File Ref: PL203/G60/01.002

FINAL RELINQUISHMENT REPORT

UK ONSHORE LICENCE PL 203

[redacted]

Date: 16/3/92.

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1. INTRODUCTION, HISTORY AND WORK PROGRAMME

PL 203 was granted on 14 February 1982 to a Conoco operated group, with a 50% mandatory relinquishment after 4 years, and licence expiry in 2006. The licence was partially relinquished by Cairn Energy on 14 February 1991, and the remaining areas consisted of two blocks, PL 203a and PL 203b. These were finally relinquished on 14 February 1992, after a detailed feasibility study indicated that the Godley Bridge development was unlikely to be commercial under the prevailing economic conditions.

At the time of final relinquishment, the national grid co-ordinates of the Licence part blocks were as follows:-

PL 203a

12 sq km	TQ 0100 4000	TQ 0500 4000	TQ 0500 3700
	TQ 0100 3700	TQ 0100 4000	

PL 203b

18.75 sq km	SU 9000 3800	SU 9750 3800	SU 9750 3550
	SU 9000 3550	SU 9000 3800	

Conoco was the initial licensee and operator with 100% of the equity, and in 1982 farmed-out 50% equally to Charterhouse and Tricentrol. Conoco transferred the remaining 50% and operatorship to Cairn Energy in 1988. In the interim, Charterhouse had been acquired by Fina Mitre in January 1986 and their 25% was sold to Monument Oil and Gas in 1988 and Tricentrol was taken over by ARCO British in February 1988. The final Licensees were:

Cairn Energy (Operator)	50%
ARCO British	25%
Monument Petroleum Mitre	25%

Seismic surveys were shot between 1980 and 1983 by Conoco, using dynamite, mini-sosie and vibroseis as the sources. These lines are typically along roads and have gaps in the vicinity of towns. The lines are not always optimally oriented for the underlying structures which trend in an east-west direction.

Following Godley Bridge-2 and 2Z, it was recognised that a major statics problem is present in these data, and the raw seismic was reprocessed in 1989 utilising the Leeds University statics model and the data from nine upholes. New maps were subsequently produced.

Godley Bridge-1 was spudded in November 1982 and reached a TD of 8,473 ft in the Lower Jurassic shales. The Portland Sandstone was gas bearing and flowed at rates between 1-1.5 MMSCFD on test. The well was plugged and abandoned as a gas discovery. West of PL 203 in PL 202b, Bordon-1 was drilled between November 1985 and January 1986, and failed to discover hydrocarbons. Similarly, Alfold-1 was drilled in 1986 and TD'd in the Kimmeridge Clay, with only minor shows encountered in the Portland Sandstone.

An appraisal well, Godley Bridge-2, was spudded in November 1986 and the Portland Sandstone was encountered low to prognosis and structurally lower than Godley Bridge-1. Gas was not present and the well was abandoned due to deteriorating hole conditions in the Kimmeridge Clay. The well was then sidetracked in a WSW direction in order to encounter the Portland Sandstone structurally higher than in Godley Bridge-1. No shows were present in the Portland Sandstone which was encountered even lower than in Godley Bridge-2, and was dry. The problems of prognoses in both these wells is believed to be due to the variable statics in the shallow Lower Greensand. A detailed analysis of the weathered zone was undertaken and the revised statics corrections were incorporated into the reprocessing.

A review in 1990 using the new mapping revised the GIIP for the Godley Bridge structure, and detailed the prospectivity of the remaining area.

2. GEOLOGICAL REVIEW

2.1 Database

The well database is shows in Figure 2 and the regional review incorporated all the available wells in the Weald basin. Greater emphasis was placed on the Alfold-1, Bordon-1 and Godley Bridge-1 and 2Z, as these are recent wells with high quality data and are within or nearby to PL 203.

2.2 Tectonic History

The Weald Basin is an easterly extension of the Wessex Basin and is bounded to the north and east by the London-Brabant Massif and is separated from the Channel and Paris Basins by the Portsdown-Paris-Plage ridge (Figure 3). The western margin with the Wessex Basin was only intermittently active, during the Lower Jurassic and, typically facies changes across the basins' westerly margin are not significant.

The pre-Mesozoic history was dominated by north-south compression in the Hercynian orogeny and the Palaeozoic subcrop map (Figure 4) shows the presence of Ordovician to Carboniferous sediments which are probably controlled by overthrusting from the south. The London high remained a positive block from this period and there was progressive onlap from the south and west as subsidence commenced in the Basin during the Triassic. The transgression appears not to have reached PL 203 until the Rhaetian (Figure 5).

Extension almost certainly started in the Channel and Paris Basins during the Triassic, but as the North Weald was resting on a stable block, faulting only affected PL 203 during the Lower Jurassic with development of a half graben.

The axis of this half-graben runs in an east-west direction and is probably related to the deep seated Hercynian trend. Faulting activity was not great throughout the Jurassic when thermal subsidence was dominant but is recognised only by changing thicknesses of certain individual units.

In the Lower Cretaceous, there was major tensional faulting and rapid subsidence from the Berriassian to Albian. Although later erosion has removed the Cretaceous sediments from the depocentre, the Basin appears to have continued to develop along the Jurassic fault framework. Thermal subsidence continued throughout the Upper Cretaceous when continuous sedimentation is believed to have occurred.

The onset of the Alpine Orogenic movements had a major effect in this area and compressional forces from the south resulted in a major inversion of the Basin. This may have commenced in the Late Cretaceous but reached its peak in the mid-Miocene. The maximum regional uplift has been estimated at 4,500 ft in the basin centre (Figure 6), and sediments down to the Lower Cretaceous have been eroded. These compressional events gave rise to the many of the present day structures in the form of anticlinal "Flower Structures" created by re-activation of the ancient extensional faults. PL 203 is on the Godley Bridge trend which consists of an anticline created by compressional reactivation of an earlier extensional trend.

2.3 Depositional History

The pre-Mesozoic depositional history is not well known (Figure 4) and apart from laying the underlying tectonic framework, is unlikely to have had any effect on the hydrocarbon geology of the Weald Basin. The exception to this is farther east where it is possible the coals in the Kent Coalfield may act as a source rock for potential gas reservoirs.

The Mesozoic history of the Weald Basin consists of an overall rising sea level with regressive events related to the underlying fault activity and relative rate of thermal subsidence. Throughout this period, the London Brabant Massif, although flooded in the Lias and Upper Jurassic remained a positive feature until inundation in the Upper Cretaceous.

The initial transgression occurred in the Late Triassic Rhaetic. A thin dark grey shale may be present between the underlying Palaeozoic and the Lower Lias limestone and this has been tentatively dated as Rhaetian. None of the wells in Licence PL 203 or PL 202 penetrated the pre-Mesozoic.

The Lower Jurassic Lias (Figures 7 and 8) commenced with a shallow water limestone and occasional thin intercalations of sand which reflect the proximity to the land-mass. With continued transgression, the water deepened and the organic claystones of the Lias were deposited. (These are typically organic rich, and basin conditions must have been euxinic to dysaerobic). Occasional limestones indicate shallower conditions and the most prominent is an oolitic packstone at the top of the middle Lias (Pliensbachian) which is regionally distributed.

The Middle Jurassic was a period of reduced clastic input and the Inferior and Great Oolite were deposited. These are separated by the Fullers Earth claystone which marks a regional high stand. The oolites represent a shallow water carbonate bank or shelf which prograded to the south and west (Figures 9 and 10). Distally the facies becomes a limy mud with thin oolites laid down by turbidity flows. The Great Oolite is the reservoir at the Humbly Grove, Hesters Copse, Herriard and Storrington oilfields and is a major target around the Weald Basin margins.

The Upper Jurassic was a period of eustatic rising sea level and is characterised by the organic rich Oxford Clay and Kimmeridge Clays, which were deposited in stagnant sea bottom conditions, during a period of continued basin subsidence. The limestone and sandstones of the Corallian (Figures 12 and 13), and the Portland Beds (Figures 14 and 15) and Purbeck Sandstone (Figure 16), mark periods of partial regression with the clastics sourced from the north and east off the London High.

The end of the Jurassic saw local dessication within the Weald Basin with deposition of the Purbeck Anhydrite. This marked a period where the Basin became isolated from open marine conditions and lagoonal and lacustrine conditions marked the transition into the Lower Cretaceous.

Fluvio-lacustrine conditions continued in the Lower Cretaceous during which the Wealden Series was deposited. More open marine conditions, prevailed towards the end of Weald Clay deposition leading into the subsequent Lower Greensand and Gault Clay. The Upper Greensand and Chalk were almost certainly present but have been removed by erosion during the Tertiary inversion (Figure 6), although PL 203 is close to the margin of the inversion.

2.4 Reservoirs

The principal reservoirs are the Portland Sandstone, Great Oolite (including the Kellaways Beds), Corallian Sandstone with possible reservoirs in the Inferior Oolite, Purbeck Sandstone and the Triassic.

2.4.1 *Portland Sandstone*

The Portland Sandstone overlies the Kimmeridge Clay and consists of a series of silt to fine sands deposited under low energy shallow marine conditions. This forms the reservoir for the gas at Godley Bridge and oil discovery at Brockham. The isopach (Figures 14 and 15) shows that this sand was deposited in a east-west trend related to the palaeo-coastline with sourcing from the north. PL 203 is on this trend and detailed sedimentological studies have been carried out (see section 4.1) on all cored material.

The overlying Purbeck Anhydrite/Purbeck beds form an excellent seal except where fractured and brecciated. The presence of gas in this reservoir shows that the integrity has been maintained.

The occurrence of H_2S in the Portland Sandstone discoveries significantly downgrades the economic potential of this reservoir.

2.4.2 *The Great Oolite*

This formation consists of prograding shoals on a carbonate bank, and is composed of oolitic bioclastic grainstone to packstone with sparry calcite occluding the intergranular porosity. Variations of the porosity over the basin (Figure 17 and 18), appear to be a function of burial diagenesis. Early calcite rims surrounded the ooliths shortly after deposition and created an initial stable framework. Late stage diagenesis resulted in the occlusion of the intergranular porosity by sparry calcite. The presence of oil filled inclusions, within the sparry calcite cement suggests this late diagenetic phase was coeval with either hydrocarbon generation and migration or with re-migration during uplift. Therefore porosity preservation may be possible, if there is early emplacement of hydrocarbons.

The Great Oolite is the productive horizon at numerous locations around the margins of the Weald Basin, eg, Storrington, Baxters Copse, Singleton, Stockbridge, Humbly Grove, Herriard and Horndean (Figure 10). The isopach around PL 203 is shown in Figure 11 and oil shows were present in Godley Bridge-1. Seal is provided by the overlying Oxford Clay. A thin calcareous sand, the Kellaways Beds is present between the Great Oolite and Oxford Clay. This is generally non-reservoir, typically with weak shows present.

The Great Oolite increases from ~170 ft in Alfold-1 to the east to ~250 ft in the west at Bordon-1. Average porosity varies from 2% in Alfold-1 increasing to 8% in the west at Bordon-1. Godley Bridge-1 has average porosity of 4% and maximum of 10%. Oil and gas shows were weak with oil only present in small vugs and fractures and Godley Bridge-1 although tested, only produced mud with an oil emulsion at low rates.

2.4.3 *The Kellaways Beds*

This is a ~25 ft thick, fine grained sandstone with calcite cement. It was deposited during a coarse clastic pulse near the start of a major transgressive event and separates the carbonate of the oolites from the clastic deposition of the Upper Jurassic. The sandstone typically cleans upwards, but the presence of calcite cement reduces porosity to ~6%. Oil shows are often present but when tested in Wallcrouch-1, DST-2 flowed a maximum of 61 BBLs water per day when swabbed. The seal is the overlying Oxford Clay.

2.4.4 *The Corallian Sandstone*

The Corallian Sandstone underlies the Kimmeridge Clay, and forms the reservoir at Palmers Wood. It consists of a series of shallow marine stacked sands, which coarsen upwards and may have been deposited as sub-tidal sand waves or offshore bars. The distribution (Figures 12 and 13) shows that they are a proximal feature with their maximum thickness trending east-west along the northern margin of the Weald Basin. PL 203 is well located for the gross development of this unit, but its occurrence in a more argillaceous and finely interbedded facies greatly reduces reservoir potential. The net sand as seen on logs is potentially as low as 2-4 ft in Godley Bridge-1 and 2Z.

The Corallian typically has excellent seal in the overlying Kimmeridge Clay and would form an excellent reservoir if sand quality and migration routes had been present.

2.4.5 *Other Reservoirs*

There are a number of secondary reservoirs in Licence PL 203, and although only shows have been found, these may have reservoir potential under suitable conditions.

The Lower Cretaceous Hastings Beds flowed gas in Heathfield-1 and Bolney-1 (Figure 2), but only rare, poor oil shows have been recorded in the Lower Cretaceous of PL 203.

The Purbeck Sandstone forms an excellent reservoir where present but has not been found in the wells in this Licence, and PL 203 is probably too far south of the play fairway.

The Inferior Oolite has similar or poorer reservoir qualities to the Great Oolite. Alfold-1 is close to the depocentre with ~500 ft AVT and thins to the east to ~300 ft AVT in Bordon-1. Tests in Godley Bridge-1 have produced 500 BWPD with 0.5 MMSCFD of gas. Matrix porosity is very low and this flow rate is a reflection of natural fracturing in the Inferior Oolite. It may be that the thick development of the Fullers Earth allowed an intraformational seal separating the Inferior from the Great Oolite in PL 203, or more likely that the gas may have exsolved from aquifer water.

Lower Liassic Limestones are present at the base of the Jurassic and although they have an excellent top seal and oil and gas shows have been found at other localities, the limestone is very tight and unlikely to yield commercial quantities of hydrocarbons.

The middle Lias Limestone was tested in Wallcrouch-1 and after swabbing, the flow rate was too small to measure but estimated at less the 1,000 SCFGPD and +/- 6 BWPD.

The Triassic Sherwood Sandstone is present as a significant sand facies in the Wessex Basin, and was considered in some detail (Section 4.2) but it is likely that PL 203 will only be underlain by argillaceous sediments of the Mercia Mudstone.

The sub-Mesozoic strata consists of a Lower Carboniferous limestone (Figure 6). Siliclastic reservoirs are considered to have better prospectivity and a thin sand of ?Devonian age tested small amounts of gas in Holtye-1.

2.5 Source Rocks and Migration History

2.5.1 *Source Rocks*

The principal source rocks in the Weald Basin are the shales of the Lias in the Lower Jurassic and the Oxford and Kimmeridge Clay in the Upper Jurassic.

The shales interbedded with the Lower Lias limestones have a high organic content with type I and II kerogen and have excellent potential as an oil generative source rock. The quality decreases from 3.0% in Godley Bridge-1 to less than 1% on the basin margins. Pyrolysis yields shows a similar pattern of 10,700 ppm in Godley Bridge-1, decreasing to 1,600-3,300 ppm in Detention-1.

The Lower Lias clays have TOCs in the range of 0.8-1.2% and yields of 3,500 ppm. The kerogen is composed of inertinitic and woody material and is most likely gas prone type III kerogen. The Upper Lias has slightly better TOCs of 0.7-2.5% and similar yields, but again the kerogen is commonly inertinitic, deposited in open marine conditions.

The Upper Jurassic Oxford Clay contains organic rich shales with TOCs from 0.6-4.3% and pyrolysis yields of 4,000-6,000 ppm. The best yields are in the centre of the basin and decline to the east where coarser clastic fraction increases. The kerogen is both amorphous and algal indicative of deposition in a basin with restricted water circulation and makes a good oil prone source rock.

The shales of the Kimmeridge Clay are a regional source rock with TOCs up to 17.5% and yield up to 65,000 ppm in some intervals. The organic matter is mostly amorphous type I and II kerogen and was deposited under dysaerobic-anaerobic conditions with rapid burial to ensure the maximum preservation. This is an excellent oil prone source rock.

Locally within the Purbeck beds some high gamma shale contains TOCs of 4.7% and yields of 12,000 ppm. The Carboniferous coal of the Kent field could be a source for gas but it is not known if the Coal Measures extend under the Weald Basin.

2.5.2 *Maturity*

Regional work on vitrinite analysis and basin modelling indicates that at the centre of the basin only the Lias is mature with the Oxfordian and Kimmeridge, immature to early mature, thus it is most likely that the oil in the Weald Basin was derived from the Lower Jurassic Lias shales. This is confirmed in recent studies by Fina which show most Weald Basin oils to be derived from a mixture of Upper and Lower Lias sources.

A burial depth profile was prepared for Godley Bridge-1 (Figure 20). This indicates the onset of oil generation occurred by mid-Cretaceous time for the Lias Claystone. In addition, oil generation was at a maximum in the Upper Cretaceous and was subsequently terminated by the Tertiary uplift.

The presence of gas in problematical as nowhere did the source rock become mature for gas generation. Three explanations have been proposed:-

i) methane exsolution from pore waters during inversion

ii) differential migration of gas from existing oil accumulations during inversion

iii) a deeper unrecognised source

The presence of H_2S in the gas is considered to be a late stage effect due to Redox reactions within the sulphate rich brines in contact with the overlying Purbeck Anhydrite seal.

2.5.3 *Migration History*

The burial depth plot and the presence of oil inclusions in intergranular calcite of the Great Oolite indicate that oil was migrating in the Late Cretaceous prior to the Tertiary Uplift. The distribution of oil discoveries (Figure 2) confirm that they are all in areas marginal to oil generative Lias shale, thus it is most likely that the migration paths are vertical with modest horizontal migration. This can be surmised from the poroperm properties of the main reservoirs, they are principally poor quality with heterogenities and not likely to promote significant lateral migration unless there was a significant pressure differential, and there is no evidence that this ever existed. Thus the most likely route for migration would have been vertically, utilising the fault framework (Figure 3). Initial migration would have been up through the extensional faults with re-migration during the Alpine movements when many faults were reactivated by the compressional movements.

2.6 *Structures*

The structures in the Weald Basin are all fault related or dependent on the underlying fault framework. Extensional faulting in the Jurassic created rollovers into faults, and local relict horsts. During the Tertiary inversion, there was a major period of compressional faulting which created both anticlines, overlying "Flower Structures" and "pop-ups" along strike slip faults.

3. GEOPHYSICAL REVIEW

3.1 Seismic Database

The seismic over these licences was acquired between 1979 and 1983 (Figure 21) with an infill line in 1986. The lines although providing a reasonable cover, had the following inherent problems.

i) Line orientations were not optimum for structural imaging

ii) Crooked line geometry gave rise to interpretational complexity

iii) Missing data where lines pass through towns.

In addition, the presence of variable weathering between the Lower Greensand and the Weald Claystones gave rise to a major statics problem.

In 1982, Conoco drilled successful well Godley Bridge-1 and decided to test the crest of the structure in 1986 with Godley Bridge-2. Both this well and the sidetrack encountered the Portland Sandstone lower to prognosis and below the "gas-water" contact. The error in converting an apparent TWT structure to depth was believed to be due to an error in the statics applied to the Greensand Hills. A review was carried out and it was considered necessary to improve the static model using a number of LVLs tied to upholes (Figure 21 and Table 2). The upholes were acquired by Spectrum Geophysical in 1989, and the results were incorporated in the reprocessing of all available seismic data by Spectrum late in 1989. A significant improvement in the seismic data set resulted (Figure 22).

3.2 Seismic Interpretation

Utilising the wells drilled on Licence PL 203, Godley Bridge-1 (1982), Godley Bridge-2, 2Z (1986) and Alfold-1 (1986), the key seismic events were chosen from the synthetic seismograms (Figure 29). These were chosen, as they represent significant lithological boundaries or are in proximity to objective reservoirs.

Event	Colour Code
Top Purbeck Anhydrite	Purple
Top Mid Kimmeridge Micrite 2	Yellow
Top Corallian Sandstone	Blue
Top Great Oolite	Red

The quality of the reprocessed data was excellent and ties were easy to pick across the licence.

3.3 Seismic Mapping

Following digitisation of the seismic events, maps were created in both time and depth for the new Top Purbeck Anhydrite and the near Top Great Oolite (Figures 24-27). The depth structure maps were created using average velocity maps (Figures 22 and 23). The latter derived from the well data over PL 203 integrated with regional average velocity information.

Following the mapping, two structural prospects were recognised - Godley Bridge Discovery and Prospect A plus Lead B, a structure in PL 203a.

The Godley Bridge discovery is a four-way dip closed anticline present at both Purbeck Anhydrite and Great Oolite levels. The evidence of the new mapping is that Godley Bridge 2 and 2Z were drilled outside closure. A relic of the structure previously known as Coombe Head still appears in time but reappraisal using the new statics data indicates that this structure is probably no longer present in depth.

Prospect A is a partially dip-fault closed feature in the north west corner of PL 203b, which is mapped at both Purbeck Anhydrite and Great Oolite levels. Lead B in PL 203a was dependent on closure to the east in PL 243. Subsequent mapping found no evidence of closure in this direction.

4. PROSPECTIVITY

4.1 Portland Reservoir

The Portland Sandstone distribution is illustrated in Figures 14 and 15 and as cores were cut in Godley Bridge-1, 2 and Alfold-1, detailed sedimentological studies integrating the core and the logs have been carried out allowing subdivision of the reservoir into 6 zones (Figure 35).

4.1.1 *Sedimentology and Diagenesis*

The Portland Sandstone in the Godley Bridge area consists of fine grained dolomitic and glauconitic quartz sandstones. The sandstones are heavily bioturbated. Primary depositional structures are only rarely observed as relict wave rippling or infrequently as less argillaceous, planar cross-bedded units. The sands are inferred to have accumulated under normal marine conditions in a low energy wave dominated shoreface environment. The preservation of primary depositional structures reflects a shallowing into the upper shoreface setting, whereas the "muddier" bioturbated units represent deeper water offshore conditions of the lower shoreface and below. Shelly beds are generally thin and interpreted as storm-layers and cherty, phosphatic, pebbly horizons may represent reworked strandline deposits.

The relative difference in water depth between the two extremes described in the Godley Bridge wells may be as little as 10 m by comparison with modern low energy shorelines. Up to 6 cycles are observed in cores and on logs in the Alfold-1 well and Godley Bridge wells (Figure 35).

The sequence of events during the diagenesis of the Portland Sandstones are summarised in Figure 33. The same sequence of events is seen in both the high and low energy deposits. An initial phase of meteoric calcite cement was followed by a period of dolomitisation, presumably as Purbeck brines circulated down into the Portland sand, along with the precipitation of microcrystalline silica derived from sponge spicules. The microcrystalline silica continued coevally with some development of syntaxial quartz overgrowths and further dolomite. A factor to emerge from the study is that diagenesis has clearly been arrested in the gas leg of the Godley Bridge-1 well. Significantly less silica/dolomite is observed in the clean intervals and an essentially calcareous matrix is preserved in the muddier intervals. Equivalents below the hydrocarbon leg have a matrix which is almost completely silicified and dolomitised as a result of continuing diagenesis.

The principal control on reservoir quality however is found to be facies related. The clean, cross-bedded intervals exhibit much better porosity/permeability relationships (regardless of gas charge or not) than the argillaceous, bioturbated intervals.

4.1.2 *Volumetrics*

Although the sixfold Portland Sandstone reservoir zonation can easily be correlated across the PL 203 area, the low relief of the Godley Bridge structure means that effectively all the gas is reservoired in Zone 2. A Monte Carlo approach was considered most appropriate to account for the possible sedimentological variations across the field.

Porosity/permeability crossplots (Figure 19) were created to help constrain net/gross and average porosity input ranges according to different facies. The zonal inputs for the 10% porosity cut-off case are shown in Table 3.

Gas reserves calculated by this method for the Portland Sandstone are shown below along with simplistic estimates demonstrating the very limited potential of other structures.

GODLEY BRIDGE	P_{90}	Mean	P_{10}	COMMENTS
Portland Sst	6.4	9.6	13.0	Sour gas
Inferior Oolite		3.5		Poor seal
PROSPECT A				
Portland Sst			1.2 MMBBLs/ 3.7 BCF	Sour gas OR oil

H_2S was detected during the test at Godley Bridge-1 and a minimum of 30 ppm is expected. Prospect A is a large footwall structure in the north west corner of PL 203. The structure, although large when mapped at Great Oolite level, is considerably reduced at the Portland Sandstone, which is considered to be the only viable reservoir in this structure. Reserves (see above) are likely to be very small due to the limited areal extent and low relief at the Portland Sandstone level.

4.2 Remaining Prospectivity

4.2.1 *The Oolites*

The Great Oolite is known to be a productive reservoir at a number of fields and there is a valid anticlinal structure (Figure 27). Unfortunately, the test results from DST 3b and 4 (Table 4) were not encouraging and it is considered unlikely that the reservoir characteristics of the Great Oolite at Godley Bridge would make it unsuitable for substantial hydrocarbon production.

The Inferior Oolite was tested in Godley Bridge in DSTs 1 and 2 (Table 4) and the test flow was 0.5 MMSCFD of gas associated with 500 BPD of water. Although mean reserves of 3.5 BCF have been calculated for the Inferior Oolite, it is considered more likely that this gas came out of solution from the formation water on test and that the Inferior Oolite will not add to the economic viability of Godley Bridge.

4.2.2 *The Triassic*

No wells in the Godley Bridge area have penetrated the Triassic and given the excellent reservoir qualities of the Triassic Sherwood Sandstone (main reservoir at Wytch farm), a detailed study was initiated to try and determine whether PL 203 could be underlain by Triassic Sandstones. Data from all the wells with

Triassic penetrations in the Weald Basin, indicates that thin sediments separating the pre-Mesozoic from the Jurassic are Rhaetian to Carnian in age. These are time equivalent to the Mercia Mudstone and considerably later than the Sherwood Sandstone which yields Scythian-Anisian ages.

Although deposition of the Sherwood does not appear to have occurred in the Weald Basin, there was still the chance of local sourcing of Triassic clastics during the Rhaetian Transgression. Paleogeographic reconstruction indicates that the Paleozoic surface prior to the Rhaetian transgression was low relief and the substrate mostly Carboniferous or Devonian Limestone. This would be highly unlikely to give rise to local deposits of coarse clastics and it is most likely that, if the Triassic is present, it will consist of argillaceous sediments of the Mercia Mudstone. Therefore, incremental reserves are unlikely to be found in the Triassic.

5. CONCEPTUAL DEVELOPMENT PLAN

5.1 Introduction

Shortly after taking over the Operatorship from Conoco, Cairn Energy initiated a major review into the development options for Godley Bridge.

The four options considered are:-

i) Gas export to the British Gas network

ii) Power generation at the wellsite

iii) Gas sales to local brickworks

iv) Conversion of gas to methanol.

Initial indications were that both options iii) and iv), gas sales to local brickwork and conversion to methanol were unlikely to be viable and the study concentrated on gas export or direct power generation.

5.1.1 *Gas Export to British Gas network*

Gas can be exported to the BG network through both a high (500 psi) and a low pressure system (50 psi). Unfortunately, the Godley bridge site is not ideally located for entry into either system and this would require expensive export pipelines. In addition, the presence of H_2S and mercaptans would require extra capital expenditure and environmental safeguards to ensure that there was no release into the atmosphere or river system of noxious chemicals.

Economic analysis was not favourable due to the high cost of the pipeline and capital equipment to sweeten the gas.

5.1.2 *Power Generation at the Wellsite*

Two cases for power generation were studied. The first for a 3.5 MW scheme reliant on a single well and gas turbine. The second was a 15 MW scheme using two wells and two gas turbines coupled to a waste heat boiler and steam turbine. Both systems would produce electricity at 11 KV and require a connection to the 33 KV substation at Milford, 6.5 km north of the wellsite. The H_2S would not be as critical in these schemes, as the sulphur emissions would be within limits set by H M Inspectorate of Pollution. Due to visual intrusion, the exhaust stack could not be greater than 10 m and an acoustic enclosure would be required around the turbine to limit noise levels.

Economics analyses of both these schemes indicated that neither comes close to generating a commercially justifiable project.

5.2 Conclusions

The most feasible methods for gas production at Godley Bridge are either Gas Export or On Site Power generation.

The costs for development of this gas field would be high because of the following factors:-

- the field is poorly located for connection to the gas and electricity networks
- the presence of H_2S and mercaptans would require costly cleaning equipment
- the field would require wells to be drilled as there are no suspended wells
- the area is environmentally sensitive and would require stringent environmental safeguards.

The economics of the different scenarios are marginal to negative at current prices and environmental constraints.

6. CONCLUSIONS AND RELINQUISHMENT DECISION

6.1 Conclusions

The Portland Sandstone discovery at Godley Bridge-1 contains proven most likely recoverable reserves of less than 10 BCF.

Lead B in PL 203a required closure in PL 243, and remapping has demonstrated this is not present.

Prospect A contains most likely reserves (unrisked) of 3.7 BCF of sour gas or 1.2 MMBBLS of oil in the Portland Sandstone.

The Great and Inferior Oolite are discounted as viable reservoirs due to poor poroperm qualities.

The underlying Triassic is considered to be non-reservoir Mercia Mudstone with no prospectivity.

The development of Godley Bridge would be expensive due to the presence of H_2S and mercaptans, distance from suitable gas pipeline and the location within an environmentally sensitive area.

The high cost of infrastructure and the distance to the market mean that the Godley Bridge project could not economically produce gas under current market and environmental conditions.

6.2 Relinquishment Decision

Subsequent to detailed Geological/Geophysical and Engineering studies which concluded the Godley Bridge Field was not commercially viable and that Licence PL 203 lacked significant exploration upside, the PL 203 licensees notified the Department of Energy of their intention to determine the licence on 13 August 1991. The licence was thus formally determined on 14 February 1992.

TABLE 1

FORMATION TOPS

	GODLEY BRIDGE-1		GODLEY BRIDGE-2Z		ALFOLD-1		BORDON-1	
	MD	TVD SS	MD	TVD SS	MD	TVD SS	MD	TVD SS
Surface	0	+233	0	+365	0	+215	0	+264
Hastings Beds	1131	-898	1343	-913	835	-611	1613	-1295
Purbeck Beds	2311	-2078	2871	-2102	2376	-1856	2822	-2279
Purbeck Anhydrite	3079	-2846	3938	-2911	3621	-2858	3448	-2803
Portland Limestone	3140	-2907	3995	-2955	3679	-2909	3510	-2854
Portland Sandstone	3156	-2923	4012	-2967	3694	-2922	3524	-2866
Kimmeridge Clay	3396	-3163	4331	-3214	3934	-3133	3741	-3039
Corallian	5052	-4819	6113	-4791			5183	-4218
Oxford Clay	5411	-5178	6576	-5240			5590	-4563
Kellaways Beds	5792	-5559	7016	-5675			6062	-4958
Great Oolite	5831	-5598	7058	-5716			6116	-4998
Fuller's Earth	6023	-5895	7300	-5957			6434	-5258
Inferior Oolite	6128	-6000	7418	-6075			6531	-5341
Upper Lias	6572	-6339	7930	-6586			6899	-5659
Middle Lias	6915	-6682					7259	-5994
Lower Lias	7282	-7049					7750	-6500
TD	8473	-8240	8092	-6698	4120	-3296	8030	-6796

TABLE 2

UPHOLE DATA

UPHOLE	TARGET	DEPTH	STATIC
CUH 101	Weald Clay velocities	76 m	40.8 ms
CUH 102	Weald Clay velocities	80 m	37.1 ms
CUH 103	Weald Clay velocities	123 m	57.9 ms
CUH 104	Atherfield and Weald Clay velocities	180 m	86.7 ms
CUH 105	Hythe Beds, Atherfield Clay, Weald Clay velocities	111 m	Datum not reached
CUH 106	Hythe Beds velocities	111 m	Datum not reached
CUH 107	Hythe Beds velocities and stringers	117 m	66.4 ms
CUH 108	Weald Clay velocities	120 m	57.5 ms
CUH 109	Hythe Beds, Atherfield Clay and Weald Clay velocities	111 m	57.3 ms

TABLE 3

PORTLAND SANDSTONE - POROSITY AND NET TO GROSS

Net to Gross and Average Porosity using a 10% (Most Likely) Porosity Cut-Off

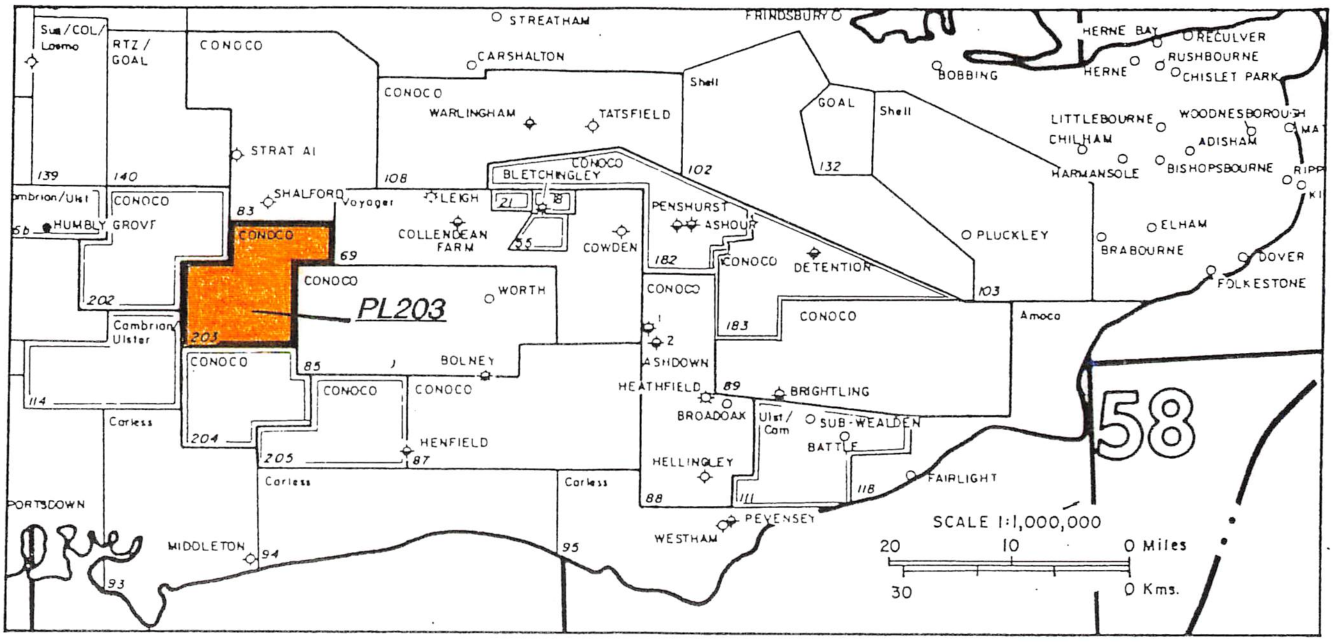
ZONE	1		2		3		4		5		6	
WELL	N/G	AVG POR	N/G	AVG POR	N/G	AVG POR	N/G	AVG POR	N/G	AVG POR	N/G	AVG POR
Godley Bridge-1	19%	11.5%	100%	18.9%	100%	15.1%	11%	11.1%	93%	16.2%	29%	14.1%
Godley Bridge-2	2%	19.9%	100%	15.7%	90%	12.5%	18%	11.4%	100%	15.5%	39%	14.2%
Alfold-1	-	-	70%	18.3%	58%	12.3%	35%	13.7%	100%	16.8%	35%	12.1%

TABLE 4

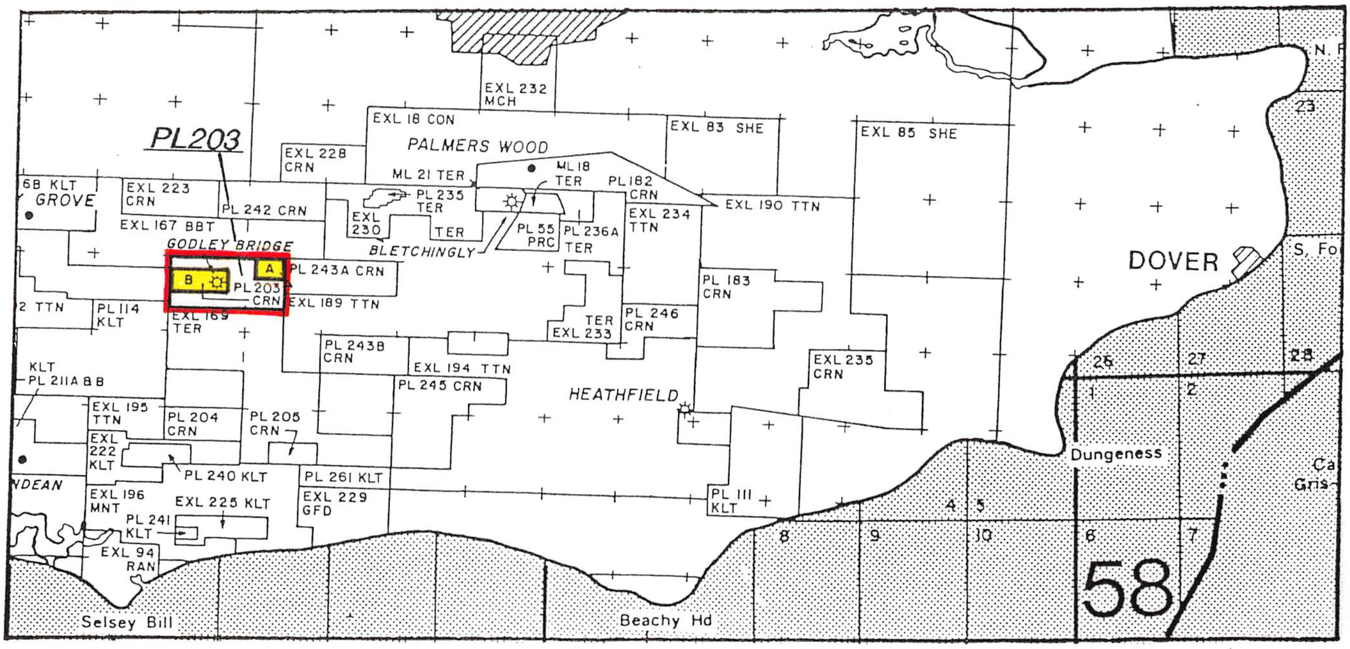
GODLEY BRIDGE-1 DST RESULTS

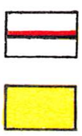
TEST	PERFORATIONS	FORMATION	FLOW	COMMENTS
1	6218-6264 ft	Inferior Oolite	Average 325 BPD	Died near surface
2	6140-6190 ft	Inferior Oolite	Flowed mud/gas/water	Could not go through separator
2a	6140-6190 ft	Inferior Oolite	0.2-0.5 MMSCFD, 300-500 BWPD, 6 gals condensate	Used nitrogen cushion
3	5900-5960 ft	Great Oolite	Low flow gas	Flow rate too small to measure, reversed out oil in water emulsion
3a	5900-5960 ft	Great Oolite	c. 500-1,000 BPD mud	Nitrogen cushion
3b	5900-5960 ft	Great Oolite	80 BWPD, 0.05 MMSCFDG gas	Nitrogen cushion
4	5844-5864 ft	Great Oolite	c. 3 BWPD	Weak blow
5	3160-3170 ft	Portland Sandstone	1.13-1.09 MMSCFD, 7 gals 66°API condensate	Nitrogen and water cushion, 5 ppm H_2S 16/64" choke
6	3160-3180 ft	Portland Sandstone	1.44 MMSCFD, c. 50 BPD filtrate, 5 gals 73°API condensate	Water cushion, nitrogen injection, 9-20 ppm H_2S 28/64" choke
7	3160-3190 ft	Portland Sandstone	1.07 MMSCFD, 24 BWPD	Nitrogen 16/64" choke injection, 30 ppm H_2S

A) LICENCE PL 203 AT AWARD



B) LICENCE PL 203 AFTER RELINQUISHMENT 1986 & 1991

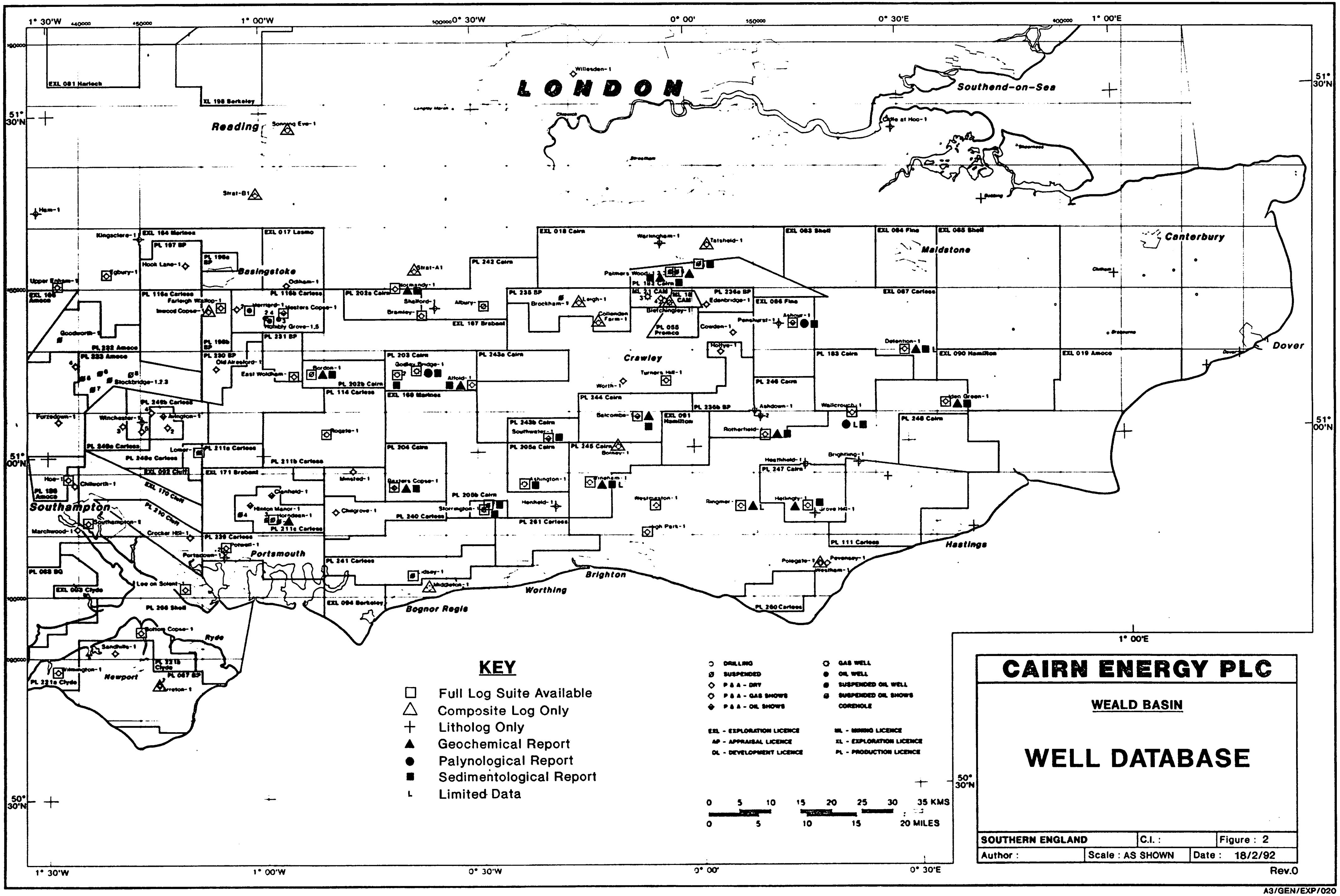


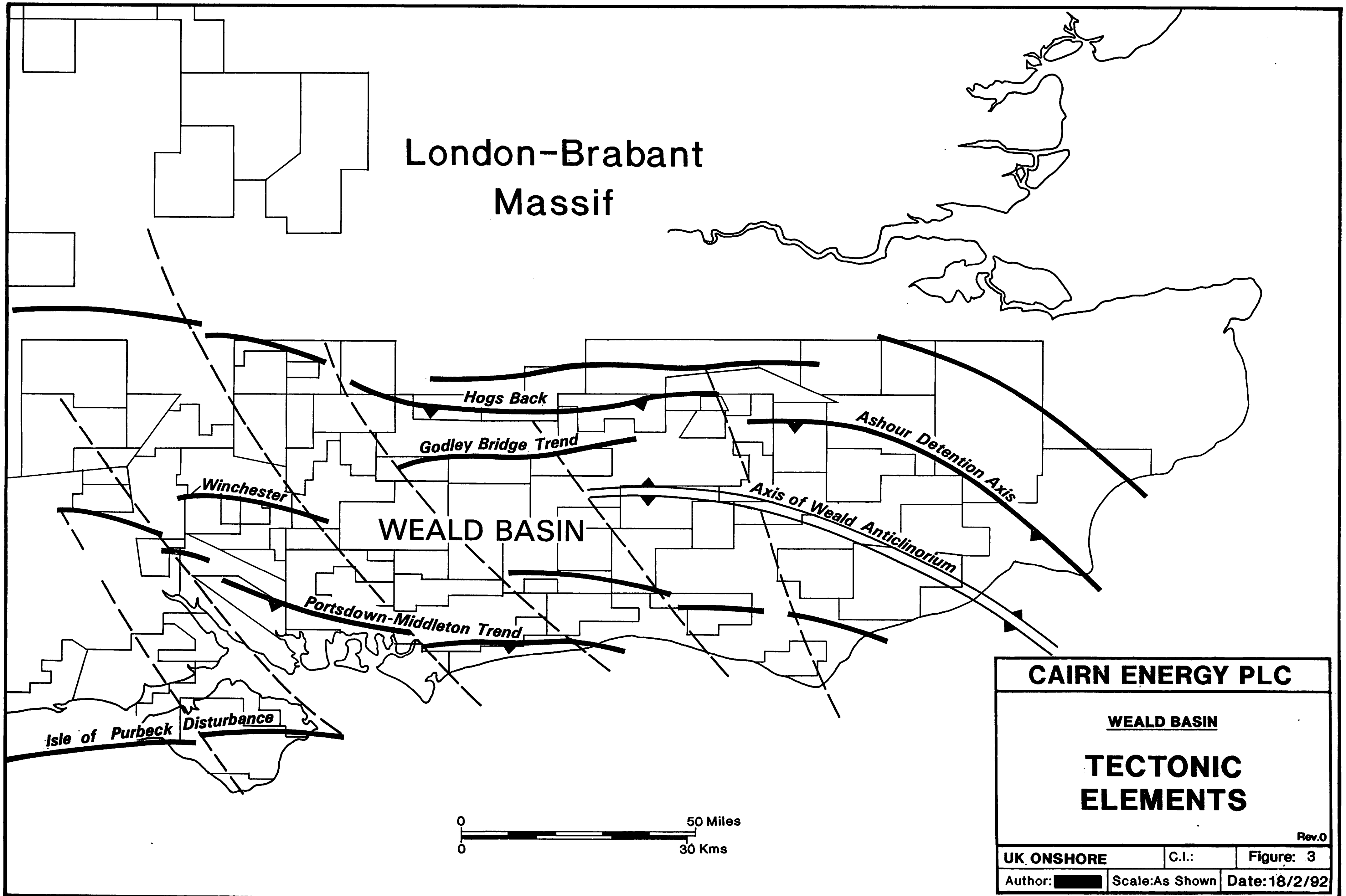

Retained post 1986

Retained post 1991

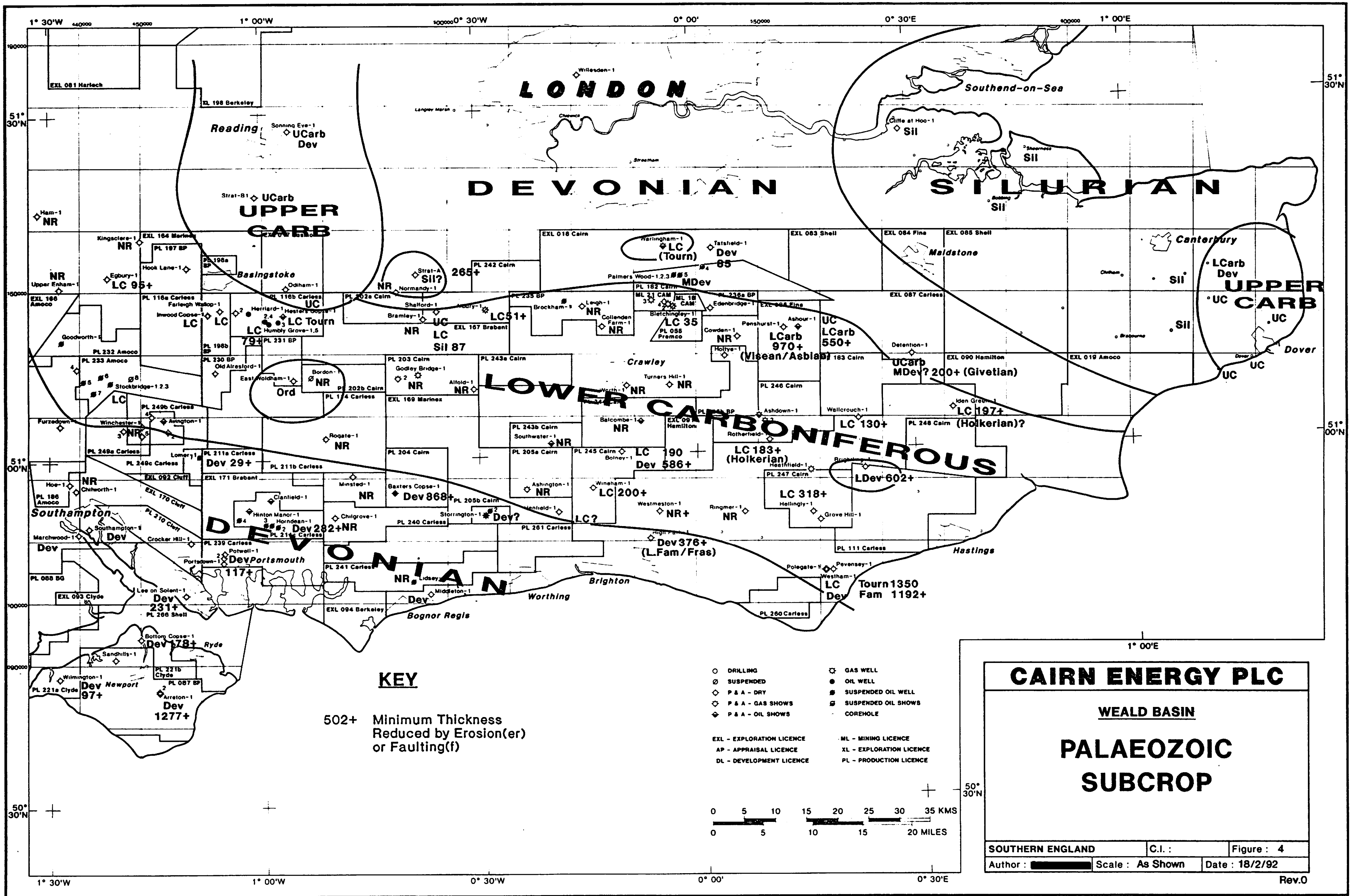
CAIRN ENERGY PLC		
LICENCE PL 203 PRE AND POST 1986		
SOUTHERN ENGLAND	C.I:	Figure: 1
Author:	Scale:	Date:18/2/92

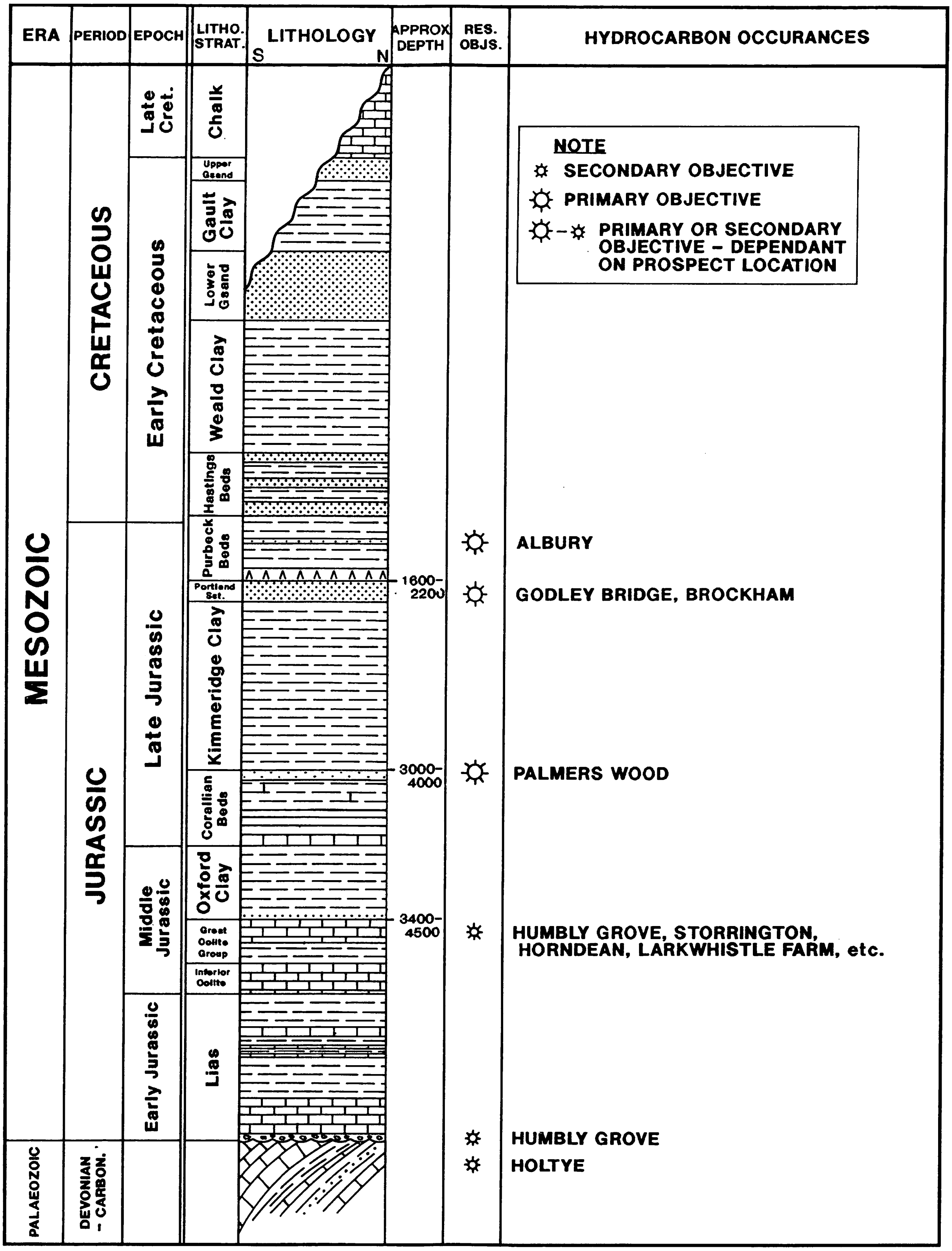
Rev.0


CAIRN ENERGY PLC
WEALD BASIN
WELL DATABASE
SOUTHERN ENGLAND
C.I. :
Figure : 2
Author :
Scale : AS SHOWN
Date : 18/2/92
Rev.0
A3/GEN/EXP/020
KEY
Full Log Suite Available
Composite Log Only
Litholog Only
Geochemical Report
Palynological Report
Sedimentological Report
Limited Data
DRILLING
SUSPENDED
P & A - DRY
P & A - GAS SHOWS
P & A - OIL SHOWS
GAS WELL
OIL WELL
SUSPENDED OIL WELL
SUSPENDED OIL SHOWS
COREHOLE
EXL - EXPLORATION LICENCE
AP - APPRAISAL LICENCE
DL - DEVELOPMENT LICENCE
ML - MINING LICENCE
XL - EXPLORATION LICENCE
PL - PRODUCTION LICENCE
0 5 10 15 20 25 30 35 KMS
0 5 10 15 20 MILES
1° 30'W
1° 00'W
0° 30'W
0° 00'
0° 30'E
1° 00'E
51° 30'N
51° 00'N
50° 30'N
LONDON
Reading
Southend-on-Sea
Canterbury
Maidstone
Basingstoke
Crawley
Dover
Southampton
Portsmouth
Worthing
Brighton
Bognor Regis
Hastings
Newport
Ryde
EXL 081 Harlech
XL 198 Berkeley
EXL 018 Cairn
EXL 017 Lasmo
EXL 083 Shell
EXL 084 Fina
EXL 085 Shell
EXL 086 Fina
EXL 087 Carless
EXL 090 Hamilton
EXL 019 Amoco
EXL 091 Hamilton
EXL 168 Marinex
EXL 171 Brabant
EXL 094 Berkeley
EXL 093 Clyde
PL 242 Cairn
PL 235 BP
PL 203 Cairn
PL 204 Cairn
PL 205a Cairn
PL 205b Cairn
PL 240 Carless
PL 241 Carless
PL 261 Carless
PL 260 Carless
PL 111 Carless
PL 247 Cairn
PL 248 Cairn
PL 246 Cairn
PL 183 Cairn
PL 244 Cairn
PL 245 Cairn
PL 239 Carless
PL 266 Shell
PL 221a Clyde
PL 221b Clyde
PL 067 BP
PL 068 BG
PL 186 Amoco
PL 055 Premco
Willesden-1
Sonning Eve-1
Strat-B1
Strat-A1
Ham-1
Kingsclere-1
Hook Lane-1
Egbury-1
Goodworth-1
Stockbridge-1,2,3
Winchester-1
Farleigh Wallop-1
Herriard-1
Humbly Grove-1,5
Bordon-1
Godley Bridge-1
Alfold-1
Albury-1
Shalford-1
Bramley-1
Brockham-1
Leigh-1
Collendean Farm-1
Bletchingley-1
Edenbridge-1
Penshurst-1
Ashour-1
Cowden-1
Detention-1
Turners Hill-1
Worth-1
Balcombe-1
Ashdown-1
Wallcrouch-1
Rotherfield-1
Heathfield-1
Brightling-1
Hellingly-1
Grove Hill-1
Ringmer-1
Westmeston-1
Henfield-1
Storrington-1
Ashington-1
Bolney-1
Rogate-1
Chilgrove-1
Hinton Manor-1
Horndean-1
Portsdown-1
Lee on Solent-1
Sandhills-1
Wilmington-1
Arreton-1
Polegate-1
Pevensey-1
Middleton-1
Marchwood-1
Southampton-1
Chilworth-1
Furzedown-1
Crocker Hill-1



A4/GEN/EXP/020


LONDON
DEVONIAN
SILURIAN
UPPER CARB
LOWER CARBONIFEROUS
DEVONIAN
UPPER CARB
Reading
Basingstoke
Southend-on-Sea
Maidstone
Canterbury
Dover
Crawley
Hastings
Brighton
Worthing
Bognor Regis
Portsmouth
Southampton
Newport
Ryde
Sonning Eve-1 UCarb Dev
Strat-B1 UCarb
Ham-1 NR
Kingsclere-1 NR
Upper Enham-1 NR
Egbury-1 LC 95+
Cliffe at Hoo-1 Sil
Sil
Warlingham-1 LC (Tourn)
Tatsfield-1 Dev 85
Palmers Wood-1,2,3 MDev
Strat-A Sil?
265+
NR
UC
LC Tourn
LC 79+
LC51+
NR
UC LC Sil 87
LC 35
LCarb 970+
UC LCarb 550+
(Visean/Asbian)
UCarb MDev? 200+ (Givetian)
LC 197+ (Holkerian)?
LC 130+
LC 183+ (Holkerian)
LDev 602+
LC 318+
LC 190
Dev 586+
LC 200+
NR+
Dev 376+ (L.Fam/Fras)
LC Dev
Tourn 1350
Fam 1192+
Dev 29+
Dev 868+
Dev?
LC?
Dev 282+NR
Dev 117+
Dev 231+
Dev 178+
Dev 97+
Dev 1277+
Ord
Bordon-1 NR
KEY
502+ Minimum Thickness Reduced by Erosion(er) or Faulting(f)
DRILLING
SUSPENDED
P & A - DRY
P & A - GAS SHOWS
P & A - OIL SHOWS
GAS WELL
OIL WELL
SUSPENDED OIL WELL
SUSPENDED OIL SHOWS
COREHOLE
EXL - EXPLORATION LICENCE
AP - APPRAISAL LICENCE
DL - DEVELOPMENT LICENCE
ML - MINING LICENCE
XL - EXPLORATION LICENCE
PL - PRODUCTION LICENCE
0 5 10 15 20 25 30 35 KMS
0 5 10 15 20 MILES
CAIRN ENERGY PLC
WEALD BASIN
PALAEOZOIC SUBCROP
SOUTHERN ENGLAND
C.I. :
Figure : 4
Author : [redacted]
Scale : As Shown
Date : 18/2/92
Rev.0
A3/GEN/EXP/005



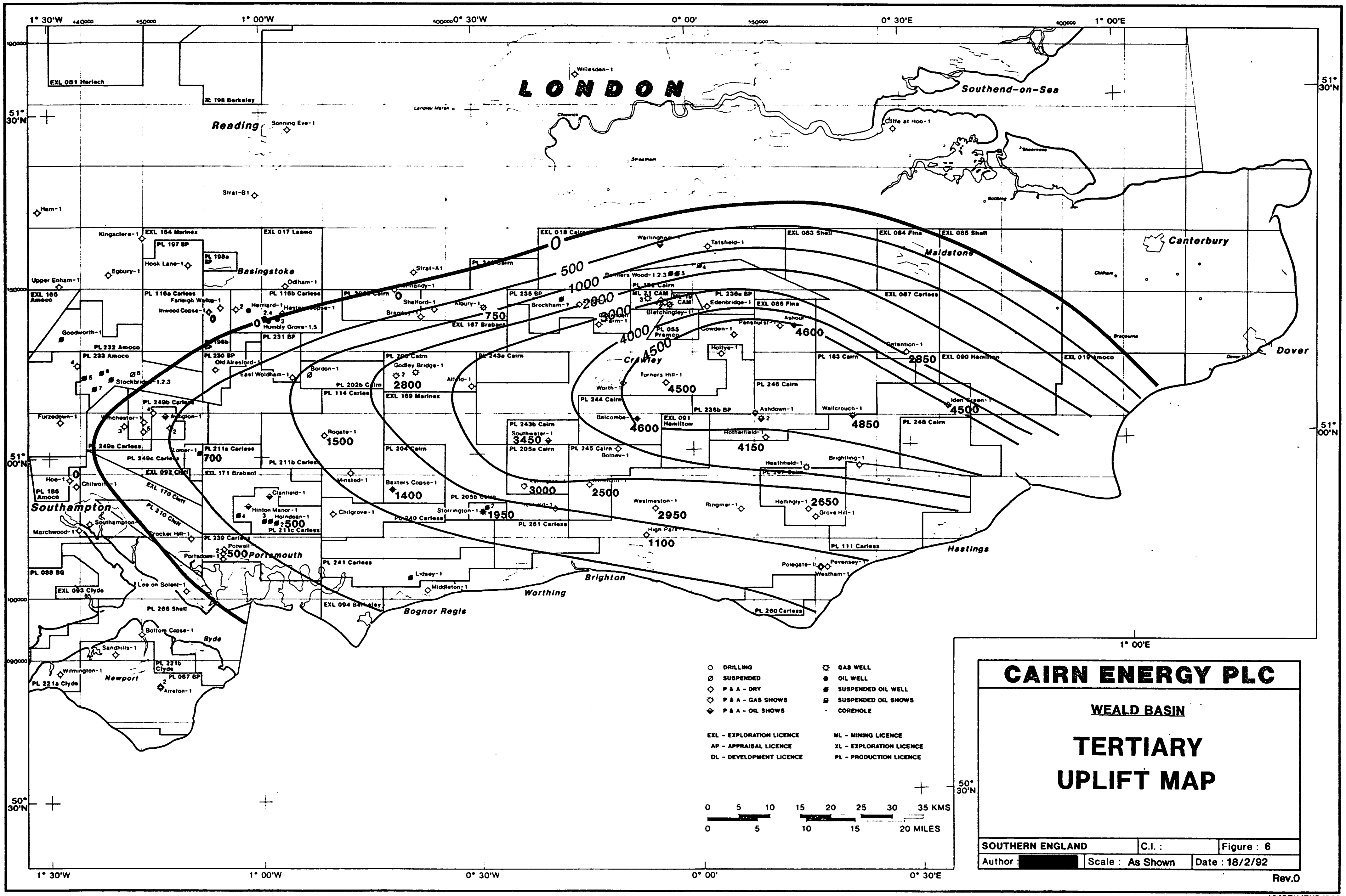
LICENCE PL 202b/203

GENERALISED STRATIGRAPHY

18/2/92 Rev.0

Figure: 5

A4/PL202b/007



CAIRN ENERGY PLC

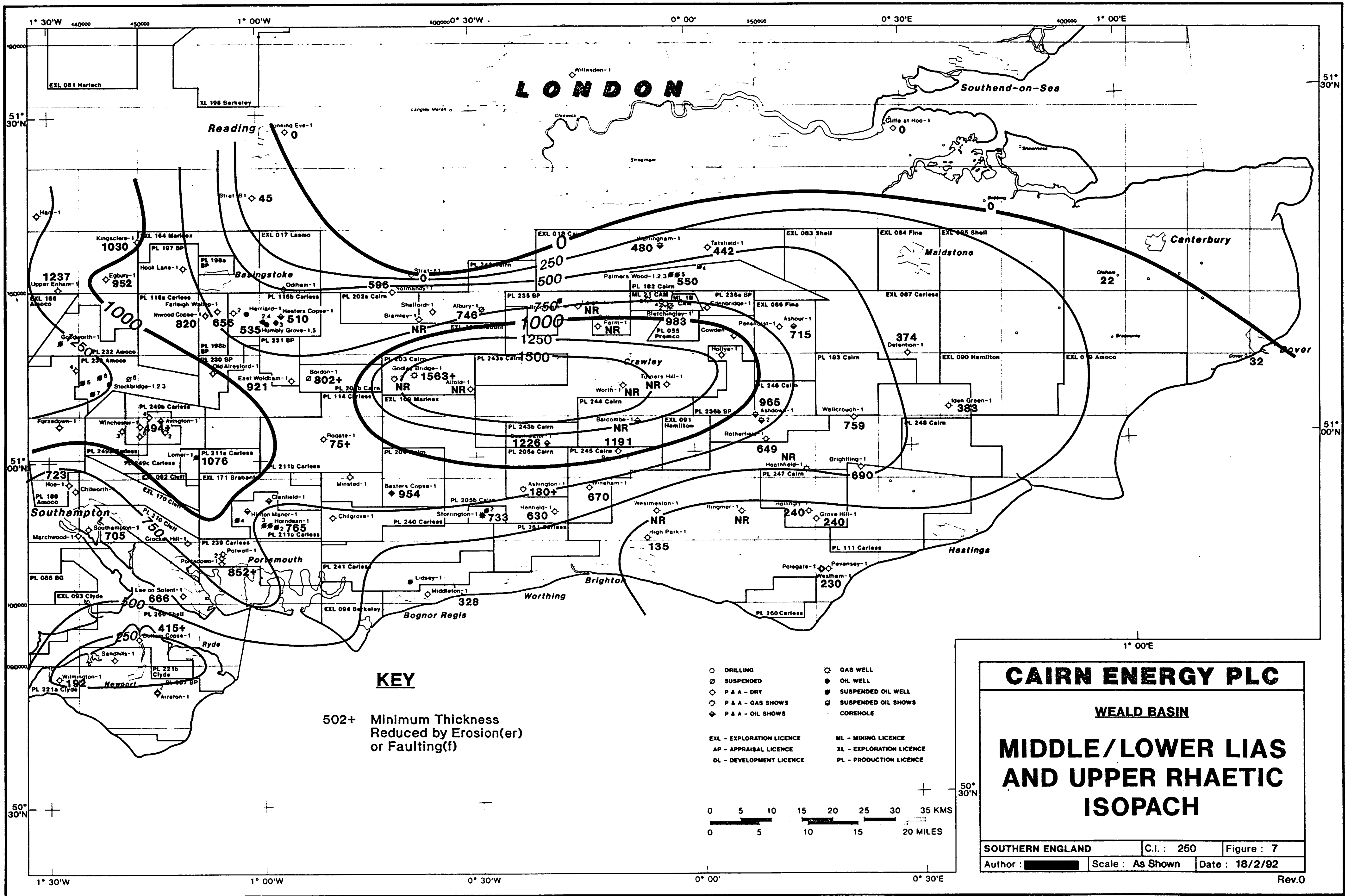
WEALD BASIN

TERTIARY UPLIFT MAP

SOUTHERN ENGLAND	C.I. :	Figure : 6
Author [redacted]	Scale : As Shown	Date : 18/2/92

Rev.0

A3/GEN/EXP/008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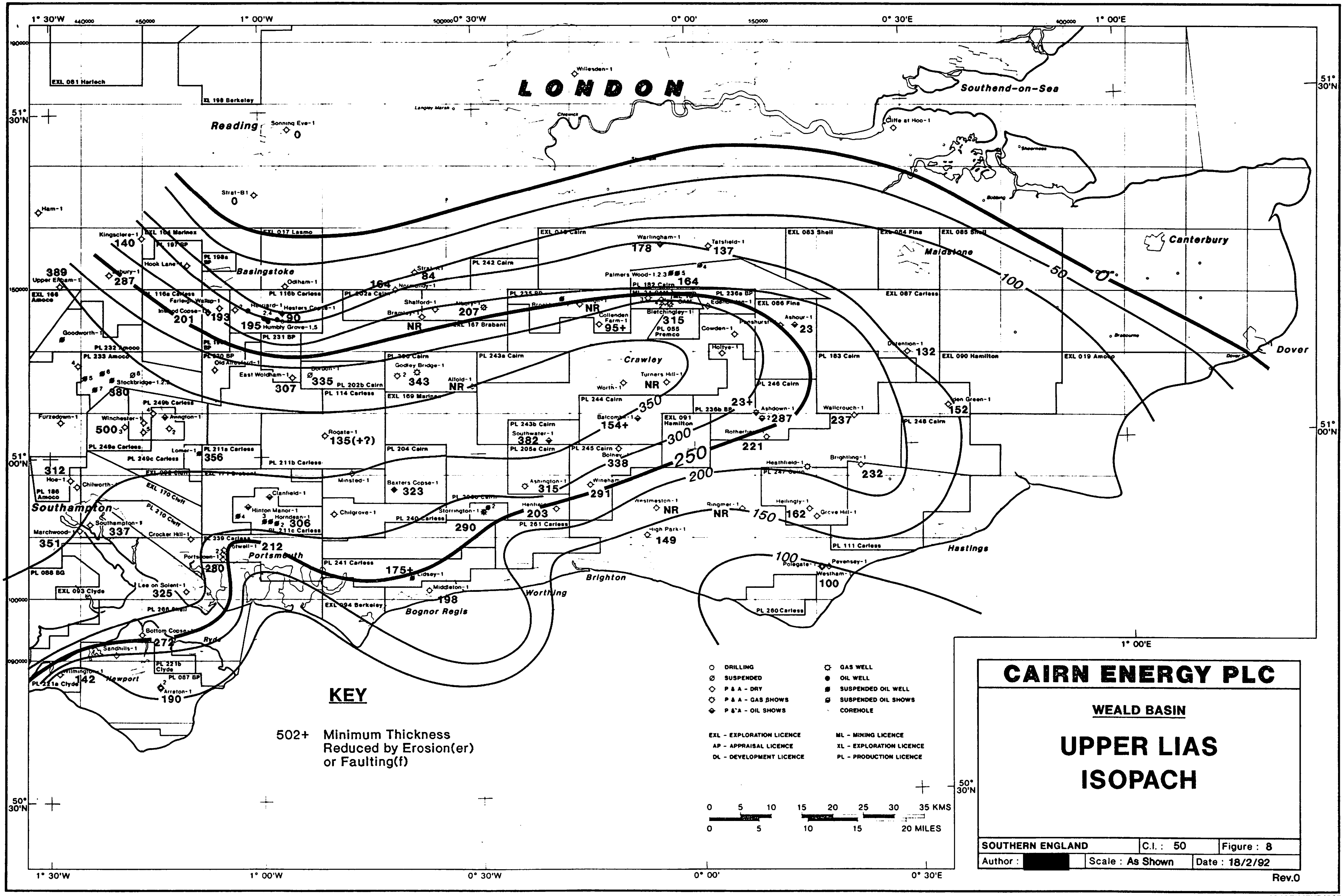
Basingstoke
Southend-on-Sea
Maidstone
Canterbury
Crawley
Dover
Southampton
Portsmouth
Worthing
Brighton
Bognor Regis
Hastings
Newport
Ryde
KEY
502+ Minimum Thickness Reduced by Erosion(er) or Faulting(f)
DRILLING
SUSPENDED
P & A - DRY
P & A - GAS SHOWS
P & A - OIL SHOWS
GAS WELL
OIL WELL
SUSPENDED OIL WELL
SUSPENDED OIL SHOWS
COREHOLE
EXL - EXPLORATION LICENCE
AP - APPRAISAL LICENCE
DL - DEVELOPMENT LICENCE
ML - MINING LICENCE
XL - EXPLORATION LICENCE
PL - PRODUCTION LICENCE
0 5 10 15 20 25 30 35 KMS
0 5 10 15 20 MILES
CAIRN ENERGY PLC
WEALD BASIN
MIDDLE/LOWER LIAS AND UPPER RHAETIC ISOPACH
SOUTHERN ENGLAND
C.I.: 250
Figure: 7
Author: [redacted]
Scale: As Shown
Date: 18/2/92
Rev.0
A3/GEN/EXP/006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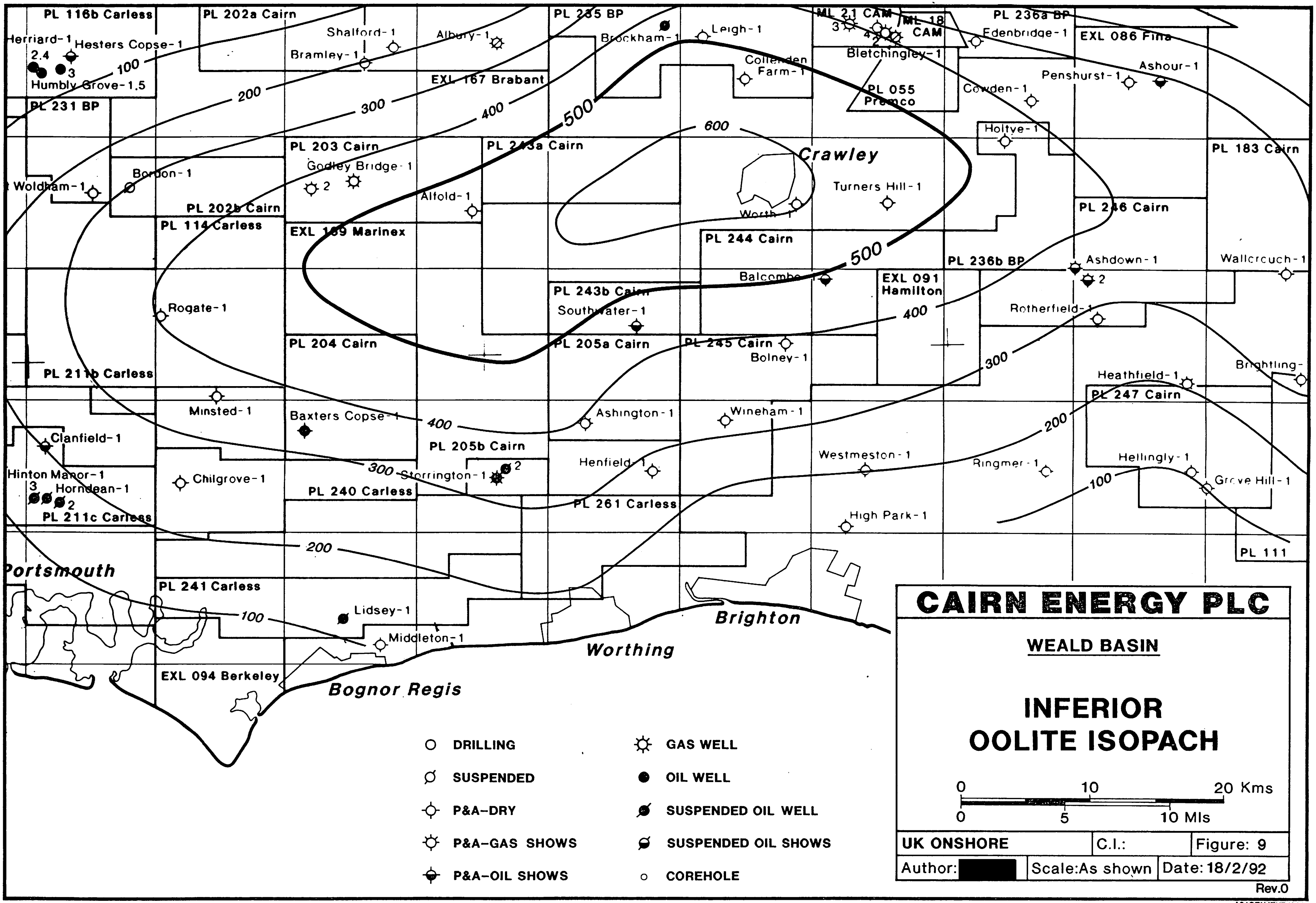
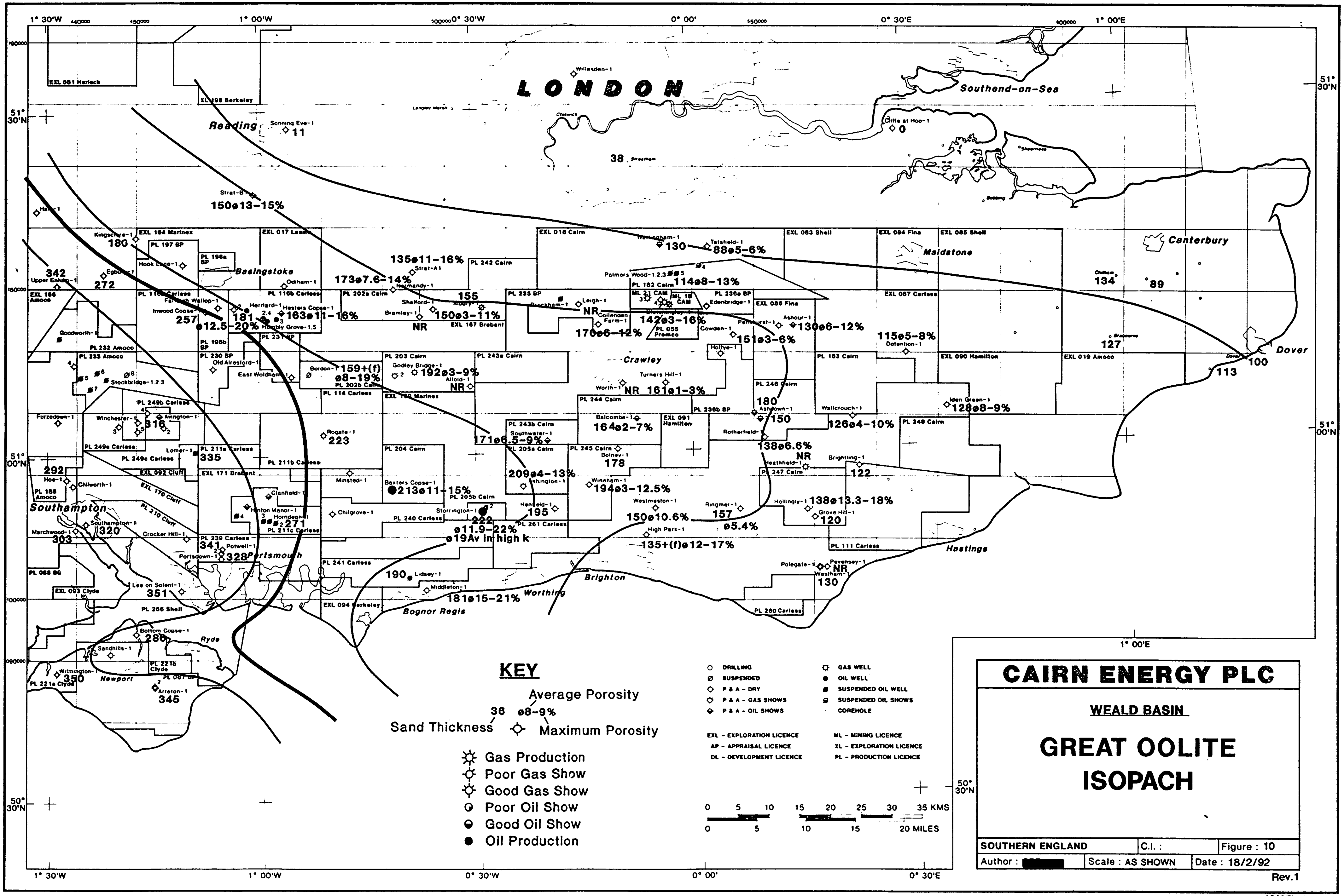
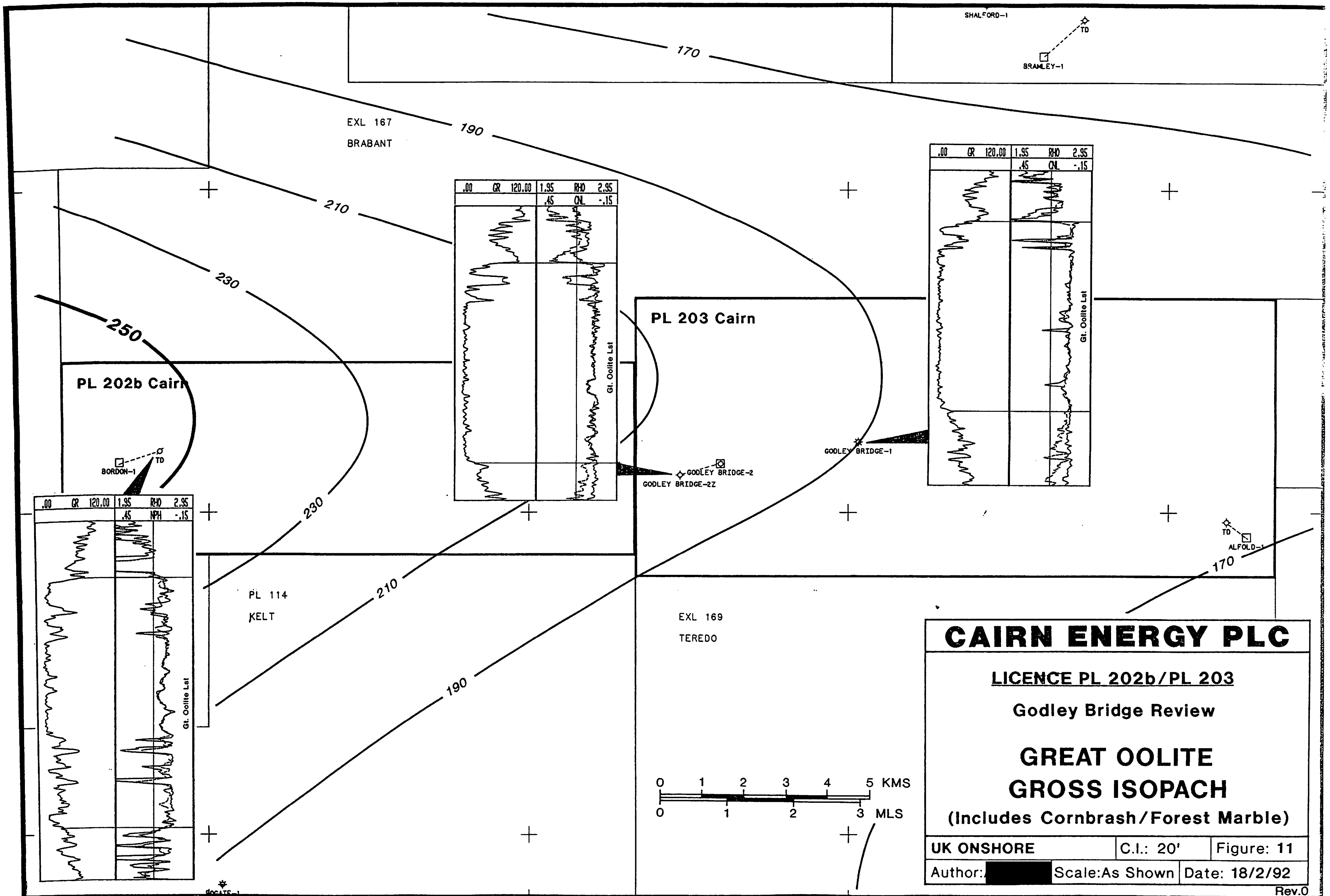
WEALD BASIN
UPPER LIAS
ISOPACH
SOUTHERN ENGLAND
C.I.: 50
Figure: 8
Author: [redacted]
Scale: As Shown
Date: 18/2/92
Rev.0
A3/GEN/EXP/007
KEY
502+ Minimum Thickness Reduced by Erosion(er) or Faulting(f)
DRILLING
SUSPENDED
P & A - DRY
P & A - GAS SHOWS
P & A - OIL SHOWS
GAS WELL
OIL WELL
SUSPENDED OIL WELL
SUSPENDED OIL SHOWS
COREHOLE
EXL - EXPLORATION LICENCE
AP - APPRAISAL LICENCE
DL - DEVELOPMENT LICENCE
ML - MINING LICENCE
XL - EXPLORATION LICENCE
PL - PRODUCTION LICENCE
0 5 10 15 20 25 30 35 KMS
0 5 10 15 20 MILES
1° 30'W
1° 00'W
0° 30'W
0° 00'
0° 30'E
1° 00'E
51° 30'N
51° 00'N
50° 30'N
LONDON
Reading
Southend-on-Sea
Canterbury
Maidstone
Dover
Basingstoke
Crawley
Southampton
Portsmouth
Brighton
Worthing
Bognor Regis
Hastings
Newport
Ryde
EXL 081 Harlech
XL 198 Berkeley
EXL 017 Lasmo
EXL 018 Cairn
EXL 083 Shell
EXL 084 Fina
EXL 085 Shell
EXL 087 Carless
EXL 086 Fina
EXL 090 Hamilton
EXL 019 Amoco
EXL 091 Hamilton
EXL 169 Marinex
EXL 170 Cluff
PL 210 Cluff
EXL 093 Clyde
EXL 094 Berkeley
PL 088 BG
PL 242 Cairn
PL 243a Cairn
PL 243b Cairn
PL 244 Cairn
PL 245 Cairn
PL 246 Cairn
PL 248 Cairn
PL 183 Cairn
PL 204 Cairn
PL 205a Cairn
PL 202b Cairn
PL 114 Carless
PL 211b Carless
PL 211a Carless
PL 241 Carless
PL 261 Carless
PL 111 Carless
PL 260 Carless
PL 231 BP
PL 232 Amoco
PL 233 Amoco
PL 249b Carless
PL 249a Carless
PL 249c Carless
PL 186 Amoco
PL 221b Clyde
PL 221a Clyde
PL 087 BP
PL 085 Premco
PL 116b Carless
PL 167 Brabant
Sonning Eve-1 0
Strat-B1 0
Ham-1
Willesden-1
Cliffe at Hoo-1
Kingsclere-1 140
Upper Enham-1 389
287
Hook Lane-1
Odiham-1
201
193
195 Humbly Grove-1,5
90
164
Strat-A1 84
Shalford-1
Bramley-1 NR
Albury-1 207
Warlingham-1 178
Tatsfield-1 137
Palmers Wood-1,2,3,5 164
NR
Collendean Farm-1 95+
Bletchingley-1 315
Penshurst-1
Ashour-1 23
Detention-1 132
Goodworth-1
Stockbridge-1,2,3 380
Old Alresford-1
East Woldham-1 307
Bordon-1 335
Godley Bridge-1 343
Alfold-1 NR
Worth-1
Turners Hill-1 NR
Holtye-1
Ashdown-1 287
23+
Wallcrouch-1 237
152
Furzedown-1
Winchester-1 500
Avington-1
Rogate-1 135(+?)
Balcombe-1 154+
Southwater-1 382
Rotherfield-1 221
Lomer-1 356
312
Hoe-1
Chilworth-1
Bolney-1 338
Heathfield-1
Brightling-1 232
Baxters Copse-1 323
Ashington-1 315
Wineham-1 291
Minsted-1
Clanfield-1
Hinton Manor-1
Horndean-1 306
Chilgrove-1
Storrington-1 290
Henfield-1 203
Westmeston-1 NR
Ringmer-1 NR
Hellingly-1 162
Grove Hill-1
Marchwood-1 351
Southampton-1 337
Crocker Hill-1
Portsdown-1 280
Stilwell-1 212
175+ Lidsey-1
Middleton-1 198
High Park-1 149
Polegate-1
Pevensey-1
Westham-1 100
Lee on Solent-1 325
Bottom Copse-1 272
Sandhills-1
Wilmington-1 142
Arreton-1 190
0
50
100
150
200
250
300
350



A3/GEN/EXP/023


CAIRN ENERGY PLC
WEALD BASIN
GREAT OOLITE ISOPACH
SOUTHERN ENGLAND
C.I. :
Figure : 10
Author : [redacted]
Scale : AS SHOWN
Date : 18/2/92
Rev.1
KEY
Average Porosity
36 ø8-9%
Sand Thickness
Maximum Porosity
Gas Production
Poor Gas Show
Good Gas Show
Poor Oil Show
Good Oil Show
Oil Production
DRILLING
SUSPENDED
P & A - DRY
P & A - GAS SHOWS
P & A - OIL SHOWS
GAS WELL
OIL WELL
SUSPENDED OIL WELL
SUSPENDED OIL SHOWS
COREHOLE
EXL - EXPLORATION LICENCE
AP - APPRAISAL LICENCE
DL - DEVELOPMENT LICENCE
ML - MINING LICENCE
XL - EXPLORATION LICENCE
PL - PRODUCTION LICENCE
0 5 10 15 20 25 30 35 KMS
0 5 10 15 20 MILES
LONDON
Southend-on-Sea
Reading
Basingstoke
Crawley
Maidstone
Canterbury
Dover
Hastings
Brighton
Worthing
Bognor Regis
Portsmouth
Southampton
Newport
Ryde
1° 30'W
1° 00'W
0° 30'W
0° 00'
0° 30'E
1° 00'E
51° 30'N
51° 00'N
50° 30'N
150ø13-15%
135ø11-16%
173ø7.6-14%
163ø11-16%
150ø3-11%
142ø3-16%
114ø8-13%
88ø5-6%
130ø6-12%
151ø3-6%
115ø5-8%
159+(f) ø8-19%
192ø3-9%
161ø1-3%
164ø2-7%
171ø6.5-9%
126ø4-10%
128ø8-9%
138ø6.6%
209ø4-13%
194ø3-12.5%
213ø11-15%
150ø10.6%
138ø13.3-18%
ø11.9-22%
ø19Av in high k
135+(f)ø12-17%
181ø15-21%
ø12.5-20%
A3/GEN/EXP/045



CAIRN ENERGY PLC

LICENCE PL 202b/PL 203

Godley Bridge Review

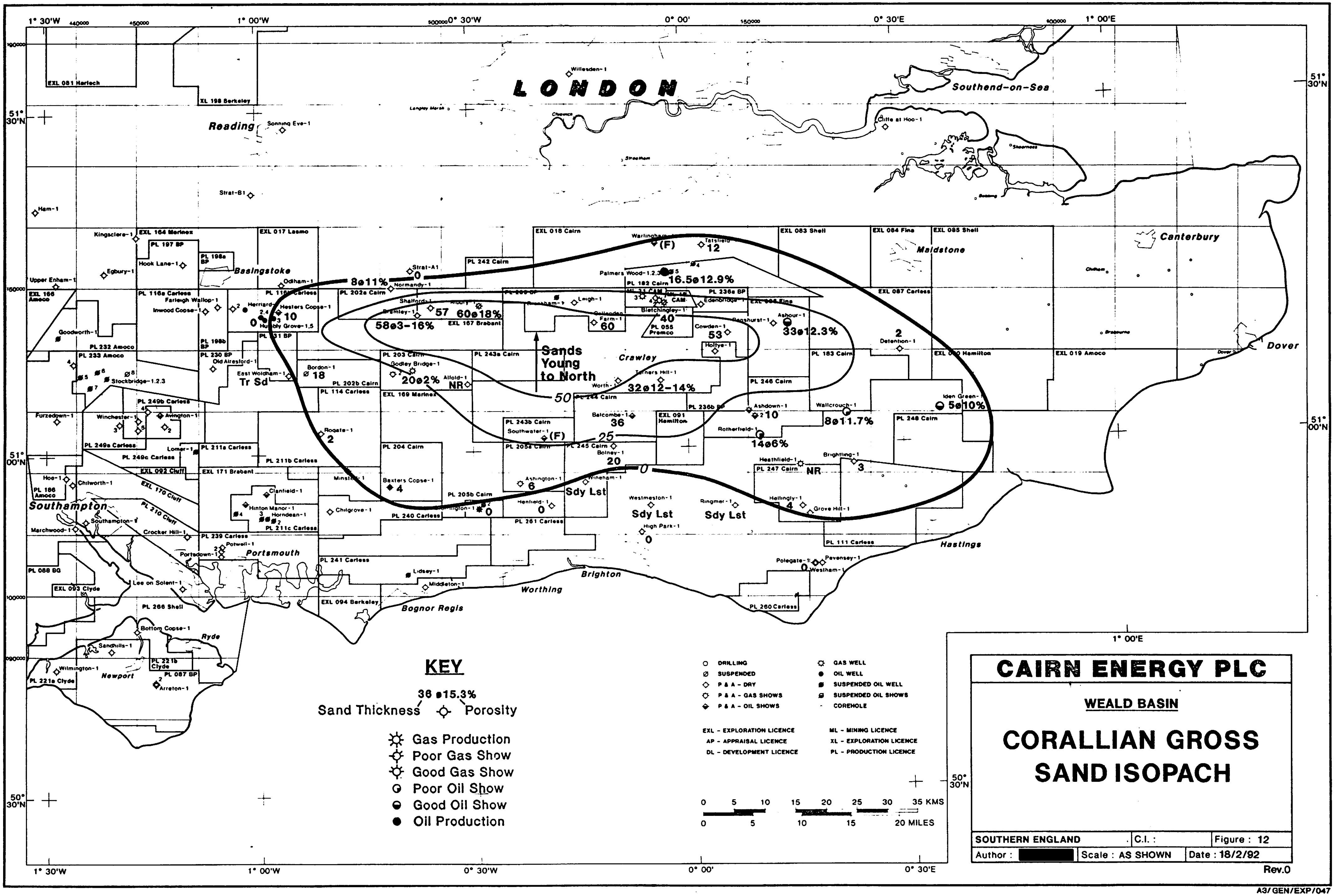
GREAT OOLITE GROSS ISOPACH

(Includes Cornbrash/Forest Marble)

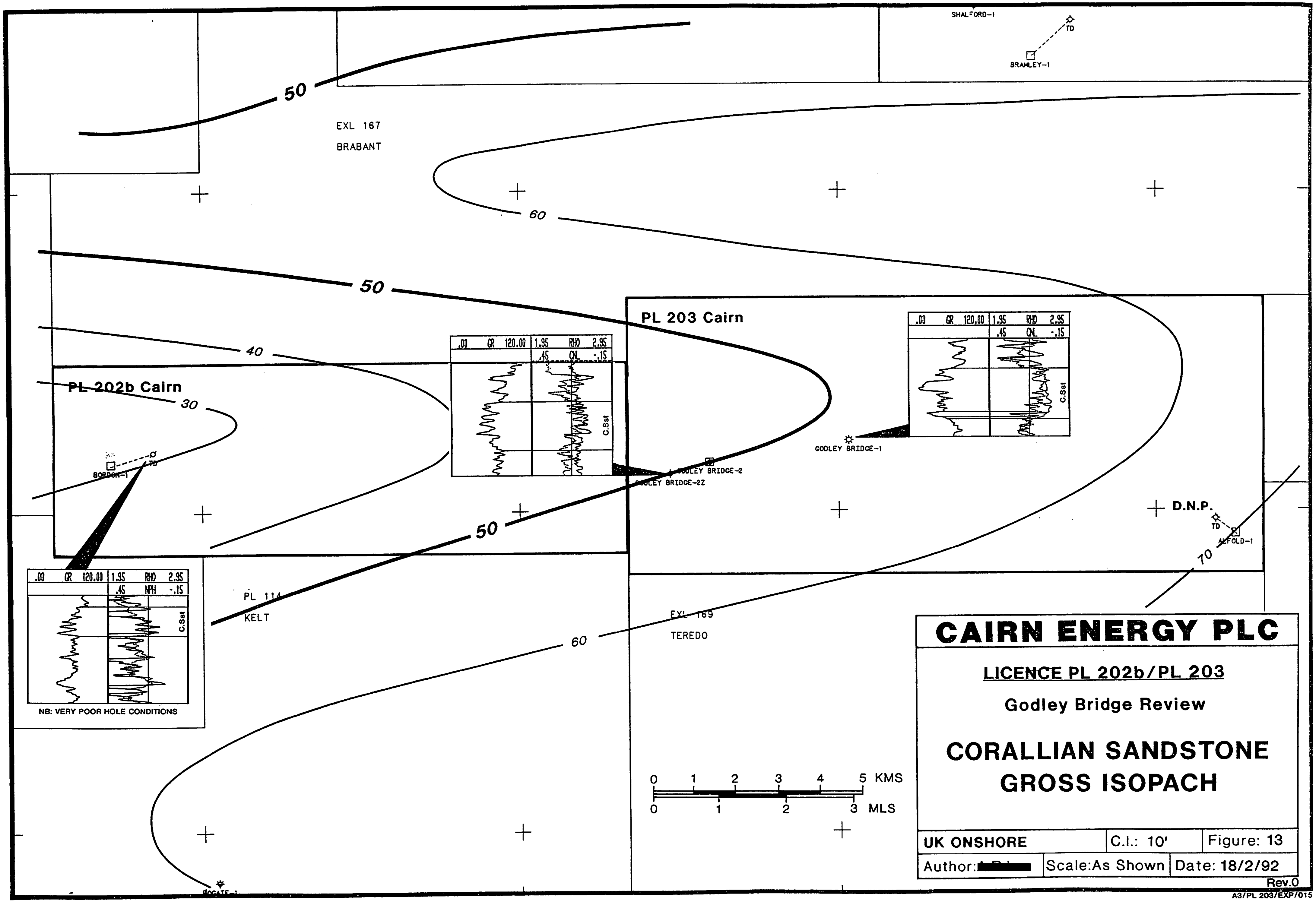
UK ONSHORE	C.I.: 20'	Figure: 11
Author: [redacted]	Scale: As Shown	Date: 18/2/92

Rev.0

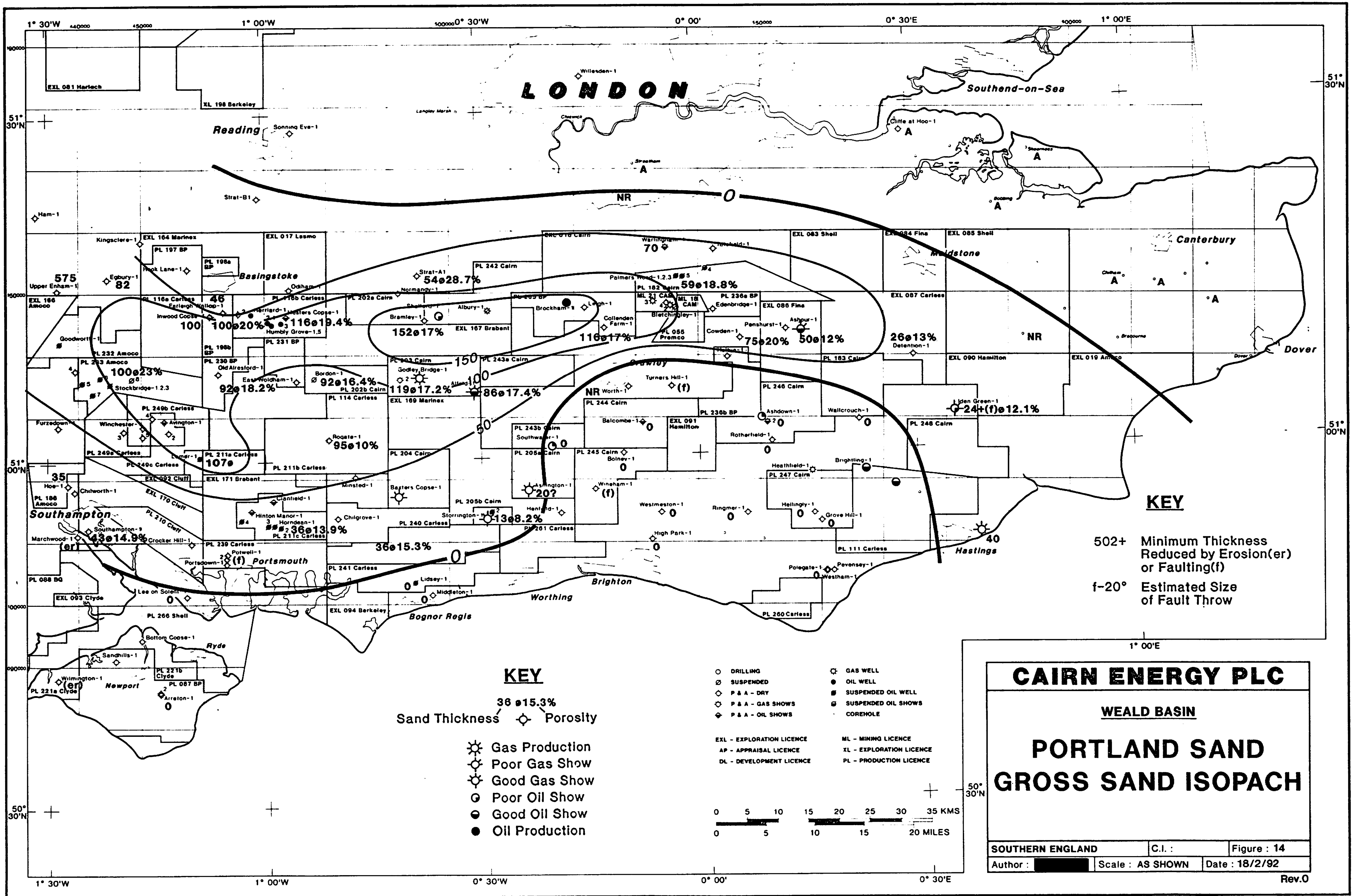
A3/PL 203/EXP/014

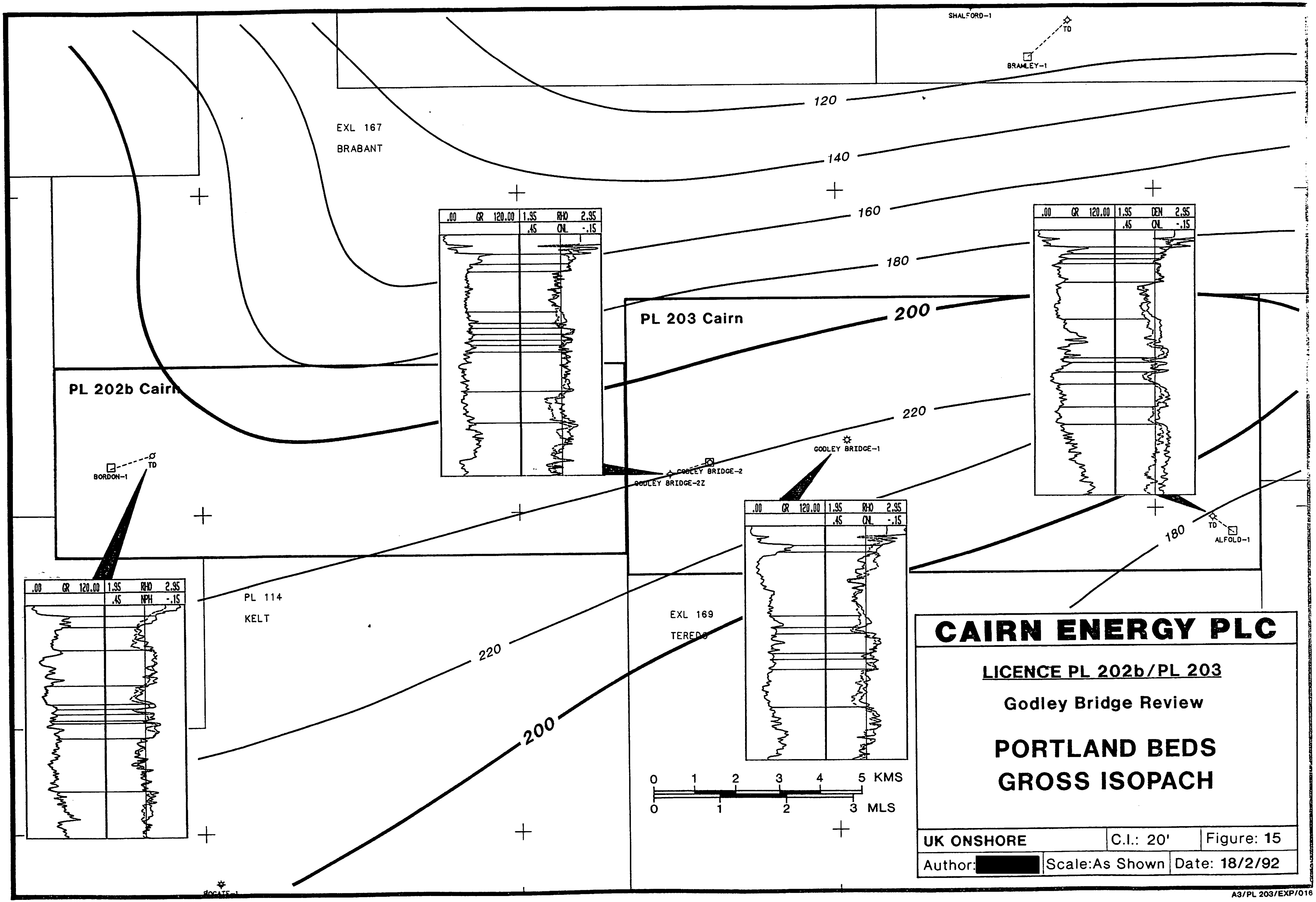


LONDON
Reading
Southend-on-Sea
Canterbury
Maidstone
Basingstoke
Crawley
Dover
Southampton
Portsmouth
Brighton
Worthing
Bognor Regis
Hastings
Newport
Ryde
Sands Young to North
50
25
0
Tr Sd
Sdy Lst
8ø11%
16.5ø12.9%
58ø3-16%
57 60ø18%
40
60
33ø12.3%
53
20ø2%
32ø12-14%
36
5ø10%
8ø11.7%
14ø6%
KEY
36 ø15.3%
Sand Thickness
Porosity
Gas Production
Poor Gas Show
Good Gas Show
Poor Oil Show
Good Oil Show
Oil Production
DRILLING
SUSPENDED
P & A - DRY
P & A - GAS SHOWS
P & A - OIL SHOWS
GAS WELL
OIL WELL
SUSPENDED OIL WELL
SUSPENDED OIL SHOWS
COREHOLE
EXL - EXPLORATION LICENCE
AP - APPRAISAL LICENCE
DL - DEVELOPMENT LICENCE
ML - MINING LICENCE
XL - EXPLORATION LICENCE
PL - PRODUCTION LICENCE
0 5 10 15 20 25 30 35 KMS
0 5 10 15 20 MILES
CAIRN ENERGY PLC
WEALD BASIN
CORALLIAN GROSS SAND ISOPACH
SOUTHERN ENGLAND
C.I. :
Figure : 12
Author : [redacted]
Scale : AS SHOWN
Date : 18/2/92
Rev.0
A3/GEN/EXP/047

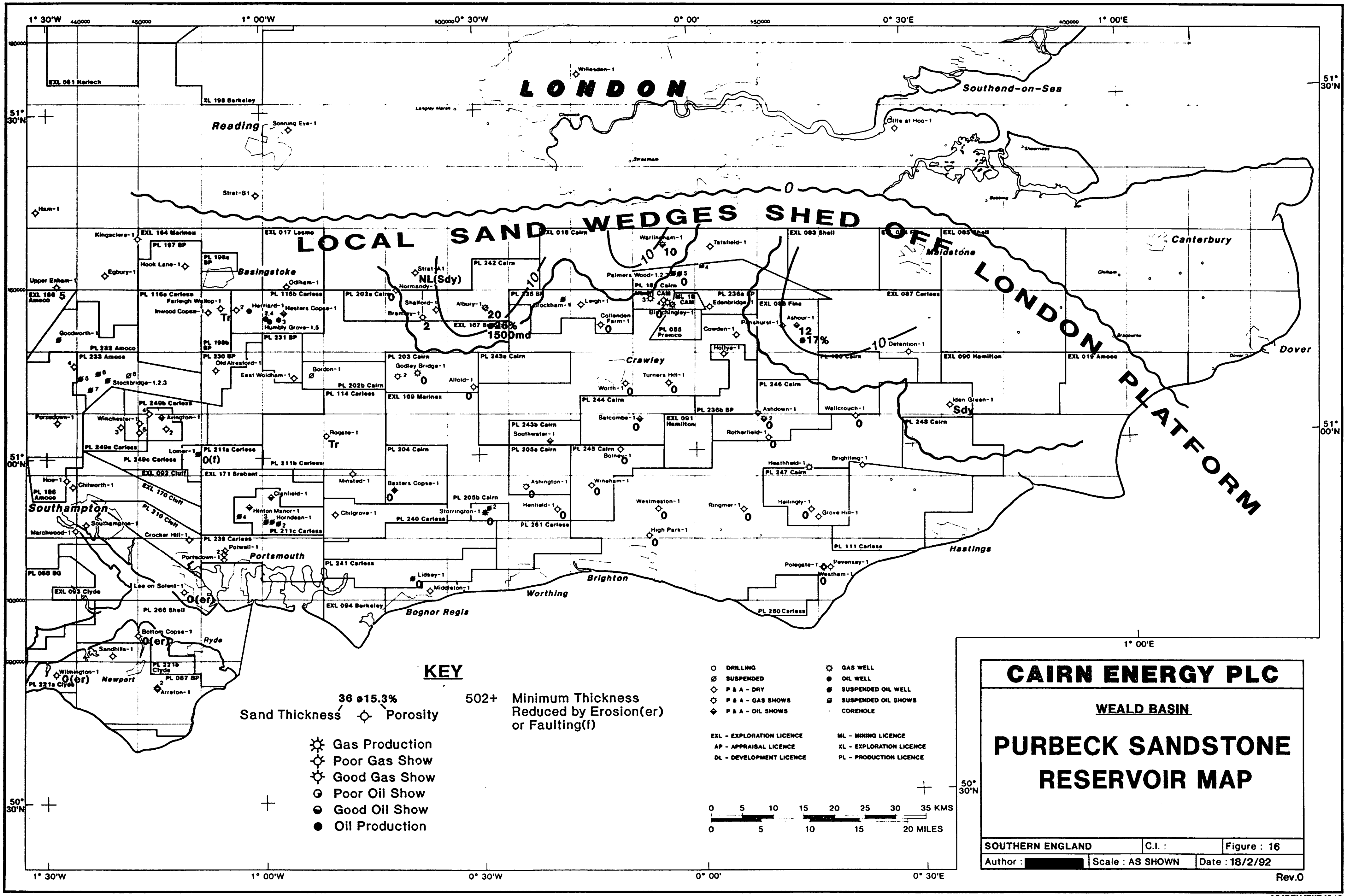


SHALFORD-1
TD
BRAMLEY-1
50
EXL 167
BRABANT
60
50
PL 203 Cairn
40
PL 202b Cairn
30
.00 GR 120.00 1.95 RHO 2.95
.45 CNL -.15
C.Sst
GODLEY BRIDGE-1
GODLEY BRIDGE-2
GODLEY BRIDGE-2Z
BORDON-1
D.N.P.
ALFOLD-1
70
.00 GR 120.00 1.95 RHO 2.95
.45 NPH -.15
NB: VERY POOR HOLE CONDITIONS
PL 114
KELT
EXL 169
TEREDO
60
0 1 2 3 4 5 KMS
0 1 2 3 MLS
CAIRN ENERGY PLC
LICENCE PL 202b/PL 203
Godley Bridge Review
CORALLIAN SANDSTONE GROSS ISOPACH
UK ONSHORE
C.I.: 10'
Figure: 13
Author: [redacted]
Scale:As Shown
Date: 18/2/92
Rev.0
A3/PL 203/EXP/015

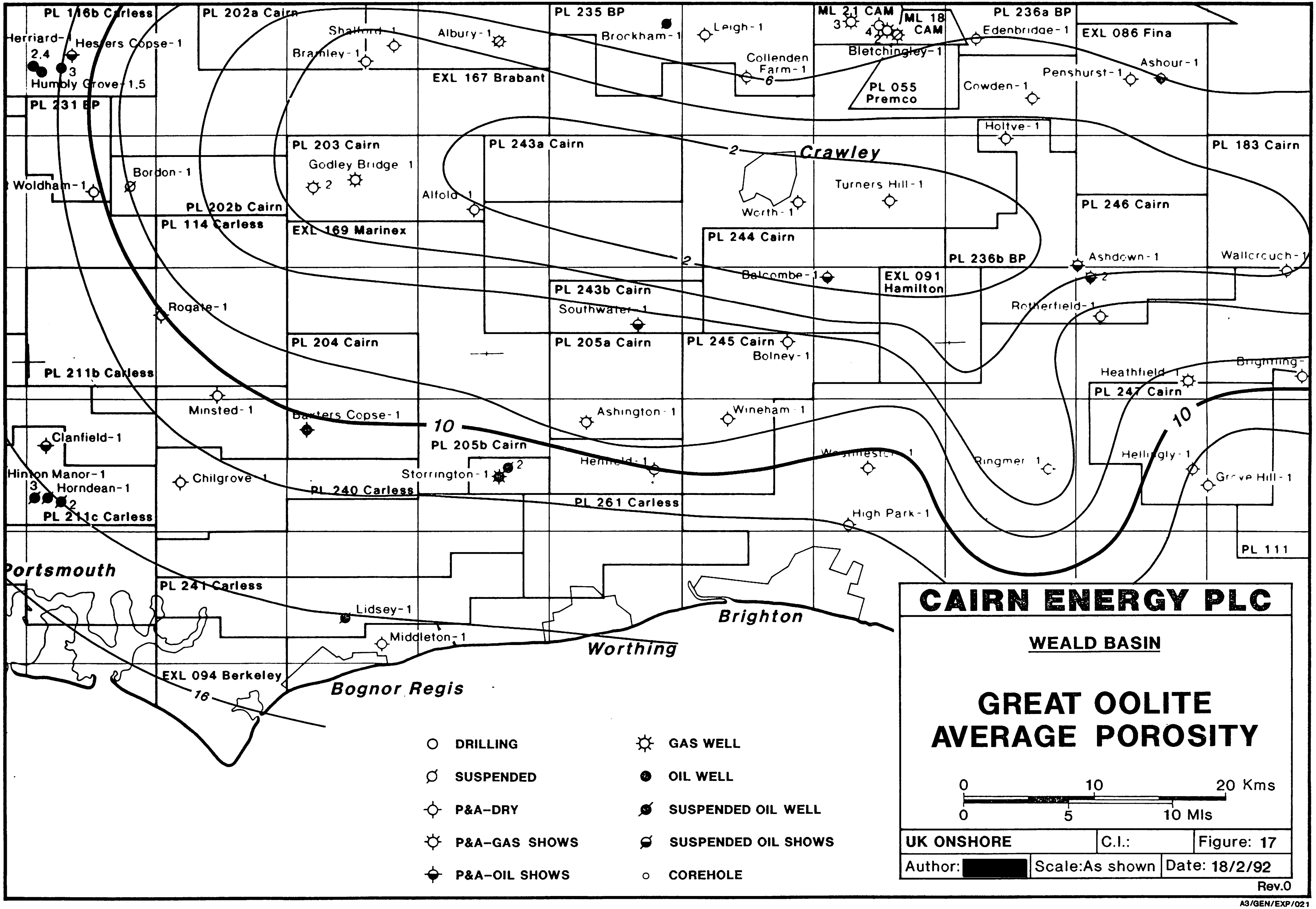

CAIRN ENERGY PLC
WEALD BASIN
PORTLAND SAND
GROSS SAND ISOPACH
SOUTHERN ENGLAND
C.I. :
Figure : 14
Author : [redacted]
Scale : AS SHOWN
Date : 18/2/92
Rev.0
A3/GEN/EXP/048
KEY
36 ø15.3%
Sand Thickness
Porosity
Gas Production
Poor Gas Show
Good Gas Show
Poor Oil Show
Good Oil Show
Oil Production
DRILLING
SUSPENDED
P & A - DRY
P & A - GAS SHOWS
P & A - OIL SHOWS
GAS WELL
OIL WELL
SUSPENDED OIL WELL
SUSPENDED OIL SHOWS
COREHOLE
EXL - EXPLORATION LICENCE
AP - APPRAISAL LICENCE
DL - DEVELOPMENT LICENCE
ML - MINING LICENCE
XL - EXPLORATION LICENCE
PL - PRODUCTION LICENCE
0 5 10 15 20 25 30 35 KMS
0 5 10 15 20 MILES
KEY
502+ Minimum Thickness Reduced by Erosion(er) or Faulting(f)
f-20° Estimated Size of Fault Throw
LONDON
Reading
Southend-on-Sea
Canterbury
Maidstone
Dover
Hastings
Brighton
Worthing
Bognor Regis
Portsmouth
Southampton
Basingstoke
Crawley
Ryde
Newport
1° 30'W
1° 00'W
0° 30'W
0° 00'
0° 30'E
1° 00'E
51° 30'N
51° 00'N
50° 30'N
575
82
46
100
100ø20%
116ø19.4%
152ø17%
54ø28.7%
59ø18.8%
116ø17%
75ø20%
50ø12%
26ø13%
70
100ø23%
92ø18.2%
92ø16.4%
119ø17.2%
86ø17.4%
24+(f)ø12.1%
95ø10%
107ø
35
43ø14.9%
36ø13.9%
36ø15.3%
13ø8.2%
20?
40
NR
150
100
50
0

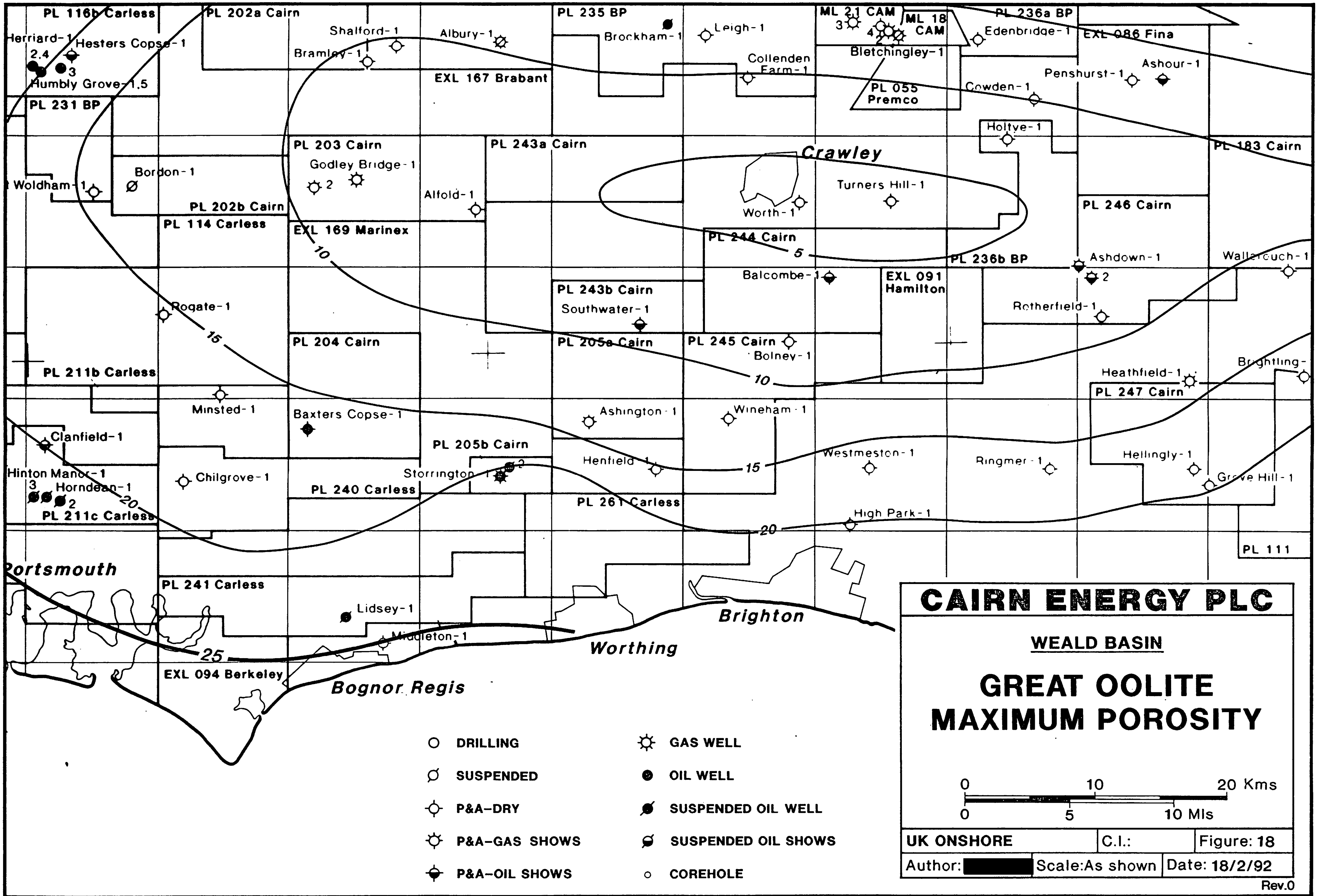


A3/PL 203/EXP/016

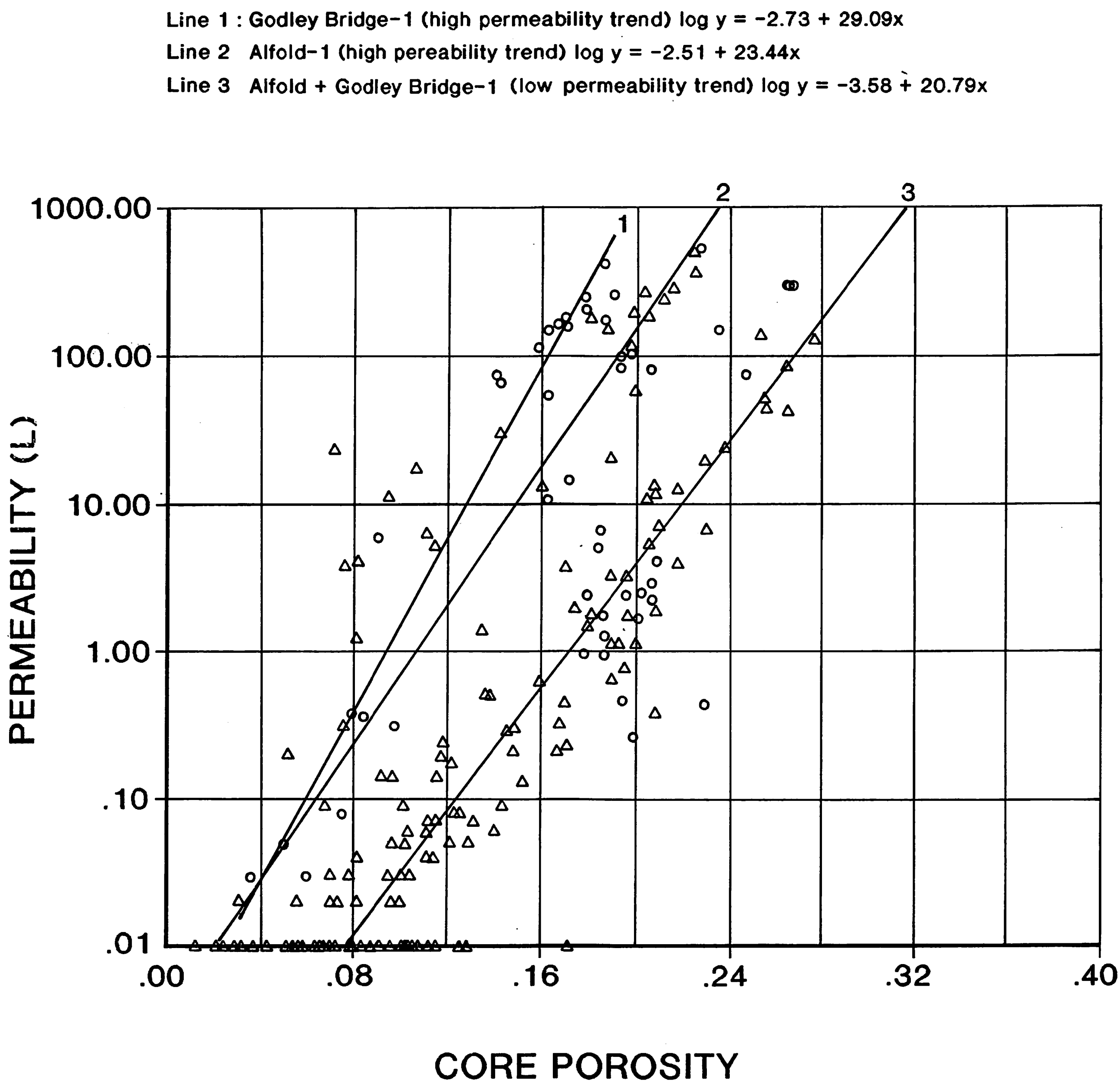


LONDON
LOCAL SAND WEDGES SHED OFF LONDON PLATFORM
Reading
Basingstoke
Southampton
Portsmouth
Bognor Regis
Worthing
Brighton
Hastings
Crawley
Maidstone
Canterbury
Dover
Southend-on-Sea
Newport
Ryde
Willesden-1
Sonning Eye-1
Cliffe at Hoo-1
Strat-B1
Ham-1
Kingsclere-1
Egbury-1
Upper Enham-1
Goodworth-1
Farleigh Wallop-1
Inwood Copse-1
Herriard-1
Hesters Copse-1
Humbly Grove-1,5
Odiham-1
Stockbridge-1,2,3
Bordon-1
East Woldham-1
Old Alresford-1
Winchester-1
Avington-1
Furzedown-1
Lomer-1
Chilworth-1
Hoe-1
Marchwood-1
Southampton-1
Crocker Hill-1
Hinton Manor-1
Horndean-1
Clanfield-1
Portsdown-1
Potwell-1
Lee on Solent-1
Bottom Copse-1
Sandhills-1
Wilmington-1
Arreton-1
Rogate-1
Minsted-1
Chilgrove-1
Baxters Copse-1
Storrington-1
Lidsey-1
Middleton-1
Godley Bridge-1
Alfold-1
Shalford-1
Bramley-1
Albury-1
Normandy-1
Strat-A1
Brockham-1
Leigh-1
Collendean Farm-1
Palmers Wood-1,2
Warlingham-1
Tatsfield-1
Bletchingley-1
Edenbridge-1
Cowden-1
Penshurst-1
Ashour-1
Detention-1
Holtye-1
Worth-1
Turners Hill-1
Balcombe-1
Bolney-1
Ashdown-1
Rotherfield-1
Wallcrouch-1
Iden Green-1
Heathfield-1
Brightling-1
Hellingly-1
Grove Hill-1
Ringmer-1
Westmeston-1
Wineham-1
Ashington-1
Henfield-1
High Park-1
Polegate-1
Pevensey-1
Westham-1
Southwater-1
NL(Sdy)
Sdy
Tr
0(f)
0(er)
20 ø26% 1500md
12 ø17%
EXL 061 Harlech
XL 198 Berkeley
EXL 164 Marinex
PL 197 BP
EXL 017 Lasmo
EXL 018 Cairn
EXL 083 Shell
EXL 085 Shell
PL 242 Cairn
PL 235 BP
PL 182 Cairn
PL 236a BP
EXL 087 Carless
PL 055 Premco
EXL 166 Amoco
PL 116a Carless
PL 116b Carless
PL 202a Cairn
PL 231 BP
PL 232 Amoco
PL 233 Amoco
PL 230 BP
PL 203 Cairn
PL 202b Cairn
PL 114 Carless
EXL 169 Marinex
PL 243a Cairn
PL 244 Cairn
PL 246 Cairn
PL 236b BP
PL 248 Cairn
EXL 090 Hamilton
EXL 019 Amoco
PL 249b Carless
PL 249a Carless
PL 249c Carless
PL 211a Carless
PL 211b Carless
EXL 092 Cluff
EXL 171 Brabant
EXL 170 Cluff
PL 210 Cluff
PL 186 Amoco
PL 204 Cairn
PL 243b Cairn
EXL 091 Hamilton
PL 205a Cairn
PL 245 Cairn
PL 247 Cairn
PL 205b Cairn
PL 240 Carless
PL 211c Carless
PL 261 Carless
PL 239 Carless
PL 241 Carless
PL 111 Carless
PL 068 BG
EXL 093 Clyde
PL 266 Shell
EXL 094 Berkeley
PL 260 Carless
PL 221a Clyde
PL 221b Clyde
PL 087 BP
1° 30'W
1° 00'W
0° 30'W
0° 00'
0° 30'E
1° 00'E
51° 30'N
51° 00'N
50° 30'N
KEY
36 ø15.3%
Sand Thickness
Porosity
502+ Minimum Thickness Reduced by Erosion(er) or Faulting(f)
Gas Production
Poor Gas Show
Good Gas Show
Poor Oil Show
Good Oil Show
Oil Production
DRILLING
SUSPENDED
P & A - DRY
P & A - GAS SHOWS
P & A - OIL SHOWS
GAS WELL
OIL WELL
SUSPENDED OIL WELL
SUSPENDED OIL SHOWS
COREHOLE
EXL - EXPLORATION LICENCE
AP - APPRAISAL LICENCE
DL - DEVELOPMENT LICENCE
ML - MINING LICENCE
XL - EXPLORATION LICENCE
PL - PRODUCTION LICENCE
0 5 10 15 20 25 30 35 KMS
0 5 10 15 20 MILES
CAIRN ENERGY PLC
WEALD BASIN
PURBECK SANDSTONE RESERVOIR MAP
SOUTHERN ENGLAND
C.I. :
Figure : 16
Author : [redacted]
Scale : AS SHOWN
Date : 18/2/92
Rev.0
A3/GEN/EXP/049


CAIRN ENERGY PLC
WEALD BASIN
GREAT OOLITE AVERAGE POROSITY
0 10 20 Kms
0 5 10 Mls
UK ONSHORE
C.I.:
Figure: 17
Author: [redacted]
Scale:As shown
Date: 18/2/92
Rev.0
A3/GEN/EXP/021
DRILLING
SUSPENDED
P&A-DRY
P&A-GAS SHOWS
P&A-OIL SHOWS
GAS WELL
OIL WELL
SUSPENDED OIL WELL
SUSPENDED OIL SHOWS
COREHOLE
PL 202a Cairn
PL 235 BP
ML 21 CAM
ML 18 CAM
PL 236a BP
EXL 086 Fina
EXL 167 Brabant
PL 055 Premco
PL 231 BP
PL 203 Cairn
PL 243a Cairn
PL 183 Cairn
PL 202b Cairn
PL 114 Carless
EXL 169 Marinex
PL 246 Cairn
PL 244 Cairn
PL 236b BP
EXL 091 Hamilton
PL 243b Cairn
PL 204 Cairn
PL 205a Cairn
PL 245 Cairn
PL 211b Carless
PL 247 Cairn
PL 205b Cairn
PL 240 Carless
PL 261 Carless
PL 211c Carless
PL 111
PL 241 Carless
EXL 094 Berkeley
Herriard-1
Hesters Copse-1
Humbly Grove-1,5
Albury-1
Brockham-1
Leigh-1
Collenden Farm-1
Bletchingley-1
Edenbridge-1
Ashour-1
Penshurst-1
Cowden-1
Holtye-1
Bramley-1
Bordon-1
Godley Bridge 1
Alfold-1
Crawley
Turners Hill-1
Worth-1
Ashdown-1
Wallcrouch-1
Balcombe-1
Rotherfield-1
Rogate-1
Southwater-1
Bolney-1
Heathfield-1
Minsted-1
Ashington-1
Wineham-1
Clanfield-1
Storrington-1
Ringmer-1
Hellingly-1
Grove Hill-1
Hinton Manor-1
Horndean-1
Chilgrove-1
High Park-1
Portsmouth
Lidsey-1
Middleton-1
Brighton
Worthing
Bognor Regis
2
6
10
16



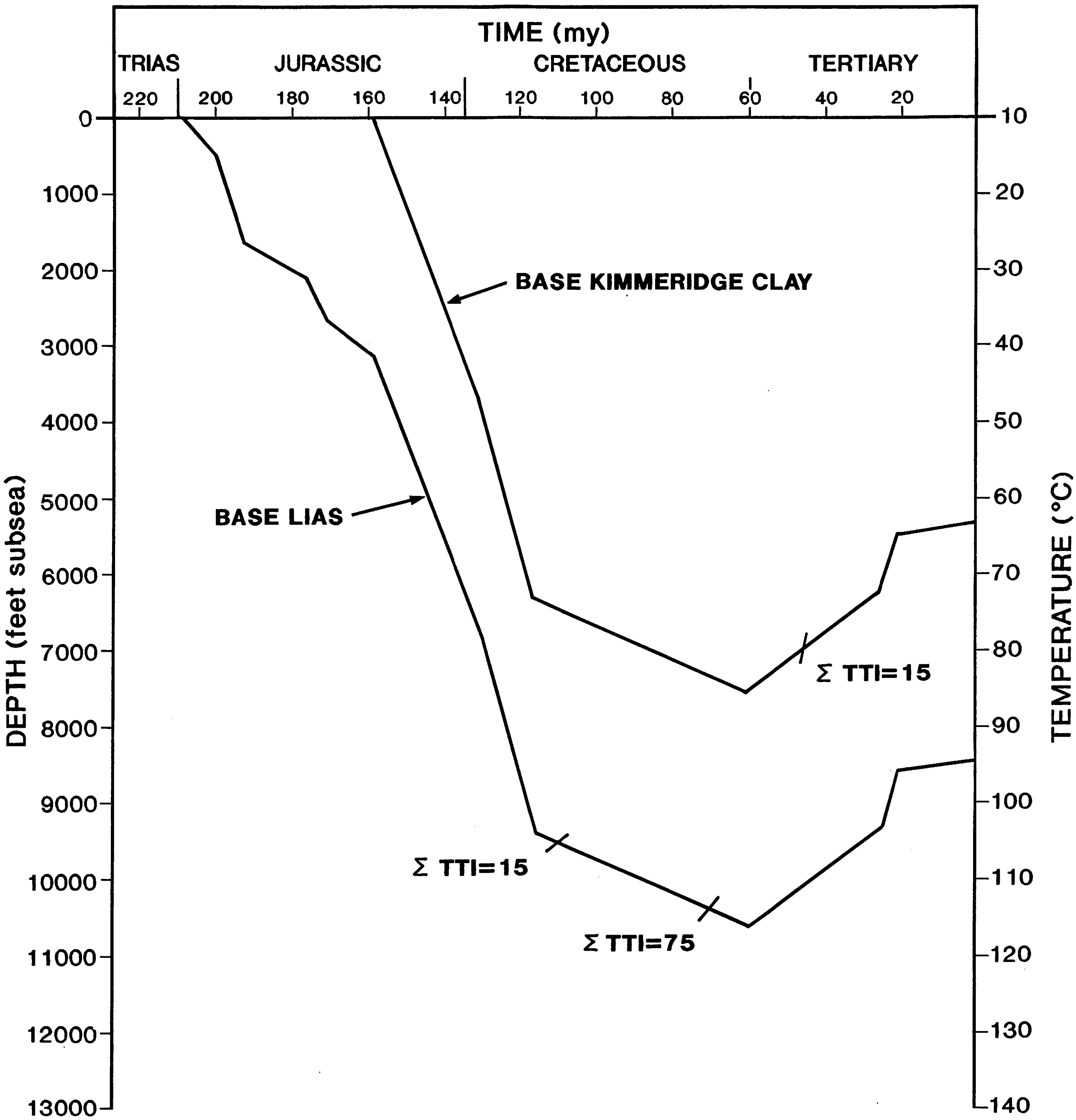
A3/GEN/EXP/022



PORTLAND SANDSTONE

ALFOLD-1 (△) & GODLEY BRIDGE-1 (○)

CORE POROSITY
VS
PERMEABILITY (L)



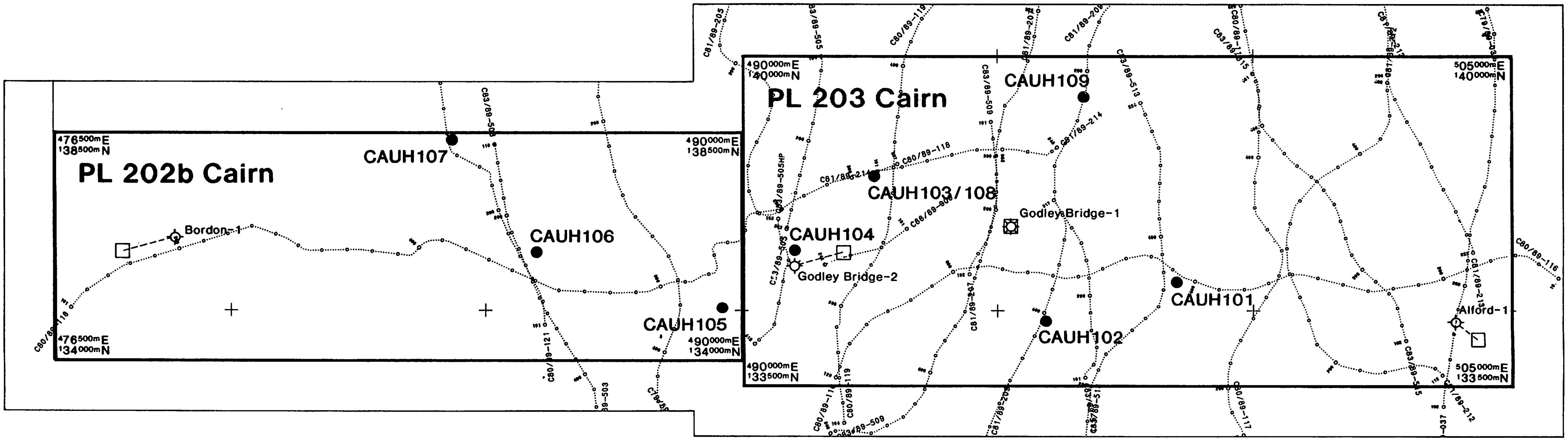
CAIRN ENERGY PLC

WEALD BASIN

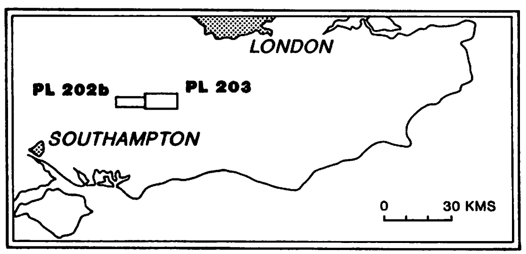
BURIAL DEPTH PLOT
GODLEY BRIDGE-1

SOUTHERN ENGLAND	C.I.:	Figure: 20
Author: [redacted]	Scale:	Date: 18/2/92

Rev.0
A4/PL 203/EXP/023



LOCATION MAP



CAUH103 ● UPHOLE LOCATIONS

CAIRN ENERGY PLC

LICENCE PL 202b/PL 203

Godley Bridge Review

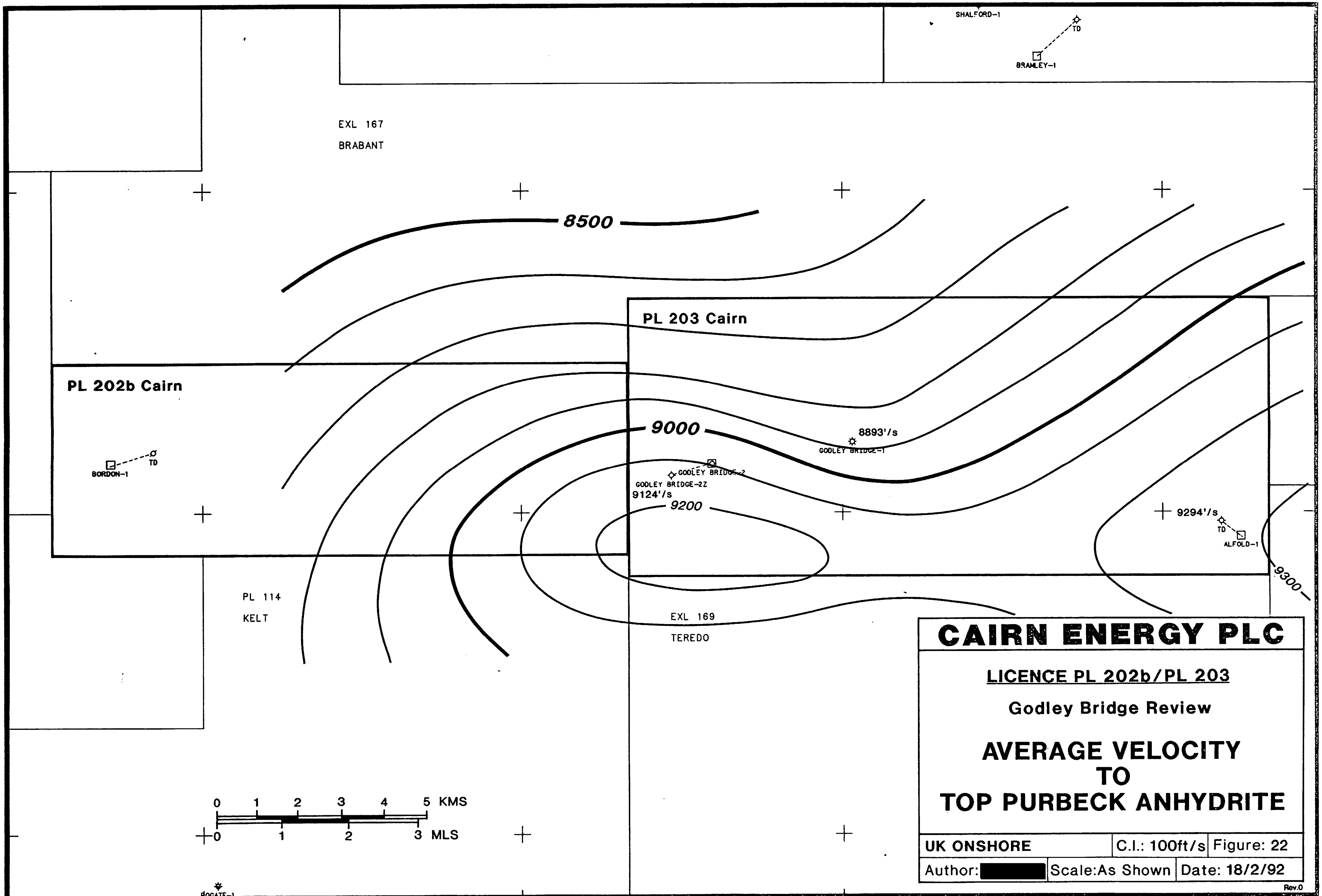
SEISMIC DATABASE

0 2 4 KMS
0 1 2 MLS

UK ONSHORE	C.I.:	Figure: 21
Author: [redacted]	Scale: As Shown	Date: 18/2/92

Rev.0

A4/PL 203/EXP/020



CAIRN ENERGY PLC

LICENCE PL 202b/PL 203

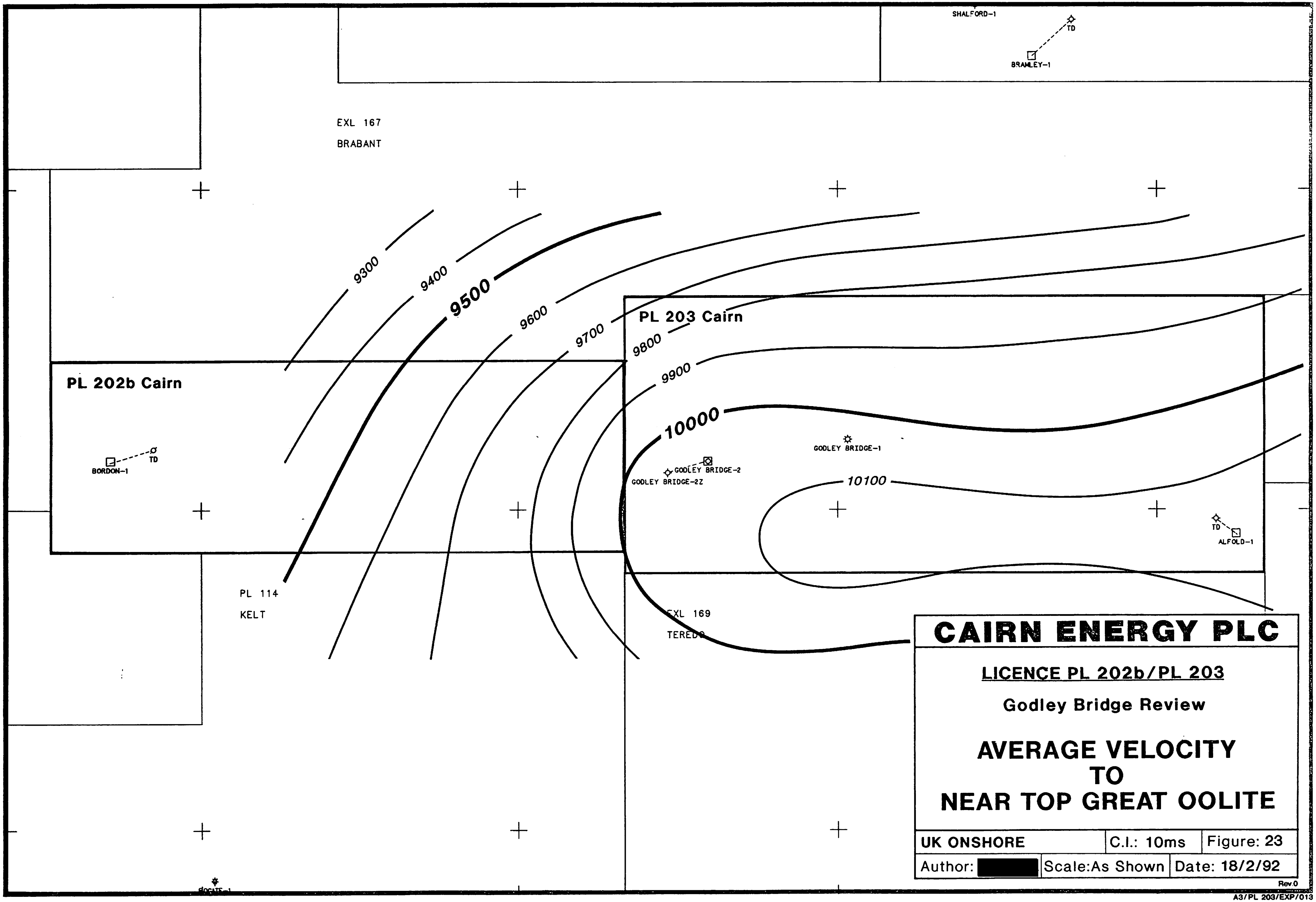
Godley Bridge Review

AVERAGE VELOCITY TO TOP PURBECK ANHYDRITE

UK ONSHORE	C.I.: 100ft/s	Figure: 22
Author: [redacted]	Scale:As Shown	Date: 18/2/92

Rev.0

A3/PL 203/EXP/012



CAIRN ENERGY PLC

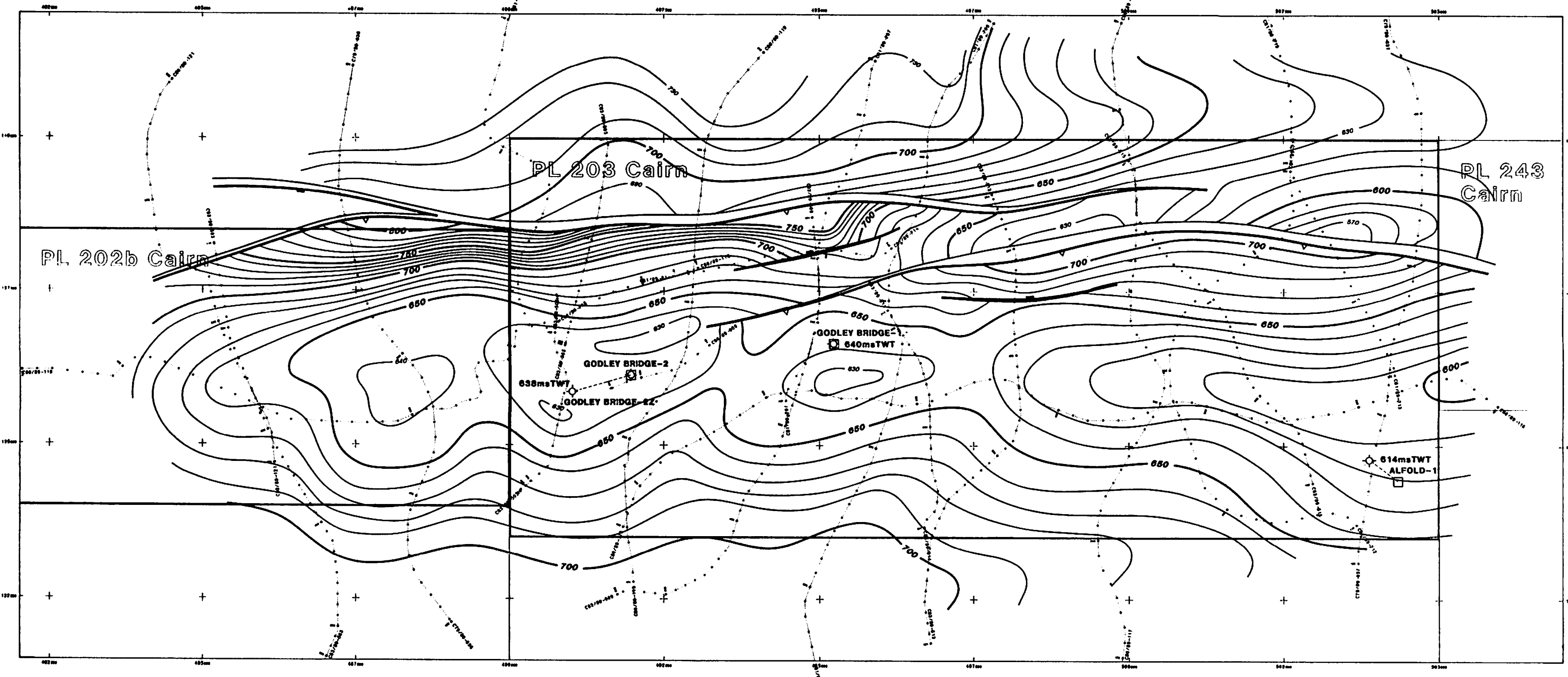
LICENCE PL 202b/PL 203

Godley Bridge Review

AVERAGE VELOCITY TO NEAR TOP GREAT OOLITE

UK ONSHORE	C.I.: 10ms	Figure: 23
Author: [redacted]	Scale:As Shown	Date: 18/2/92

Rev.0
A3/PL 203/EXP/013



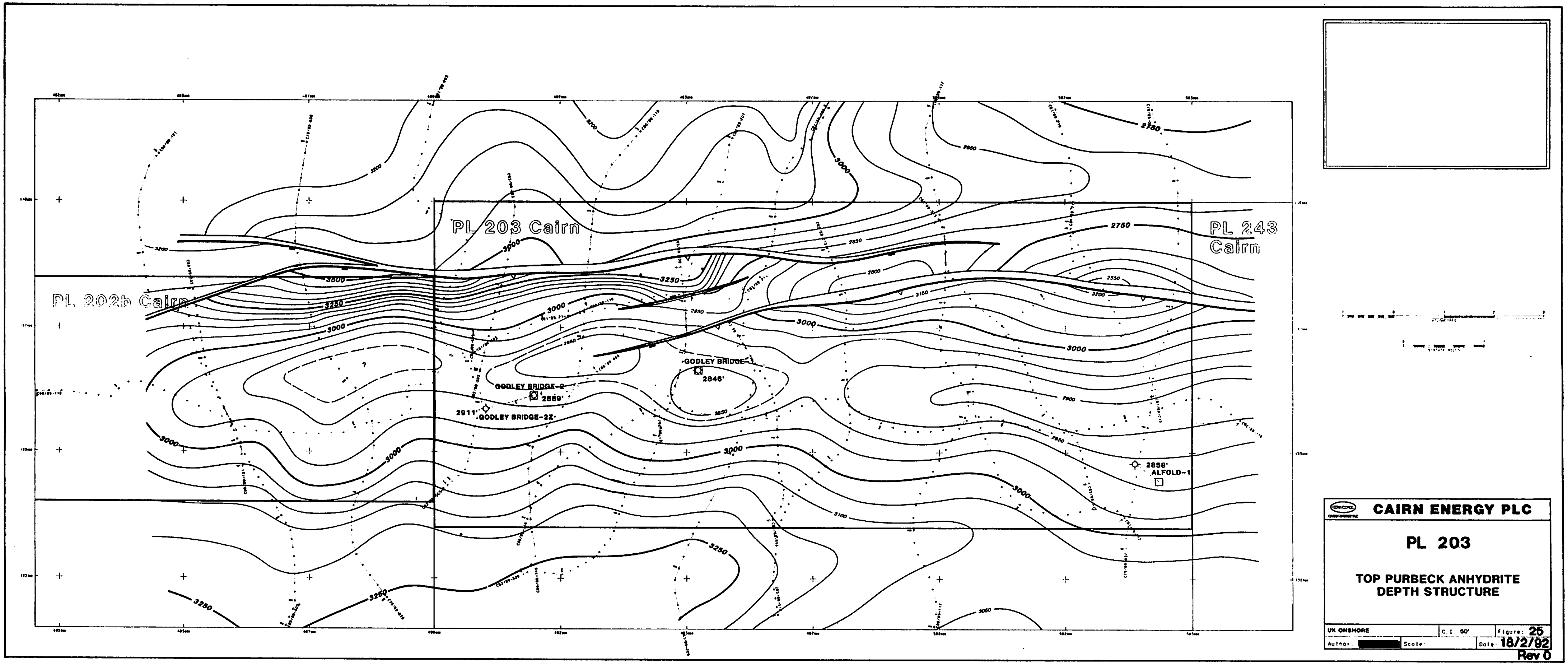
CAIRN ENERGY PLC

PL 203

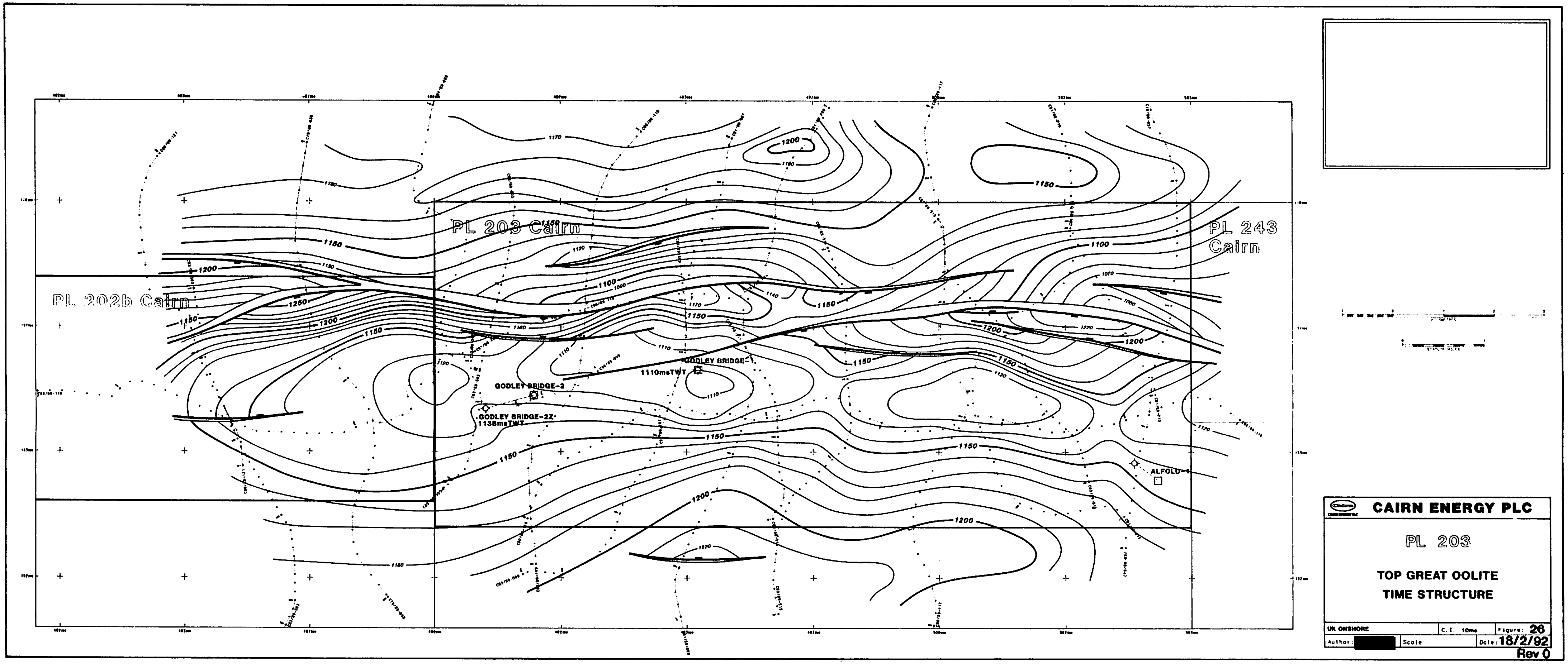
TOP PURBECK ANHYDRITE TIME STRUCTURE

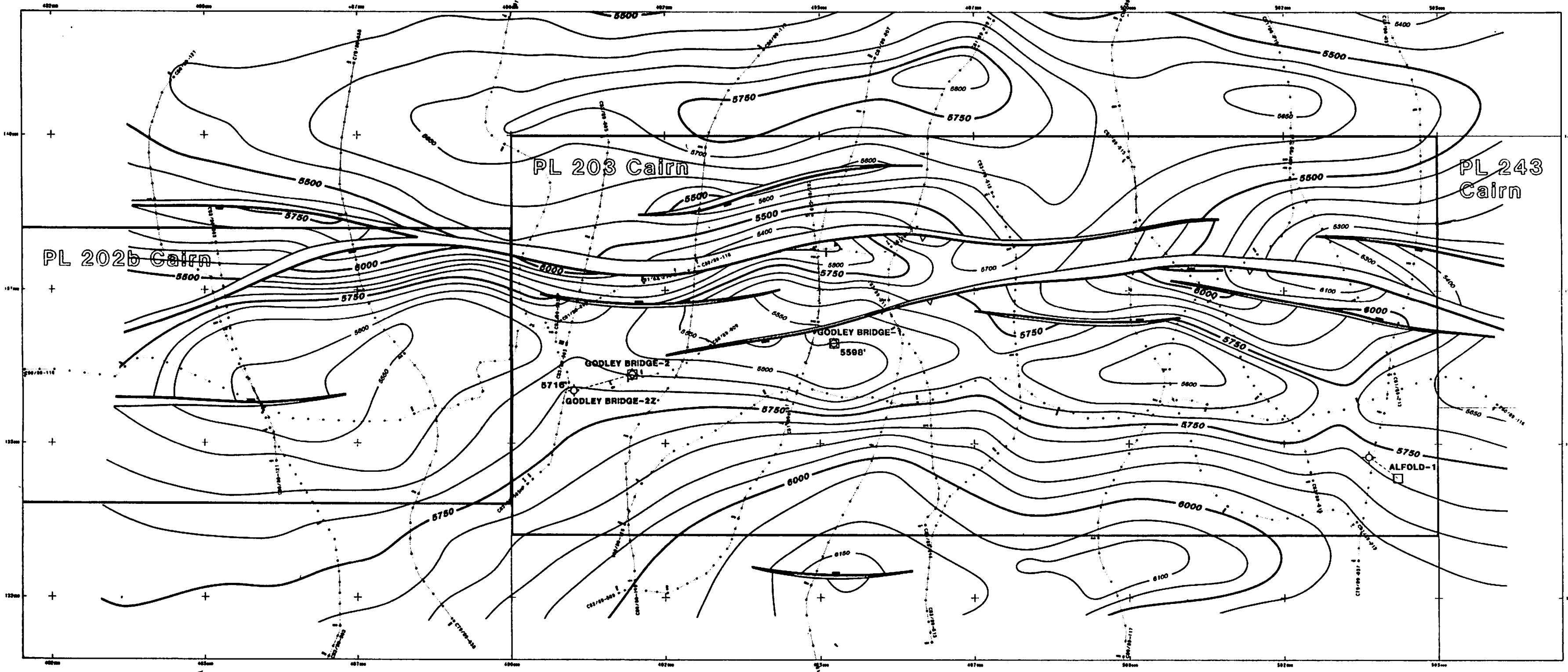
UK ONSHORE	C.I. 10ms	Figure: 24
Author [redacted]	Scale:	Date: 18/2/92

Rev 0



PL 203 Cairn
PL 243 Cairn
PL 202b Cairn
GODLEY BRIDGE
2846'
GODLEY BRIDGE-2
2869'
2911'
GODLEY BRIDGE-2Z
2858'
ALFOLD-1
3000
3250
3500
2750
2850
3150
3100
CAIRN ENERGY PLC
PL 203
TOP PURBECK ANHYDRITE
DEPTH STRUCTURE
UK ONSHORE
C.I 50'
Figure: 25
Author [redacted]
Scale
Date: 18/2/92
Rev 0


PL 203 Cairn
PL 243 Cairn
PL 202b Cairn
GODLEY BRIDGE-1
1110msTWT
GODLEY BRIDGE-2
GODLEY BRIDGE-2Z
1135msTWT
ALFOLD-1
1100
1150
1200
1250
CAIRN ENERGY PLC
PL 203
TOP GREAT OOLITE
TIME STRUCTURE
UK ONSHORE
C.I. 10ms
Figure: 26
Author: [redacted]
Scale:
Date: 18/2/92
Rev 0



CAIRN ENERGY PLC

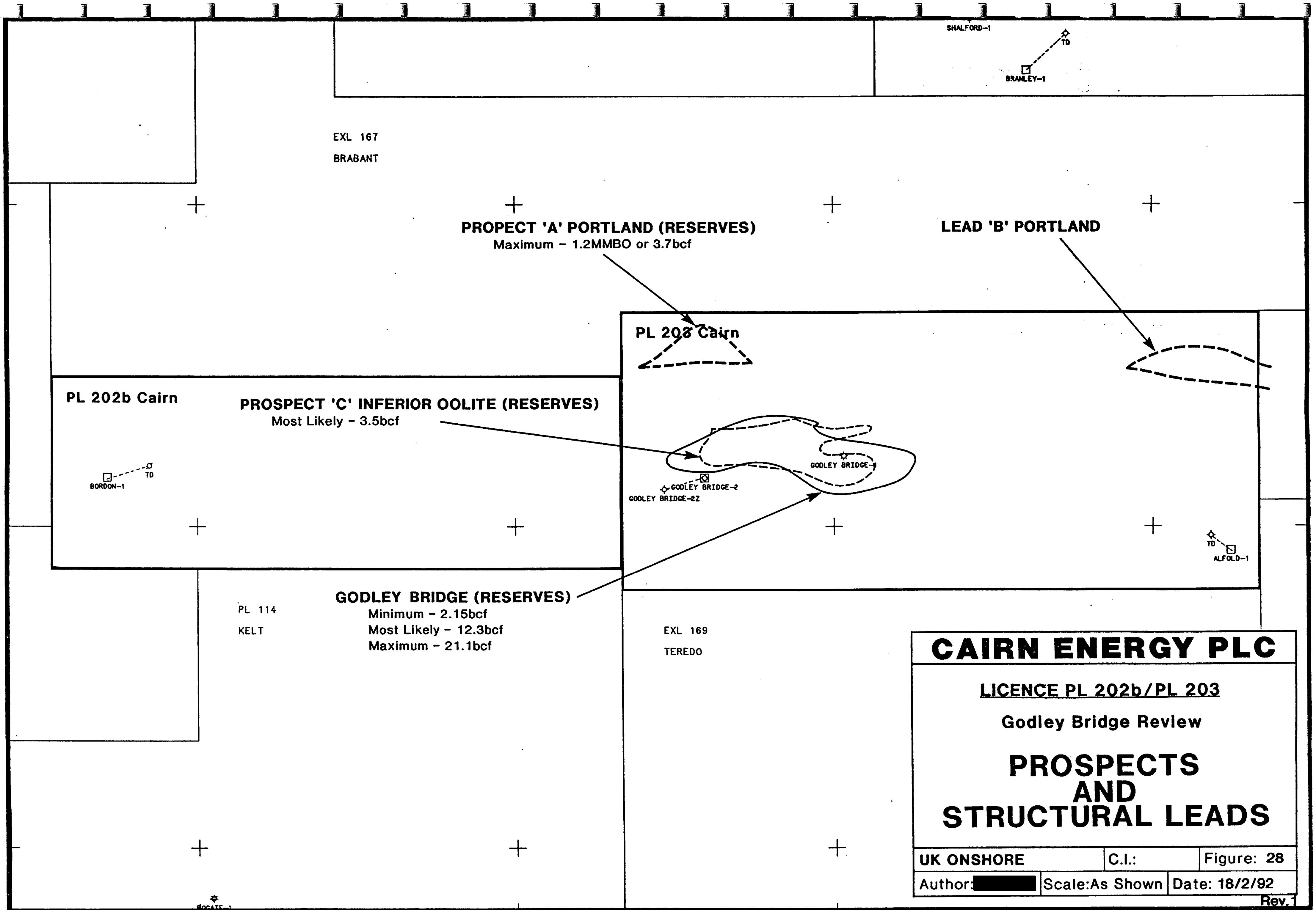
PL 203

TOP GREAT OOLITE
DEPTH STRUCTURE

UK ONSHORE	C.I. 50'	Figure: 27
Author: [redacted]	Scale:	Date: 18/2/92

Rev 0

A4/PL 203/EXP/029



CAIRN ENERGY PLC

LICENCE PL 202b/PL 203

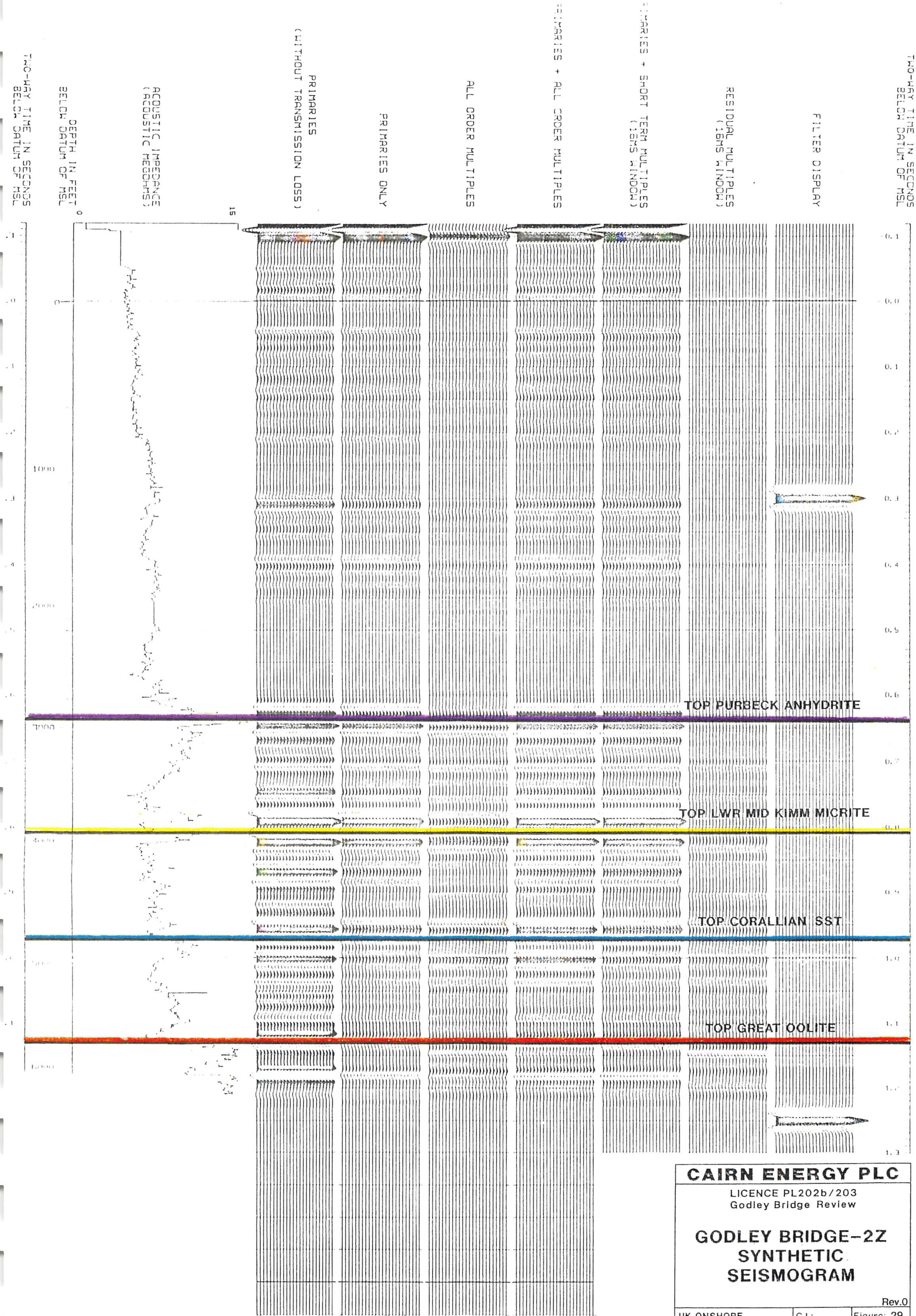
Godley Bridge Review

PROSPECTS AND STRUCTURAL LEADS

UK ONSHORE	C.I.:	Figure: 28
Author: [redacted]	Scale:As Shown	Date: 18/2/92

Rev.1

A3/PL 203/EXP/006



CAIRN ENERGY PLC

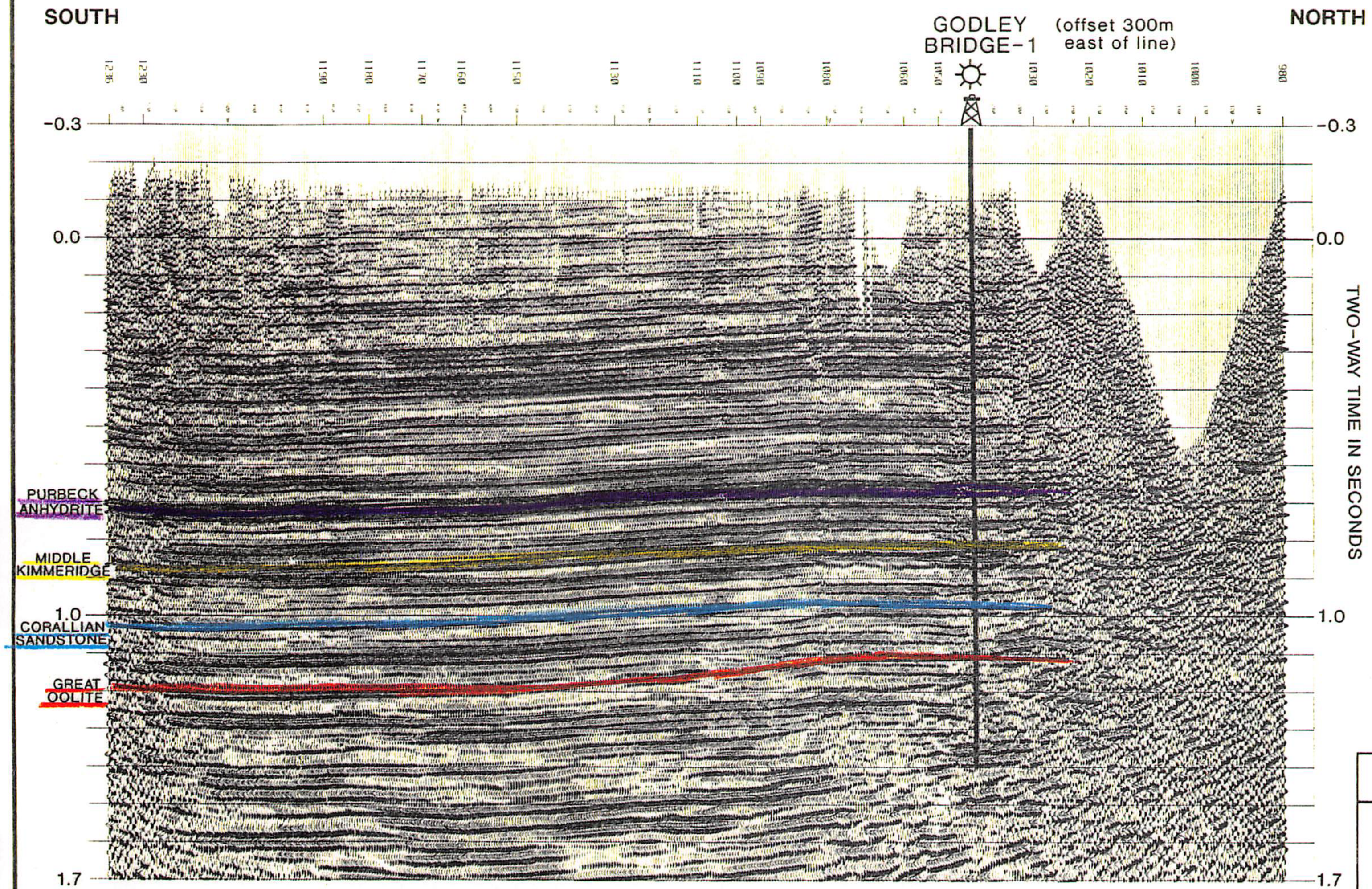
LICENCE PL202b/203
Godley Bridge Review

GODLEY BRIDGE-2Z SYNTHETIC SEISMOGRAM

Rev.0

UK ONSHORE		C.I.:	Figure: 29
Author:	Scale:		Date: 18/2/92

A3/PL 203/EXP/017

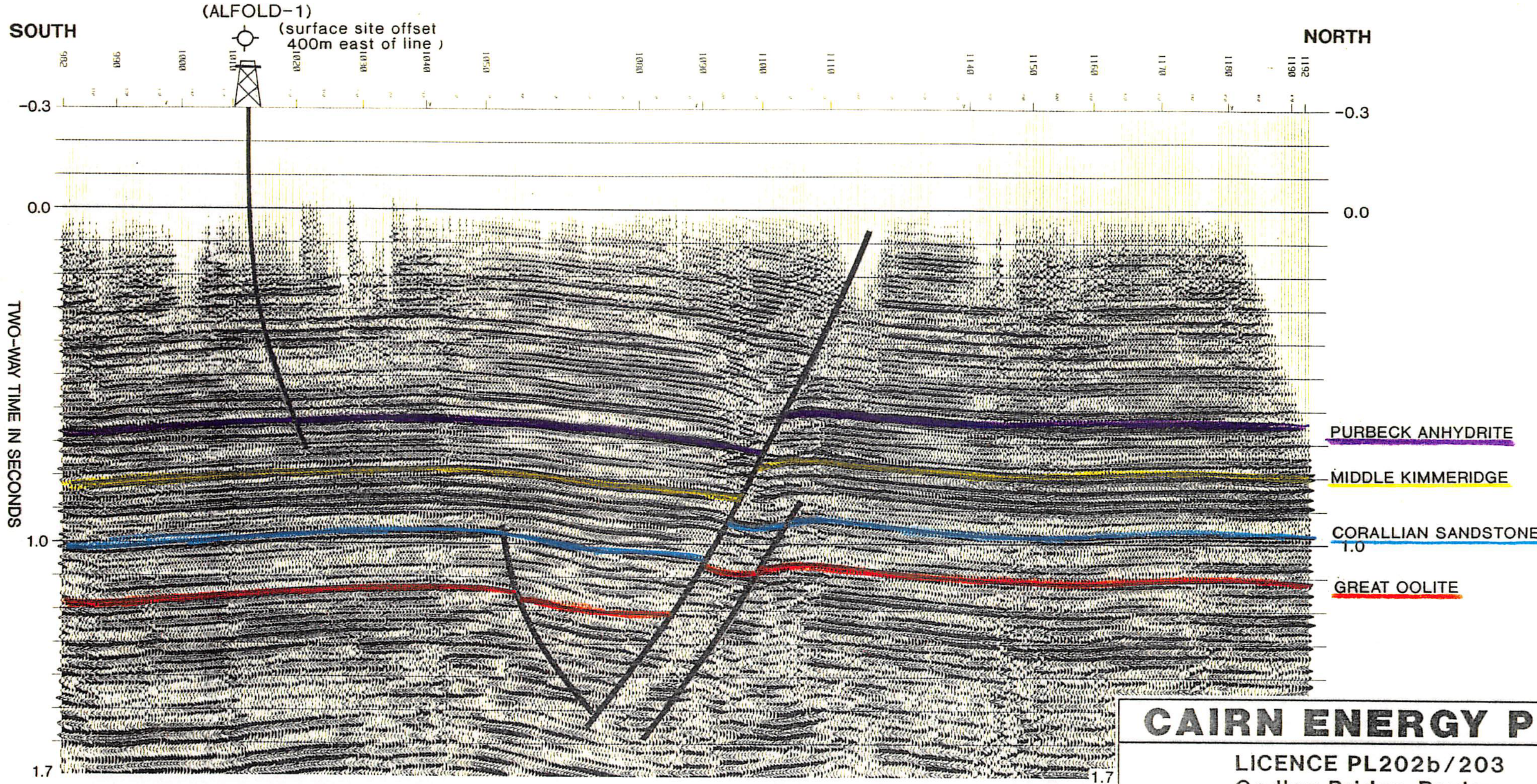


C83/89-509 SPECTRUM PROCESSING

CAIRN ENERGY PLC		
LICENCE PL202b/203 Godley Bridge Review SEISMIC LINE C83/89-509 (GODLEY BRIDGE-1)		
UK ONSHORE	C.I.:	Figure: 30
Author: [redacted]	Scale:	Date: 18/2/92

Rev.0

A3/PL 202b/EXP/010



C79/89-037 SPECTRUM PROCESSING

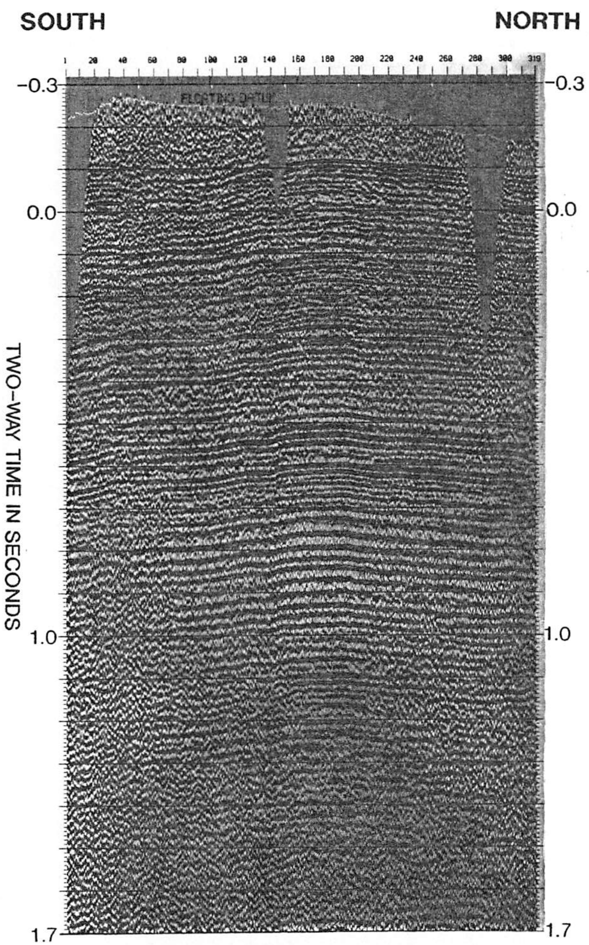
CAIRN ENERGY PLC

LICENCE PL202b/203
Godley Bridge Review

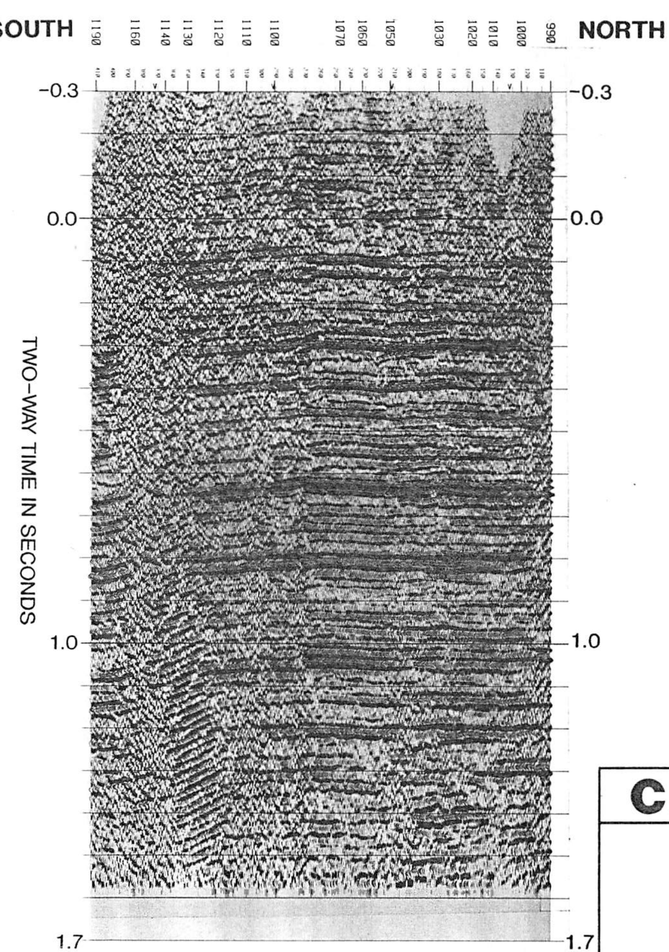
SEISMIC LINE C79/89-037
(ALFOLD-1)

UK ONSHORE	C.I.:	Figure: 31
Author: [redacted]	Scale:	Date: 18/2/92

Rev.0



LINE C83–505HP
HORIZON PROCESSING



LINE C83/89–505HP
SPECTRUM PROCESSING

CAIRN ENERGY PLC

LICENCE PL202b/203
Godley Bridge Review

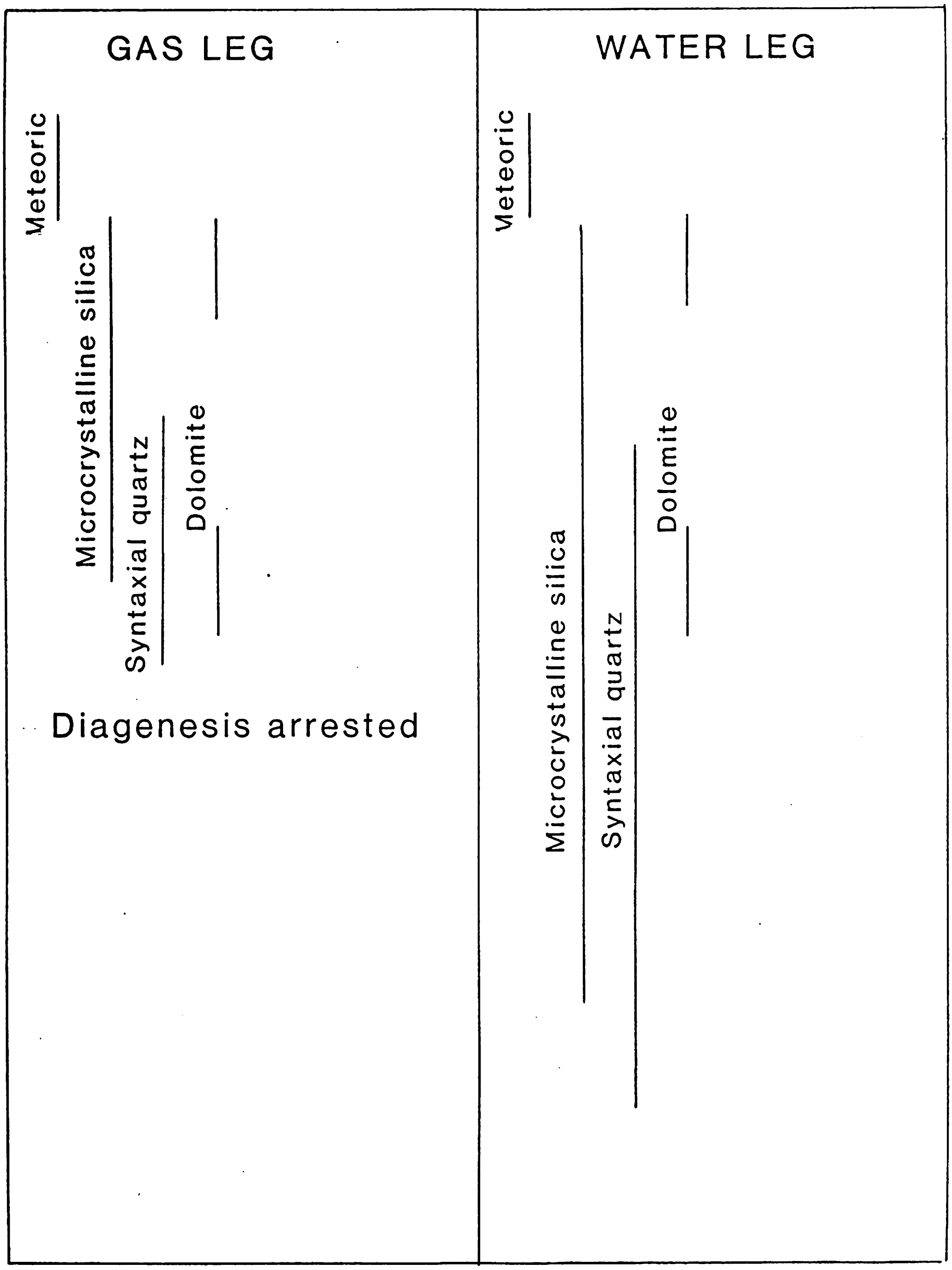
SEISMIC LINES C83–505HP AND C83/89–505HP COMPARISON

UK ONSHORE	C.I.:	Figure: 32
Author: [redacted]	Scale:	Date: 18/2/92

Rev.0

A3/PL 203/EXP/009

GODLEY BRIDGE #1
SEQUENCE OF MAJOR DIAGENETIC EVENTS



18/2/92
Rev.0

Figure:33
A4/PL.203/EXP/004