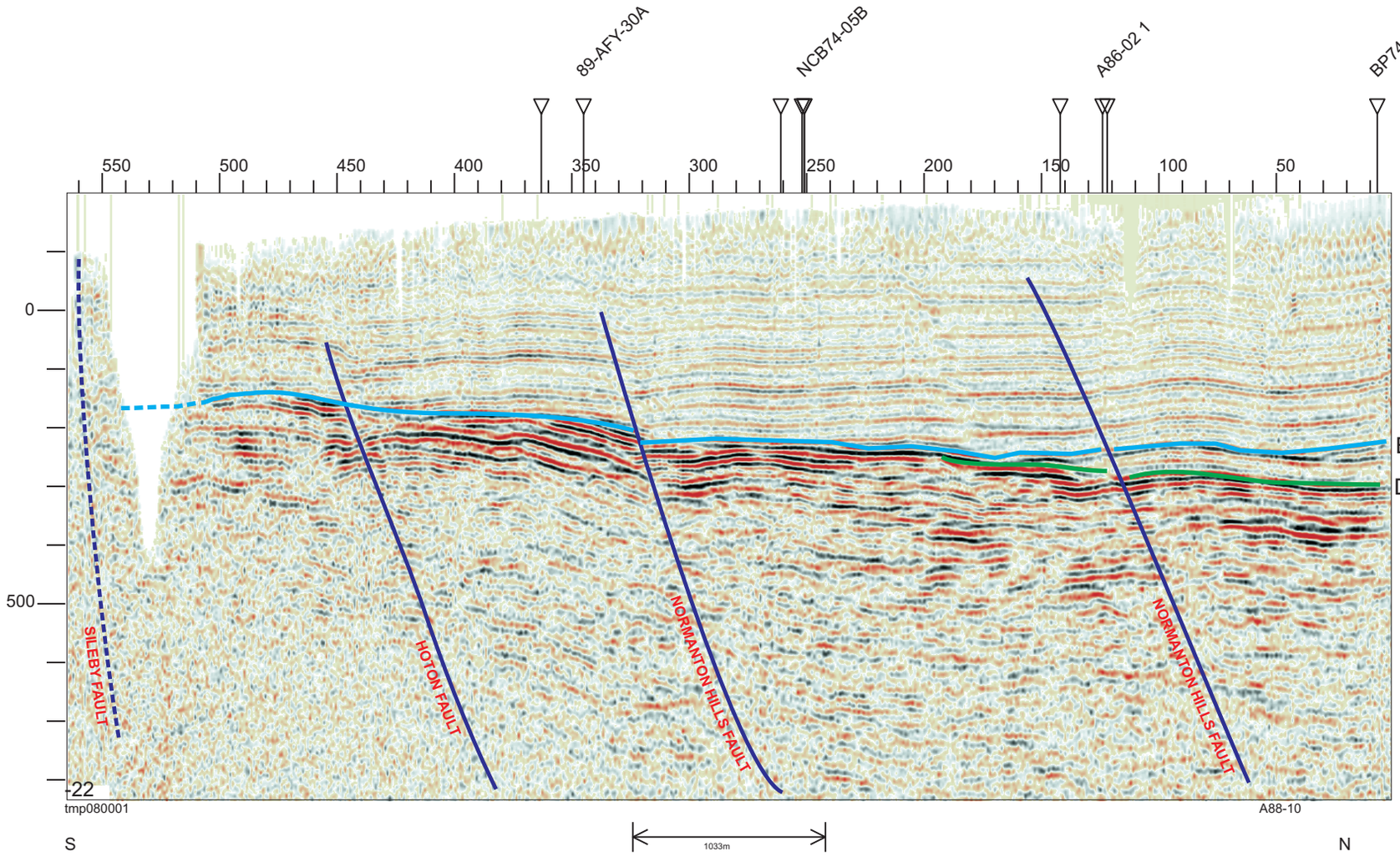


ROC OIL (GB) LIMITED

PEDL003

Seismic line BP84-12 across the central part of PEDL003.

Author : [redacted]	Date :JUNE 10 2005	**FIGURE 4.8**

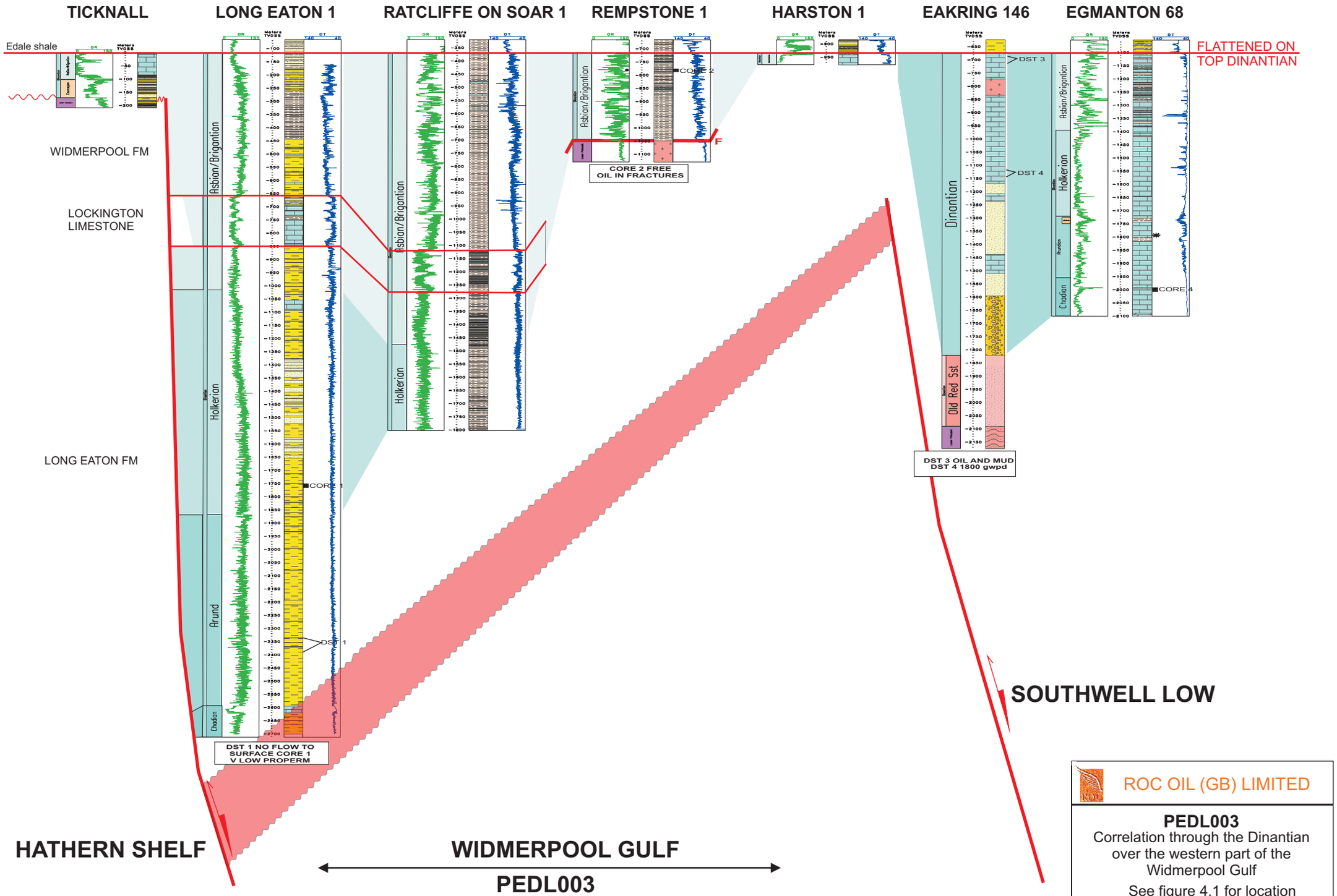


ROC OIL (GB) LIMITED

PEDL003

Seismic line A88-10 across the eastern end of the Widmerpool Gulf, where the southern boundary fault has split into three segments.

Author : [redacted] | Date :JUNE 10 2005 | **FIGURE 4.9**



ROC OIL (GB) LIMITED

PEDL003

Correlation through the Dinantian over the western part of the Widmerpool Gulf

See figure 4.1 for location

Author : [redacted] | Date :JUNE 10 2005 | **FIGURE 4.10**

5 STRUCTURAL MAPPING

5.1 TWT mapping

All available oil industry and coal exploration 2D seismic in and around PEDL003 (Fig. 3.1) has been interpreted. There was considerable uncertainty in the eastern structural closure of the Old Hills prospect. In order to clarify this and provide a tie to the Long Clawson Field, two additional seismic lines, RUK02A-01 and 02, in total 8.75 km, were shot by Roc in 2002.

An attempt has been made to interpret 10 reflectors across the licence. Those mapped are shown in bold.

Near Top Triassic

Base Permo-Triassic (Top Carboniferous) Fig. 5.1

Westphalian

Deep Main Coal, Fig. 5.2

Intra-Westphalian A

Near Amaliae Marine Band

Namurian

Near Top Namurian

Near Top Chatsworth Grit

Near Top Pendleian (Near Top Rempstone sandstone reservoir), Figs 5.3, 5.4

Dinantian

Near Top Dinantian, Figs 5.5, 5.6

Near Top Asbian

Intra-Asbian

Top Pre-Rift ('Base Dinantian'), Fig. 5.7

There is sufficient well and check-shot data to tie the wells within the Carboniferous, but seismic resolution is too poor to resolve the detailed stratigraphy of the Coal Measures, especially since there are numerous highly reflective sills and coal units, the responses of which interfere. In many wells, neither check-shots nor even logs were run over the post-Carboniferous section.

Only the Base Permo-Triassic (Top Carboniferous) and Near Top Dinantian can be mapped across the entire licence. The Westphalian reaches a western sub-crop limit beneath the Base Permo-Triassic over the central part of the licence. West of that point, the intra-Dinantian reflectors can be interpreted. To the east Dinantian/Namurian reflectors are increasingly poorly imaged. To the west, the units sub-cropping the Base Permo-Triassic become progressively older through the Namurian and Dinantian.

The Liassic-Triassic section comprises a series of 'high-frequency' reflections of similar character, which are easy to mistie. These have not been mapped, since they do not add to understanding prospectivity.

Potential prospects have been defined by mapping the Deep Main Coal, Amaliae Marine Band, Top Chatsworth and near Top Pendleian, and other intermediate reflectors.

Fraser et al. (1990, 2003) have published a detailed seismic sequence scheme for the Carboniferous of Northern England (Fig. 4.4), but this was not adopted here. Much of the scheme deals with subdividing the syn-rift and early post-rift Dinantian, where sequence thickness and lithology vary considerably within basins. The Dinantian was not seen as prospective in PEDL003, and there is little well control so no attempt was made to subdivide it. There are also two further practical problems in subdividing the Dinantian using seismic data. Much of the data, especially that acquired for coal exploration, does not image far below the top of the Namurian. Also, the PEDL003 licence extends for only 10km north-south, too short a distance for there to be much change in the nature of the Dinantian Basin. Longer sections, extending north towards the Gainsborough Trough, are required to see such changes.

5.2 Prospective structures

Prospectivity was identified by mapping the Deep Main Coal reflector over the east of the licence, and the near Top Pendleian in the east. A more detailed interpretation was then carried out over the two main prospects of Wymeswold and Old Hills.

5.2.1 Rempstone/Wymeswold

Definition of the structure around Remptone and the Wymeswold prospects was based on interpreting the following picks, although only the first two could be followed widely.

- **Near Top Reservoir (Near Top Pendleian), Fig. 5.4, 3D over Rempstone, Fig. 5.8**
- **Near Top Dinantian (near base reservoir), Fig. 5.9**
- Near Top Asbian

- Intra Asbian
- Base Dinantian

Only the top and base reservoir picks could be tied with confidence, to the nearby Rempstone 1 and 2 wells.

5.2.2 Old Hills

The basal Westphalian/upper Namurian was the main target in the Old Hills prospect, with a secondary target in the Namurian Rempstone Fm. The following reflections were mapped to define the structure (see Chapter 6 for maps):

- Base Permo-Triassic
- Deep Main Coal, Fig. 6.1
- Amaliae Marine Band, Fig. 6.2
- Near Top Chatsworth, Fig. 6.4 (depth)
- Near Top Rempstone Fig. 6.3
- Near Top Dinantian

The Deep Main Coal can be tied confidently to nearby wells (Long Clawson wells, Old Dalby Great Framlands, Old Hills and other coal exploration wells), and was the main guide to structure. A four-way dip closure was defined 300m above the Chatsworth Grit target.

The Amaliae MB could be tied with less confidence, and the top Chatsworth even less so. Data quality on most coal exploration lines is poor below the Amaliae MB, and this horizon was used as a guide for the Chatsworth. Mapping deferred a four-way, dip-closed structure.

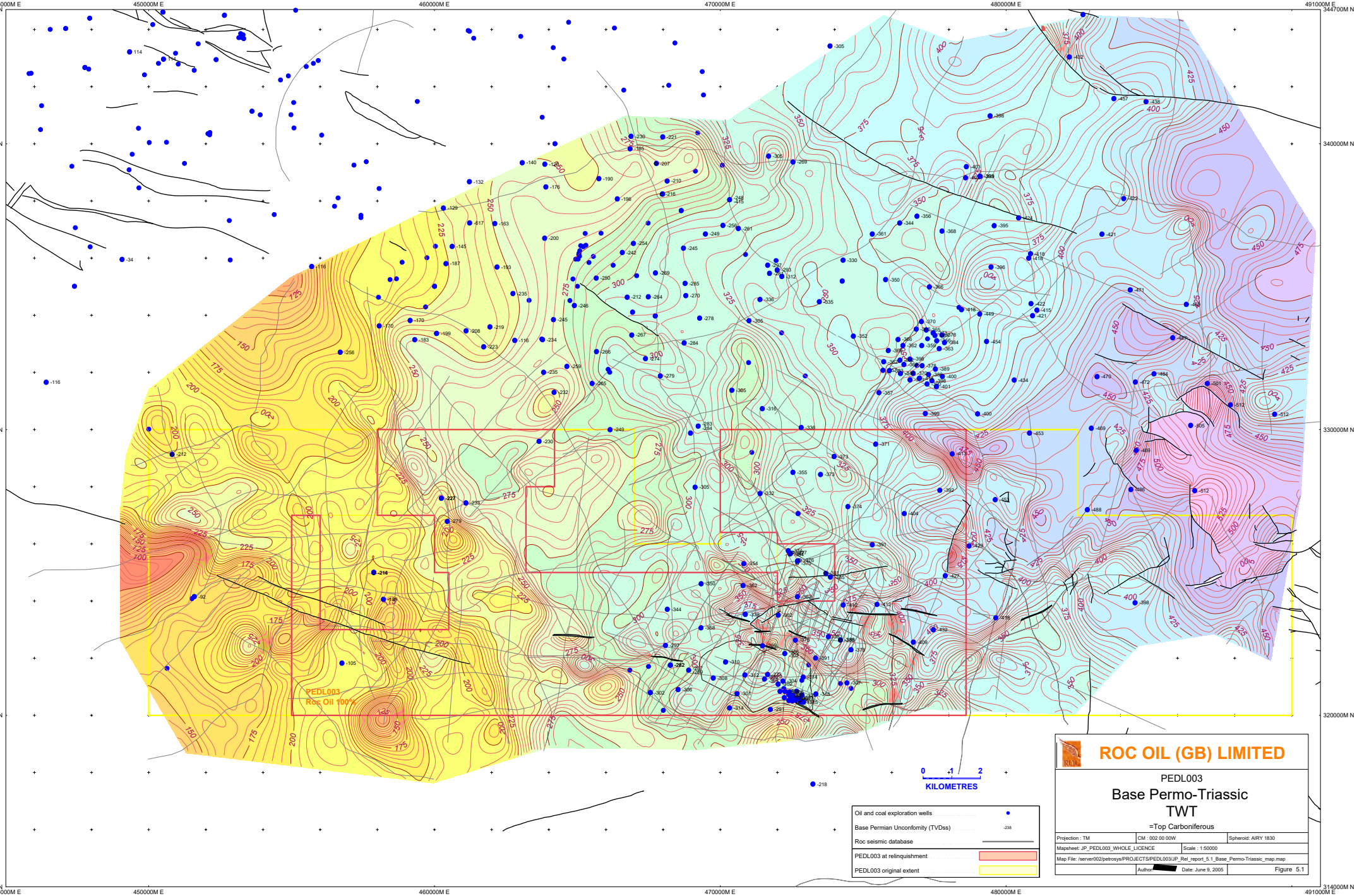
5.2.3 Depth Conversion

A simple function relating depth to TWT in 9 nearby wells was used to depth convert the Deep Main Coal and Amaliae MB.

Depth = 1.4842TWT+18.5

The top Chatsworth pick was considered unreliable and a map at this level was created by adding a constant isopach of 115m down from the Amaliae MB, this being the thickness of the interval at Great Framlands.

The Rempstone Formation was also depth-converted using a simple function relating depth to TWT, based on all the penetrations of the interval within or near the licence.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470000M E
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340000M N
330000M N
320000M N
314000M N
PEDL003
Roc Oil 100%
0 1 2
KILOMETRES
Oil and coal exploration wells
Base Permian Unconfomity (TVDss)
Roc seismic database
PEDL003 at relinquishment
PEDL003 original extent
ROC OIL (GB) LIMITED
PEDL003
Base Permo-Triassic
TWT
=Top Carboniferous
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Spheroid: AIRY 1830
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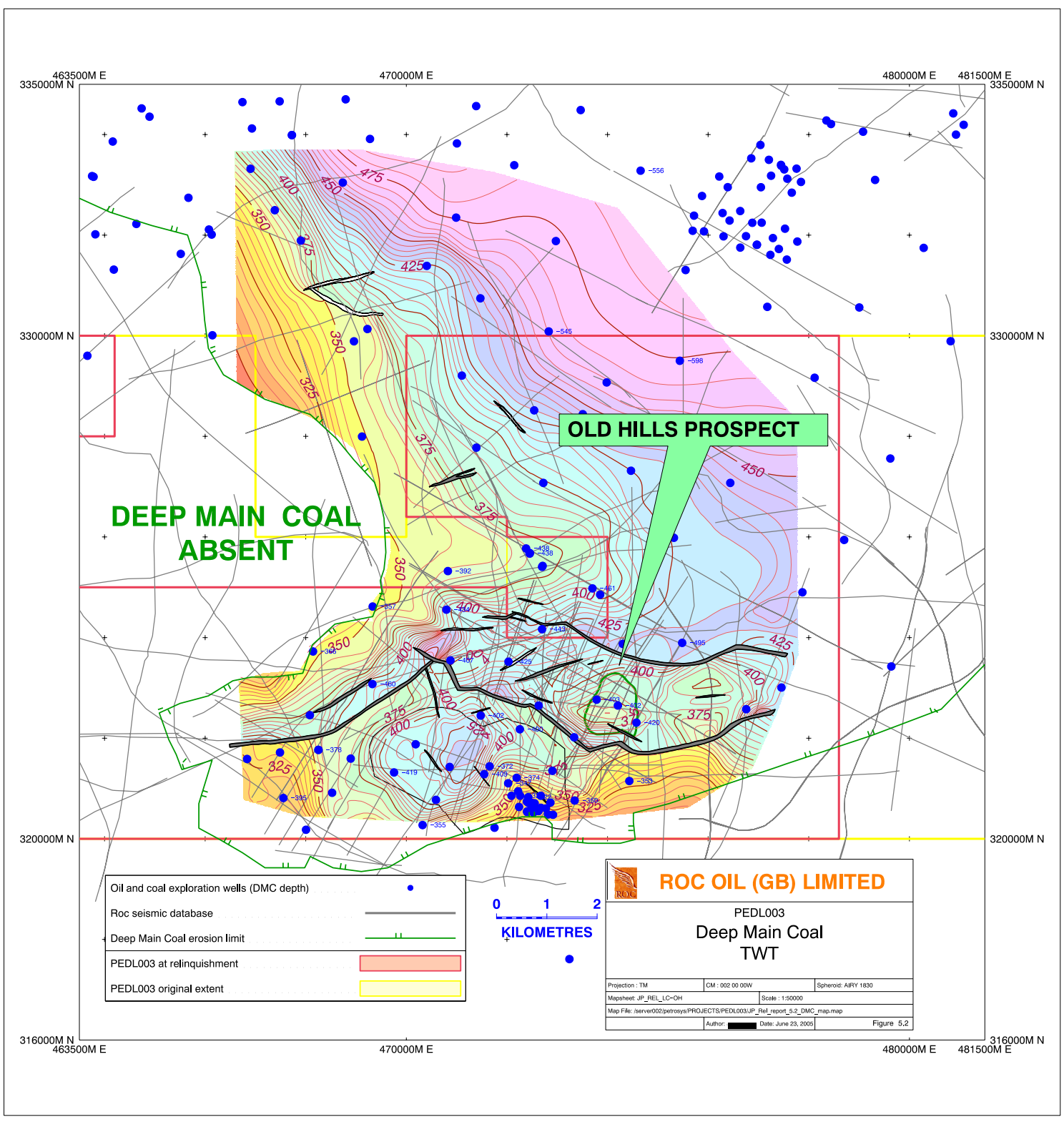
Author:
Date: June 9, 2005
Figure 5.1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470000M E
480000M E
481500M E
335000M N
330000M N
320000M N
316000M N
OLD HILLS PROSPECT
DEEP MAIN COAL
ABSENT
Oil and coal exploration wells (DMC depth)
Roc seismic database
Deep Main Coal erosion limit
PEDL003 at relinquishment
PEDL003 original extent
0 1 2
KILOMETRES
ROC OIL (GB) LIMITED
PEDL003
Deep Main Coal
TWT
Projection : TM
CM : 002 00 00W
Spheroid: AIRY 1830
Mapsheet: JP_REI_LC~OH
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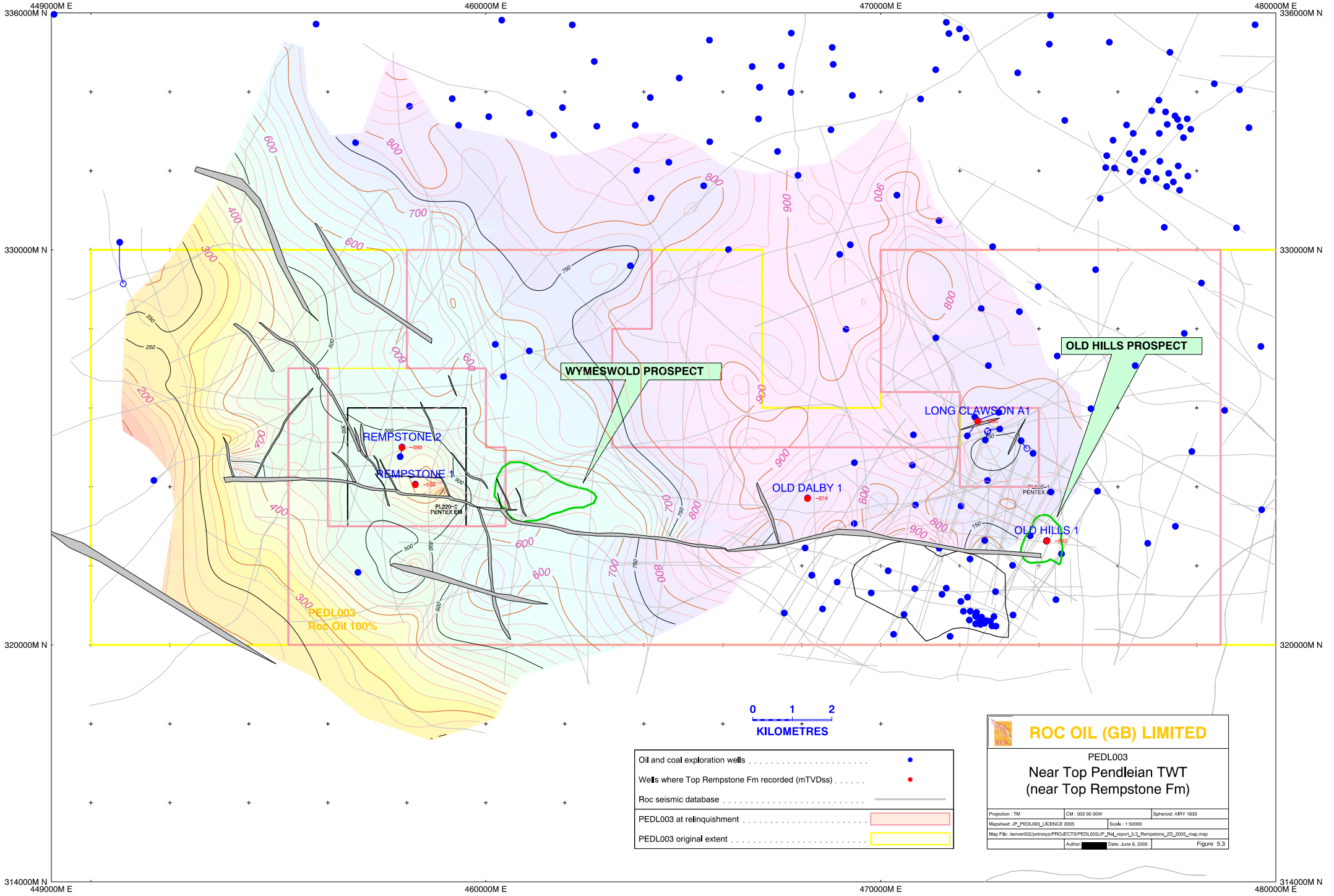
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WYMESWOLD PROSPECT
OLD HILLS PROSPECT
REMPSTONE 2
REMPSTONE 1
OLD DALBY 1
LONG CLAWSON A1
OLD HILLS 1
PL220~1
PENTEX EM
PL220~1
PENTEX
PEDL003
Roc Oil 100%
0 1 2
KILOMETRES
Oil and coal exploration wells
Wells where Top Rempstone Fm recorded (mTVDss)
Roc seismic database
PEDL003 at relinquishment
PEDL003 original extent
ROC OIL (GB) LIMITED
PEDL003
Near Top Pendleian TWT
(near Top Rempstone Fm)
Projection : TM
CM : 002 00 00W
Spheroid: AIRY 1830
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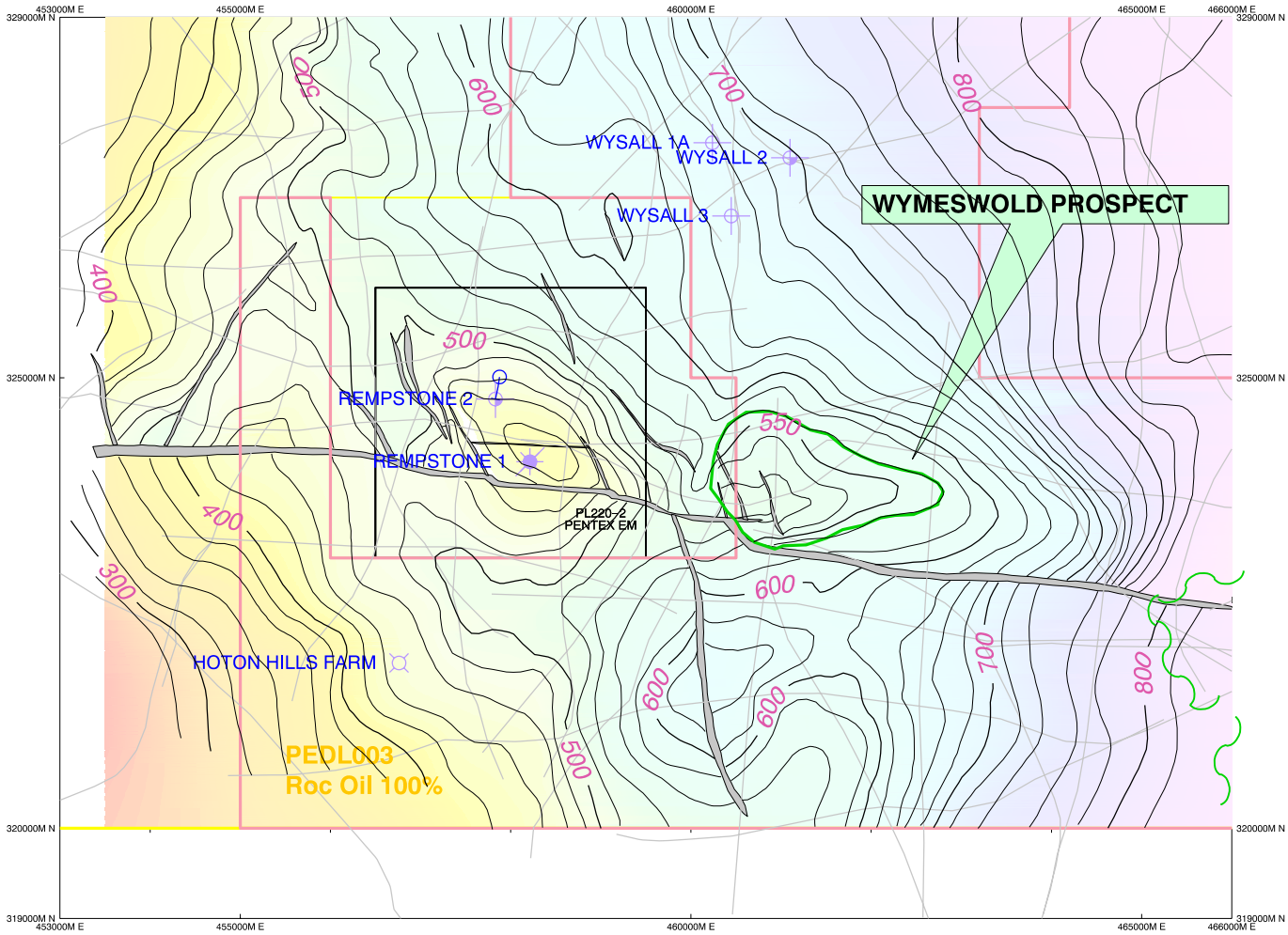
Figure 5.3



Oil and coal exploration wells . . . . . ●

Roc seismic database . . . . . ——

Deep Main Coal erosion limit . . . . . ∿∿

PEDL003 at relinquishment . . . . . □

PEDL003 original extent . . . . . □

ROC OIL (GB) LIMITED

PEDL003

Near Top Pendleian TWT (near Top Rempstone Fm)

Projection : TM	CM : 002 00 00W	Spheroid: AIRY 1830
Mapsheet: JP_REL_REMPSTONE	Scale : 1:50000	
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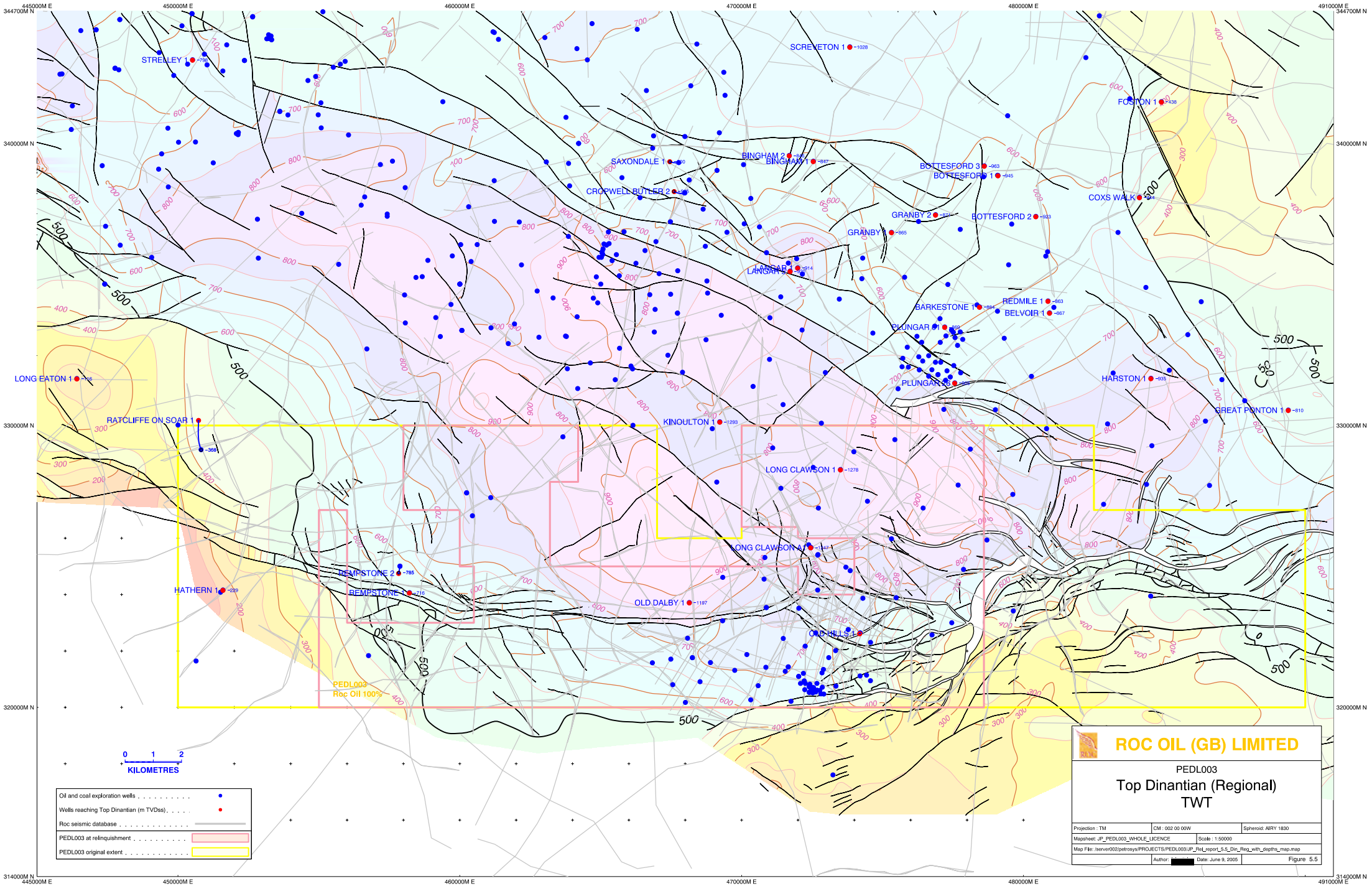
	Author: [redacted] Date: June 9, 2005	Figure 5.4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470000M E
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491000M E
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340000M N
330000M N
320000M N
314000M N
STRELLEY 1
SCREVETON 1
FOSTON 1
SAXONDALE 1
BINGHAM 2
BINGHAM 1
BOTTESFORD 3
BOTTESFORD 1
CROPWELL BUTLER 2
COXS WALK
GRANBY 2
BOTTESFORD 2
GRANBY 1
LANGAR 2
LANGAR 1
BARKESTONE 1
REDMILE 1
BELVOIR 1
PLUNGAR 1
PLUNGAR 2
HARSTON 1
LONG EATON 1
RATCLIFFE ON SOAR 1
KINOULTON 1
GREAT PONTON 1
LONG CLAWSON 1
LONG CLAWSON A1
REMPSTONE 2
REMPSTONE 1
HATHERN 1
OLD DALBY 1
OLD HILL 1
PEDL003
Roc Oil 100%
0 1 2
KILOMETRES
Oil and coal exploration wells
Wells reaching Top Dinantian (m TVDss)
Roc seismic database
PEDL003 at relinquishment
PEDL003 original extent
ROC OIL (GB) LIMITED
PEDL003
Top Dinantian (Regional)
TWT
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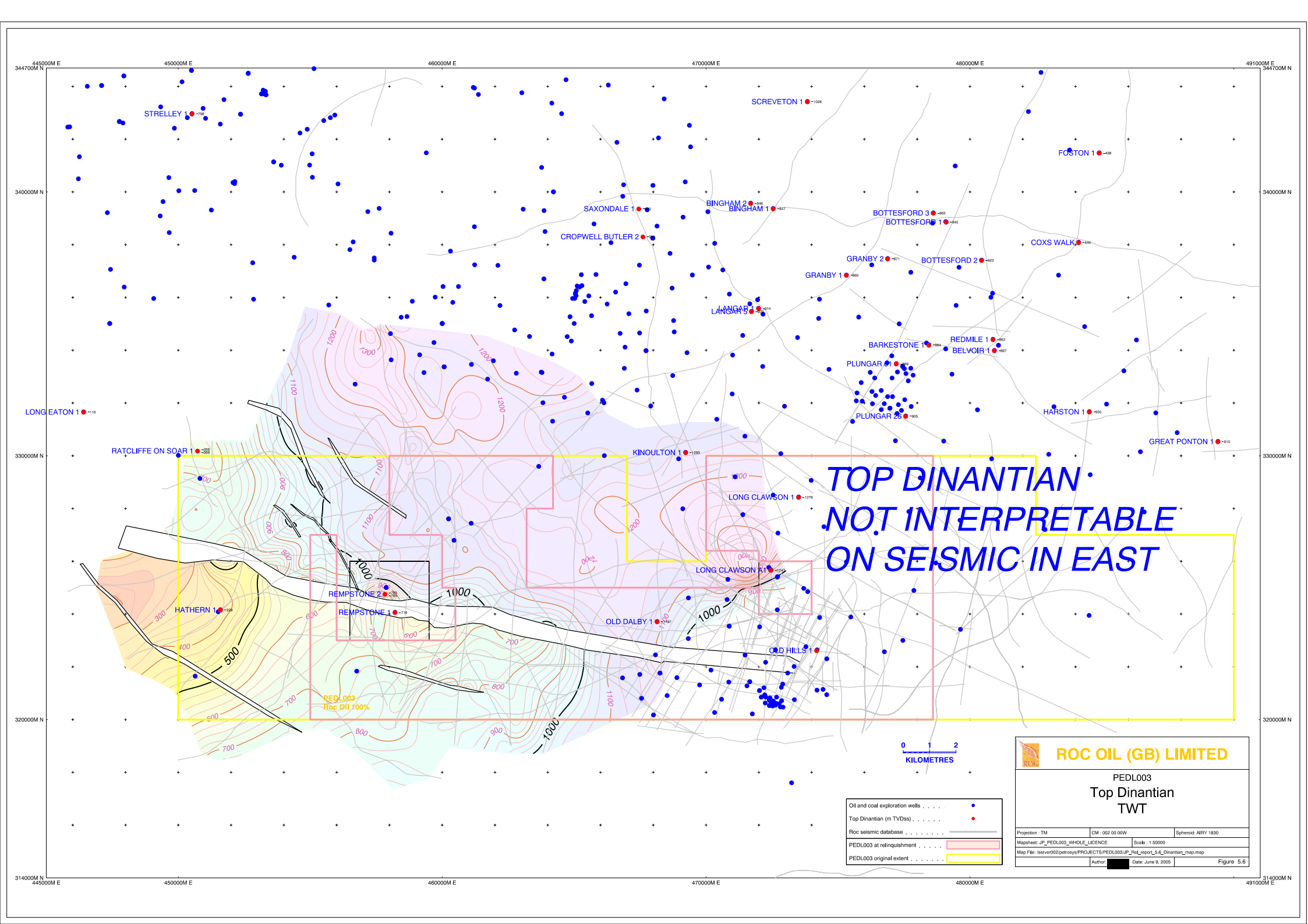
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314000M N
STRELLEY 1
SCREVETON 1
FOSTON 1
SAXONDALE 1
BINGHAM 2
BINGHAM 1
BOTTESFORD 3
BOTTESFORD 1
CROPWELL BUTLER 2
COXS WALK
GRANBY 2
BOTTESFORD 2
GRANBY 1
LANGAR
LANGAR 5
BARKESTONE 1
REDMILE 1
BELVOIR 1
PLUNGAR
PLUNGAR 26
HARSTON 1
LONG EATON 1
GREAT PONTON 1
RATCLIFFE ON SOAR 1
KINOULTON 1
LONG CLAWSON 1
LONG CLAWSON 21
REMPSTONE 2
REMPSTONE 1
HATHERN 1
OLD DALBY 1
OLD HILLS 1
PEDL003
Roc Oil 100%
TOP DINANTIAN
NOT INTERPRETABLE
ON SEISMIC IN EAST
0 1 2
KILOMETRES
Oil and coal exploration wells
Top Dinantian (m TVDss)
Roc seismic database
PEDL003 at relinquishment
PEDL003 original extent
ROC OIL (GB) LIMITED
PEDL003
Top Dinantian
TWT
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Date: June 9, 2005
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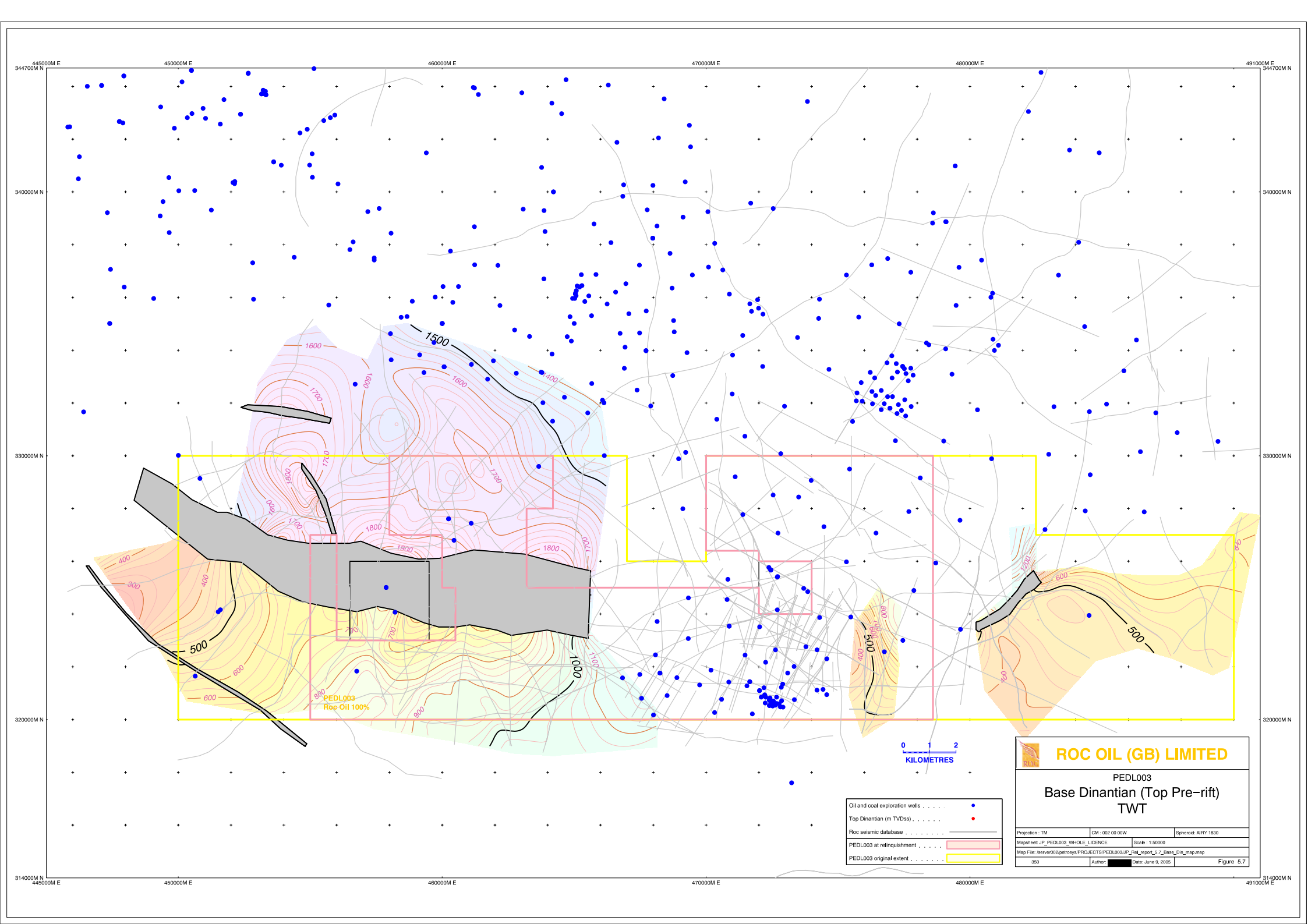
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344700M N
340000M N
330000M N
320000M N
314000M N
PEDL003
Roc Oil 100%
0 1 2
KILOMETRES
Oil and coal exploration wells
Top Dinantian (m TVDss)
Roc seismic database
PEDL003 at relinquishment
PEDL003 original extent
ROC OIL (GB) LIMITED
PEDL003
Base Dinantian (Top Pre-rift)
TWT
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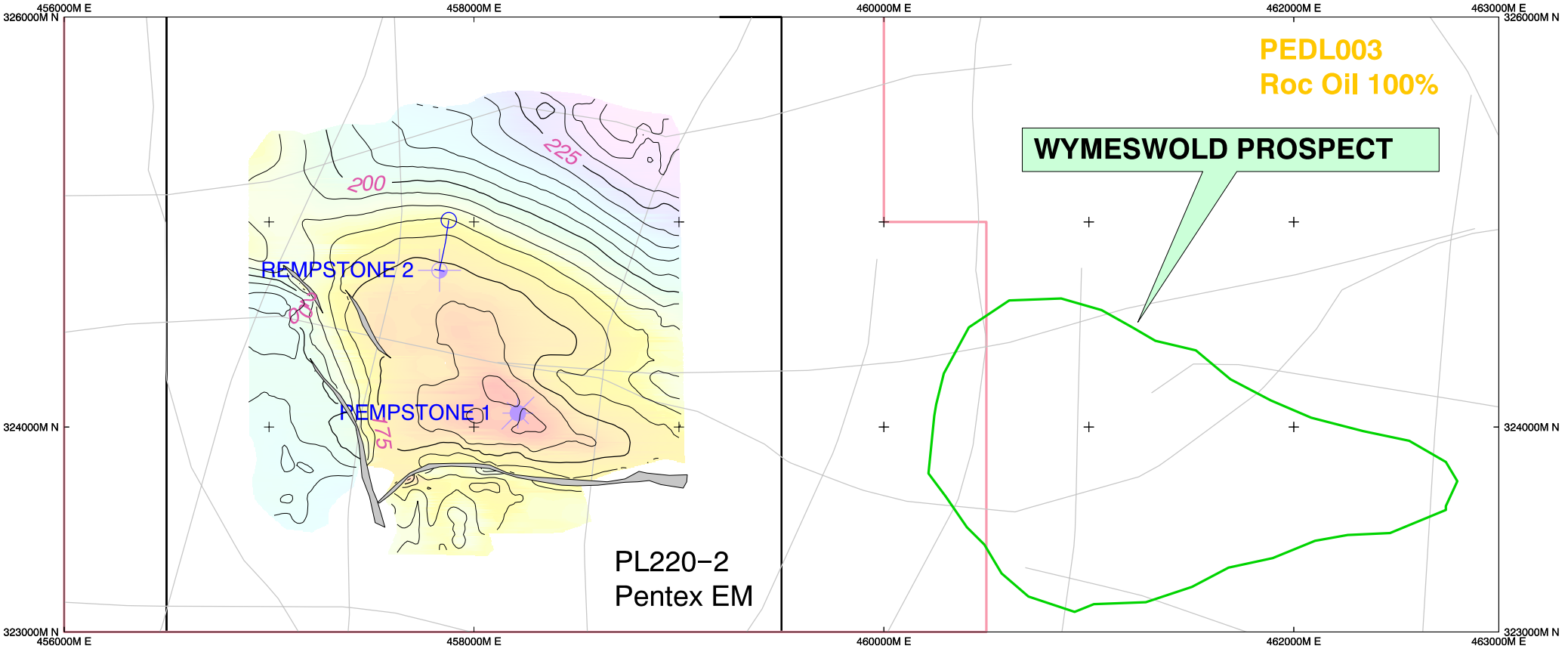
350
Author:
Date: June 9, 2005
Figure 5.7

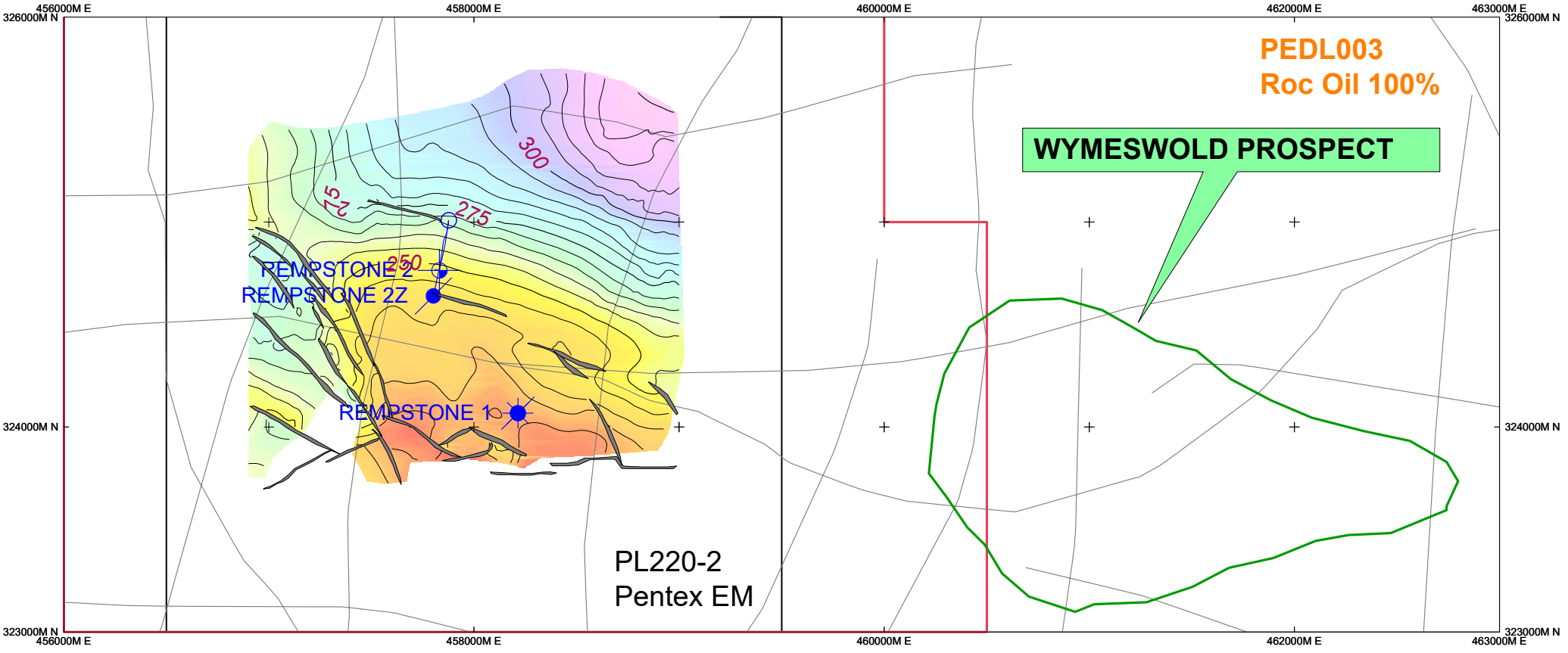


ROC OIL (GB) LIMITED

PEDL003

Near Top Pendleian from 3D (TWT)
(Near Top Rempstone Fm)

Projection : TM	CM : 002 00 00W	Spheroid: AIRY 1830
Mapsheet: JP_REL_REMPSTONE_3D	Scale : 1:25000	
Map File: /server002/petrosys/PROJECTS/PEDL003/JP_Rel_report_5.8_Rempstone_3D_295_map.map		
295	Author: [redacted] Date: June 9, 2005	Figure 5.8



ROC OIL (GB) LIMITED

PEDL003

Near Top Dinantian from 3D (TWT)
(near Base Rempstone Fm)

Projection : TM	CM : 002 00 00W	Spheroid: AIRY 1830
Mapsheet: JP_REL_REMPSTONE_3D	Scale : 1:25000	
Map File: /server002/petrosys/PROJECTS/PEDL003/JP_Rel_report_5.9_Rempstone_3D_300_map.map		
300	Author: [redacted] Date: June 9, 2005	Figure 5.9

6 PROSPECTIVITY

The Long Clawson and Rempstone fields lie within the bounds of the PEDL003 licence, but are excluded from it, being part of the older licence PL220. They produce principally from Pendleian/Anrnsbergian turbidite sandstones (Rempstone), and the Chatsworth Grit (Long Clawson). These two intervals were considered to be prospective throughout PEDL003, and were the focus of detailed mapping.

It is unusual to find a well within the Widmerpool Gulf which does not have hydrocarbon shows, suggesting that there is no source/maturity/migration problem within the basin. There are sandstones with adequate reservoir quality. At Long Clawson the Chatsworth Grit interval has N:G of 0.92 and average porosity of 20%, although this is close to a 1mD cut-off Petrophysical evaluation of the sandstones is difficult, because the pay zone displays low resistivity, down to 2 ohms, and can be indistinguishable from non pay. For other sandstones a 15% cut-off may be applicable.

There are also numerous potentially sealing shale intervals, particularly within the Coal Measures. This is confirmed by the presence of stacked reservoirs at Plungar, Eakring and even Long Clawson, where oil has been interpreted in three levels, including the main Chatsworth Grit. Failure of wells within the Widmerpool Gulf is generally attributed to lack of structure, although even the structure of the Long Clawson Field is difficult to define, because of the limited seismic coverage.

The search for prospects within PEDL003 concentrated, therefore, on well defined structures. Two main prospects were recognised: Wymeswold (Fig. 5.5), east of and downdip from Rempstone, with the same trap type and reservoir as Rempstone itself, and Old Hills (Fig. 6.1), just south of Long Clawson, with the same reservoir, but a slightly different trap. Both were robust structures in time.

6.1.1 Wymeswold prospect

The Wymeswold structure is an inversion anticline, formed where a NNW-SSE fault intersected the Widmerpool Gulf Boundary Fault (Hoton Fault). Detailed analysis of the Rempstone 3D showed a very complex fault pattern on the southern margin of the inversion anticline there (Fig. 5.8), such that the spill of the structure was very difficult to define. It was considered that a 3D survey, contiguous with the Rempstone survey, would be required to define the Wymeswold structure, in order to understand the SW margin of the closure and the spill relationship up-dip towards Rempstone. Consequently a high risk was attached to the prospect, which meant that the lower risk Old Hills prospect was preferred.

6.1.2 Old Hills prospect

The Old Hills structure is a low amplitude inversion anticline (Figs 6.1, 6.5), formed in the hangingwall of one of the splays of the Widmerpool Gulf boundary fault, (it is these splays which BGS refer to as the Normanton Hills faults) The boundary of the basin is less well defined in the SE corner of the basin than further west at Wymeswold (Figs 4.1, 4.9). BP had recognised the structure in the 1980s, but had preferred to drill at Long Clawson, 3km to the north. Shows had been recognised in the NCB well Great Framlands, which BP deepened from the base of the productive Coal Measures into the Namurian. Structure maps from the period showed the potential for the structure to spill to the SE, into the boundary fault zone.

During the period 1987-1993 NCB/British Coal acquired significantly more seismic and well data for the development of the Asfordby Mine, 3km to the SW. This included a well near to the crest of the structure, Old Hills. In this well the Deep Main Coal was 15m higher than at nearby Great Framlands, where strong oil shows had been observed. The form of the structure was confirmed by new seismic line RUK02A-02 (Fig. 6.6), which was interpreted to show continuation of the structure down into the Namurian. The deeper Rempstone Formation formed a secondary target at Old Hills (Fig. 6.3).

A well to test the prospect, named Old Hills 1, sited a few hundred metres east of the British Coal Old Hills well, was drilled in January 2004. This confirmed a structure at the Deep Main Coal, but this reduced in amplitude downwards, such that the oil-zone, and presumed closure, in the Chatsworth Grit was only 5 metres thick. The discovery was declared sub-commercial. The difference between the prognosed structure, and the actual structure, was attributed to multiple contamination of the seismic obscuring the real reflections.

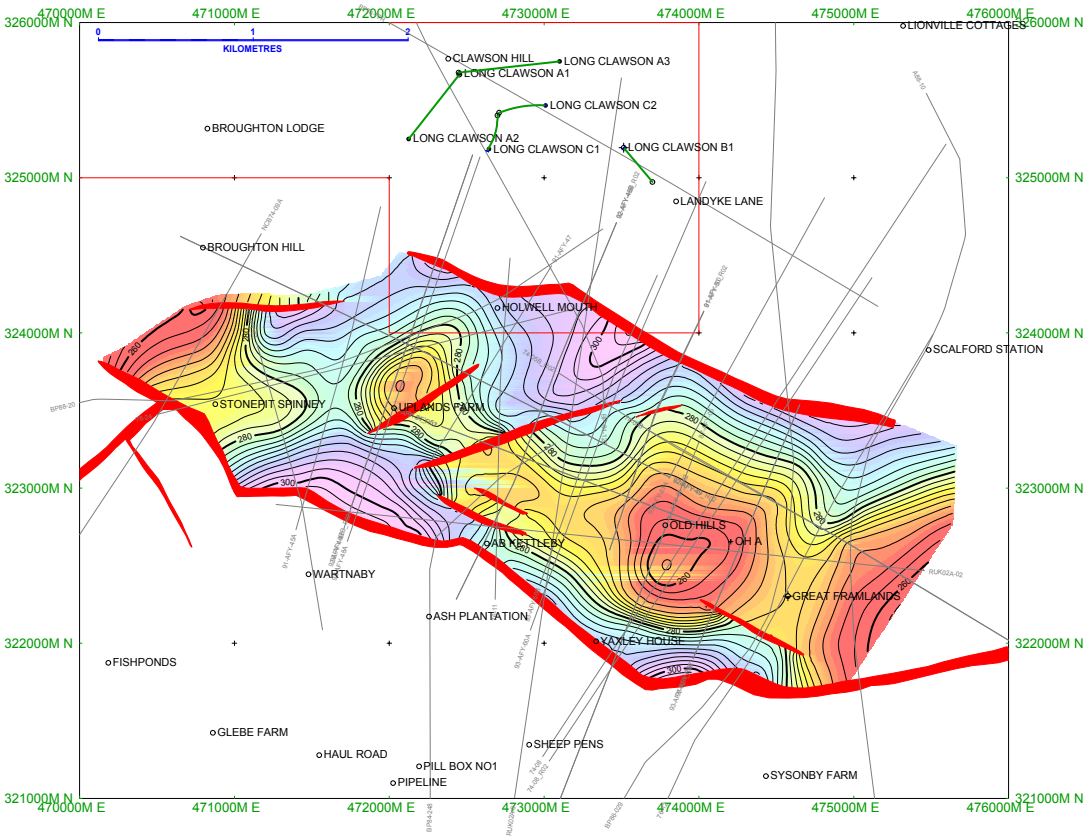


Fig. 6.1 Deep Main Coal TWT structure map, defining the Old Hills prospect.

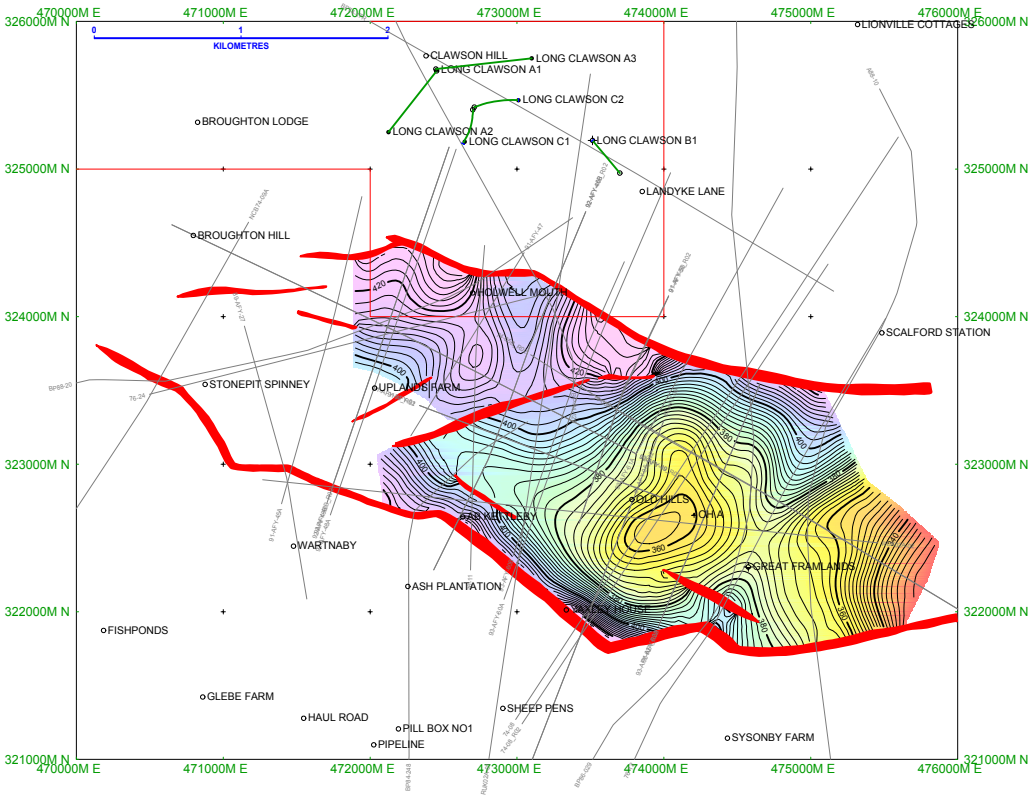


Fig. 6.2 Amaliae Marine Band TWT structure map, defining the Old Hills prospect.

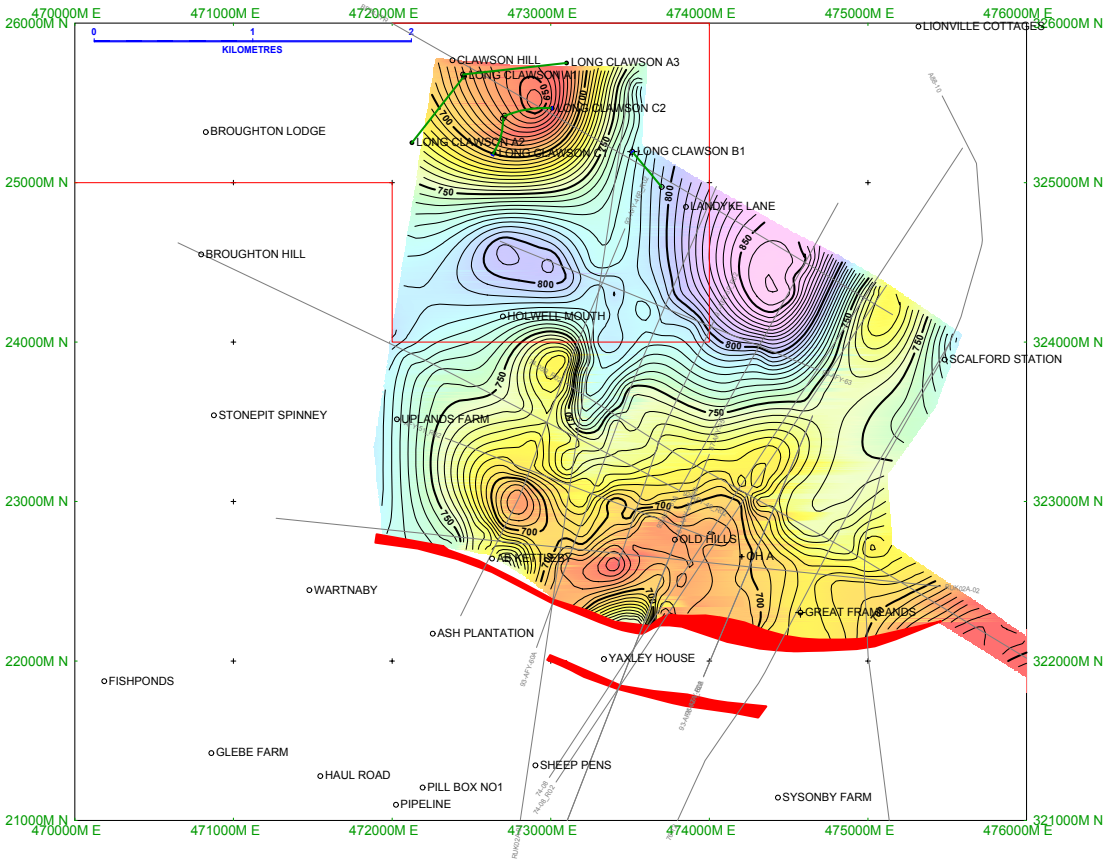


Fig. 6.3 Top Rempstone Fm TWT structure map.

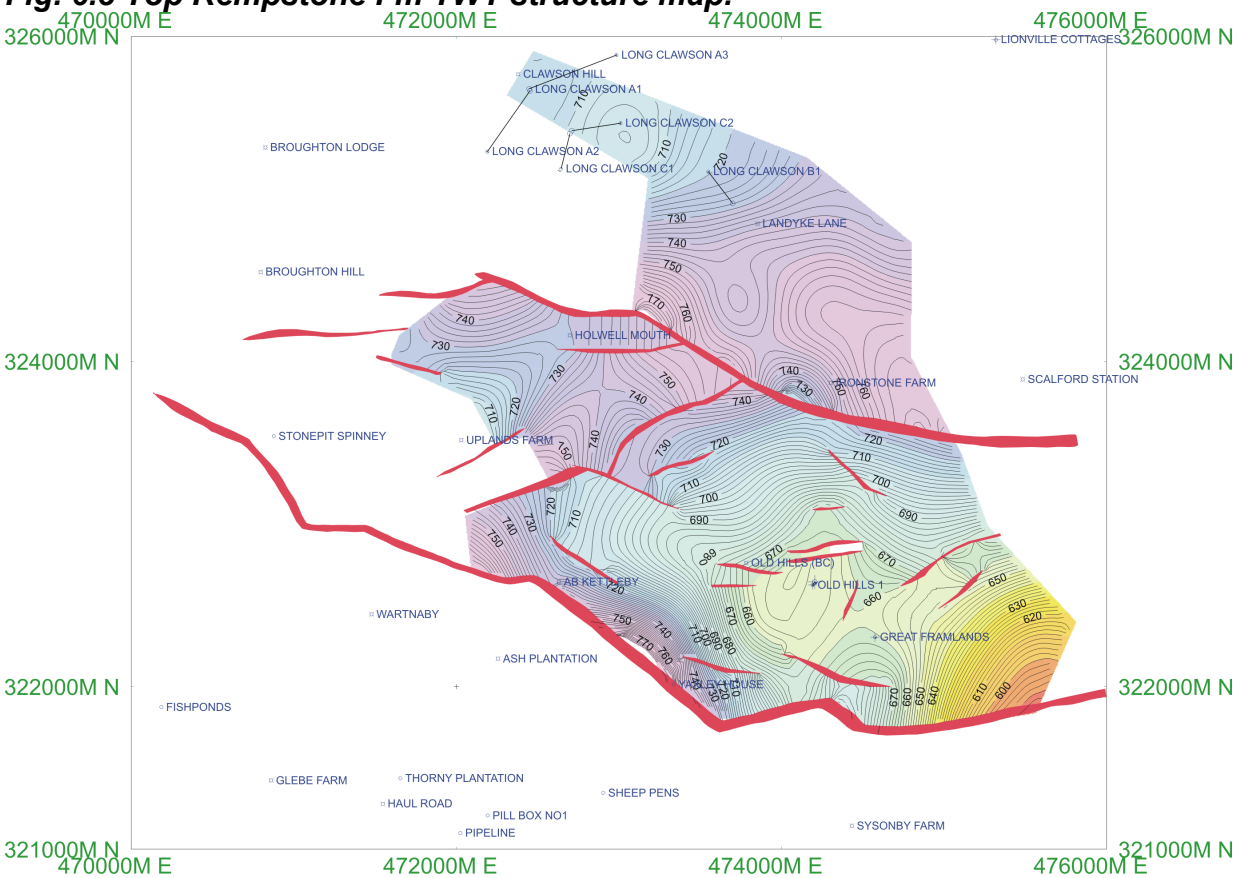


Fig. 6.4 Top Chatsworth Grit depth structure map.

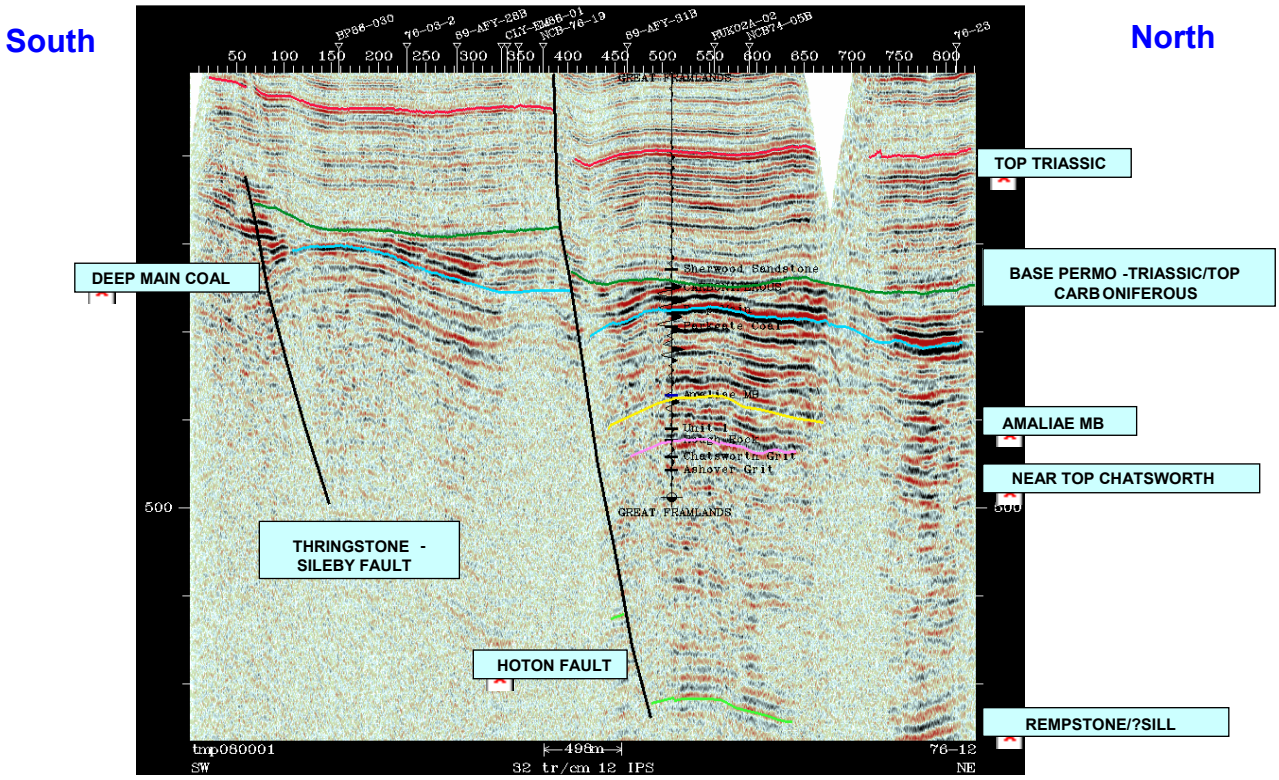


Fig. 6.5 North-south seismic section (76-12)just east of the Old Hills structure, passing through Great Framlands.

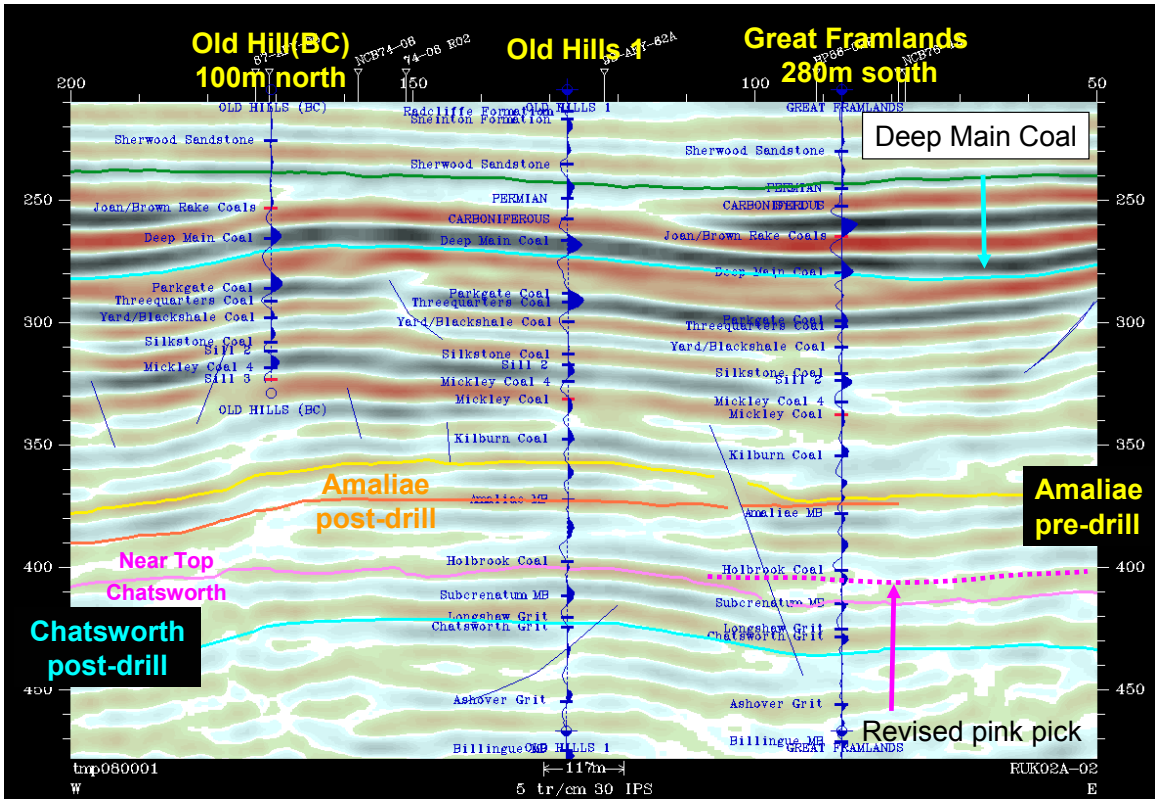


Fig. 6.6 West-east seismic section through the Old Hills structure and Old Hills 1.

7 OLD HILLS 1 DRILLING RESULTS

The Old Hills 1 well was drilled to a TD of 1315m BRT, reaching lowermost Namurian after 19 days. Hydrocarbons were encountered in the Chatsworth Grit and the Rempstone Formation. A pay zone of at most 3m was interpreted in the Chatsworth Grit, and the accumulation estimated to have a reserve of 0.036-0.087mmbo. The well was abandoned as a non-commercial discovery.

Before drilling, mean reserves of 0.99mmbo (P10/P90, 5.2 and 0.6mmbo), based on the rock fluid properties observed at Long Clawson, 3km to the north, had been estimated. Thickening of the sequence below the Deep Main Coal resulted in progressive loss of structural elevation downhole, and consequent loss of volume of Chatsworth Grit within closure.

Old Hills	Depth relative to prognosis	Elevation above Great Framlands
Deep Main Coal	-3.7	17.8
Amaliae MB	+18.9	7.1
Chatsworth Grit	+8.8	4.8

Table 7.1 Old Hills 1 depth prognosis and results. Positive values signify depths greater than prognosed, i.e. 'deep to prognosis'.

There were no significant gas shows during drilling, but hydrocarbon fluorescence was described from the Chatsworth Grit and the Rempstone Formation. Wireline log evaluation was undertaken using a single run gamma/density/neutron/sonic/array induction sonde from the base of the Triassic to TD, and RFT pressure points.

Hydrocarbons were interpreted to be restricted to a zone below 820m BRT within the Chatsworth Grit, with a reserve in the range 0.036-0.087mmbo. Saturations of up to 49% were interpreted in the lower part of this interval giving a net pay of 2.5m. This reserve was considered not to be commercial.

The mismatch between the interpreted structure, and the lesser elevation found by the well, was attributed to the presence of multiples in the seismic data, giving rise to a false interpretation ca 20m shallow at the key Amaliae MB level.

Line RUK02A-02 had been shot purposely to show that the Old Hills structure closed to the east, and to tie Old Hills (BC) to Great Framlands (Fig. 6.6). It was not possible to shoot the

line exactly through the surface location of the wells, which were projected onto the line to effect a tie. The projection undoubtedly resulted in lack of precision in the tie.

Correlations through the Westphalian/upper Namurian and lower Namurian are shown on Figure 6.4 and 6.5.

Fuller details of the planning for the Old Hills well can be found in the well proposal (Roc report TECH 1685), and of the results of the well in the completion report and formation evaluation report (Roc report TECH 2004).

A

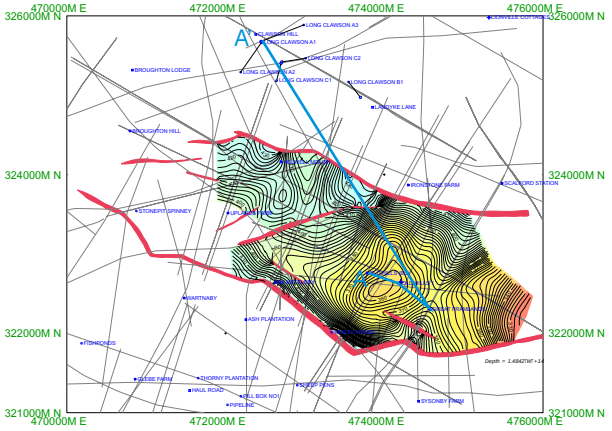
A'

OLD HILLS (BC)

OLD HILLS 1

GREAT FRAMLANDS

LONG CLAWSON A1



Revised Correlation of Westphalian and Upper Namurian

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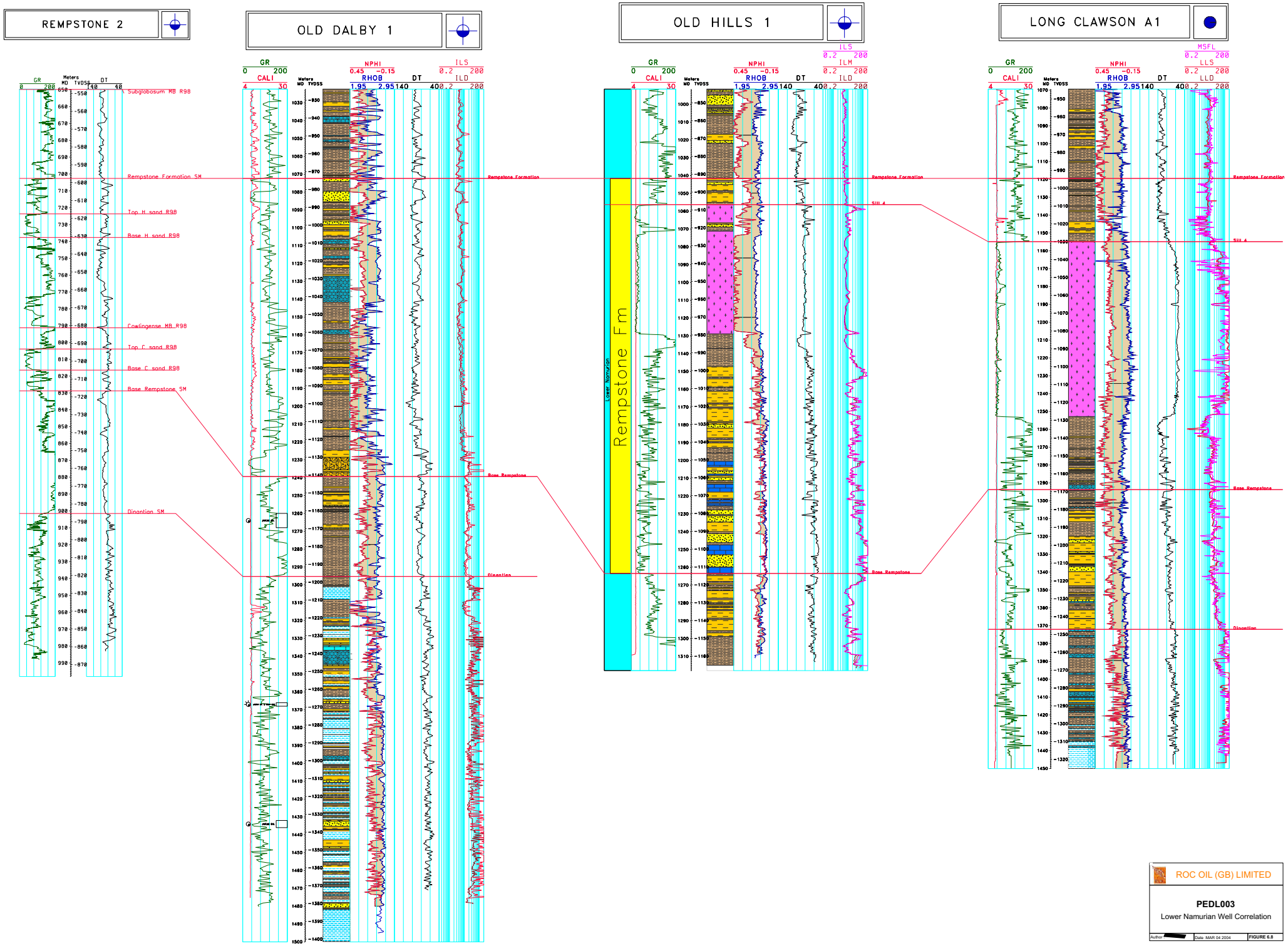
WESTPHALIAN/UPPER NAMURIAN WELL CORRELATION

Author | Date : MAR 04 2004 | FIGURE 6.7



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Lower Namurian Well Correlation

Author | Date :MAR 04 2004 | FIGURE 6.8

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